SMITH-ROOT, INC.
Technology For Fisheries Conservation

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2007005030

Enclosures
FHW Div
JS
SC
F+W State staff

PATTY O'TOOLE
NORTHWEST POWER AND CONSERVATION COUNCIL
851 SW 6TH AVENUE, SUITE 1100
PORTLAND, OR 97204-1348
503-222-5161

20075400

MAY 15, 2007

PATTY —

I'M FORWARDING YOU SOME ORIGINAL SUPPORT LETTERS FROM OUR PARTNERS, THAT WERE INADVERTENTLY SENT TO ME INSTEAD OF DR. KARIER. (WE'VE TAKEN THE LIBERTY TO PROVIDE EXTRAS FOR OTHER COUNCIL MEMBERS.)

PLEASE SEE THAT DR KARIER AND MEMBERS GET THESE. THAT WOULD BE DEEPLY APPRECIATED.

ALSO, AND ATTACHED TO ~~THIS~~ COVER LETTER ARE THE RESULTS OF OUR TESTS UP IN BRITISH COLUMBIA, ON A SEAL DETERRENCE BARRIER. THESE WERE WRITTEN UP BY JIM CAVE, OF THE PACIFIC SALMON COMMISSION. THESE CAN BE SHARED WITH COUNCIL MEMBERS.

THANKS PATTY!

SINCERELY,

Carl V. Burger

CARL BURGER, SENIOR SCIENTIST

Evaluation of an Electrical Gradient as a Seal Deterrent
Vancouver Aquarium Study
March 27, 2007
Preliminary Results

On March 26, 2007, staff from the Pacific Salmon Commission and Smith-Root Inc. installed a system to create an electrical voltage gradient in a research pool at the Vancouver Aquarium. The anode and cathode of the system were located directly across from one another approximately 4.9 m on opposite sides at the west end of the research tank. The test seals could not simultaneously touch both electrodes. In addition, a non-electrified area within the pool was created. The electric field occupied approximately one third of the pool. Final calibration of the system was completed on March 27, 2007 and the voltage gradient in the field area was mapped following each trial. Electrical field density readings ranged between 0.10 - 0.32 Volts/cm. Two harbour seals (*Phoca vitulina*) were evaluated during separate trials in this study: Seal 1, a male weighing 92 kg and Seal 2, a male of 89 kg. The purpose of the trials was to determine the minimum voltage field that elicits a change in the behaviour of the harbour seals used in the study. The intensity of the voltage field was manipulated by varying pulse width.

The pulse frequency was fixed during the trials at 2.25 Hz. Pulse width was increased at approximately 5 minute intervals during the trials with steps beginning at 75 micro-seconds, 100 micro-seconds, 200 micro-seconds and 400 micro-seconds. Prior to the commencement of the trials, the test animals were allowed to acclimate to the research pool and the study equipment. During the acclimation, the animals showed no apparent interest in the equipment and their behaviour was judged normal by the Vancouver Aquarium marine mammal trainers and Dr. Martin Haulena, the Vancouver Aquarium veterinarian.

The first study animal, Seal 1, demonstrated no change in behaviour at a pulse width of 75 micro-seconds (5 minute period) or at a pulse width of 100 micro-seconds. The seal swam into all areas of the pool and used haul-outs on both ends of the pool. However, at a pulse width of 200 micro-seconds, he demonstrated a noticeable change in behaviour by swimming in a tight little circle (less than one body length in diameter) near the edge of the electric field and exiting to the non-electrified portion of the pool outside of the voltage gradient. During the 5 minute interval at a pulse width of 200 micro-seconds, the seal approached the electric field 4 times demonstrating active avoidance of the electrical gradient area on each occasion. At this point the electrical gradient was turned off and Seal 1 resuming normal swimming patterns in the area that was previously avoided at the 200 micro-second pulse width setting.

The second study animal, Seal 2, demonstrated no change in behaviour at pulse width settings ranging from of 75-200 micro-seconds (5 minute periods each). However, at a pulse width of 400 micro-seconds, he demonstrated a noticeable change in behaviour by turning around at the edge of the electric field and returning to the area outside the voltage gradient. The seal approached the electric field 18 times demonstrating apparent avoidance of the voltage gradient areas on each occasion. This animal did not demonstrate the same behaviour as the previous animal, which swam in the quick, tight little circle each time it entered the voltage gradient. As in the previous trial, at this point the electrical gradient was turned off and Seal 2 resumed swimming in the area that was avoided at the 400 micro-second pulse width setting. The study was repeated with Seal 2 using a pulse frequency of 1.32 Hz with the same avoidance behaviour noted at 400 micro-second pulse width with resumption of normal

swimming patterns after the gradient was removed. Seal 2 was more active throughout the study than was Seal 1.

A more careful review of the results will be made when the hand-held video footage is made available. However, both seals demonstrated avoidance responses at voltage gradients and pulse width settings much less than typically required for freshwater fish (Dave Smith, Personal communication, Smith-Root Inc). At the conclusion of each of the trials, the study animals demonstrated no negative effects of the experiment as judged by the marine mammal trainers and Dr. Martin Haulena. The animals resumed feeding 3 hours after the experiment and exhibited no abnormal behaviours.

Jim Cave
Head, Stock Monitoring
Pacific Salmon Commission

Evaluation of an Electrical Gradient as a Seal Deterrent

Puntledge River Study, April 10 – 24, 2007

Preliminary Results

From April 10 – 25, 2007, staff from the Pacific Salmon Commission (PSC), Department of Fisheries and Oceans Canada (DFO), and Smith-Root Inc. installed and tested an electrical deterrent system to create an electrical voltage gradient across the Puntledge River, in Courtenay, B.C. During March – May harbour seals (*Phoca vitulina)* typically enter the Puntledge River around dusk and use the light-shadow boundary from the lights on the 5th Street Bridge to forage for out-migrating juvenile salmon. The Puntledge River at the 5th Street Bridge was considered to be an ideal location to field test the electrical deterrent system as it is freshwater, the gear can be fixed, and the response of harbour seals that predictably congregate to forage on out-migrating Chum salmon fry (*Oncorhynchus keta*) can be easily observed. Our primary objective was to assess how foraging seals respond to electrical fields so as to be able to evaluate whether the method might be a humane, effective and practical deterrent. The Puntledge River Study was Part II of an ongoing PSC Southern Boundary Restoration & Enhancement Fund (SEF) Project. The Animal Care Committee, Department of Fisheries and Oceans, Canada (DFO) approved the Animal Use Protocol for the Puntledge River study and Marine Mammal Scientific License 2007-10 was issued by DFO.

