

2010 Lower Fraser River Sockeye Recreational Hook and Release Mortality Study

Summary of Findings

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Background

- Prior to 2008 there had been no mortality studies for sockeye caught and released in freshwater using recreational gear.
- In recent years, the Department has been using a 10% mortality rate for sockeye that have been hooked and released in freshwater.
- Due to the nature of bottom bouncing, the majority of sockeye caught with this method are primarily hooked on the outside of the mouth or head. The location and degree of hooking injuries suggests that mortality rates should be low, however this needs to be quantified.

Introduction

- In 2007, the Cheam Band submitted a proposal to the Fraser Salmon & Watershed Program (FS&WP) to conduct a recreational hook and release sockeye mortality study. The study was not conducted.
- In 2008 and 2009, the FS&WP lead the development of a comprehensive study design to estimate short-term (0-24h) release mortality on sockeye caught and released in the lower Fraser River recreational fishery.
- The study design team worked with First Nations, recreational anglers, consultants and DFO employees to ensure agreement on study design, goals and implementation.

Study Design & Partnerships

- JOT: Jim Thomas, Project Biologist
- PSF/FSWP: Terry Tebb, Andrew Stegemann
- DFO (Stock Assessment): Sue Grant, Richard Bailey, Jason Mahoney, and Joe Tadey
- DFO (Resource Management): Debra Sneddon
- FRAFS: Pete Nicklin, Mike Staley
- BCWF: Bill Otway and Ed George
- BCFDF: Rod Clapton
- FVSS/SFAC: Frank Kwak
- LFR-FN: Isaac Aleck, Lester Mussell, Chemaine Douglas, Patricia Kelly
- Physiology and Radio Tagging (UBC-CACR): M. R. Donaldson (UBC), D. Patterson (DFO), J. Hills (DFO), S. J. Cooke (Carlton), G. Raby (Carlton), K. K. English (LGL), D. Robichaud (LGL), and S. G. Hinch (UBC)
- 100+ volunteer anglers

Objectives

- The primary objective of the study was to estimate the short-term (0-24 h) mortality of hooked sockeye in a recreational catch & release fishery that commonly occurs in the Fraser River.
- A secondary objective was to assess the influence of selected angling variables like hooking location, hook size, leader length, landing method, degree of bleeding/scale loss, river environment, etc. on hooking mortality rates.
- A third objective was to insert radio tags into sockeye caught by anglers or beach seine and to track their survival and migration after immediate release. Additional physiological data was also collected from a cross-section of captured sockeye.

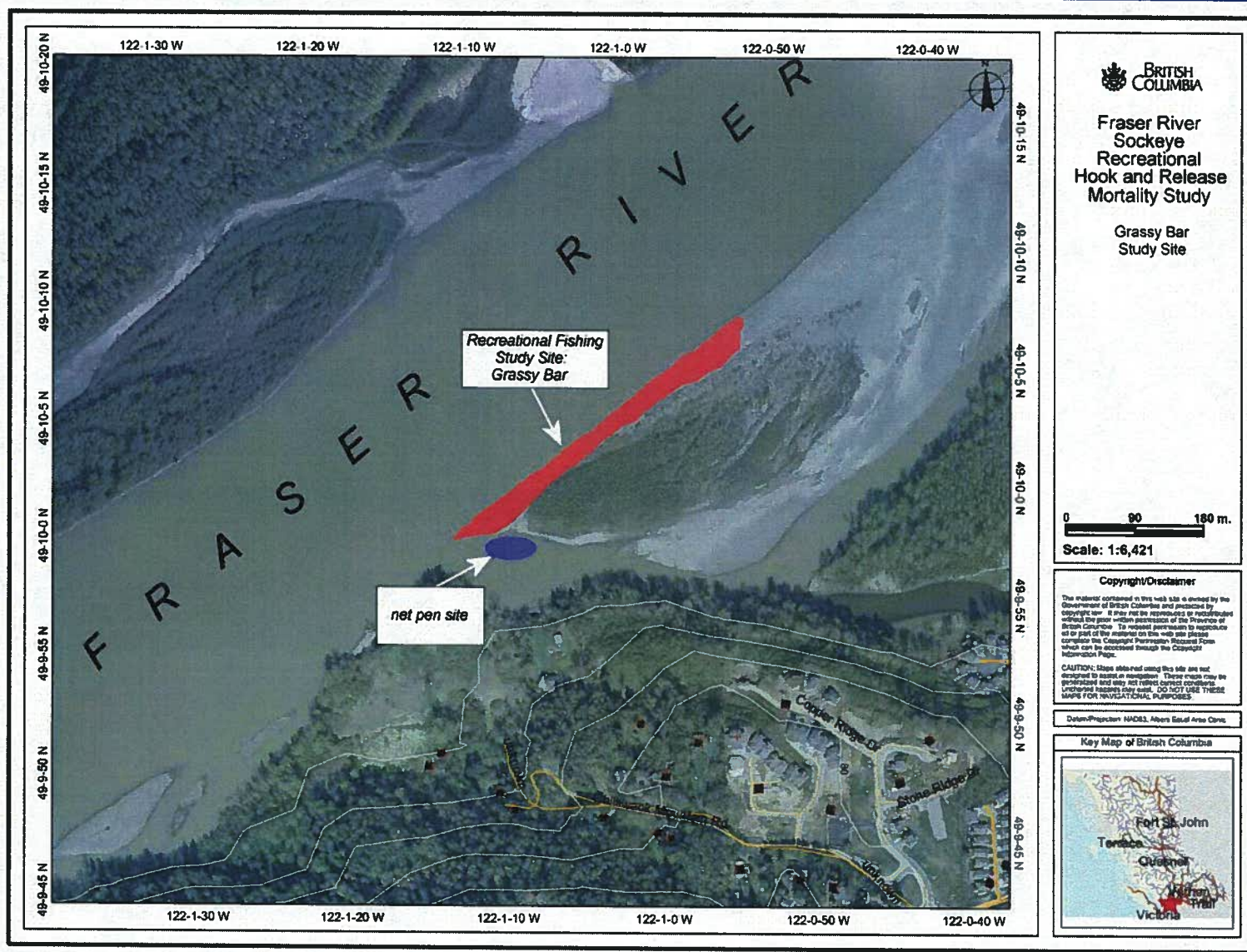
2010 Study Plan

- The 2010 study resumed at Grassy Bar and repeated the study design and methodology used in 2008 and 2009.
- Radio tagging was expanded from 99 sockeye in 2009 to 163 sockeye in 2010, with all tags applied to angled or beach seined sockeye released immediately after tagging.
- The 2010 study was conducted over three weekly periods from Aug 9 to 26.

