

East Coast Vancouver Island Salmon Carcass Retention/Distribution Program – Seed Project

Summary Report



by:

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and

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Introduction

Recycling of marine derived nutrients (MDN) has recently been identified as a major factor affecting the health of freshwater salmonid ecosystems (Stockner 2003). In the majority of Vancouver Island watersheds, marine-derived phosphorus is limiting to periphyton accrual. Consequently, aquatic invertebrate production is limited, resulting in less food for juvenile salmon and trout. Coupled with the indirect benefit from marine derived nutrients, there is also a direct food source provided by eggs and carcasses of spawning salmon. These factors have been shown to increase the size of juvenile salmonids, and subsequently increase survival to the smolt stage.

In April 2002, a seed proposal submitted by BC Conservation Foundation (BCCF) was funded by the Habitat Conservation Trust Fund to improve salmon carcass retention and distribution on East Coast Vancouver Island streams. This proposal represents a small but significant aspect of the Greater Georgia Basin Steelhead Recovery Plan (GGBSRP; www.steelheadrecoveryplan.ca) and is identified as a recovery option in the GGBSRP report by A.F. Lill and Associates (2002). The intent of the proposal is to start to develop long term, coordinated plans for the redistribution of salmon carcasses from spawning channels in the Big and Little Qualicum rivers, and to improve retention of salmon carcasses in other central east coast Vancouver Island watersheds by involving streamkeepers and government fisheries agencies.

Results

In the project development stage, it was soon apparent that resources were required to bring this concept to local fisheries agencies and educate the public about the benefits of salmon carcasses and the reductions in ecosystem productivity that occur when spawning returns are depleted. A workshop was organized to bring together DFO Community Advisors and provincial/federal hatchery staff from Victoria to Campbell River.

Salmon Carcass Workshop

A Salmon Carcass Workshop was held on June 14, 2002 in Parksville. Existing carcass distribution programs and guidelines (including DFO's draft in-house document *Guidelines for In-stream Placement of Hatchery Carcasses – Appendix A*) were reviewed and issues regarding future programs were discussed. The minutes from the workshop, along with a list of attendees follows in Appendix B. These minutes summarize existing carcass distribution programs. In addition to potential field activities for the fall of 2002, two administrative objectives were identified during the workshop that would make planning and tracking projects easier for both government and public groups:

1. Develop a procedures workbook for public stream stewardship groups. The workbook should be short and concise and provide necessary information for local groups regarding salmon carcass retention/distribution. A preliminary draft of this workbook follows in Appendix C. Further consultation with DFO staff and public representatives will be required to finalize the workbook.

2. Develop a template data form that could be used for all carcass programs and is compatible with DFO's "ENPRO" database. Further consultation is required with DFO hatchery staff to ensure the form meets their needs.

Carcass Distribution Pilot Field Project

As a test of the potential to conduct community-based carcass planting programs, a pilot project was completed on the Little Qualicum River near Qualicum Beach. This pilot project would normally compliment carcass distribution work undertaken by Little Qualicum Project (LQP) staff (Appendix B), though no plants were done this year (J. Hargrove, Fish Culturist, LQP)

Approvals were obtained in advance from DFO following submission of a detailed proposal (Appendix D) to C. Cross, Senior Program Biologist, Enhancement Support Assessment Unit, DFO, Vancouver.

On November 26, 2002, native chum and coho carcasses were re-distributed in the Little Qualicum watershed. A total of 1,105 carcasses were loaded into a rented $\frac{3}{4}$ ton 4x4 truck during a dead-pitch operation at the Little Qualicum River spawning channel. The carcasses were trucked to three locations upstream and pitched into riparian areas, or placed amongst woody debris in the stream (Appendix E). Locations were chosen based on access and were in or adjacent to anadromous reaches of the upper mainstem and a major tributary (Kinkadee Creek) with habitat suited to rear steelhead parr.

Members of the Qualicum Beach Streamkeepers volunteered the required labour with coordination and permit approvals provided by one technician from BCCF. Volunteers were supplied with deadpitch pew sticks and gloves, and used their own waders. Volunteers generally enjoyed the experience and agreed that a larger program could be undertaken in following years. A thank-you letter and a GGBSRP ball cap and bumper sticker were mailed to each participant to acknowledge their participation.

DFO staff from the Little Qualicum Project (side channel facility) were very supportive of the work and helped load carcasses manually and with their automated conveyor system.

Costs associated with this seed proposal are detailed in Appendix F.

Conclusions

Having received solid support from both the fisheries agencies and the public, this seed proposal achieved good results and will be an important step in the implementation of additional and/or larger projects on the east coast of Vancouver Island.

The federal authorities having jurisdiction over salmon appear willing to include procedural changes to local operations that allow for improved use of carcasses where abundant numbers exist and where a biological rationale for carcass planting is evident or can be demonstrated. The desire of provincial and federal agencies to conduct carcass programs based on a scientific approach with the best possible communications was both evident and appreciated.

With continued funding, procedures will be further established and more programs implemented. Based on the enthusiasm demonstrated during the Little Qualicum pilot project, this type of enhancement work will be supported by a variety of fish and game and stream stewardship organizations. With such broad public support, costs associated with this program should be reduced over time as community groups undertake the work with local funding.

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Appendix A.

Draft DFO In-house Document
Guidelines for In-stream Placement of Hatchery Carcasses

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Guidelines for In-stream Placement of Hatchery Carcasses

Draft September 9 , 2002

Table of Contents

INTRODUCTION	3
CARCASS PLACEMENT GUIDELINES	3
A. ADVICE, APPROVAL, AWARENESS	3
B. WATER QUALITY AND WATER USE CONCERNS	4
C. CONCERNS OVER DISEASE AND CHEMICALLY TREATED/MEDICATED CARCASSES	4
D. CARCASS LOADING DENSITY	4
E. TEMPORAL AND SPATIAL CARCASS DISTRIBUTION.....	5
F. CARCASS MUTILATION AT PLACEMENT	6
G. CARCASS ANCHORING.....	6
H. RECORDS OF CARCASS PLACEMENT	6
REFERENCES	7
APPENDIX 1. BACKGROUND INFORMATION.....	8
APPENDIX 2. CALCULATIONS OF LOADING DENSITIES FOR STREAMS WITH DIFFERENT CARCASS RETENTION PROPERTIES.....	10

Introduction

Historically, huge numbers of salmonid carcasses provided entire watersheds with abundant nutrients derived from the ocean. Recent research strongly supports the hypothesis that salmon carcasses play a key role in maintaining the productivity of salmonid systems and benefiting the aquatic and terrestrial ecosystem as a whole. Rearing juveniles consume salmon eggs, feed directly on spawned-out carcasses, and benefit from increased abundance of invertebrates and algal growth. The presence of carcasses in streams has been related to increased juvenile density, growth rate, body size, improved fish condition, improved overwintering survival and ultimately increased marine survival.