Part I of the SEF Project was conducted on March 26, 2007 at the Vancouver Aquarium (Vancouver, BC) by the PSC, DFO, Smith-Root Inc. and Vancouver Aquarium staff. The captive seals at the Vancouver Aquarium demonstrated an avoidance response at minimal voltage gradients and pulse width settings (0.5 volts/cm and 200 – 400 micro-seconds). These values served as a starting point for Puntledge River trials. Prior to commencement of all trials the seals were allowed to acclimate to the study area and equipment. Dr. Martin Haulena (Vancouver Aquarium Staff Veterinarian) observed all trials at both the Vancouver Aquarium and in the Puntledge River.

The electrical array was installed into the Puntledge River between April 10 and April 12, 2007. The 5th Street Bridge crosses the Puntledge River approximately 1 km upstream from Comox Harbour. The river has been channelized upstream and downstream of the 5th Street Bridge. At the 5th Street Bridge the river depth and flow are influenced by tide, but salt water intrusions have not been observed at this location (personal communication, Brian Munro, DFO). Water conductivity in the Puntledge River was 25.5 µSiemen/Cm, considerably lower than at the Vancouver Aquarium. The bottom gradually sloped towards mid channel, although the water was slightly deeper on the south or right bank side of the river. The bottom substrate consisted primarily of rocks of varying size. The mid channel depth ranged from approximately 1.5 meters at low tide to 2 – 3 meters at high tide, with the current velocity being the greatest at low tide and little or no flow at high tide. The respective night time high tides at Comox Harbour were at 03:07 (4.6 m.), 03:43 (4.7 m.) and 04:13 (4.7 m.) on April 12 – 14 and 00:15 (4.9 m) and 01:19 (4.8 m) on April 23 & 24.

The electrodes of the array consisted of 4, half-inch copper cables spaced 1.8 meter apart with plastic PVC cross-members every 4.6 Meters. (Figure 1). Eleven PVC cross-members were spaced at 4.6 meter intervals, perpendicular to the cables and parallel to the flow, across the 49 meter width of the Puntledge River. The electrical array was floated into place, sunk and anchored on the bottom of the river. The downstream edge of the array was located approximately 3 meters upstream from the 5th Street Bridge. The array measured approximately 5.5 meters in width by 49 meters in length and lay on the bottom of the river below the area where seals are known to congregate and forage. The entire 5.5 m x 49 m water column directly above the array could be electrified? energized when the power was turned on. The array was designed by Smith-Root to produce a graduated electric field at a very low level of pulsed direct current (DC). The copper cables were attached to 3 of Smith-Root 1.5 POW DC Pulse Generator units powered by a portable 5.5 KW, AC generator. The pulse frequency was fixed during the trials at 2 Hz. The intensity of the voltage field was manipulated by varying the pulse width. Final calibration of the system was completed on April 12, 2007 and the voltage gradient in the field area was mapped prior to testing. Electrical field density readings ranged between 0.12-0.28 volts/cm. By design, the highest field strength was at the most upstream edge of the array.

The first series of trials were conducted on April 12 - 14, 2007. During the evening of April 12, 2007, the parameters of the electric field were reviewed with Vancouver Aquarium veterinarian, Dr. Martin Haulena; DFO Marine Mammal Coordinator, Marilyn Joyce; Marine Mammal Biologist, Peter Olesiuk; Puntledge River Hatchery Manager, Chris Beggs, and staff from Smith-Root and the Pacific Salmon Commission, and it was agreed that the study could proceed. The initial pulse width setting was 200 micro seconds. With the power turned off to the electrical array at 00:00 (midnight) on April 13, 3 seals were observed from the 5th Street Bridge. Two of those seals appeared to be actively feeding within the array area. At 00:15 the power was turned on to the array. Both seals showed an abrupt change in behaviour and both seals left the vicinity of the electrical array. At 00:16 1 seal was observed, and 16 seconds later the seal swam within the electrical field. After 12 seconds the seal swam downstream and out of sight. At 00:20 1 seal was observed above the array and at 00:21 the seal quickly swam upstream and out of sight. At 00:30 power was turned off. At 00:34 1 seal was observed upstream and after a few seconds swam upstream and out of sight. At 00:38 1 seal was observed within the array area, but within a few seconds the seal swam away and out of sight. This same pattern of behaviour occurred twice over the next 10 minutes. With no seals observed after an additional 45 minutes of observations the trials were concluded at 01:25, April 13.

Dr. Martin Haulena did not identify any behaviour by the seals that would indicate the animals were distressed during, or immediately following the period that the electrical equipment was turned on. Seals resumed usual behaviour during the time that they occupied the area 10-20 meters upstream of the apparatus. In addition, Peter Olesiuk, Marilyn Joyce and Dr. Christine MacWilliams were present as DFO observers. No seals were observed on the following evening, April 13/14. This may have been due to heavy rain, high water levels, high river velocity, and high turbidity.

A second series of trials were conducted during the evening hours of April 23–24 and April 24-25, 2007. Prior to April 23rd Chris Beggs (Puntledge River Hatchery Manager, DFO) observed several seals foraging beneath the 5th Street Bridge as well as upstream of the Bridge. Present during the April 23 – 24 trials were Keith Forrest (PSC),

Chris Beggs (DFO), Brian Munro (DFO), Peter Olesiuk (DFO), Dr. Martin Haulena (Vancouver Aquarium), Lisa Harlan (Smith-Root), Lee Carstensen (Smith-Root). The electrical field density readings ranged between 0.16–0.26 volts/cm. On April 23, at 21:30 7 seals were observed feeding within the array area in addition to several other animals feeding upstream of the 5th Street Bridge. The seals were observed for 30 minutes prior to turning on the power to the array. The power was turned on to the array at 22:07. The pulse width was set at 500 micro-seconds. At 22:10 3 seals were present upstream of the array. At 22:11 1 – 2 seals remained in the vicinity of the array. The observed seals were no longer feeding. At 22:13 the power was turned off to the array and 2 seals appeared from upstream. At 22:19 3 seals were present in the array area and by 22:24, 4 seals were present. The seals did not appear to be foraging as vigorously compared to earlier observations. Over the next 30 minutes, the number of seals observed from the 5th Street Bridge ranged between 2 – 8 animals. In addition to the 5th Street Bridge observations 7 seals were observed approximately 200 meters upstream from the Bridge. At 23:00 there were 4 seals present within the array area and the power was turned on. The pulse width was set at 1 millisecond. The 4 seals responded abruptly, splashed and immediately left the area. At 23:06 1 seal briefly swam into the array, but turned way immediately. At 23:08 the power was turned off to the array. No seals were observed over the next 45 minutes and trials were concluded at 23:43 pm.

