Jun 9th, 3:50 PM - 4:10 PM

Unintended Fishway Passage and Transport of Native and Non-Native Lampreys (Petromyzontidae)

C. Bunt
University of Wisconsin - Madison

Biotactic
FISH AND WILDLIFE RESEARCH

Unintended Fishway Passage and Transport of Native and Non-Native Lampreys

Rainbow Trout (*Oncorhynchus mykiss*) with Silver Lamprey (*Ichthyomyzon unicuspis)*

Chinook Salmon (*Oncorhynchus tshawytscha)* with Sea Lamprey *(Petromyzon marinus)*

Presented by: Christopher Bunt, Ph.D

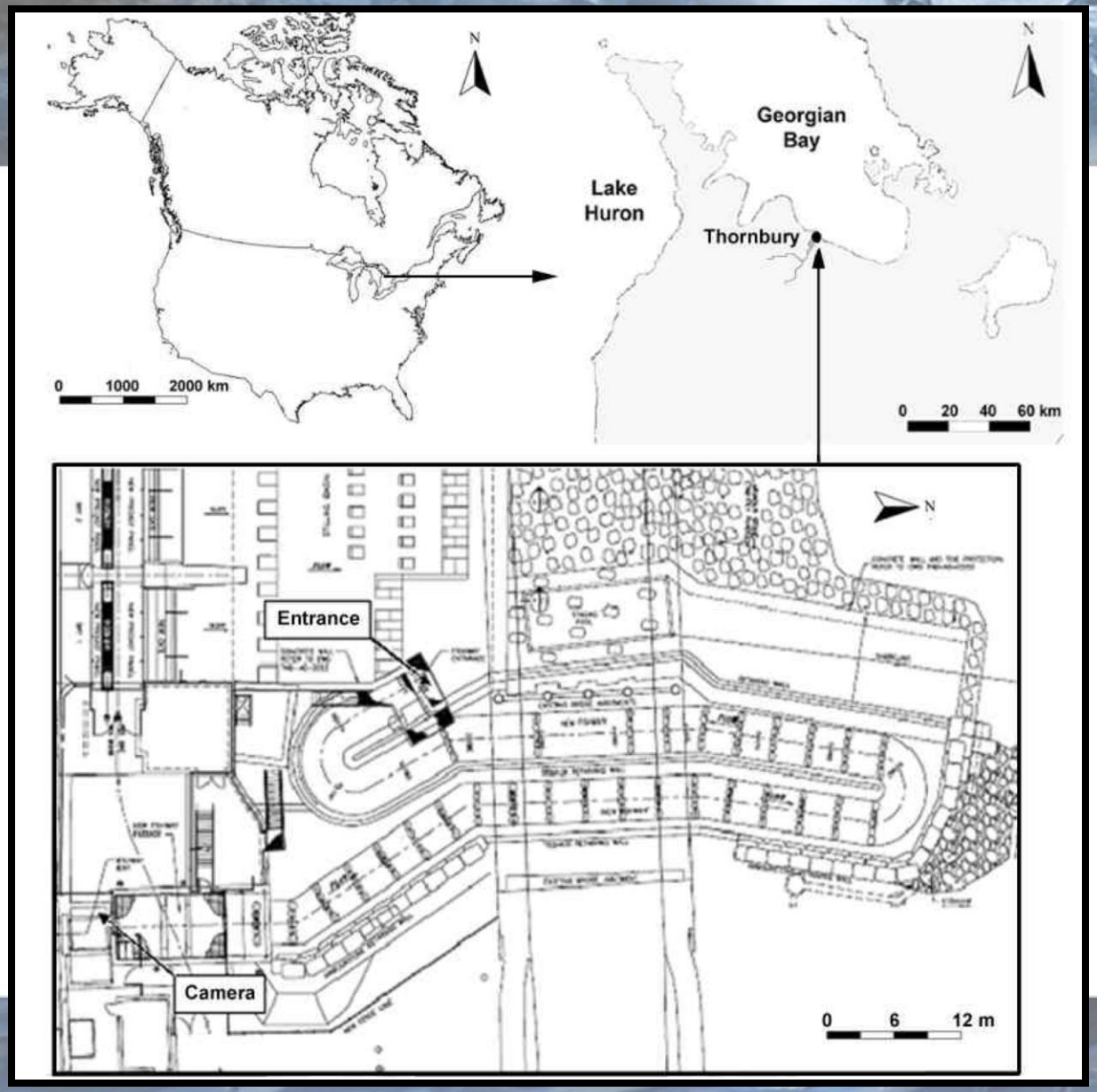
For the International Conference on Engineering and Ecohydrology for Fish Passage 2014