Numerous factors affect the benefits of carcass placement in streams. These include ambient nutrient content in treatment streams, abundance of native salmon spawners, retention and distribution of carcasses in waterways, water temperatures, flow levels, light penetration, and predator / scavenger activity on carcasses by insects, fish, birds and mammals.

The major intent of the present guidelines is help increase the overall benefits from carcass placement by minimizing disease risks and other concerns, providing general management strategies for carcass placement, and highlighting the interagency process to avoid conflicts with potentially affected groups and agencies.

These guidelines are intended for all enhancement facilities, including PIPs (Public Involvement Programs), and for all situations where there is the desire and the capacity to distribute salmon carcasses that might otherwise not be placed to good use. The guidelines are not intended to enforce the distribution of carcasses nor to replace harvest under an ESSR (Excess Surplus to Spawning Requirements) licence.

In the present guidelines, those streams that receive carcasses are referred to as “treatment” streams and those that provide carcasses are referred to as “donor” streams. Literature and documents that support these guidelines are available upon request. Appendix 1 provides some relevant background information.

Carcass Placement Guidelines

A. Advice, Approval, Awareness

1. All relevant groups and agencies should be advised of carcass placement plans. These groups will include area stock assessment personnel, area resource management staff, C&P Fishery Officers, local DFO habitat staff, First Nations, stewardship groups, affected landowners or other affected groups. It is also important to contact the regional Ministry of Water, Land and Air Protection office to ensure that carcass placement is coordinated with MWLAP inorganic nutrient enrichment projects. Background material and signage may also be provided to advise members of the public of carcass placement activity and its benefits.
2. Transport and deposition of carcasses will be accompanied by a letter of authorization

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B. Water Quality and Water Use Concerns

1. Under the Water Act, downstream water users (primarily local municipalities), must be advised of activities that may potentially impact water quality of their withdrawals. Accordingly, Water Licensees on treatment streams should be advised prior to placement programs in order to alleviate concerns over water quality and health issues.
2. Carcasses should be distributed in such a way as to avoid or minimize impacts on public-use areas and private property (e.g., away from domestic and other types of intakes or water supplies).

C. concerns over Disease and Chemically treated/medicated carcasses

1. Only those fish killed with CO₂ or blunt trauma will be allowed for carcass placement, and only freshly killed fish that show no visible evidence of serious disease will be used.
2. Fish that received chemical treatments or medications will not be used.
3. Generally, no carcasses may be moved outside their natal stream. However, movement of carcasses from the watershed to nearby streams may be considered if the donor and treatment streams are geographically proximate and within the zone of influence of the donor stock (i.e. adults may be straying from donor to treatment stream). Such carcass movements must be specifically approved through the PBS Fish Pathology Program.
4. For carcass transfers between watersheds where disease profiles are available, disease history should be obtained and provided upon request. If the disease history indicates a potential for introduction of a fish pathogen exotic to a particular watershed, transfer of carcasses will not be permitted.
5. For carcass transfers between watersheds where disease history is unknown, development of disease profiles may be required for donor and treatment streams.

d. Carcass loading Density

1. For coho-bearing streams where no other salmon species are present, the recommended loading density is the higher of two values – either 100 coho carcasses / km based on studies in Washington State, or the maximum historical coho escapement density for that stream reach. Where other salmon species are also present, they will be considered separately and the cumulative total used as the overall carcass loading biomass for that area (see item below).
2. For rivers with historically large runs of multiple salmon species (e.g., pink, chum, sockeye), carcass loading densities should be calculated for each species separately. That is, maximum historical escapement densities for each species should be used to determine carcass loading densities per km per species (except for coho, see item above). The sum of these densities will be the recommended overall maximum loading density for that area. Appendix 2 provides an example for calculating carcass loading

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densities where several species are present in a stream. Note that for existing DFO programs, carcass loading densities need not be changed.

3. Where agricultural, rural or other human activities are adding nutrients to the system, the majority of carcasses should be placed in the riparian zone.
4. For those streams with expected good carcass retention (low gradient, low flows, abundant pools and numerous in-stream structures such as large woody debris, beaver dams, etc.), the maximum carcass loading density may be adjusted downward by the current spawner density. Conversely, for streams with expected poor carcass retention (high gradient, high flows, few pools and few in-stream structures), no such adjustment is required. (see Appendix 2).
5. Any given carcass species may be substituted for another by first calculating the total biomass required, then converting this total into fish numbers of the available salmon species. Where system-specific weight data are not available, the following average weights for returning B.C. salmon are provided for weight conversion.

Suggested Average Weights for B.C. salmon *

Pink	1.5 kg	Steelhead	4.0 kg
Sockeye	2.5 kg	Chum	4.5 kg
Coho	3.0 kg	Chinook	8.5 kg

* Data sources: mean weights from B.C. catch statistics (J. Bateman, pers. comm.); age composition at return from Fraser et al. (1982) and Groot and Margolis (1991).

e. Temporal and Spatial Carcass Distribution

1. Use common sense for carcass placement and distribution, duplicating nature where possible. For a given treatment reach, the temporal and spatial distribution of carcasses should reflect the historic spawning timing and abundance of salmon.
2. Carcasses should be placed in stream areas that are normally (or recently historically) accessible to salmon, (i.e., not above barriers), unless specifically approved by PBS Diagnostics. However, carcass placement into inaccessible stream segments may be permitted where juveniles have been previously outplanted (e.g., colonized upper areas above impassable barriers).
3. For streams with good access, carcasses should be distributed throughout the treatment reach, both in-stream and throughout the riparian corridor adjacent to the stream. For riparian placement, carcasses may be distributed as far as 10-20 m outside the stream banks at a density of about 5 carcasses per 100 m² (based on observations of natural streams).
4. For streams with poor access (and low public use), a few accessible sites may be used for regular carcass dumping. These sites should be inspected periodically to ensure adequate natural dispersion of carcasses. Where dispersal is poor, carcass loading should be reduced.