On April 24, 2007 the power was turned on at 19:00, 1.5 hours before dark. The pulse width was set at 1 millisecond. From the 5th Street Bridge the array was continually monitored and observations upstream of the Bridge were conducted every 15 minute intervals. At 20:35 1 seal turned around as it approached the array from downstream. At 21:10 a second seal turned around as it entered the array area from downstream. At 21:30 a third seal turned around as it swam upstream into the array area. One seal was observed upstream of the bridge and at 22:30 1 seal was observed swimming downstream towards the array. Between 22:30 and 23:00 several seals were observed downstream of the 5th Street Bridge. At 23:00 the power was turned off to the array and by 23:30 there were 10 – 12 seals actively feeding upstream of the Bridge (near the tennis courts). At 00:30 no seals were present beneath the 5th Street Bridge, however 10 – 12 seals remained feeding upstream of the Bridge. With the array removed from the Puntledge River, on April 26, 2007 at 00:01 9 seals were observed feeding slightly upstream of the 5th Street Bridge light shadow in addition to 6 seals feeding upstream of the Bridge.

In conclusion, during this study an avoidance response of the seals to the array area was demonstrated at pulse width settings of 200 and 500 micro-seconds. However continuous deterrence of seals from foraging was not demonstrated at these settings. A clear avoidance response was evident at a pulse width setting of 1 millisecond and seals avoided moving upstream through the electrical field. The voltage gradient and pulse width settings are much less than required for an effective barrier of freshwater fish migration (Dave Smith, Personal communication, Smith-Root Inc). The one seal that was observed upstream of the electrical array, on April 24th, may have swam through the electrical field unobserved, or the animal may have already been upstream prior to turning the power on to the array at 7:00 pm. There did not appear to be any lingering or adverse effects of the electric field on the seals as they were observed swimming and feeding normally within the array area shortly after the power was turned off and during the evenings that followed. Dr. Martin Haulena was present to observe all trials in the

Puntledge River and indicated that a 1 millisecond pulse width would be the maximum setting that he would authorize during the trials in the Puntledge River.

Factors such as water conductivity, pulse width, voltage gradient, size of animal, species, motivation and habituation to electric field could influence the avoidance response by individual animals. Additional pilot studies, will be required to ascertain how these factors may influence the avoidance response of seals and other pinnipeds to a DC-pulsed electric voltage gradient. However, this feasibility study indicates that this technology has potential for deterring marine mammal predation on fish.

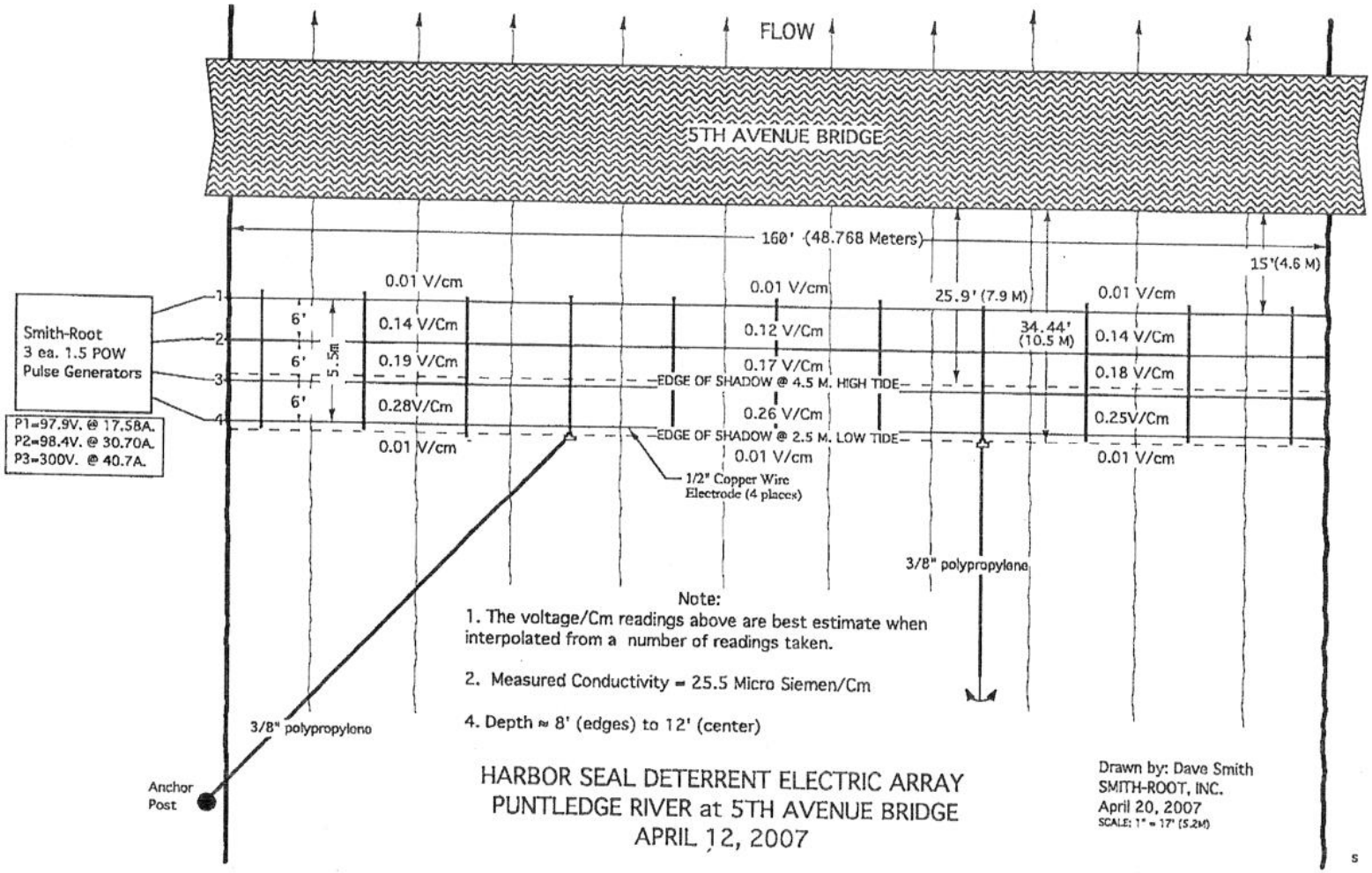
FLOW
5TH AVENUE BRIDGE
160' (48.768 Meters)
15'(4.6 M)
25.9' (7.9 M)
34.44' (10.5 M)
Smith-Root
3 ea. 1.5 POW
Pulse Generators
P1=97.9V. @ 17.58A.
P2=98.4V. @ 30.70A.
P3=300V. @ 40.7A.
1
2
3
4
6'
6'
6'
5.5m
0.01 V/cm
0.14 V/Cm
0.19 V/Cm
0.28V/Cm
0.01 V/cm
0.01 V/cm
0.12 V/Cm
0.17 V/Cm
0.26 V/Cm
0.01 V/cm
0.01 V/cm
0.14 V/Cm
0.18 V/Cm
0.25V/Cm
0.01 V/cm
EDGE OF SHADOW @ 4.5 M. HIGH TIDE
EDGE OF SHADOW @ 2.5 M. LOW TIDE
1/2" Copper Wire
Electrode (4 places)
3/8" polypropylene
3/8" polypropylene
Anchor
Post
Note:
1. The voltage/Cm readings above are best estimate when interpolated from a number of readings taken.
2. Measured Conductivity = 25.5 Micro Siemen/Cm
4. Depth ≈ 8' (edges) to 12' (center)
HARBOR SEAL DETERRENT ELECTRIC ARRAY
PUNTLEDGE RIVER at 5TH AVENUE BRIDGE
APRIL 12, 2007
Drawn by: Dave Smith
SMITH-ROOT, INC.
April 20, 2007
SCALE: 1" = 17' (5.2M)