Methodology

- Sockeye were caught by anglers using a range of bottom-bounce gear and angler experience.
- Handling methods were representative of catch and release practices common during in-river sockeye recreational fisheries.
- A reference group of sockeye captured by beach seine was included in the study to estimate the hooking mortality by adjusting for any mortality that might be associated with handling, fish transport, and holding in net pens.

Study Location



Results:

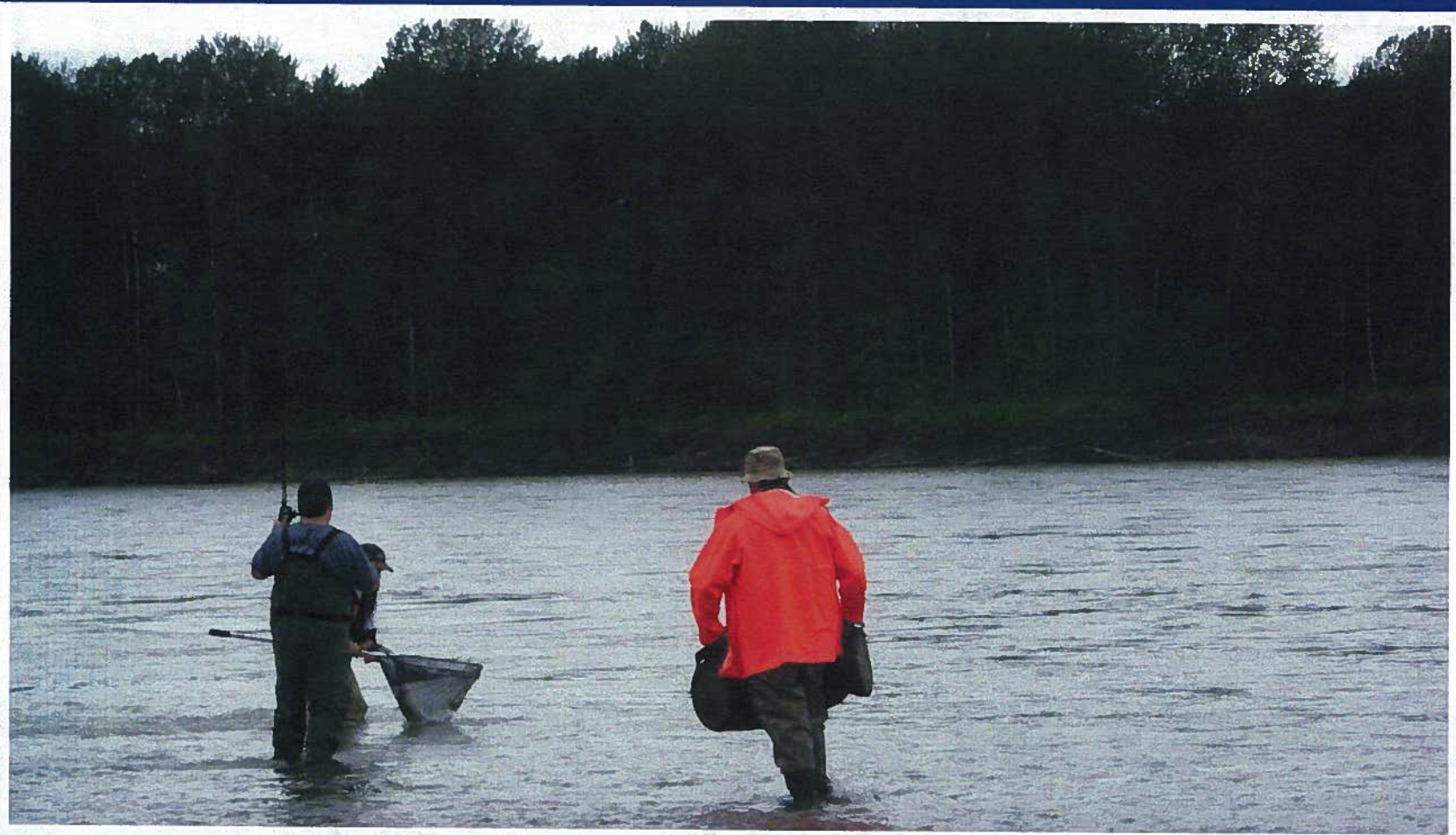
Angling and Beach Seine Catch and Effort

- The number of volunteer anglers ranged from 11 to 25 anglers per day. The average daily number was 15.
- 504 sockeye were hooked and landed by anglers over the 14 day study period from Aug 9 to Aug 26, 2010. Of these, 121 sockeye were radio tagged and released immediately leaving 383 sockeye for 24h assessment in holding net pens.
- A total of 132 sockeye were captured by beach seine. 42 of these fish were radio tagged and released immediately, leaving 90 sockeye for holding.