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5. Carcasses should be distributed strategically in stable stream areas, where possible. This should help avoid rapid transport of carcasses downstream. Optimal sites include shallow, slow-moving backwaters, pools, side-channels, small headwater tributaries, areas with abundant woody debris and beaver-dam complexes.
6. If a treatment stream has a late natural spawning timing, carcasses from earlier runs may be frozen and stored for later placement. The use of frozen carcasses is also convenient for long-distance transport.
7. Carcass distribution schedule should consider anticipated problems of poor stream accessibility due to snow and other constraints.

f. Carcass Mutilation at Placement

1. Where escapement enumeration programs will be conducted on treatment streams, carcasses should be cut in half or otherwise mutilated at placement, as directed by area stock assessment staff. This is crucial in order to avoid double-counting and ensure that enumeration programs are not affected.

g. Carcass Anchoring

1. Carcasses may be tethered or anchored in place, especially in unstable, higher-flow areas as this will improve carcass retention.
2. Where carcass anchoring is desirable, natural anchors (e.g., large woody debris, log-jams, beaver-dams) or bio-degradable tethers such as natural-weave ropes, should be used where possible. External identification tags should be removed from carcasses prior to their placement.
3. Carcass placement should be avoided or delayed during high flow events, especially where anchoring and/or riparian placement is not feasible.
4. Where frozen carcasses are used, they should be tethered in place (frozen carcasses float and may be readily transported downstream). Where tethering is not possible, it is preferred to thaw out at least one fourth of the frozen carcasses before distributing them in order to enhance carcass retention at the point of access. Riparian placement of frozen carcasses is also recommended at about 5 carcasses / 100 m².

h. Records of Carcass Placement

1. Records of numbers and species of carcasses placed in treatment streams should be maintained in annual data summaries.

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Appendix 1. Background information

Disease considerations

The return of hatchery salmon carcasses to streams may pose a risk of disease transmission (e.g., if carcasses of highly infected fish are used, if carcasses are moved to within watershed areas that are normally not accessible to salmon, or if carcasses are moved to streams outside the watershed).

Carcass loading density

Carcass loading density should be specific for a given reach, sub-basin or watershed because numerous factors affect the ultimate benefits to the system. These factors include original nutrient content, water temperature, light penetration, carcass retention, and carcass redistribution through flooding and scavenging (Wipfli et al. 1999). Accordingly, when developing carcass loading densities, the above bio-physical properties of the treatment area should be considered. The present loading guidelines are based on the amalgamation of the following key points:

- 1) For B.C. streams, for upper river sections, coho spawner carcasses may be placed at densities of up to 50 per km. For lower river sections with historically large runs of pink and chum, the stream's historic escapement levels may be used to determine carcass loading densities (M. Sheng, pers. comm.).
- 2) For Northwest Pacific streams where only coho are known to return, 93-155 salmon carcasses per km of stream should provide maximum ecological benefit from marine-derived nutrients (R.E. Bilby, pers. comm. in Gresh et al. 2000).
- 3) Carcass placement guidelines by Washington Department of Fish and Wildlife (WDFW 2002):
 - a) For coho salmon, the target level is 0.15 kg / square metre of stream surface area (based on a bankfull channel width). The same value can be used for steelhead as the life histories of the two species are similar. (The above density translates into 100 coho carcasses / km; for this conversion, we used a stream segment 1 km long by 2 m wide, and a mean coho weight of 3 kg).
 - b) For mass spawning pink, sockeye and chum salmon, 0.78 kg / square metre will be used.

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- c) For chinook which is a mass spawning species but also uses the freshwater environment for rearing up to a year, a value of 0.39 kg per square metre will be used.
 - d) For treatment streams where estimates of natural spawning escapement are made, carcass loading can be reduced by the recent 5-year moving average for natural escapement to treatment reach.
 - e) For determining total carcass deposition maximums, the area historically available to each species will be used to calculate the loading rates. This will result in a separate calculation for each species. Spawning timing will need to be factored into distribution schedules.
- 4) Maximum loading densities may be adjusted to reflect the stream's carcass retention properties. Carcass retention in streams is affected by predator / scavenger activity, carcass transport during high flows, and abundance of in-stream structures to catch and retain carcasses (Bilby et al. 2001). Accordingly, our guidelines suggest that for streams with expected poor carcass retention, maximum carcass densities may be adjusted downward by the current spawner densities. Conversely, for streams with expected poor carcass retention, no such adjustment is needed.
- 5) All salmonid carcasses are considered equal from a nutrient content basis. That is, the actual distribution goal may be calculated as biomass and then converted to fish numbers of the available species. For example, chinook carcasses may be substituted for coho, and vice versa (WDFW 2001). See present Guidelines (Section D-6) for suggested average weights of B.C. salmon.

Spatial and temporal carcass distribution

Carcasses should be distributed throughout both the stream and the riparian corridor (adjacent to stream banks). Riparian placement is particularly beneficial as this is the key to a slow, long-term release of nutrients from carcasses. Slow migration of nutrients into the soil will benefit local biota, water chemistry in the stream, and the ecosystem as a whole.

Timing of carcass placement is also important as nutrients should be made available to young salmon upon their emergence from the gravel (Bilby et al. 1998). Timing may be early, mid or late, and may be used to influence the ecological response to loading within watersheds. For example, the use of later runs (fall and winter) may benefit the next growing season, provided that some nutrients are stored through the winter (Wipfli et al. 1999). Also, the use of carcasses from several species, each with a different run timing (e.g., early sockeye, mid-chum, late coho), will provide a longer nutrient pulse in the treatment stream than if only one or two species were used, each with a brief spawning period (Wipfli et al. 1999).

Appendix 2. calculations of loading densities for streams with different carcass retention properties

The following examples show calculations of carcass loading density for two 1-km long streams where both coho and chinook salmon are present. These streams have identical historical and current escapement densities for each species. However, stream (A) has excellent carcass retention properties (low gradient, low flows, and numerous pools and in-stream structures), while stream (B) has poor carcass retention properties (high gradient, high flows, and few pools and in-stream structures).

Stream A. Expected high carcass retention – Loading density may be adjusted downward by natural spawner density.

	Coho	Chinook
Average weight	3 kg	8.5 kg
Max. historical escap. density	40 / km	200 / km
Current escapement density	20 / km	80 / km
Adjusted loading density*	$(100^{**} - 20) = 80 / \text{km}$	$(200 - 80) = 120 / \text{km}$
Recommended loading biomass	$(80 \times 3 \text{ kg}) = 240 \text{ kg} / \text{km}$	$(120 \times 8.5 \text{ kg}) = 1,020 \text{ kg} / \text{km}$

Total recommended biomass (Chinook + Coho) = 1, 260 kg / km

* Adjusted loading density = (Recommended max. loading density less Current natural spawner density).

** For coho, used 100 coho / km stream as this exceeds the maximum historic escapement density.

Stream B. Expected low carcass retention – No adjustment required.