figure 1

COMMITTEE ON THE BUDGET

COMMITTEE ON SCIENCE
Chairman
Subcommittee on Research and Science Education

COMMITTEE ON TRANSPORTATION
AND INFRASTRUCTURE

BRIAN BAIRD
CONGRESS OF THE UNITED STATES
3RD DISTRICT, WASHINGTON

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WEBSITE: http://www.house.gov/baird

May 7, 2007

Jeff Smith, President
Smith-Root Inc.
14014 NE Salmon Creek Avenue
Vancouver, WA 98686

Dear Jeff,

I write to extend my strong support to Smith-Root in your effort to secure an Innovative Fish and Wildlife Project grant which is offered through the Northwest Power and Conservation Council Columbia River Fish Basin Fish and Wildlife Program.

The grant program encourages projects that employ technology that has not been used before in Columbia Basin fish and wildlife projects. The program seeks out innovating projects that will improve knowledge, encourage creative thinking and provide an opportunity to test or demonstrate new methods and technologies that directly benefit fish and wildlife in the Columbia Basin. It would seem the grant program and your project would be a good fit.

I support Smith-Root in its efforts to find a non-lethal approach to reduce sea lion predation of endangered Columbia River salmon. I have introduced legislation that allows for lethal removal of the most aggressive sea lions in order to deter predation. In recent years, the U.S. Army Corps of Engineers has observed that thousands of returning salmon are killed by sea lions in the area around Bonneville Dam. We share a mutual goal in protecting endangered salmon. To that end, the legislation also supports the development of non-lethal measures such as yours.

Smith Root has shown due diligence in developing initial data that demonstrates the potential effectiveness of its electrical barriers in controlling the movement of marine mammals such as seals. The preliminary results suggest that seals may be extremely sensitive to an underwater electric field, that underwater electric barriers have potential for non-lethal deterrence of marine mammals.

I commend you for your innovation in addressing the sea lion predation problem in the Columbia River Basin and I support your in your efforts to secure this grant that will allow you to continue your investigatory work.

Sincerely,

Brian Baird

Brian Baird
Member of Congress

Association of Northwest Steelheaders

PO Box 22065 • 6641 SE Lake Road • Milwaukie OR 97269
503-653-4176 • fax 503-653-8769
www.nwsteelheaders.org

April 23, 2007

Contributions to ANWS are tax deductible.

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

Dear Dr. Karier:

As you know, marine mammal predation on salmon, steelhead and sturgeon is getting out of hand in the Columbia River, and it has created immense problems for fishers and managers alike in many NW drainages. The Northwest Steelheaders have taken a parallel approach to the problem. First, to work within the existing Marine Mammal Protection Act (MMPA), urging our fish and wildlife management to implement effective harassment methods to keep Sea Lions from fish migration bottlenecks such as the Bonneville Dam fish ladder. The second is to work with our federal legislators toward revisions to section 120 of the MMPA to allow a streamlined process, giving fish and wildlife agency managers the ability to act quickly and appropriately to remove the most aggressive animals from the habitat.

The Northwest Power and Conservation Council is in the position to enable a new harassment technology that may dramatically improve the performance of this approach to the problem. We support trials of this new technology that could help resolve the sea lion predation and human conflict issues, to the mutual satisfaction of both resource managers and the fishing public at-large.

We are referring to the conceptual technology proposed by a private sector firm from Vancouver, WA (Smith-Root, Inc), a company who has been providing electrofishing technology to our nation's fishery scientists and administrators for the past 43 years (www.smith-root.com).

The Association of Northwest Steelheaders comprise a diverse array of over 2,000 members throughout Washington and Oregon. These members work hard to restore our wild salmon and steelhead runs through volunteer in stream projects, funding, and advocacy. These dedicate conservationists support the testing of the Smith-Root's approach as we do any technology or approach that can resolve marine mammal predation on salmon, steelhead and sturgeon in the Columbia River and other Northwest basins. In turn, we urge your support of Smith-Root's upcoming proposal to the Northwest Power and Conservation Council for a demonstration project to test their concept.

Their proposal is being submitted for NWPCC funding under the Innovative Technology category. It deserves the chance to at least be tested via a demonstration project to deter marine mammals using an electric barrier and sonar array. We are interested in seeing their technology applied in the Columbia River and elsewhere in the Pacific Northwest, where seal and sea lion predation has caused serious threats to our region's fisheries. This company has an established track record with electrical barrier installations, and their array in the Chicago Shipping Canal is deterring aggressive Asian carp populations from colonizing upstream habitats in the Great Lakes. The barrier they are proposing in Pacific Northwest rivers would target marine mammals, and would be designed to allow boats and salmon to pass unaffected. This technology needs to be tested in a rigorous scientific manner. Please support the opportunity for Smith-Root to deploy and test this technology via their proposed demonstration project.

We urge the Power and Conservation Council to support Smith-Root's science methodology and their application for Innovative Science funding, to proceed with a planned demonstration project to address the harassment approach to this serious issue.