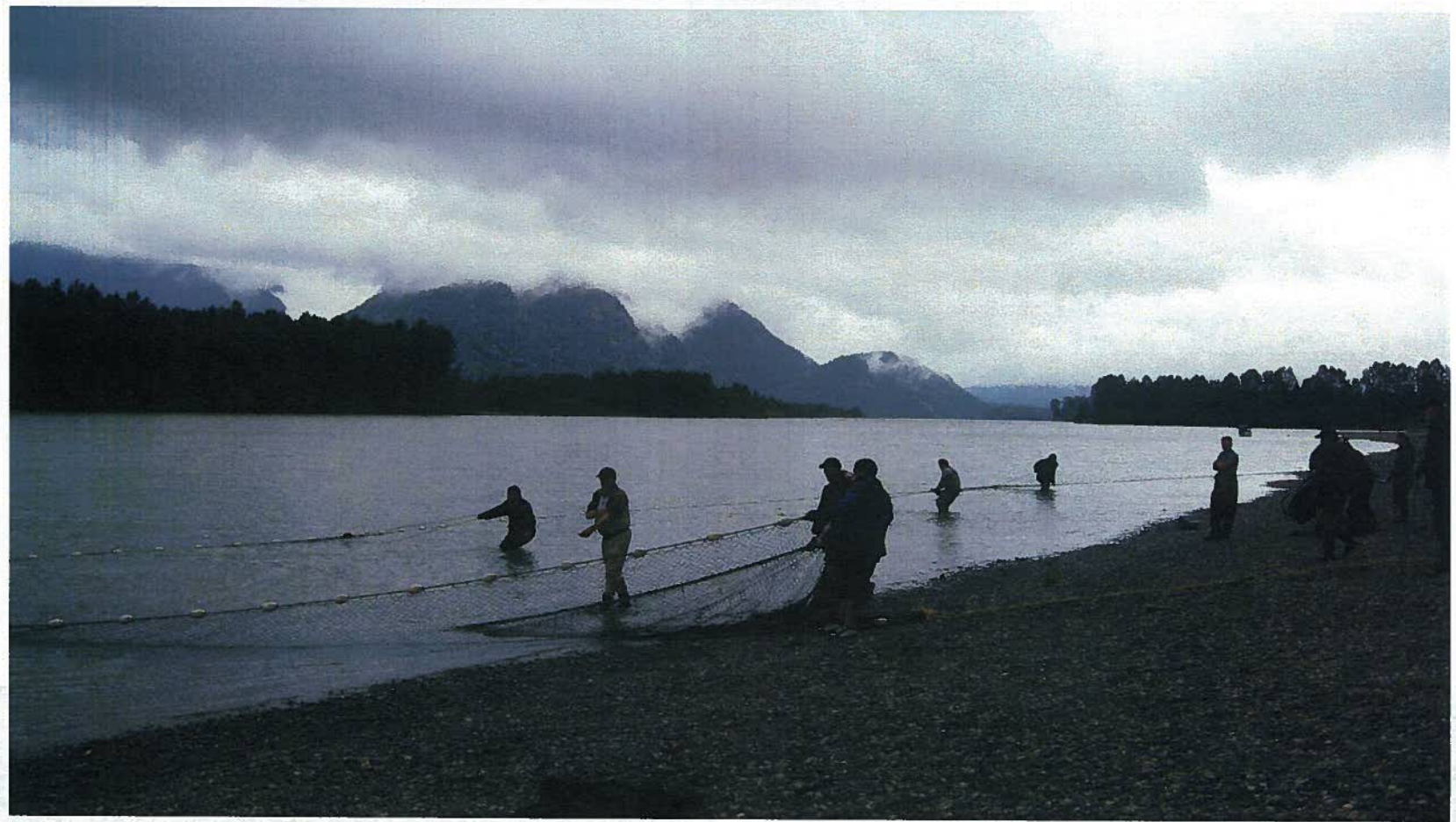
Shore-based volunteer anglers fishing at Grassy Bar...



Retrieving a hooked sockeye...



Beach seining for reference group sockeye...



Results – cont'd

Angling Variables

- Leader lengths ranged from 3 to 22 feet. 60% of the leader lengths were between 12 and 15 feet.
- Hook sizes used in the fishery varied from size 1/0 to 4/0. 98% of hooks used were either 2/0 or 3/0.
- 95% of the angled sockeye in the study were hooked by shore-based anglers and 5% were from anglers fishing from boats anchored close to shore.