	Coho	Chinook
Average weight	3 kg	8.5 kg
Max. historical escap. density	40 / km	200 / km
Current escapement density	20 / km	80 / km
Adjusted loading density*	-	-
Recommended loading biomass	$(100^{**} \times 3 \text{ kg}) = 300 \text{ kg} / \text{km}$	$(200 \times 8.5 \text{ kg}) = 1,700 \text{ kg} / \text{km}$

Total recommended biomass (Chinook + Coho) = 2,000 kg / km

* No adjustment is needed.

** As for stream (A) above.

Appendix B.

**Minutes from Salmon Carcass Workshop
June 14, 2002, Parksville, BC.**

MINUTES

Salmon Carcass Workshop

Held June 14, 2002, at the Best Western Bayside Inn Resort, Parksville

- Present:

Tom Forrest	DFO, Technician, Little Qualicum Project
Barry Cordocedo	DFO, Community Advisor, Nanaimo
Patti McKay	CDP Hatchery, Nanaimo
Henry Bob	CDP Hatchery, Nanaimo
Tom Rutherford	DFO, Community Advisor, South Island
Dave Davies	DFO, Community Advisor, Central Island
Eric Fortkamp	DFO, Technician, Quinsam Hatchery
Chris Beggs	DFO, Manager, Puntledge Hatchery
Ken Ashley	MWLAP, UBC Research
Tony Massy	MWLAP, Technician, Vancouver Island Trout Hatchery
Harlan Wright	BCCF, Technician, Nanaimo
James Craig	BCCF, Technician, Nanaimo

- Meeting commenced at 0900h.

- Project background and scope – Craig (Chair).

- PowerPoint presentation – Ashley. History and role of marine-derived nutrients (MDN), salmon anadromy, keystone species, and concepts of the “Anadromous Nutrient Pump” and the “Nutrient Shadow.”

- Review of “Guidelines for In-stream Placement of Hatchery Carcasses” – DFO Draft Policy Paper, May 2002. Each section of the *Carcass Placement Guidelines* was discussed:
 - A. Advice, Approval, Awareness. Participants agreed that a short, concise **procedures booklet** would be beneficial for both agency reps and public groups – Craig. Booklet would have all required contacts and steps laid out, and be locally based, i.e., focus (initially at least) on this project’s target area – Victoria to Campbell River. The Public Information Pamphlet (DFO draft) is a good start and could be an introductory component of the booklet, or a stand-alone pamphlet to promote the carcass concept to the public. Participants agreed that carcass programs in general are ultimately the mandate of Carol Cross (DFO Vancouver).
 - B. Water Quality and Water Use Concerns. Key among the users in the target area would be local municipalities.
 - C. Disease and Chemically Treated/Medicated Carcass Considerations. Currently within the target area, only Puntledge CH (summer run females) are treated with antibiotics. These are all landfilled - there is rarely a “3 week” clean out, thus no opportunity for use - Beggs. This project’s scope does not include carcass transfers outside their native watersheds (though one transfer of chums has been arranged on the South Island between Goldstream and Mount Douglas creeks for this coming season – Rutherford). BKD cited as a common disease in target area – must consider when moving fish between sub-basins etc. At Puntledge, fish with visual signs of BKD are rejected for carcass placement – Beggs. Participants questioned the validity of item #7 (freezing carcasses for 48 hours at –20°C for carcass transfers between watersheds). Group acknowledged that freezing was certainly convenient (transport as well as storage), and several strategies were discussed.
 - D. Carcass Placement Density. Participants in agreement with most of this point, stressing the desire to achieve historic escapement level densities (lesser when there are agricultural or rural activities adding nutrients). Some participants agreed that Item #4 is confusing – clarification required here – must define L, M, H gradient – Cross.

- E. Temporal and Spatial Carcass Distribution. Group agreed that a diverse approach is best, with placement mirroring nature where possible (throughout riparian corridor).
 - F. Carcass Mutilation at Placement. Participants agreed this is crucial to avoid escapement estimation errors. Only complication may be when a retention component is planned, i.e., tethering carcasses in position. Though this scenario is unlikely, carcass halves would have to be tied individually, by “stringer” method (through gills), and by tail (around caudal peduncle).
 - G. Carcass Anchoring. Aesthetics considered important here – carcass “cages” may be efficient, but group agreed procedures should be natural (ie. biodegradable pre-made tethers). Need to capitalize on volunteer labour where possible.
 - H. Records of Carcass Placement. DFO’s “ENPRO” database being brought into hatcheries (– Fortkamp) suggested as template for a waterproof form – Craig. Form easy enough for agency or public use.
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1215h – 1300h: Lunch.

- Existing Programs / Discussion. Detailed spreadsheet to follow – Craig.

Rutherford (South of Chemainus):

- Broodstock only programs (with new Mt. Douglas Creek exception).
- No retention techniques used.
- Will forward contact/program details.
- 3 groups have expressed interest in a carcass program:
 1. Hancock Forest Products (Lake Cowichan tribs)
 2. Friends of Mount Douglas Creek
 3. Cowichan Lake Salmon Society

Cordocedo (Chemainus to Nanoose):

- Broodstock only programs, typically less than 50 adults, typically returned to capture site.
- Works primarily with 4 First Nations (paid by AFS), Ladysmith Sportsman’s Club (vol), Nanaimo CEDP (paid), Malaspina College (vol).
- Advocates common sense, duplicating nature where possible
- No retention techniques used.
- Other possible participants: Nanaimo Area Land Trust, Nanaimo F&G.
- Will forward contact/program details.

McKay/Bob (Nanaimo CEDP):

- Potential to better use CM brood carcasses
- Using clove oil as anesthetic for maturity checks, etc – OK for carcass distribution.
- Would like to see L. Hansen water chemistry data on Nanaimo – Craig.
- Nanaimo F&G (Al Brown) ready for carcass program.

Davies (Parksville to Oyster):

- All volunteer, many elderly, 28 groups!
- 15 streams with carcass placement (mostly broodstock)
- No retention techniques used.
- Most intensive program is Fanny Bay: 5 years running, carcasses frozen and labeled, placed in late season.
- WEST COAST: Gold River Streamkeepers/Chinook Club has annual target of 1M CH eggs (rarely meet) – may be potential to distribute CH carcasses in upper Gold.

- Would like to see L. Hansen water chemistry data on Oyster – Craig.
- Oyster PKs – potential to distribute in upper river (steelhead parr habitat).
- Will forward contact/program details.