Biotactic
FISH AND WILDLIFE RESEARCH

Videographic Fish Monitoring

Biotactic
FISH AND WILDLIFE RESEARCH

BRAVO - Observation Stations with Underwater Video, Sensor & Telemetry Monitoring NODES



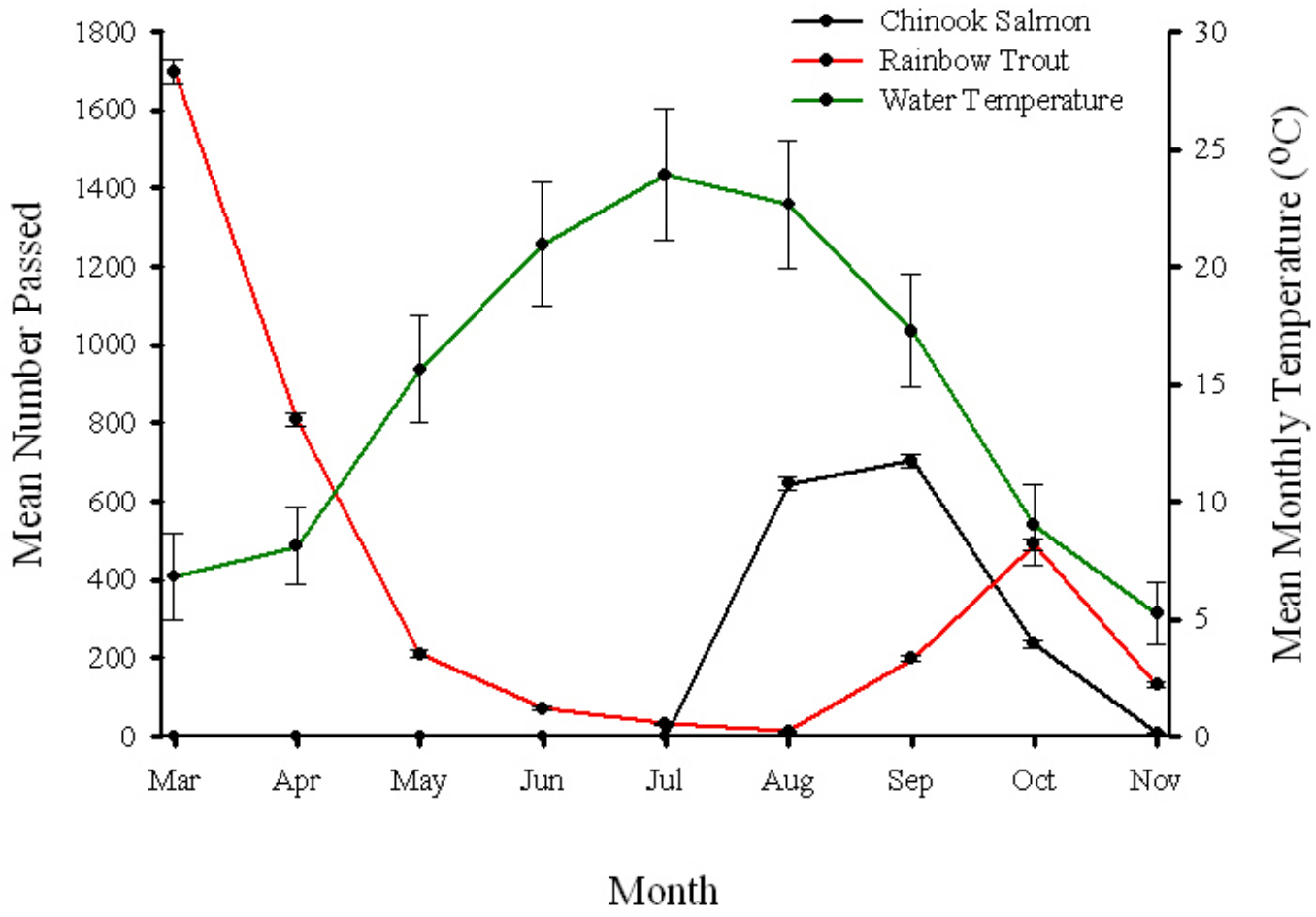
Biotactic
FISH AND WILDLIFE RESEARCH

Thornbury Fishway – Node 10

Beaver River, Ontario Online since April 4, 2011

Biotactic
FISH AND WILDLIFE RESEARCH

Mean (± SE) monthly passage of Chinook Salmon and Rainbow Trout at the Thornbury fishway from 2011 to 2013 across water temperature ranging from 5 - 25 ºC (mean ± SE). Only Rainbow Trout used the fishway in the spring and both species used the fishway in the fall.