Results – cont'd

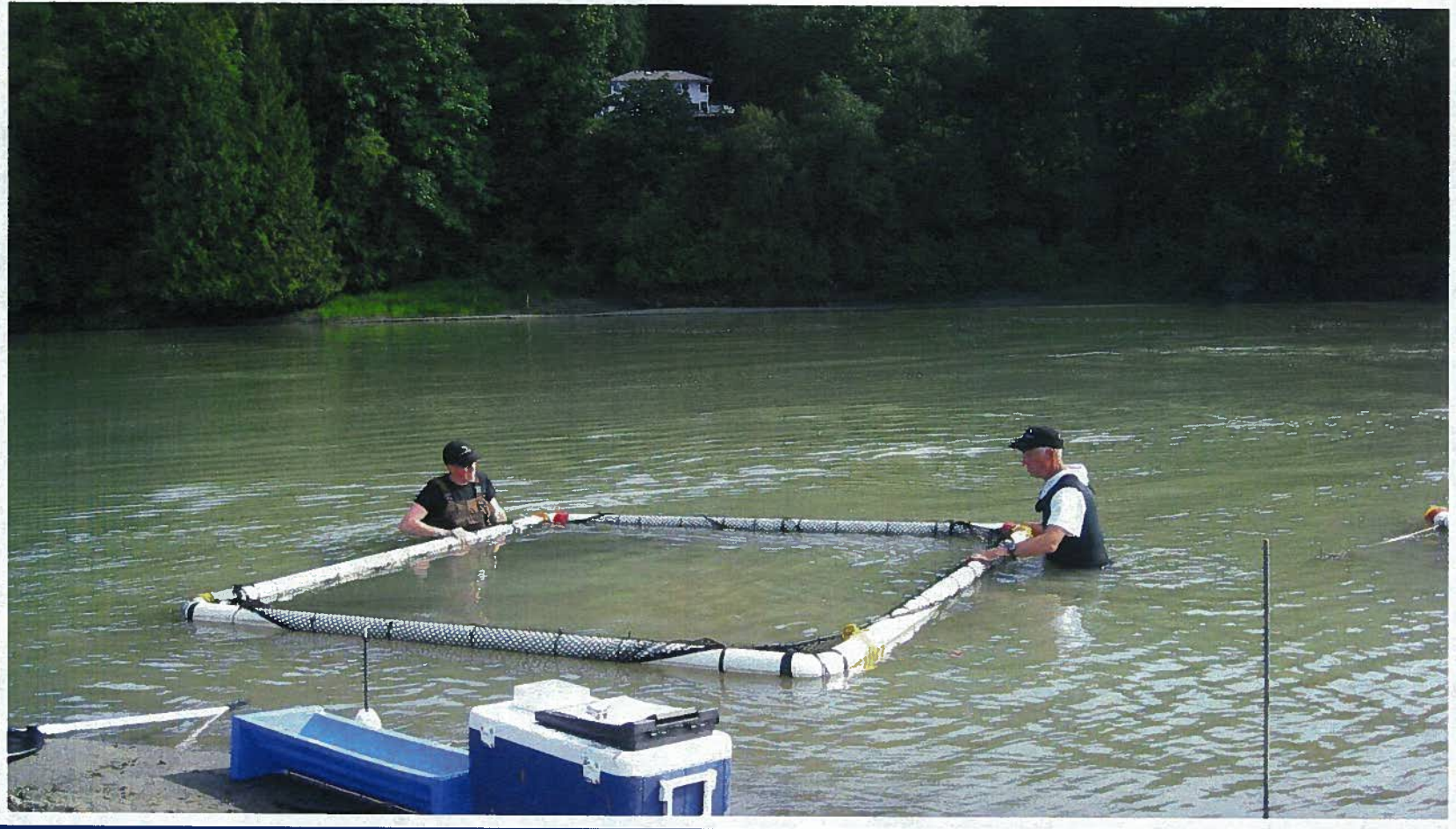
Hooking Locations & Fish Condition

- 86% of the sockeye landed were hooked on the outside of the mouth or body and 14% were hooked on the inside of the mouth.
- 74% of the sockeye hooked on the outside of the mouth or body, were hooked in the maxillary bone (and usually on the left side).
- 95% of the hooked sockeye were vigorous at time of landing. 74% showed no signs of bleeding, 18% had light, and 7% had moderate bleeding.

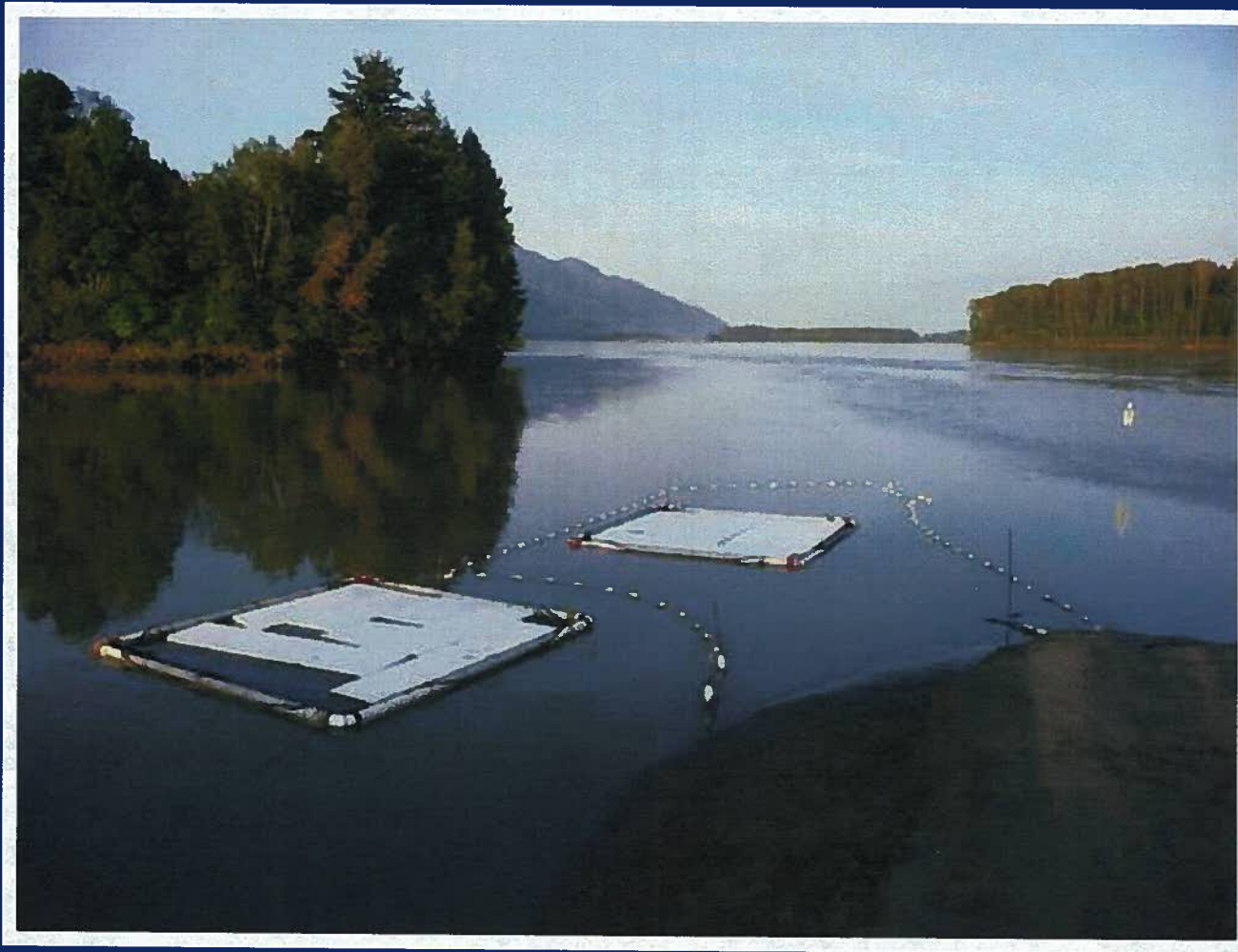
Typical sockeye hooking location in the left maxillary...