Forrest (Little Qualicum):

- ESSR in place (CH brood carcasses).
- 15-30% of CM pitched from channel composted.
- ~60% pitched and dumped on fields adjacent to channel.
- In last couple of years, up to 5% trucked and dumped in Glory Hole (~ 1.5 km downstream of anadromous barrier) and on Waring's land per MELP request. Note made that Little Qualicum "Jam" was bypassed during Jan 11 flood and thus would not capture as many carcasses in upper river as in the past.
- Largest "roadblock" to better distribution is manpower/funding – when die off starts, barely enough time to pitch – little time to distribute. If volunteer group coordinated, there is potential for improved distribution.
- Whisky Creek seen as good candidate for re-distribution, particularly in light of recent barrier removal. Also, confirmation that nutrient levels are indeed low in the mainstem – system may be productive enough? Water chem data required – Craig.
- Swamp on right (south) bank near Ozero's bridge also potential carcass site.

Beggs (Puntledge):

- ESSR in place (CO and CM)
- Portions of CH and CO brood injected and landfilled as a result.
- Approvals for live and dead fish similar – easier to enroll volunteers to assist with live transfers (accomplishes carcass objectives).
- Copper still a problem in Tsolum, but tribs receive live transfers (7.5K PK to Headwaters) and 4K-5K CM to Tsolum
- 3K-3.5K live PK to Tsable.
- Courtenay F&G and Tsolum River Restoration group active.

Fortkamp (Quinsam):

- At least 6 years of outplanting carcasses so far.
- 5 sites currently receive carcasses:
 1. outlet of Middle Quinsam Lake
 2. Elk River Mainline bridge crossing
 3. John Hart spillway
 4. Elk Falls side channel
 5. Raven log dump (side channel?)
- 31,000 kg to Quinsam, 50,000 kg to Campbell (22K PK, 2K CH, 2.5K CO)
- Water sampling program (BCRP funded) scheduled for mid August 02-March 03 using lakes as controls.
- Some live transfer of PK to Mohun and Menzies creeks.
- Quinsam is CH key stream – all are cut in half when counted.

Meeting adjourned at 1530h.

Appendix C.

Draft Workbook:
Salmon Carcass Planting Procedures for
Public Stream Stewardship Groups

DRAFT

Salmon Carcass Planting Procedures

for

Public Stream Stewardship Groups



INTRODUCTION

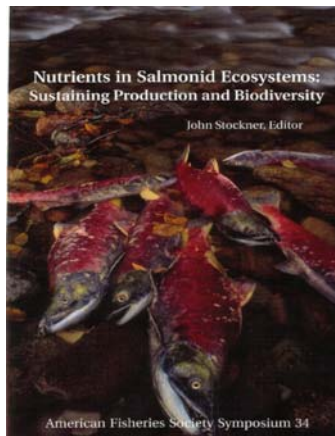
This booklet was designed to assist stream stewardship groups, small community hatcheries and non-government organizations with salmon carcass planting programs. Much of the content is based on the draft Fisheries and Oceans Canada document ***Guidelines for In-stream Placement of Hatchery Carcasses***. The first section outlines factors that must be considered in deciding if a carcass program is applicable in the target watershed. If applicable, all stakeholders must be advised in advance and approval must be obtained from Fisheries and Oceans Canada. The second section lists contacts and outlines the steps involved in making a proposal. The final section describes carcass planting techniques and methodology.

IS SALMON CARCASS PLANTING APPLICABLE IN YOUR AREA OR TARGET WATERSHED?

Before starting a carcass planting program, consider the following issues:

1. **Does the target stream need enhancement?** Salmon carcass programs are generally intended to improve distribution and retention in areas that had stronger salmon runs historically. Carcasses should not be placed upstream of barriers where salmon were not historically present, and carcasses should only be placed in areas where existing densities are low.

A good description of the benefits salmon carcasses provide to freshwater ecosystems can be obtained through the following publication:



Stockner, J. 2003. *Nutrients in Salmonid Ecosystems: Sustaining Production and Biodiversity*, American Fisheries Society Symposium 34.

2. **Is there a source of salmon carcasses in your area?** Transporting salmon carcasses between different watersheds requires special approval. This approval can be gained through the Federal-Provincial Introductions and Transfers Committee. Generally, there should be a source of carcasses within the target watershed. Typical sources include:
 - a. DFO and community hatcheries,
 - b. man-made spawning channels,
 - c. stream channels with high numbers of spawning salmon.

Salmon carcasses intended for planting must not have:

- a. received chemical treatments, medications, or anesthetics (except clove oil or CO₂).
- b. obvious evidence of serious disease.

3. **Other concerns:**

- a. Can access be gained to the target area by vehicle? Loading rates can require high numbers of carcasses be placed in or near the stream. Therefore, vehicle access to the placement sites is usually necessary.
- b. Are there enough workers/volunteers available? Carcass planting can require significant manual labour and co-ordination to be successful.
- c. What level of public use occurs in the target area? Rotting salmon carcasses are unsightly and have a strong odour. Site selection must consider these factors.

NOTIFICATION/APPROVAL

Be sure to notify all relevant groups and government agencies of your proposed carcass planting program and receive approval before taking the next step. Refer to the list of contacts at the end of the booklet.

APPROVAL

Approval can be obtained from DFO Habitat Enhancement Headquarters in Vancouver. The proposal should be addressed to:

Carol Cross, Senior Assessment Biologist
200 – 401, Burrard St., Vancouver, BC V6C 3S4
Tel: (604) 666-8598
crossc@pac.dfo-mpo.gc.ca

The proposal should include the following details:

1. Proponent/co-ordinator contact information
2. Brief rationale – describe why carcass retention/distribution is applicable to the target area
3. Carcass source
4. Carcass planting locations – include a detailed map with sites and access points identified
5. Loading rate – number of carcasses of each species
6. Number of carcasses placed in the stream vs. riparian zone
7. Anchoring method used (i.e., tethering, placement amongst woody debris) if applicable
8. People and/or organizations in support of the proposal (attach letters or emails of support)

CARCASS PLANTING PROCEDURES

When distributing carcasses, there are several factors that must be considered. Loading rates should be based on fish size and historic escapements. Also, vehicle access and stream flows can play a large role in spatial and temporal distribution.

Loading Densities:

The following guidelines should be applied when calculating the number of carcasses to be placed in an area:

1. Coho bearing streams with no other salmon species – load at either 100 fish/km, or match maximum historic escapement densities.
2. Multi-species streams – loading rates for each species must be calculated separately based on historic escapement data (except for coho, where a standard 100 fish/km may be applied). The cumulative total is the total carcass loading biomass.
3. Specific species may be substituted for another by first calculating the total biomass required and dividing by the average weight of the substitute species. If stock specific average weights are not available, the following average weights can be used for these calculations:

Pink	1.5 kg
Sockeye	2.5 kg
Coho	3.0 kg
Steelhead	4.0 kg
Chum	4.5 kg
Chinook	8.5 kg

Loading rates can be adjusted up or down based on common sense. In low flow areas with potential for better than average retention, fewer carcasses should be planted. In high flow areas more carcasses can be distributed.