April 8th 2011, Rainbow Trout transporting two Silver Lampreys

September 1st 2011, Chinook Salmon with a Sea Lamprey lingers inside the fishway

Biotactic
FISH AND WILDLIFE RESEARCH

Sea Lamprey (*Petromyzon marinus*)

- Adult length 350 - 600 mm
  (max 1200 mm, Page and Burr 1991)
- Brown and mottled
- Separated dorsal fin lobes
- Mortally parasitic

Silver Lamprey (*Ichthyomyzon unicuspis*)

- Adult length 260 – 320 mm
  (max 390 mm, Page and Burr 1991)
- Silver – grey/brown with no mottling
- Conjoined dorsal fin lobes
- Distinct teeth patterns in oral disc

Biotactic
FISH AND WILDLIFE RESEARCH

Tools Window Help

Type a question for help

ile format)

Date	Start Time	End Time	Fish	Species	Size (s)	File Start Time	File End Time
3/25/2012	5:51:30 PM	5:58:33 PM	1	Rainbow Trout	Large	1:29	2:51
3/25/2012	6:00:41 PM	6:07:12 PM	1	Rainbow Trout	Large	0:27	2:39
3/25/2012	8:01:30 PM	8:02:40 PM	1	Rainbow Trout	Large	0:22	0:30
3/26/2012	3:19:30 AM	3:21:19 AM	1	Rainbow Trout	Large	3:07	3:19
3/26/2012	5:25:16 AM	5:27:25 AM	4	Rainbow Trout	Medium - Large	2:41	3:07
3/26/2012	5:32:25 AM	5:47:05 AM	7	Rainbow Trout	Large	0:24	2:35
3/26/2012	5:53:31 AM	6:31:52 AM	6	Rainbow Trout	Large	0:17	3:11
3/26/2012	6:32:24 AM	6:32:25 AM	1	Rainbow Trout	Large	0:53	0:54
3/26/2012	6:37:47 AM	6:38:27 AM	2	Rainbow Trout	Large	2:35	2:54
3/26/2012	1:06:53 PM	1:06:55 PM	1	Rainbow Trout, Silver Lamprey	Large	2:24	2:4[illegible]
3/26/2012	1:25:00 PM	1:28:28 PM	2	Rainbow Trout, Silver Lamprey	Large	1:09	1:39
3/26/2012	3:35:30 PM	3:35:50 PM	1	Rainbow Trout	Medium	3:11	3:18
3/26/2012	3:45:35 PM	3:45:36 PM	1	Rainbow Trout	Large	0:39	0:43
3/26/2012	4:14:47 PM	4:29:29 PM	2	Rainbow Trout	Medium	2:04	2:54
3/26/2012	5:08:20 PM	6:15:45 PM	10	Rainbow Trout	Large	2:19	2:40
3/26/2012	6:31:56 PM	6:31:57 PM	1	Rainbow Trout	Medium	0:03	0:03
3/26/2012	7:22:59 PM	7:23:00 PM	1	Rainbow Trout	Medium	1:17	1:18
3/26/2012	10:34:25 PM	11:07:16 PM	6	Rainbow Trout	Medium - Large	0:45	3:12
3/26/2012	11:08:32 PM	11:33:42 PM	5	Rainbow Trout	Medium - Large	0:10	2:33
3/26/2012	11:51:38 PM	11:51:39 PM	1	Rainbow Trout	Large	0:54	0:55
3/27/2012	4:50:18 AM	4:50:19 AM	1	Rainbow Trout	Medium	1:53	1:54
3/27/2012	2:41:13 PM	2:41:21 PM	1	Rainbow Trout	Large	0:44	0:51
3/27/2012	4:52:05 PM	4:52:12 PM	1	Rainbow Trout	Large	0:02	0:10
3/27/2012	5:52:43 PM	5:52:47 PM	1	Rainbow Trout	Large	1:06	1:12
3/27/2012	6:32:24 PM	6:32:26 PM	1	Rainbow Trout	Large	1:27	1:32
3/27/2012	6:37:54 PM	6:39:24 PM	2	Rainbow Trout	Large	0:01	3:18
3/27/2012	6:39:52 PM	6:39:53 PM	1	Rainbow Trout	Large	0:59	1:01
3/27/2012	6:41:02 PM	6:41:09 PM	2	Rainbow Trout	Large	0:11	0:25
3/27/2012	6:55:50 PM	6:44:57 PM	1	Rainbow Trout	Large	1:50	2:03