Please support this concept and this harassment technology. Methods in use today are clearly ineffective in dealing with the more aggressive and abundant California Sea Lions. MMPA section 120 revisions will not affect the ESA listed Stellar Sea Lions, which do show some positive response to harassment and are the primary threat to sturgeon. The Smith-Root harassment method could very well be the only effective solution of the Stellar Sea Lion while also providing a deterrent for the less aggressive members of the California Sea Lion population. Your constituents and the resource users of the Pacific Northwest need this kind of out-of-the-box thinking to resolve a very complex natural resource issue in the Columbia River Basin and beyond, through the use of novel and innovative science.

Thank you in advance for your consideration.

Sincerely.

Norman E. Ritchie

Norman E. Ritchie, P.E.

CC: Bill Williams, ODFW
Ed Bowls, ODFW

STATE REPRESENTATIVE
17th DISTRICT
DEB WALLACE

State of
Washington
House of
Representatives

HIGHER EDUCATION
CHAIR
TRANSPORTATION
APPROPRIATIONS SUBCOMMITTEE
ON EDUCATION
JOINT LEGISLATIVE AUDIT
& REVIEW COMMITTEE

April 26, 2007

Dr. Tom Karier, Chair
Joan Dukes, Vice-Chair
Northwest Power and Conservation Council
851 SW 6th Ave., Suite 1100
Portland, OR 97204-1348

Dear Members of the Northwest Power and Conservation Council:

I am writing in support of the Smith-Root Incorporated's sea lion project funding request. Washington State and fisheries along the Columbia River have been searching for solutions to the growing problem posed by sea lions to endangered salmon. Smith-Root's approach utilizes non-lethal technology as a deterrent to the sea lions. This technology continues to be tested by Smith-Root as a possible solution to mitigate sea lion predication.

I have worked with Smith-Root in the past couple of years and have been impressed with their innovative forward thinking processes. I appreciate your time and consideration of this project.

Sincerely,

Deb Wallace
State Representative
17th Legislative District

LEGISLATIVE OFFICE: 401 JOHN L. O'BRIEN BUILDING, PO BOX 40600, OLYMPIA, WA 98504-0600
360-786-7976 • **DISTRICT:** 360-260-6110 • **E-MAIL:** wallace.deb@leg.wa.gov
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Lower
Columbia
River Estuary
Partnership

April 23, 2007

Dr. Tom Karier, Chair
Joan Dukes, Vice Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

Dear Dr. Karier, Vice Chair Dukes and Members of the Northwest Power and Conservation Council:

The Lower Columbia River Estuary Partnership is pleased to offer its support for the Smith-Root, Inc. sea lion project, an application for funding that you are considering. Smith-Root recently made a presentation to our Board of Directors on this potential new technology focused on resolving the predation issue with sea lions and salmon in the lower Columbia River. This conflict is escalating and exists not only between sea lions and fish but between sea lions, fish and people. The Estuary Partnership is interested in this technology because it takes a new and different approach than those currently being employed. We value the innovation and we look forward to more testing being done with the Smith-Root technology.

Marine mammal predation has become a serious threat to fisheries in the Columbia River and elsewhere in the Pacific Northwest. Fishery managers struggle to implement restoration and recovery plans for listed salmon and sturgeon populations in light of *existing* challenges associated with hydropower, hatchery and habitat issues. Marine mammal predation on these endangered fish populations exacerbates an already complex situation. Smith-Root has proposed an approach to address this issue using non-lethal technology (an electric barrier coupled with an innovative sonar detection system) to deter marine mammal predation on fish. The Lower Columbia River Estuary Partnership encourages innovations in scientific thinking that assist resource managers and planners in solving difficult resource conflicts.

The Lower Columbia River Estuary Partnership supports the development and use of sound management principles and best science practices to promote healthy aquatic ecosystems and abundant aquatic resources. The management of sea lions will enhance the efforts we are undertaking with Council support to restore habitat for threatened and endangered salmonid populations. We look forward to working with Smith-Root with this technology and hope that you are able to support this project.

Sincerely,

Debrah Marriott
Executive Director

McLoughlin Chapter
PO Box 68354
Oak Grove OR 97268-0354

May 7, 2007

Senator Patty Murray
Marshall House
1323 Officer's Row
Vancouver, WA 98661

Dear Senator Murray:

I am writing to you in support of a proposal by Smith-Root of Vancouver, WA, to field test a method for controlling sea lions and seals in the Columbia River basin.

First, it is clear we have a serious problem with predation of ESA listed salmon, steelhead and sturgeon.

Second, the initial trials in Canada have shown it has the promise envisioned by Smith-Root.

Third, it is much more humane than the two other proposed methods, killing them or attempting to drive them away. The public probably won't stand for killing them - after all, they, like salmon are protected but, unlike salmon, they are very visible. Driving them away is not proving to be successful and the rubber bullets have the potential of taking an eye out or permanently maiming the animal.

Fourth, it is a locally developed product from a successful company with roots here in the Pacific Northwest. As they can tell you, they have been providing fisheries research related products to fisheries professionals for many years throughout the world.

Fifth, it is really ridiculous to call this a new product - it is not. All the components have been used in, for example, the Chicago Ship Canal, to repel undesirable fish or identify them or count them. It is the packaging of the individual components that is unique and that is what makes Smith-Root an innovative and far thinking company.

It is unfortunate they have had to do their initial product testing in Canada rather than here and it would be embarrassing to have their new product first adopted in Canada.

Your staff can obtain many examples of successful applications at their web site, www.smith-root.com. I personally know the Smith-Root president, Jeff Smith, and their chief scientist, Carl Burger. I invited them to speak at our chapter about this innovation and have since kept abreast of their progress.

I ask you to have your staff look into this important issue and I remain available for discussions.

Sincerely yours,

Mads Ledet, PhD
Past President
(503) 784-7022
1333 SW 19th Drive
Gresham OR 97080

cc: Jeff Smith, Carl Burger

1359 Down River Drive • Woodland, WA 98674

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

May 3, 2007

Dear Dr. Karier and Council Members:

As you well know, marine mammal predation on salmon, steelhead and sturgeon has become a serious threat to fisheries in rivers throughout the Pacific Northwest, from northern California to Canada. This is particularly true in areas such as the Columbia River Basin, where fishery managers are already faced with complex challenges and international issues that affect the recovery of endangered fish populations.

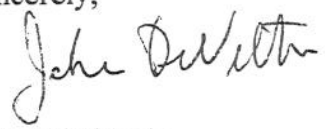
Fish First has a long history of salmonid restoration activities and supports the development and use of sound management and best science to promote healthy aquatic ecosystems and abundant fishery resources. The marine mammal situation has risen to such prominence in the Columbia River that fishery managers have recently discussed or sought permission to institute lethal take programs, to cull problematic marine mammals that are destroying runs of threatened and endangered salmonids.