Distribution Guidelines:

1. When access is good, plant carcasses throughout the treatment reach. Place carcasses in the stream and in the riparian area adjacent to the stream. For stream placement – carcasses should be placed in backwater areas, pools, and amongst woody debris to increase retention. For riparian placement – keep within 20 m of the stream, and load at a density of approximately 5 carcasses per 100 m².
2. When access is poor, a small number of locations may be used for regular carcass dumping. These sites should be monitored to ensure carcasses are being distributed downstream. Confirm there is low public use in the dumping area.

Anchoring:

Anchoring carcasses is recommended in high-flow areas, and when low numbers of carcasses are available. Carcasses can be secured with biodegradable tethers and/or placed amongst large woody debris to increase retention.

Data Recording:

Records of carcass numbers and species should be maintained in annual data summaries. A standard data template that is compatible with DFO's ENPRO data base is being developed.

CONTACTS

Water Licensees

Downstream water users must be advised of activities that may potentially impact water quality of their withdrawals. Therefore, Water Licensees on treatment streams should be notified to alleviate concerns. Information on community water use can be obtained through the local municipal office.

Other Relevant Groups

Local First Nations, community stewardship groups, landowners, and other affected groups should be advised of carcass planting activity.

A representative for the area from each of the following government agencies should be consulted:

Department of Fisheries and Oceans Community Advisors

Aleria Ladwig – Northern Vancouver Island, Tsitika River on east coast to Gold River on west; mainland, Knight's Inlet to Cape Caution
Box 10 Port Hardy, BC V0N 2P0
Tel: (250) 949-1558 Fax: (250) 949-6755
Email: ladwiga@pac.dfo-mpo.gc.ca

Barry Peters – Campbell River area
150-1260 Shoppers Row, Campbell River, BC V9W 2C8
Tel: (250) 286-5823 Fax: (250) 286-5896 Cellular: (250) 230-2113.
Email: PetersB@pac.dfo-mpo.gc.ca

Dave Davies – Central portion, east coast of Vancouver Island and adjacent mainland inlets
148 Port Augusta Street, Comox, BC V9N 7Z4
Tel: (250) 339-0431 Fax: (250) 339-4612 Car: (250) 338-3325
Email: daviesd@pac.dfo-mpo.gc.ca

Barry Cordocedo – Central west coast of Vancouver Island, east to Nanaimo, south to Chemainus
3225 Stephenson Point Rd. Nanaimo, BC V9T 1K3
Tel: (250) 756-7263 Fax: (250) 756-7020
Email: CordocedoB@pac.dfo-mpo.gc.ca

Tom Rutherford – Lower Vancouver Island, including southern Gulf Islands & Cowichan River
Box 241-5653 Club Road, Duncan, BC V9L 3X3
Tel: (250) 746-5137 Fax (250) 746-8397
Email: RutherfordT@pac.dfo-mpo.gc.ca

Department of Fisheries and Oceans Habitat Restoration Biologists

Mel Sheng, South Coast Habitat Restoration Biologist
4166 Departure Bay Road, Nanaimo, BC V9T 4B7
Tel: (250) 756-7016 Fax: (250) 756-7088
Email: ShengM@pac.dfo-mpo.gc.ca

Shannon Anderson, Central Coast Habitat Restoration Biologist
150-1260 Shoppers Row,
Campbell River, BC V9W 2C8
Tel: (250) 286-5807 Fax (250) 286-5898
Email: AndersonS@pac.dfo-mpo.gc.ca

Department of Fisheries and Oceans Salmon Stock Assessment

Kent Simpson, Program Head, South Coast Area Salmon Stock Assessment (Oyster River south)
3225 Stephenson Point Rd. Nanaimo, BC V9T 1K3
Tel: (250) 756-7180 Fax: (250)
Email: SimpsonK@pac.dfo-mpo.gc.ca

Pieter VanWill, Johnstone Strait Salmon Stock Assessment Coordinator (Campbell River north)
2159 Unit 10, Port Hardy, BC V0N 2PG
Tel: (250) 949-9273 Fax (250)
Email: VanWillP@pac.dfo-mpo.gc.ca

Ministry of Water, Land and Air Protection

Craig Wightman, Senior Fisheries Biologist, Vancouver Island Region
2080-A Labieux Road, Nanaimo, BC V9T 6J9
Tel: (250) 751-3230 Fax (250) 751-3103
Email: Craig.Wightman@gems4.gov.bc.ca

Appendix D.

Proposal submission and approval for Little Qualicum River pilot project

Attention: Carol Cross
Fisheries and Oceans Canada
Vancouver, BC

Project Proposed: Little Qualicum Project (LQP) Chum Carcass Distribution

Proponent: James Craig, Fisheries Technician
BC Conservation Foundation (BCCF)
3-1200 Princess Royal Avenue,
Nanaimo, BC V9S 3Z7
(250) 716-8776
email: jcraig@bccf.com

Target Date: November 29 and 30, 2002 (approximate)

Objective: Involve the local community stewardship group in increasing wild fish production (primarily steelhead, coho) in the Little Qualicum watershed through improved use of chum carcasses from spawning channel deadpitch operations.

Background: This small project is part of a larger seed program funded by the Habitat Conservation Trust Fund in 2002/03. The “Salmon Carcass Retention/Distribution Program” was proposed by BCCF to better utilize marine-derived nutrients (carcasses) in east coast Vancouver Island watersheds with the aim of improved freshwater survival rates of stream rearing salmonids, particularly depressed winter steelhead stocks. A Carcass Workshop was held in June 2002 and involved ECVI hatchery representatives and Community Advisors. BCCF has been under contract by the province since 1998 conducting steelhead stock assessment and habitat restoration primarily on the east coast of Vancouver Island.

Proposed Activities:

This project will only deal with carcasses within the Little Qualicum watershed. NO TRANSFERS OUT OF THE WATERSHED WILL OCCUR, AND NO CARCASSES WILL BE DISTRIBUTED ABOVE ANADROMOUS BARRIERS. As a result, no disease issues need be considered. As chum carcasses pitched from the LQP’s spawning channel are natural, post-spawn mortalities, there are no chemical and/or medical treatment issues. There are no potential impacts on the quality of water withdrawals beyond what normally occurs in these streams during the salmon season. Where access is required (Whisky Creek, Ozero Road), landowners have been notified and are supportive of the program.