2910

Biotactic
FISH AND WILDLIFE RESEARCH

Microsoft Access

File Edit View Insert Format Records Tools Window Help

Node 10 : Database (Access 2000 file format)

Node 10 Camera : Table

File	Date	Start Time	End Time	Fish				
+ 201109150848 1387	9/15/2011	7:35:29 AM	7:35:49 AM	1	Chinook Salm			
+ 201109150849 1388	9/15/2011	7:37:44 AM	7:37:44 AM	1	Chinook Salm			
+ 201109150850 1389	9/15/2011	7:39:02 AM	7:39:03 AM	1	Chinook Salm			
+ 201109151225 1419 - 1421	9/15/2011	9:21:40 AM	5:54:23 PM	6	Chinook Salm			
+ 201109160403 1422	9/16/2011	12:24:29 AM	12:24:30 AM	1	Chinook Salm			
+ 201109160734 1430	9/16/2011	7:11:05 AM	7:11:06 AM	1	Unknown	Medium	3:04	3:05
+ 201109161906 1470 - 1472	9/16/2011	11:32:08 AM	10:34:13 PM	10	Rainbow Trout, Chinook Salmon, Sea Lamprey, Catostomid	Small - Large	0:52	1:41
+ 201109170742 1484	9/17/2011	7:30:27 AM	7:30:38 AM	2	Chinook Salmon, Sea Lamprey	Large	1:27	1:50
+ 201109170754 1485	9/17/2011	7:31:50 AM	7:31:51 AM	1	Chinook Salmon	Large	1:06	1:10
+ 201109170814 1488	9/17/2011	7:36:20 AM	7:36:53 AM	1	Chinook Salmon, Sea Lamprey	Large	0:56	2:08
+ 201109170816 1489	9/17/2011	7:38:15 AM	7:38:28 AM	1	Chinook Salmon, Sea Lamprey	Large	1:44	2:07
+ 201109170822 1491	9/17/2011	7:41:29 AM	7:41:33 AM	1	Chinook Salmon	Large	1:29	1:39
+ 201109170825 1493	9/17/2011	7:45:04 AM	7:45:11 AM	1	Chinook Salmon, Sea Lamprey	Large	2:22	2:37
+ 201109170829 1494	9/17/2011	7:46:21 AM	7:46:22 AM	1	Chinook Salmon, Sea Lamprey	Large	1:45	1:46
+ 201109170831 1495 - 1496	9/17/2011	7:47:21 AM	7:49:12 AM	1	Chinook Salmon	Large	0:33	1:16
+ 201109171[illegible] 1504 - 1505x	9/17/2011	10:43:09 AM	12:40:09 PM	2	Chinook Salmon, Sea Lamprey	Large	2:49	2:43
+ 201109171539 1505x - 1508	9/17/2011	3:02:43 PM	7:08:50 PM	9	Chinook Salmon, Rainbow Trout, Sea Lamprey	Medium - Large	3:09	0:04
+ 201109180117 1508	9/17/2011	8:38:51 PM	1:11:16 AM	4	Chinook Salmon, Rainbow Trout	Large	1:07	3:11
+ 201109180516 1509	9/18/2011	1:33:20 AM	1:43:45 AM	1	Chinook Salmon	Large	0:16	0:26
+ 201109180732 1513	9/18/2011	7:04:50 AM	7:04:51 AM	1	Chinook Salmon	Medium	3:15	3:16
+ 201109181124 1580	9/18/2011	9:21:01 AM	10:31:02 AM	2	Chinook Salmon	Large	0:37	1:55
+ 201109181437 1581x - 1582	9/18/2011	11:25:12 AM	2:35:08 PM	5	Rainbow Trout, Chinook Salmon	Large	0:05	0:04
+ 201109181627 1582 - 1583	9/18/2011	3:13:46 PM	4:24:16 PM	2	Chinook Salmon	Large	0:17	2:01
+ 201109181908 1583	9/18/2011	5:34:04 PM	6:20:09 PM	1	Chinook Salmon	Large	2:20	3:01
+ 201109182230 1584	9/18/2011	8:35:05 PM	9:09:29 PM	2	Rainbow Trout	Small - Medium	1:40	2:05
+ 201109190036 1585 (1)	9/18/2011	11:00:03 PM	11:13:58 PM	5	Chinook Salmon, Rainbow Trout, Rock Bass	Small - Large	1:27	1:38
+ 201109190036 1585 (2)	9/19/2011	12:10:18 AM	12:10:19 AM	1	Chinook Salmon	Medium	2:11	2:12
+ 201109190637 1587	9/19/2011	4:47:53 AM	5:35:41 AM	2	Rainbow Trout	Large	2:35	2:56
+ 201109190812 1603	9/19/2011	7:29:37 AM	7:29:38 AM	1	Rainbow Trout	Large	2:53	2:54