Assembling the net pen used for holding sockeye...



Net pens with predator net enclosure...



Transferring a sockeye to the net pen after tagging...



Results – cont'd

Release Condition

- 96% of the hooked sockeye held for 24 hours were released in a vigorous and not bleeding condition. 4% of the hooked sockeye (6 fish) were lethargic and not bleeding when released.
- No beach seined fish died during the study, suggesting that handling, transport, and holding exerted no measurable effects on short-term (0-24h) hooking mortality.

Releasing a live sockeye after holding for 24 hours...



Results – cont'd

Mortality Estimates

- Of the 383 sockeye that were hooked and held, 9 died during the 24h holding period, representing a short-term hooking mortality rate of 2.3%.
- Necropsies on the 9 dead sockeye revealed that all of the mortalities could be directly attributed to a hooking injury that occurred on the ventral surface or inside the mouth, damaging gills, vital internal organs, or blood vessels.

Catch-and-release mortality rates for salmon in other British Columbia recreational fisheries compared to sockeye in this fishery

<i>Species</i>	<i>Bait/Style</i>	<i>Mortality Rate</i>
Coho	Plug cut herring	24%
Chinook	Plug cut herring	16%
Coho	J-hook Bar fishing (roe)	30%
Coho	Circle-hook Bar fishing (roe)	15%
Sockeye	Bottom-bouncing	1.2% (2008)
		1.7% (2009)
		2.3% (2010)

Results – cont'd

Environmental Sampling

- Air and water temperatures were taken throughout the study period.
- Continuous in-river water temperatures were collected at the both the angling site and the net pen site.

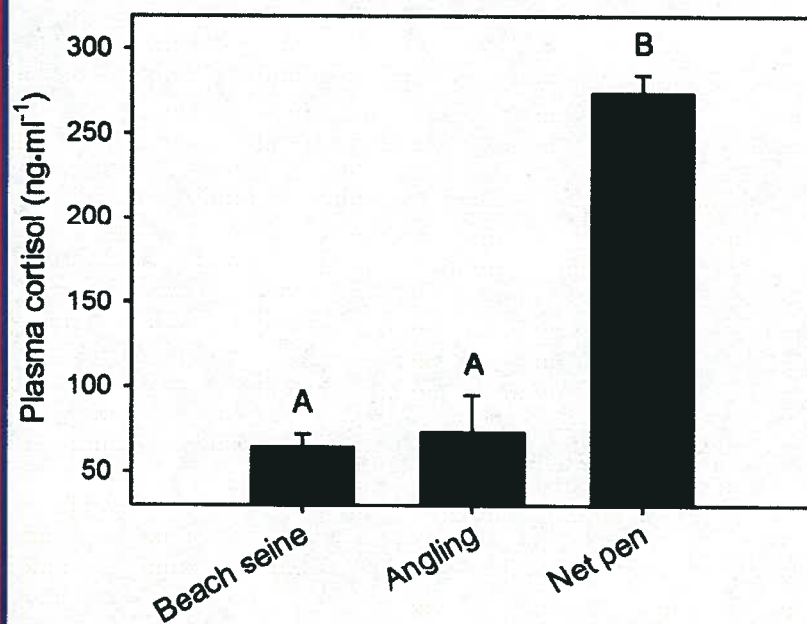
*Water temperature profiles at the
angling site and at the net pen site*

Results – cont'd

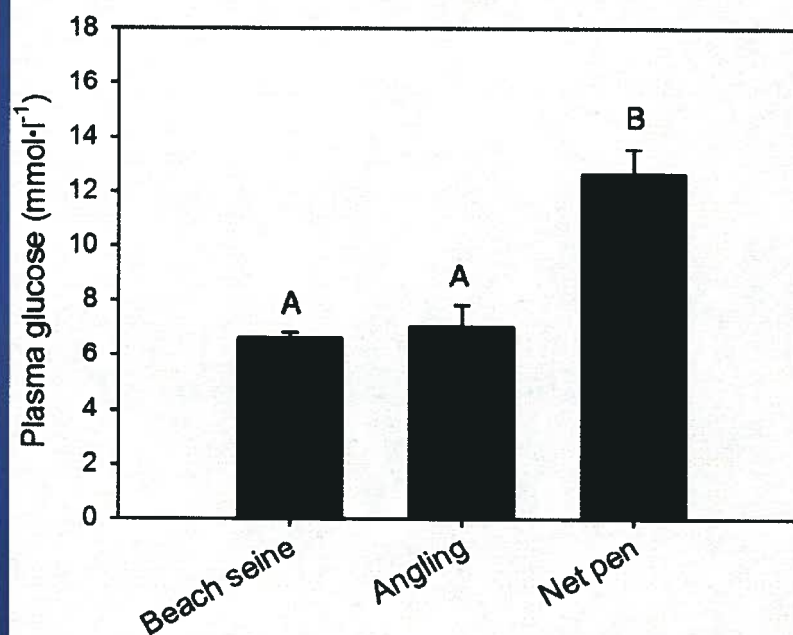
Physiological Sampling

- Samples of blood and tissue were taken from about 20% of the sockeye over the course of the study to assess physiological condition at time of capture (beach seine and angled).
- Analysis of 2008 data showed increased levels of stress indices (cortisol, glucose) and depressed osmoregulation indices (sodium, chloride, osmolality) in the net pen group compared to the immediate capture groups. Plasma lactate levels were not significantly different among groups.