Chum carcasses will be moved from the LQP spawning channel to three areas in the Little Qualicum watershed:

1. Little Qualicum River mainstem (Note: anadromous falls is at river km 11.5):
 - Inland Island Highway 19 bridge access (~2 km downstream of falls)
 - “Glory Hole” access (~1 km downstream of falls), and
 - Ozero Bridge access (~800 m downstream of falls).
2. Whisky Creek (Little Qualicum watershed) at site of recent dam removal (~1 km downstream of Melrose Road).
3. Kinkade Creek (Little Qualicum watershed) at Corcan Road bridge crossing (~2.4 km upstream of the confluence with Little Qualicum River).

Over two days, carcasses will be loaded onto a rented 3/4-ton 4x4 pick up truck, 250 at a time (1,125 kg), using the facility's conveyor belt system and/or by hand. LQP staff believe this procedure will have minimal or nil impact on their normal dead-pitch operation. Qualicum Beach Streamkeepers will supply labour for loading and off loading/distribution. Loading will average 15 minutes and distribution will range from ¾ to 1.5 hours. The truck will be rented for two days, and we hope to distribute 14 loads. BCCF will supervise, document, supply necessary equipment/materials (extra waders, gloves, pew sticks, safety/first aid, tethers, etc) and report results to FOC stock assessment, habitat, hatchery and CA staff.

Target Distribution (assumes 14 loads – may be optimistic):

Location	# carcasses	# truck loads ¹	Weight ² (kg)
Mainstem @ Hwy 19	1,000	4	4,500
Mainstem @ Glory Hole	750	3	3,375
Mainstem @ Ozero Bridge	750	3	3,375
Whisky Creek @ old dam site	250	1	1,125
Kinkade Creek @ Corcan Road	250	1	1,125
Totals	3,200	14	13,500

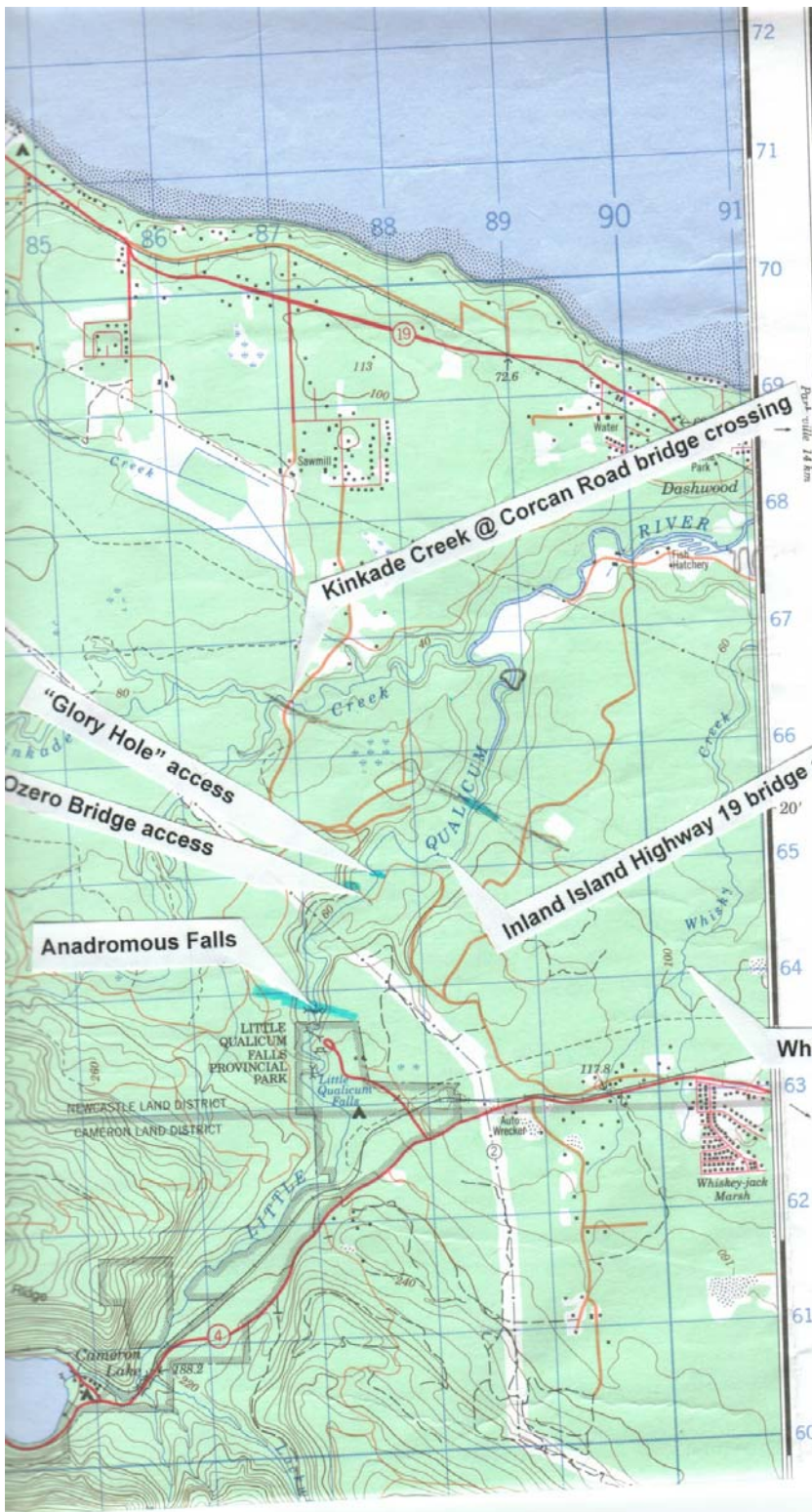
¹ Based on a ¾ ton rental truck.

² Assumes 4.5 kg/chum (*Guidelines for In-stream Placement of Hatchery Carcasses, DRAFT, Sept 2002*)

Preliminary escapement estimates are good for 2002 Little Qualicum chum (J. Hargrove, Technician, Little Qualicum Project, pers. comm.). As there is likely to be a reasonable number of fish in the stream channel, our distribution efforts will focus on **improving retention** in the upper watershed. In all cases, these sites are relatively high in the watershed (still below barriers) where natural salmon distribution has been relative low. At least 50% of the carcasses will be placed in the riparian corridor just off the stream channel to provide nutrients through hyporehic zone ground water. The other half will only be placed in off-channel wetted areas, and in the channel near LWD to increase retention. Carcasses will be spread out spatially as much as possible, given the low number of accesses available. Where carcasses are placed instream, a loading density of 14 fish/unit (unit=100m2) will be strived for (*Guidelines for In-stream Placement of Hatchery Carcasses, DRAFT, Sept 2002*). Some tethering may occur if time permits, and the success of this will be monitored. The three mainstem sites are located in a reach that sees high use by steelhead, as documented by extensive adult surveys and juvenile assessments (MWLAP files, Nanaimo).