Record: 2523 of 2910

Name of file(s) (group single)

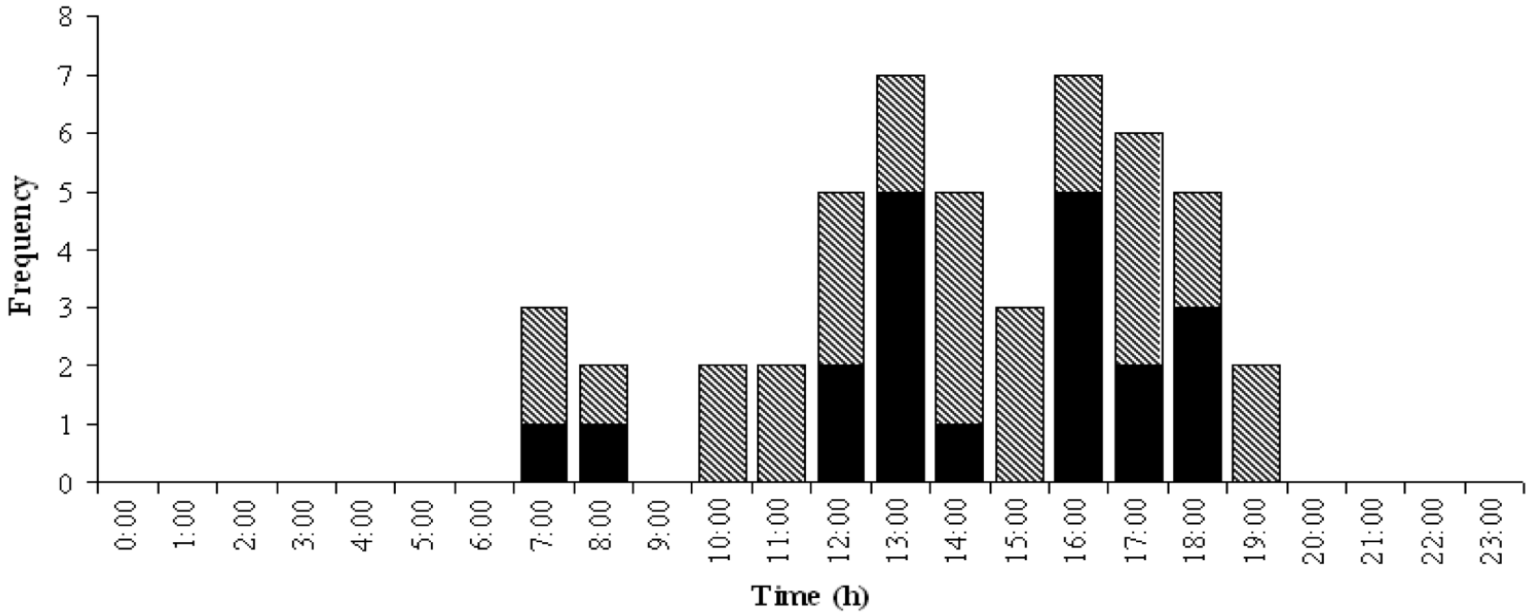
Biotactic
FISH AND WILDLIFE RESEARCH

Lake Huron ⟶ Beaver River

- Nature-like fishway designed for Salmonids that inadvertently transport native and non-native Lampreys
- Rainbow Trout transport Silver Lampreys from March to May with water temperatures ranging from 6.8-15.6˚ C
- Chinook Salmon transport both Silver and Sea Lampreys from August (mean temp = 22.6 ˚ C) to October (mean temp = 9.0˚ C)
- Transport of Lampreys significantly reduce swimming performance