It has come to our attention that an additional deterrence approach is being proposed by Smith-Root, Inc. in Vancouver, WA. This concept involves the testing of their innovative technology (a non-lethal electric barrier coupled with a sonar detection system) to evaluate the potential to deter marine mammal predation on fishes. Smith-Root has been one of the pioneers in the development of electro-fishing technology over the past 43 years, and has manufactured these sampling tools for a wide array of fishery professionals in diverse, aquatic science applications. I have seen video of Smith-Root's recent tests on captive marine mammals at the Vancouver BC Aquarium which have already demonstrated strong deterrence potentials using a very mild electric field. The results of this early experiment were amazing. However, to be used broadly, more testing is required to validate positive results.

Fish First encourages innovations in scientific thinking that produce tools and techniques to help natural resource managers solve difficult resource issues — using whatever strategies the managers deem essential to the restoration and recovery of the Pacific Northwest's fishery resources. **Fish First urges the Northwest Power and Conservation Council to approve and fund Smith-Root's proposed demonstration project for marine mammal deterrence.** Fishery management efforts need multi-faceted approaches for resolving extremely complex issues that affect natural resources and the people who use and rely on them. Please provide Smith-Root the opportunity to demonstrate their technology in the Columbia River Basin, and the chance to test and evaluate its applicability and

relevance for a wide array of other potential settings, where marine mammal predation is a serious issue.

Sincerely,



John DiVittorio
Executive Director
Fish First

360-713-7460
www.fishfirst.org

Northwest Marine Technology, Inc.
Pioneering solutions for the problems of aquatic resource management

Dr. Tom Karier, Chair, and Members
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

April 24, 2007

Dear Dr. Karier and Council Members:

Northwest Marine Technology has enjoyed a long legacy of developing innovative conservation tools and new technology for world-wide applications in fisheries conservation and research. We are pleased to offer our support to a private-sector partner (Smith-Root, Inc; Vancouver, WA) who is submitting a proposal to the Council for a demonstration project to deter marine mammal predation on Columbia River Basin fish populations.

Marine mammal predation on salmon, steelhead and sturgeon populations has become a serious challenge for fishery managers and a dilemma for the fishing public. Following implementation of the Marine Mammal Protection Act in 1972, seal and sea lion populations have increased exponentially, as have their impacts on sensitive fish populations (some of which are listed under the ESA). Despite numerous control and hazing programs, marine mammals continue to exploit fish stocks as evidenced by frequent articles in regional news outlets from northern California to Canada.

Northwest Marine Technology supports the use of innovative science in conserving and managing the fisheries resources of the Pacific Northwest. Accordingly, we also support the concept being proposed by Smith-Root. It incorporates a passive electric barrier coupled with a sonar array to identify and deter marine mammal predation using non-lethal technology. Based on Smith-Root's preliminary evaluations in British Columbia with captive seals, marine mammals appear to be quite sensitive to the effects of an underwater field of pulsed direct current. Accordingly, Smith-Root's concept and their technology deserve to be tested via a demonstration project in the Columbia Basin. Northwest Marine Technology urges the Northwest Power and Conservation Council to fund this project because of its relevance and its implications for potentially resolving a critical natural resource issue that is adversely affecting our fisheries and the people who rely on them.

Sincerely,

Dr. Keith Jefferts, President

P.O. Box 427 Ben Nevis Road Shaw Island Washington 98286 U.S.A.
Phone (360) 468-3375 FAX (360) 468-3844 Tax I.D. No. 22-1935793

Native Fish Society
PO Box 19570
Portland, OR 97280

Fighting for the Future of Native Fish
Conserving biological diversity of native fish and protecting their habitats

May 7, 2007

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

Dear Dr. Karier and NPCC members:

Each year, marine mammal predation on salmon, steelhead and sturgeon is increasing in the Columbia River, creating challenging problems for both the fishing public and resource managers. We are seeing a 4 percent take of Columbia River ESA listed salmon and steelhead. The Oregon Department of Fish and Wildlife estimated that 500 Columbia River sturgeon were killed by sea lions. At this kill rate, it will not be long before Columbia River sturgeon will be up for ESA listing.

We have become aware of some new technology that could help resolve this issue, to the mutual satisfaction of both resource managers and the public at-large. This concept and its associated technology would meet the goals of the Council's recent solicitation for Innovative Science Proposals.

I am referring to the conceptual technology proposed by a private firm from Vancouver, Washington, Smith-Root, Inc, a company that has been providing electrofishing technology to our nation's fishery scientists for the past 43 years (www.smith-root.com).

The Native Fish Society has over 700 members throughout Washington and Oregon. We support Smith-Root's approach as we do any technology that can resolve marine mammal predation on salmon, steelhead and sturgeon in the Columbia River, We urge your support for Smith-Root's demonstration project proposal. Their proposal is being submitted to the Council for funding under the Innovative Technology category. A non-lethal deterrence of seal and sea lion predation of salmonids and sturgeon is important to the success of the Council's fish and wildlife program.

The barrier they are proposing in the Pacific Northwest would target marine mammals, allowing salmon and sturgeon to pass unharmed. But this technology needs to be tested in a rigorous scientific manner, so we are requesting that the council fund this proposed demonstration project by Smith-Root, Inc.

Respectfully,

Richard Kennon
Director
37814 NE 234th Ave.
Yacolt, WA 98675
tightlines@centurytel.net
www.nativefishsociety.org

CC:
Senator Gordon Smith (OR)
Senator Ron Wyden (OR)
Senator Patty Murray (WA)
Senator Maria Cantwell (WA)
Rep Brian Baird (WA)
Rep Doc Hastings (WA)
Rep Norm Dicks (WA)
Rep Darlene Hooley (OR)
Rep David WU (OR)
Rep Greg Walden (OR)
Interested Parties

Sustainable Fisheries Foundation

Building Partnerships for the Future

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

April 25, 2007

Dear Dr. Karier and Council Members:

As you well know, marine mammal predation on salmon, steelhead and sturgeon has become a serious threat to fisheries in rivers throughout the Pacific Northwest, from northern California to Canada. This is particularly true in areas such as the Fraser and Columbia River Basins, where fishery managers are already faced with complex challenges and international issues that affect the recovery of dwindling fish populations.