There are no costs to FOC. BCCF will cover all expenses for the operation, and will be responsible for all coordination and reporting.

Page 3 is an NTS map showing the five proposed carcass placements and the mainstem anadromous falls.



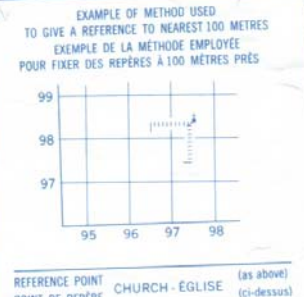
METRIC/MÉTRIQUE

Use diagram only to obtain numerical values
 APPROXIMATE MEAN DECLINATION 1991
 FOR CENTRE OF MAP
 Annual change decreasing 7.3'

N'utiliser le diagramme que pour obtenir les valeurs numériques
 DÉCLINAISON MOYENNE APPROXIMATIVE
 AU CENTRE DE LA CARTE EN 1991
 Variation annuelle décroissante 7.3'

ONE THOUSAND METRE
 UNIVERSAL TRANSVERSE MERCATOR GRID
 ZONE 10
 QUADRILLAGE UNIVERSEL, TRANSVERSE DE MERCATOR
 DE MILLE MÈTRES

GRID ZONE DESIGNATION DÉSIGNATION DE LA ZONE DU QUADRILLAGE:	100 000 m SQUARE IDENTIFICATION IDENTIFICATION DU CARRÉ DE 100 000 m
10U	CK



Whisky Creek @ site of recent dam removal

ABSCISSE: Noter le chiffre de la ligne du quadrillage immédiatement à gauche du repère:	97
Estimate tenths of a square from this line eastward to point. Estimer le nombre de dixièmes du carré entre cette ligne et le repère en direction est:	$\frac{5}{975}$
NORTHING: Read number on grid line immediately below point. ORDONNÉE: Noter le chiffre de la ligne du quadrillage immédiatement en dessous du repère:	98
Estimate tenths of a square from this line northward to point. Estimer le nombre de dixièmes du carré entre cette ligne et le repère en direction nord:	$\frac{4}{984}$
GRID REFERENCE:	984
REFERENCE AU QUADRILLAGE:	975984
Nearest similar grid reference 100 000 metres La référence similaire la plus près est à 100 000 mètres	

From: LadouceurG@pac.dfo-mpo.gc.ca
To: jcraig@bccf.com
Cc: SlobodzianP@pac.dfo-mpo.gc.ca, GouldAI@pac.dfo-mpo.gc.ca
Subject: LQ Carcass Distribution
Date: Fri, 22 Nov 2002 16:16:03 -0500
X-Mailer: Internet Mail Service (5.5.2654.89)

James, this is to advise you that your proposal has been reviewed and approved by Carol Cross and area staff. Please contact Pat at LQ to arrange for carcass pick up. I suggest that you mobilize quickly (by early next week) to access fresh fish being pitched/conveyed from the channel, otherwise the task becomes more labour intensive and unpleasant; salvaging ugly ones from the compost pile or field.

Grant

Appendix E.

**Summary of carcass distribution during
pilot field project on the Little Qualicum River**

Little Qualicum Project - Carcass Distribution
November 26, 2002

Origin:

Load #	From	CM Fem	CM Male	CM Total	CO Fem	CO Male	CO Total	Carcass Total	Comments
1	Diff #5	*	*	218	0	0	0	218	* counted by Tom (M/F breakdown)
2	Diff #5	133	117	250	0	0	0	250	
3	Diff #5	166	169	335	0	0	0	335	
4	Diff #4 & above	107	108	215	13	5	18	233	
4	Lab			69				69	already counted and sampled by Shane
TOTAL		406	394	1087	13	5	18	1105	

Destination:

- Load 1** all beneath Inland Island Highway bridge crossing, right bank, riparian edge d/s of bridge
Load 2 all beneath Inland Island Highway bridge crossing, right bank, riparian edge u/s of bridge
Load 3 66 to Glory Hole off Ozero Road, right bank and riparian edge.
127 to wetland on south side of Ozero Road, between Glory Hole and Ozero Bridge.
142 to Ozero Bridge crossing, north side, riparian area above and below abutment
Load 4 64 to Ozero Bridge crossing, south side, riparian edge
60 directly into river channel beneath Ozero Bridge
68 to Ozero Bridge crossing, north side, riparian area above and below abutment
110 to Kinkade Creek at Corcan Road, in and adjacent to stream channel above culvert.

Notes: *Marked chum were left for sampling by LQP staff*
All coho were checked for marks - none found.
Volunteers: Qualicum Streamkeepers (Peter Dawe, Peter Drummond, Kyrti Eno, Doug Taylor)
Vehicle: Rented Budget 3/4 ton 4x4

Appendix F.
Project Cost Summary

British Columbia Conservation Foundation
 Project Summary Statement of Expenditures

Today's Date : 03/04/2003

Regional
 Coordinator: Pat Stephenson

CLIENT NAME :	Craig Wightman	PROJECT NAME	Salmon Carcass Retention
CLIENT AGENCY:	MWLAP	BCCF PROJECT #	110327
ADDRESS :	2080-A Labieux Road	CLIENT CONTRACT #	0
CITY, PROVINCE :	Nanaimo, B.C.	TOTAL CONTRACT	3,544.00
POSTAL CODE :	V9T 6J9	FEES	393.78
TEL. NUMBER :	250-751-3100	CARRY-OVER OR	
FAX NUMBER :	250-751-3103	SUBSIDY	0.00
			3,150.22

GL ACC'T.	EXPENDITURE	AMOUNT
	3050 Fees Earned	393.78
	4050 Equipment Rental	0.00
	4051 Other charges	0.00
	Project Coordinator	
	4055 Wages	0.00
4056..5030	Contract wages	2,208.26
	5110 Sub Contracts	0.00
	5210 Equipment > 100	0.00
	5220 Equipment < 100	0.00
	5230 Equipment Repairs	0.00
	5235 Rentals	0.00
	5240 Communications	0.00
	5245 Computer costs	0.00
	5300 Materials/Supplies/Courier	45.01
	5400 Project Publications	8.30
	5500 Vehicle Operating Costs	0.00
	5520 Transportation	156.19
	5530 Vehicle Rental	108.78
	5540 Mileage (only)	30.96
	5545 Travel Costs/fuel	78.43
	5550 Accommodation/Food	454.95
	5560 Per Diems	11.25
	5600 Miscellaneous :	18.31
	5700 Training/Safety	0.00
	5800 GST	29.78
	Total Project Costs	3,544.00