August 24th, 2011 A Chinook Salmon with Sea Lamprey attached swims through fishway

Pooled daily distribution of Lamprey transported at Thornbury (black bars – Silver Lamprey; Grey bars – Sea Lamprey)



Pooled monthly passage of scarred and parasitized Rainbow Trout and Chinook Salmon at Thornbury

Month	Mean temperature (°C)	Mean water level (m)	Rainbow Trout			Chinook Salmon		
			Scars	Silver Lamprey	Sea Lamprey	Scars	Silver Lamprey	Sea Lamprey
Mar	6.80	1.069	5	3	0	-	0	0
Apr	8.10	1.105	3	2	0	-	0	0
May	15.60	0.954	-	1	0	-	0	0
Jun	20.93	0.755	-	0	0	-	0	0
Jul	23.90	0.600	-	0	0	-	0	0
Aug	22.63	0.586	-	0	0	12	8	14
Sep	17.27	0.953	-	0	0	6	5	14
Oct	8.97	0.811	-	1	0	-	0	1
Nov	5.23	0.972	-	0	0	-	0	0

Biotactic
FISH AND WILDLIFE RESEARCH

March 26th 2012, Rainbow Trout ascend the fishway, with and without scars

Rainbow Trout with Silver Lamprey attached, lingering in the fishway, March 26th, 2012

Mean time (min ± SE) in the camera FOV

	With Scar(s)	Sea Lamprey Attached	Silver Lamprey Attached	No Scars or Lampreys
Rainbow trout	0.09 ± 0.02	-	0.12 ± 0.06	0.04 ± 0.00
n	8	0	4	40
Chinook salmon	0.21 ± 0.05	0.67 ± 0.16	0.33 ± 0.08	0.22 ± 0.04
n	14	11	10	40

Biotactic
FISH AND WILDLIFE RESEARCH

SC=Scarred, Sil=Silver Lamprey, Sea= Sea Lamprey, (* = sig. diff)

Comparison	df	*t*	*p*
Rainbow Trout (SC) vs Rainbow Trout	46	2.936	0.0052*
Chinook Salmon (SC) vs Chinook Salmon	52	0.159	0.8740
Rainbow Trout vs Chinook Salmon	78	4.146	0.0001*
Rainbow Trout (SC) vs Chinook Salmon (SC)	20	1.636	0.1174
Chinook Salmon (Sil) vs Rainbow Trout (Sil)	12	1.517	0.1551
Rainbow Trout (Sil) vs Rainbow Trout (SC)	10	0.637	0.5386
Rainbow Trout (Sil) vs Rainbow Trout	42	3.407	0.0015*
Chinook Salmon (Sea) vs Chinook Salmon (Sil)	19	1.847	0.0804
Chinook Salmon (Sea) vs Chinook Salmon	49	3.959	0.0002*
Chinook Salmon (Sil) vs Chinook Salmon	48	1.184	0.2423
Chinook Salmon (Sea) vs Chinook Salmon (Sc)	23	3.039	0.0058*
Chinook Salmon (Sil) vs Chinook Salmon (Sc)	22	1.308	0.2043

Conclusions

- **Fish transporting Lampreys took significantly longer**
- **Lamprey transport did not prohibit successful passage**
- **Time in FOV suggests bio-energetic consequences of parasitism coupled with increased drag coefficient and hydrodynamic resistance**
- **Scarring affects swimming performance**
- **Multiple Lamprey transport observed**
- **Lampreys only used the fishway by transportation**
- **Lamprey reproduction after passage is unknown**

Biotactic
FISH AND WILDLIFE RESEARCH

Acknowledgements

Jody Scheifley and Shawn Carrie (OMNR) facilitated installation of the fish monitoring system used for this project, and Ralph Fisher (OMNR) and Billy Sack provided field assistance. Stephanie Choo-Wing, Dana Eddy, Barbara Piolunowska, Sammy Crowley and Dan Watkins transcribed data and helped prepare figures and tables