The Sustainable Fisheries Foundation will always support the development and use of sound management and best science to promote healthy aquatic ecosystems and abundant fishery resources. The marine mammal situation has risen to such prominence in the Pacific Northwest that fishery managers from British Columbia, Washington, Oregon, and Idaho have recently discussed (Canada) or sought (USA) permission to institute lethal take programs, to cull problematic marine mammals in areas where salmonid predation is highest. (As you well know, the pinniped issues in the Columbia River involve predation on ESA-listed populations of salmon, steelhead and sturgeon, further compromising the ability of U.S. fishery managers to recover endangered fish.)

It has come to our attention that an additional deterrence approach is being proposed by a private sector firm from Vancouver, WA (Smith-Root, Inc.). Smith-Root's concept involves the testing of their innovative technology (a non-lethal electric barrier coupled with a sonar detection system) to evaluate the potential to deter marine mammal predation on fishes. Smith-Root has been one of the pioneers in the development of electrofishing technology over the past 43 years, and has manufactured these sampling tools for a wide array of fishery professionals in diverse, aquatic science applications. Smith-Root's recent tests on captive marine mammals at the Vancouver BC Aquarium have already demonstrated strong deterrence potentials using a very mild electric field. Those preliminary results also provide new data on threshold responses of marine mammals to electric current, information that was previously unavailable (published accounts of the effects of electricity on marine mammals do not exist). These findings and this innovative technology now need a more comprehensive evaluation in-situ.

Sustainable Fisheries Foundation
#24-4800 Island Hwy N
Nanaimo, BC V9T 1W6
Phone: 250-729-9623; Fax 729-9628
Email: sff@island.net; www.sff.bc.ca

Sustainable Fisheries Foundation
120 Avenue A, Suite D
Snohomish, WA 98290
Phone: (360) 862-1255 Fax: 563-0393

The Sustainable Fisheries Foundation encourages innovations in scientific thinking that produce tools and techniques to help natural resource managers solve difficult resource issues — using whatever strategies the managers deem essential to the restoration and recovery of the Pacific Northwest's fishery resources. The Foundation urges the Northwest Power and Conservation Council to approve and fund Smith-Root's proposed demonstration project for marine mammal deterrence. Fishery management efforts need multi-faceted approaches for resolving extremely complex issues that affect natural resources and the people who use and rely on them. Please provide Smith-Root the opportunity to demonstrate their technology in the Columbia River Basin, and the chance to test and evaluate its applicability and relevance for a wide array of other potential settings, where marine mammal predation is a serious issue.

Smith-Root's innovative science may help managers resolve this complex natural resource issue and sustain regional fisheries resources. The novel concept and the demonstration project proposed by Smith-Root may represent yet another viable technique with which to address the marine mammal predation issues in the Columbia River Basin and beyond.

Sincerely,

Don MacDonald
Executive Director

Port of Ridgefield
RAISING TOMORROW'S STANDARD

COMMISSIONERS
Joe Melroy
Roy Randel
Bruce Wiseman

EXECUTIVE DIRECTOR
Brent Grening

May 8, 2007

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

Dear Dr. Karier and Council Members:

Marine mammal predation on salmon, steelhead and sturgeon has become a serious threat to fisheries in rivers throughout the Pacific Northwest, including the Columbia River Basin. To meet the challenges of resource management and fish recovery, the Port of Ridgefield supports the development and application of sound management and best science to promote healthy aquatic ecosystems, abundant fishery resources and sustainable use of rivers.

The marine mammal situation has risen to such prominence in the Pacific Northwest that fishery managers from, Washington, Oregon, and Idaho have recently sought permission to institute lethal take programs, to cull problematic marine mammals in areas where salmonid predation is highest.

It has come to our attention that, Smith-Root, Inc. a private sector firm from Vancouver, WA (Smith-Root, Inc.) has begun testing a safe, species selective, non-lethal predator deterrence technology. Smith-Root's technology includes a non-lethal electric barrier coupled with a sonar detection system. We support the company's proposal to evaluate the potential of their concept to deter marine mammal predation on fishes. Smith-Root has been one of the pioneers in the development of electrofishing technology over the past 43 years, and has manufactured these sampling tools for a wide array of fishery professionals in diverse, aquatic science applications.

Smith-Root's initial field tests appear to demonstrate the strong deterrence potential of applying a very mild electric field to an approaching pinneped. These preliminary findings suggest that this innovative technology should undergo comprehensive in situ evaluation.

The Port of Ridgefield encourages innovation and scientific analysis in the development and application of tools and techniques to help natural resource managers solve difficult resource issues. The Port urges the Northwest Power and Conservation Council to approve and fund Smith-Root's proposed demonstration project for marine mammal deterrence.

Please provide Smith-Root the opportunity to demonstrate and test their technology in the Columbia River Basin. This is an opportunity to evaluate the technology's applicability and relevance for a wide array of other potential settings, where marine mammal predation is a serious issue.

Smith-Root's innovative science may help managers resolve this complex natural resource issue and sustain regional fisheries resources. The novel concept and the demonstration project proposed by Smith-Root, may represent yet another viable technique with which to address the marine mammal predation issues in the Columbia River Basin and beyond.

Sincerely,

Brent A. Grening
Executive Director

May 7, 2007

Dr. Tom Karier, Chair
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

Dear Dr. Karier and Council Members:

As I am sure you are aware, sea lion predation on salmon, steelhead and sturgeon has become a serious threat in the Columbia River, specifically in the area immediately down stream of Bonneville Dam. However the issue of seal and sea lion predation seems to be an ever increasing concern in rivers throughout the Pacific Northwest, from northern California to Canada. This problem becomes even more frustrating when certain predators are ESA listed species that are preying on salmon and steelhead which are also listed.

I am writing you on behalf of the Clark-Skamania Flyfishers. The Clark-Skamania Flyfishers is a non-profit, tax-exempt organization incorporated in the State of Washington. Founded in 1975, CSF and its 150 members are dedicated to the preservation of wild fish stocks and the natural resources that sustain them. CSF is further committed to the promotion of fly-fishing as a method of angling and, through it, an understanding of and appreciation for the diversity of nature. Because of our mission and concern for wild salmon and steelhead I am asking you to give particular consideration to a new and innovative approach for controlling these predators that is in the preliminary stages of testing by a North West based company, Smith-Root.

I am sure you have been provided all of the technical details on this non-lethal exclusionary method based upon a low level electronic field, so I will not take your time with a recitation of that information once again. I have had the opportunity to review the preliminary results from testing of the Smith-Root system in Canada and it appears very promising. If this system would ultimately be effective in excluding seals and sea lions from areas where their predation is having profound effects on fish populations, then from a legal, social, and political stand point, it would be far and away preferable to killing these animals which many of our citizens value far more than, salmon, steelhead and sturgeon.