Mean (\pm SE) plasma cortisol and glucose concentrations by treatment group (from 2008)

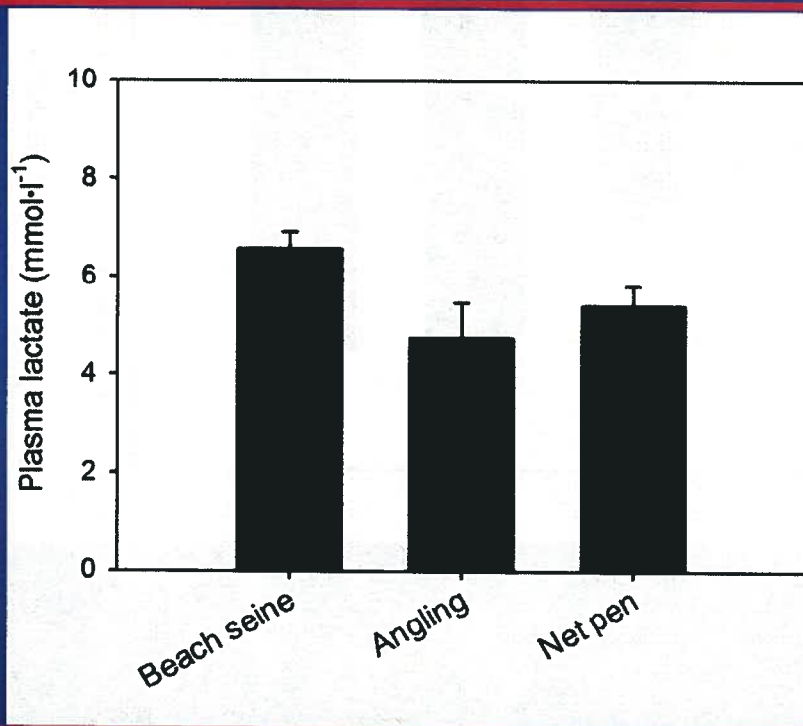


ANOVA, $F_{2,106}=99.0$, $P < 0.001$;
Tukey-Kramer HSD test, $P < 0.05$

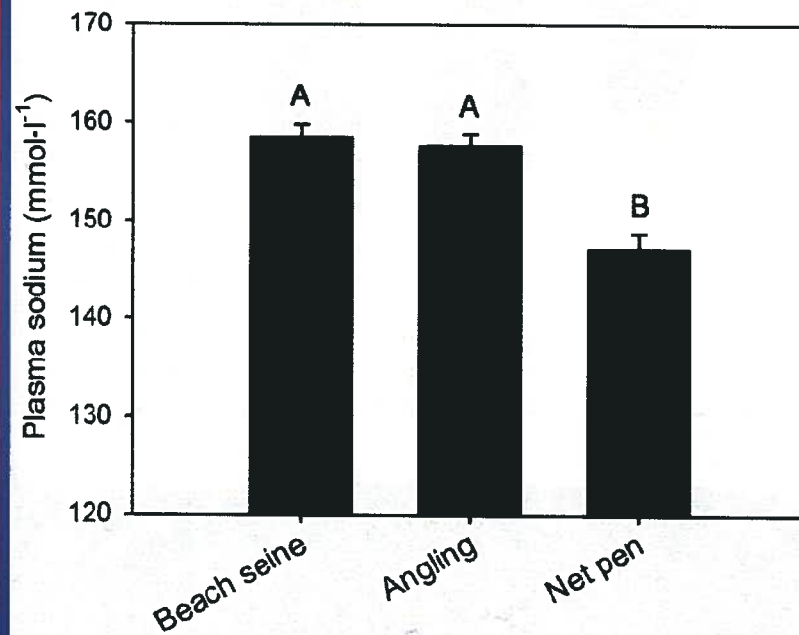


ANOVA, $F_{2,105}=16.2$, $P < 0.001$;
Tukey-Kramer HSD test, $P < 0.05$

Mean (\pm SE) plasma lactate and sodium concentrations by treatment group (from 2008)