We would recommend that you provide the opportunity and funding for Smith-Root to adequately test their new non-lethal electronic marine mammal exclusionary system on the Columbia River via a demonstration project. If this system is found to be effective it will have highly beneficial effects on the issue of marine mammal predation in many areas throughout the North West, the Columbia River being only one of those areas.

Sincerely,

Dennis Ward
President, Clark-Skamania Flyfishers

LOWER COLUMBIA Fish ENHANCEMENT GROUP

"Working with public and private landowners to enhance the region's salmon populations since 1981"

Dr. Tom Karier, Chair, and Members
Northwest Power and Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, OR 97204 -1348

May 8, 2007

Dear Dr. Karier:

Sea lion predation on salmon, steelhead and sturgeon is a serious threat to fisheries in the Pacific Northwest, particularly in the Columbia River, where fishery managers are trying to recover endangered populations.

The Lower Columbia Fish Enhancement Group is a non-regulatory, non-profit recovery organization that works in watersheds throughout Clark, Skamania, Lewis, Wahkiakum, and Cowlitz counties to provide leadership in salmon recovery in ways that promote partnerships, collaboration and community involvement. Our members and partners also work to restore habitats that sustain salmon and steelhead runs in the Lower Columbia Basin. We support the development and use of sound resource management and best science to promote healthy aquatic ecosystems and abundant fishery resources.

The marine mammal situation has risen to such prominence in the Pacific Northwest that managers from Washington, Oregon, and Idaho have recently sought permission to institute a lethal take program, to cull problematic marine mammals in areas where salmon and steelhead congregate in the Columbia River. An additional approach (recently evaluated in British Columbia, Canada) is under development by Smith-Root, Inc., a private company in Vancouver, WA. It involves the testing of innovative technology (a non-lethal electric barrier coupled with a sonar detection system) to deter marine mammal predation on fish. Smith-Root pioneered the development of electrofishing equipment and has manufactured this technology for a wide array of fishery biologists, researchers and managers over the past 43 years.

The Lower Columbia Fish Enhancement Group encourages innovations in scientific thinking that can assist managers in solving difficult resource issues – using whatever strategies the managers deem essential to restoration and recovery plans for Columbia Basin fishery resources. The Northwest Power and Conservation Council should provide demonstration opportunities for the testing and evaluation of innovative science that may help managers resolve complex natural resource issues and sustain regional fisheries resources. Multiple approaches are often necessary to address challenging issues. The novel concept and demonstration project proposed by Smith-Root may represent yet another viable technique with which to address the marine mammal predation issues in the Columbia River Basin.

Sincerely,

Tony Meyer
Executive Director

Evaluation of an Electrical Gradient as a Seal Deterrent
Vancouver Aquarium Study
March 27, 2007
Preliminary Results

On March 26, 2007, staff from the Pacific Salmon Commission and Smith-Root Inc. installed a system to create an electrical voltage gradient in a research pool at the Vancouver Aquarium. The anode and cathode of the system were located directly across from one another approximately 4.9 m on opposite sides at the west end of the research tank. The test seals could not simultaneously touch both electrodes. In addition, a non-electrified area within the pool was created. The electric field occupied approximately one third of the pool. Final calibration of the system was completed on March 27, 2007 and the voltage gradient in the field area was mapped following each trial. Electrical field density readings ranged between 0.10 - 0.32 Volts/cm. Two harbour seals (*Phoca vitulina*) were evaluated during separate trials in this study: Seal 1, a male weighing 92 kg and Seal 2, a male of 89 kg. The purpose of the trials was to determine the minimum voltage field that elicits a change in the behaviour of the harbour seals used in the study. The intensity of the voltage field was manipulated by varying pulse width.

The pulse frequency was fixed during the trials at 2.25 Hz. Pulse width was increased at approximately 5 minute intervals during the trials with steps beginning at 75 micro-seconds, 100 micro-seconds, 200 micro-seconds and 400 micro-seconds. Prior to the commencement of the trials, the test animals were allowed to acclimate to the research pool and the study equipment. During the acclimation, the animals showed no apparent interest in the equipment and their behaviour was judged normal by the Vancouver Aquarium marine mammal trainers and Dr. Martin Haulena, the Vancouver Aquarium veterinarian.

The first study animal, Seal 1, demonstrated no change in behaviour at a pulse width of 75 micro-seconds (5 minute period) or at a pulse width of 100 micro-seconds. The seal swam into all areas of the pool and used haul-outs on both ends of the pool. However, at a pulse width of 200 micro-seconds, he demonstrated a noticeable change in behaviour by swimming in a tight little circle (less than one body length in diameter) near the edge of the electric field and exiting to the non-electrified portion of the pool outside of the voltage gradient. During the 5 minute interval at a pulse width of 200 micro-seconds, the seal approached the electric field 4 times demonstrating active avoidance of the electrical gradient area on each occasion. At this point the electrical gradient was turned off and Seal 1 resuming normal swimming patterns in the area that was previously avoided at the 200 micro-second pulse width setting.

The second study animal, Seal 2, demonstrated no change in behaviour at pulse width settings ranging from of 75-200 micro-seconds (5 minute periods each). However, at a pulse width of 400 micro-seconds, he demonstrated a noticeable change in behaviour by turning around at the edge of the electric field and returning to the area outside the voltage gradient. The seal approached the electric field 18 times demonstrating apparent avoidance of the voltage gradient areas on each occasion. This animal did not demonstrate the same behaviour as the previous animal, which swam in the quick, tight little circle each time it entered the voltage gradient. As in the previous trial, at this point the electrical gradient was turned off and Seal 2 resumed swimming in the area that was avoided at the 400 micro-second pulse width setting. The study was repeated with Seal 2 using a pulse frequency of 1.32 Hz with the same avoidance behaviour noted at 400 micro-second pulse width with resumption of normal

swimming patterns after the gradient was removed. Seal 2 was more active throughout the study than was Seal 1.

A more careful review of the results will be made when the hand-held video footage is made available. However, both seals demonstrated avoidance responses at voltage gradients and pulse width settings much less than typically required for freshwater fish (Dave Smith, Personal communication, Smith-Root Inc). At the conclusion of each of the trials, the study animals demonstrated no negative effects of the experiment as judged by the marine mammal trainers and Dr. Martin Haulena. The animals resumed feeding 3 hours after the experiment and exhibited no abnormal behaviours.

Jim Cave
Head, Stock Monitoring
Pacific Salmon Commission