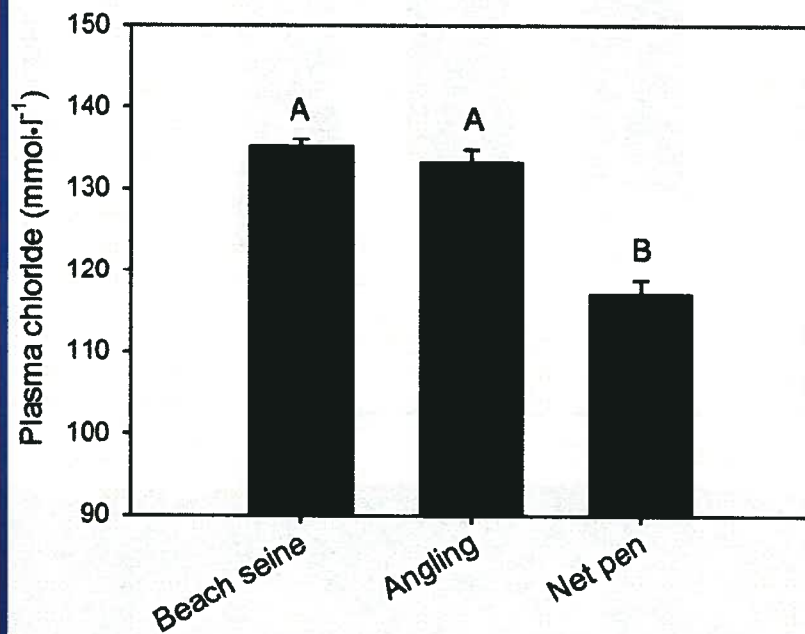


ANOVA, $F_{2,105}=3.0$, $P = 0.051$

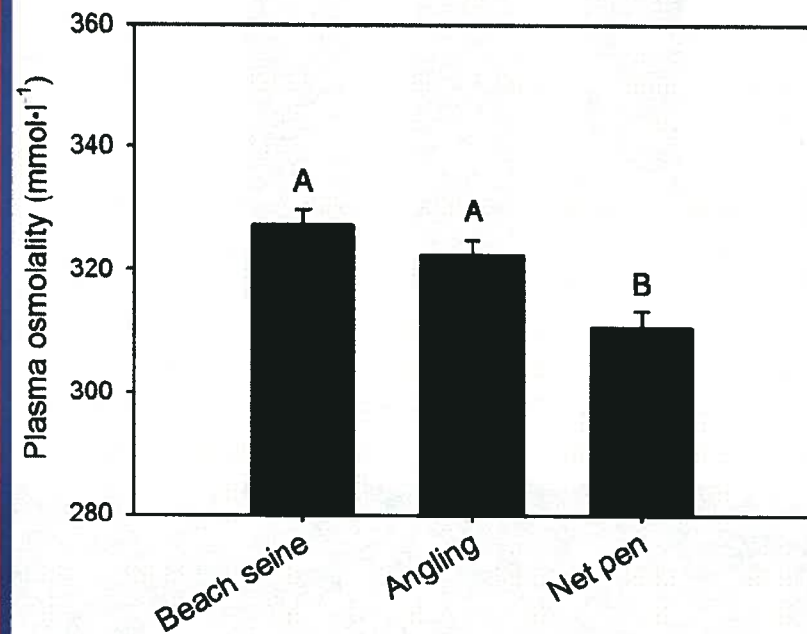


ANOVA, $F_{2,105}=16.3$, **$P < 0.001$** ;
Tukey-Kramer HSD test, $P < 0.05$

Mean (\pm SE) plasma chloride and osmolality concentrations by treatment group (from 2008)



ANOVA, $F_{2,105}=37.3$, $P < 0.001$;
Tukey-Kramer HSD test, $P < 0.05$



ANOVA, $F_{2,105}=10.3$, $P < 0.001$;
Tukey-Kramer HSD test, $P < 0.05$

Radio Tagging

- 163 sockeye were radio tagged in the 2010 study. 121 sockeye were tagged and released immediately after capture by anglers and 42 sockeye were tagged and released immediately after capture in the beach seine.
- Data are preliminary, however more individuals from the capture and immediate release groups survived compared to those that were angled and held in the net pens prior to release.
- Migration rates were slowest between release and the next closest upriver receiving station at the Harrison River confluence. Migration rates were consistent with other studies on Fraser River sockeye throughout the remainder of the migration.

Table 1. Survival^a of sockeye salmon captured by beach seine or angling and released immediately or fish that were captured by angling and held in a net pen to recover for 24 h.

Capture method	Survived ^b > 24 h	Survived ^b > 48 h	Survived ^b > 96 h	Reached natal subwatershed ^c
Beach seine (immediate release)	21 of 22 (95.5%)	20 of 22 (90.9%)	16 of 22 (72.7%)	12 of 23 (52.2%)
Angling (immediate release)	31 of 32 (96.9%)	25 of 32 (78.1%)	19 of 32 (59.4%)	12 of 33 (36.3%)
Angling (net pen for 24 h)	29 of 36 (80.6%)	22 of 36 (61.1%)	12 of 36 (33.3%)	1 of 35 (2.9%)

a. Total numbers have not been adjusted to reflect unreported fisheries harvest or tagging and handling effects.

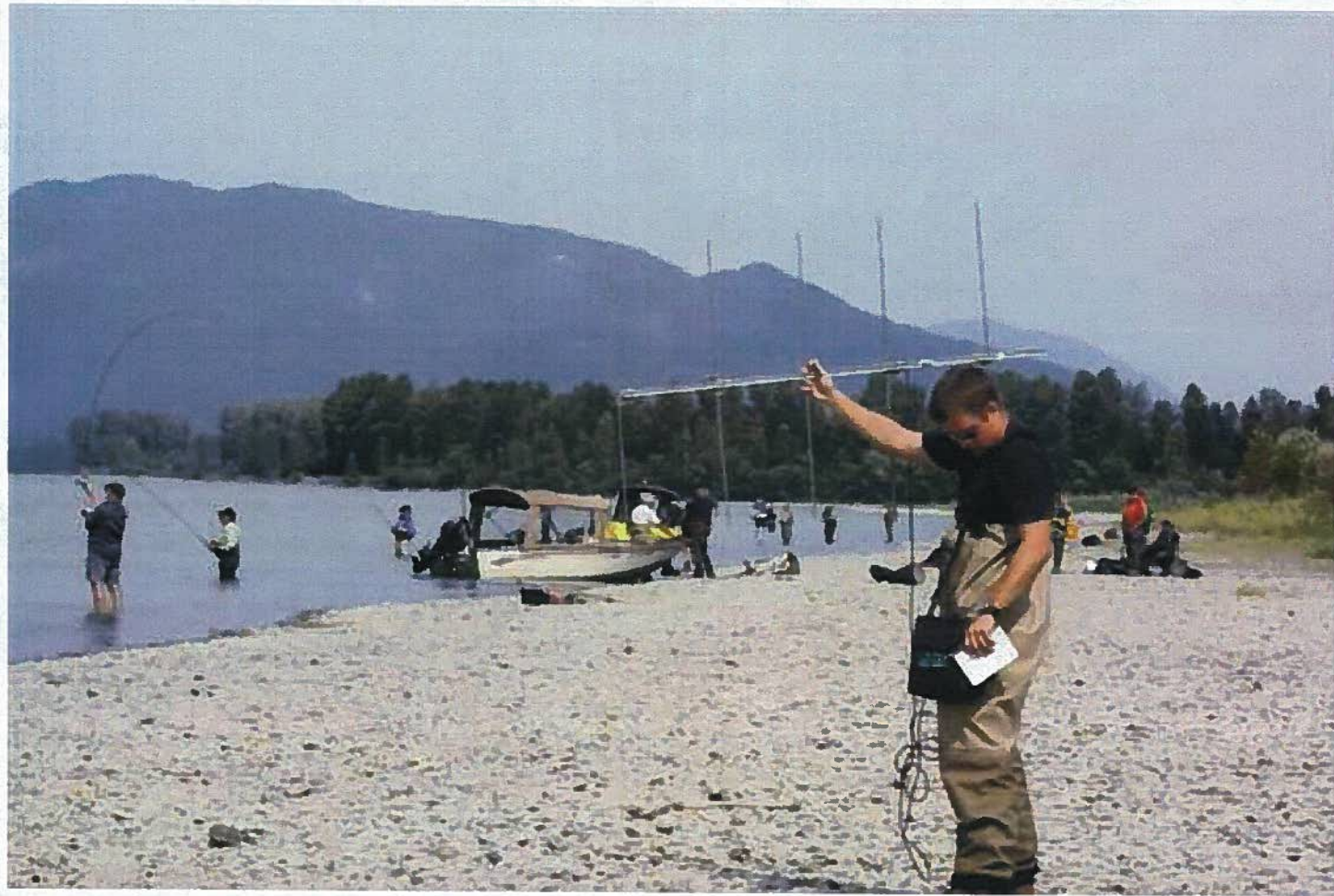
b. Note that this value may under-represent true survival time as it only reflects the duration from release to when an individual was detected at its last receiver site and does not account for travel between receivers.

c. Total number of tagged and released fish exclude individuals for which stock identification has not yet been confirmed by DNA analysis. Survival to reach natal subwatersheds represents only individuals that were detected by fixed station receivers at terminal areas.

Inserting a radio tag...the transmitter is inserted into the stomach and the antenna hangs outside the mouth.



Tracking radio tagged sockeye after release...

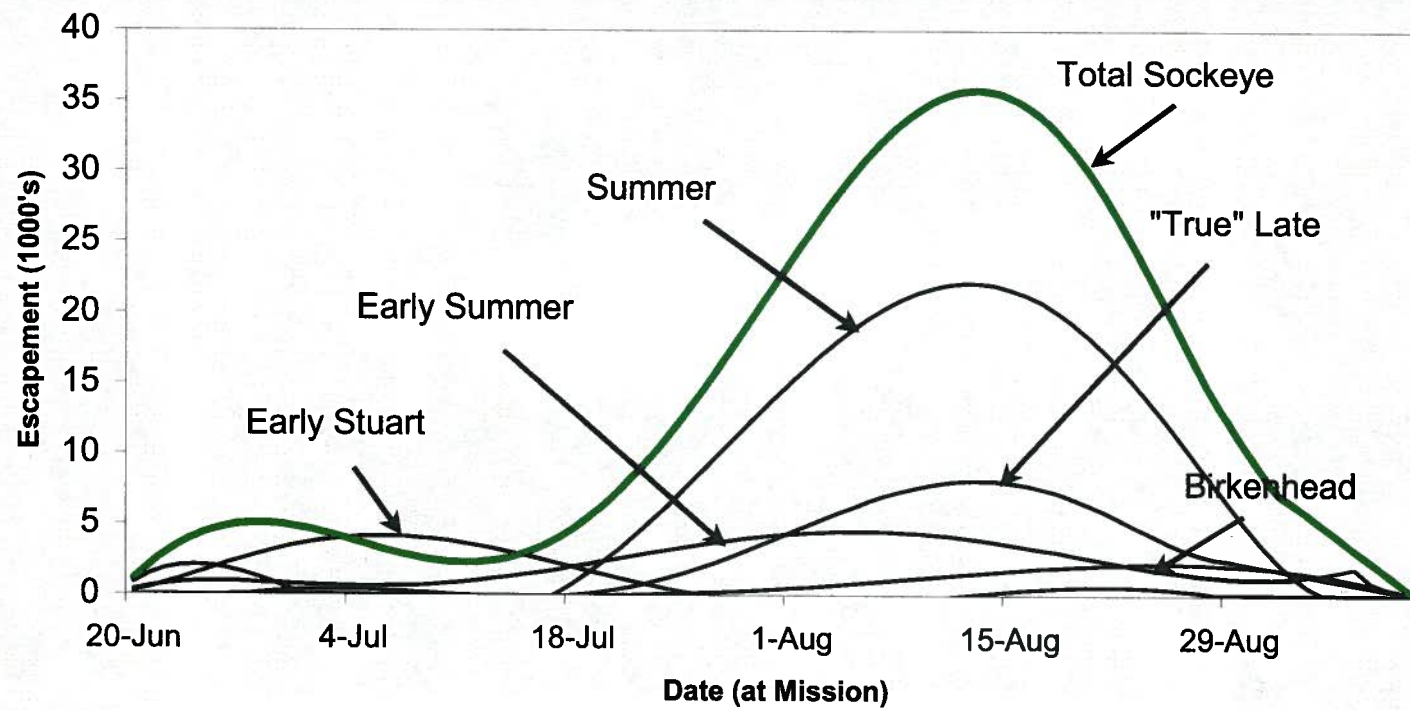


Other species are also caught by bottom-bouncing...



In addition to sockeye, anglers in the study also hooked and landed a total of 36 chinook, 1 coho and 27 pink.

2009 Fraser River sockeye stock timing



Source: Pacific Salmon Commission

*Estimated percent of migrating sockeye hooked in the
2009 Fraser River sockeye mortality study*

Study Week	Early Stuart	Early Summer	Summer	Late (Birkenhead)	"True" Late	Total	Number hooked in study	Percent hooked to migrating
Aug 8 to 14	796	24,361	131,122	4,345	58,708	219,333	112	0.05%
Aug 15 to 21	8	14,432	104,863	14,237	44,499	178,039	164	0.09%
Aug 22 to 28	0	4,658	39,154	5,542	18,045	67,399	52	0.08%

a. In-river migration time for sockeye from Mission to Grassy Bar is estimated to be 2 days. Escapement estimates from PSC.

Acknowledgments:

- Pacific Salmon Foundation
- Fraser Salmon & Watershed Program
- Fisheries and Oceans Canada
- British Columbia Wildlife Federation
- Fraser River Aboriginal Fisheries Secretariat
- British Columbia Federation of DriftFishers
- Fraser Valley Salmon Society
- Lower Fraser River First Nations
- Carlton University (Cooke Lab)
- University of British Columbia, Centre for Applied Conservation Research, Forest Sciences Centre
- LGL Limited – Environmental Research Associates
- Natural Sciences and Engineering Research Council of Canada
- All the volunteer anglers