R & E Grant Application 13 Biennium

Project #: 13-082

Performance of triploid summer steelhead

Project Information

R&E Project Request:	$60,610.00
Match Funding:	$64,455.00
Total Project:	$125,065.00
Start Date:	8/1/2014
End Date:	6/30/2015
Project Email:	Marc.Johnson@oregonstate.edu
Project Biennium:	13 Biennium
Organization:	ODFW - Corvallis Research Lab

Applicant Information

Name:	Marc Johnson
Address:	28655 Highway 34 Corvallis, OR 97333
Telephone:	541-757-5152
Email:	Marc.Johnson@oregonstate.edu

Past Recommended or Completed Projects

Number	Name	Status
13-055	Assessing hatchery-wild hybridization in steelhead	Recommended

Project Summary

This project is NOT part of ODFW's 25 Year Angling Plan.

Activity Type: Research

Summary: Genetic introgression from hatchery summer steelhead poses a genetic risk to native Upper Willamette River winter steelhead (NMFS 2008). Sterilization mitigates the risk of genetic introgression from hatchery fish (Utter et al. 1983). Sterile triploid fish can easily be produced by exposing eggs to pressure shock after fertilization (Chourrout 1984). In 2012, ODFW produced over 14 million triploid rainbow trout eggs (ODFW 2013). Surprisingly few studies have investigated juvenile-to-adult performance of triploid salmon or steelhead. Our ongoing PIT tag-based research will evaluate triploidy as a management tool to reduce potentially negative genetic effects from hatchery summer steelhead.

Objectives: The overarching objective of this work is to evaluate the performance of triploid summer steelhead, relative to full-sibling diploid controls. This work is aimed to

develop a fisheries management tool that will reduce genetic impacts from hatchery summer steelhead on wild, native fish, as consistent with ODFW Hatchery Management Policy (ODFW 2010).

To meet this objective we will:

1) Use induced pressure treatment on fertilized eggs to produce triploid steelhead (COMPLETED with match funding and in-kind support)

2) Use flow cytometry to measure triploid induction rates (in progress and TO BE COMPLETED with match funding and in-kind support)

3) PIT tag 30,000* experimental hatchery summer steelhead in 2014 (R&E FUNDS REQUESTED to finance a portion of this tag purchase). In 2013, a total 14,000 fish were tagged for this study (COMPLETED with match funding and in-kind support)

4) Measure the growth and survivorship of triploid steelhead and compare to that of full-sibling diploid controls at South Santiam and Willamette hatcheries

5) Release PIT-tagged juvenile summer steelhead (equal number of diploids and triploids) from South Santiam (n=15,000) and Willamette (n=15,000)* hatcheries in 2015. In 2014, a total 14,000 tagged steelhead were released from South Santiam Hatchery for this project

6) Record and compare the number of detections at Willamette Falls and estimated rate-of-travel by juvenile diploid and triploid steelhead released from South Santiam and Willamette* (at Dexter) hatcheries

7) Record and compare the number of detections for adult diploid and triploid steelhead at Willamette Falls. Adult detections for 2013 cohort will mostly occur in 2016 (previously funded by ODFW) and adult detections for 2014 cohort will mostly occur in 2017 (requested R&E funding for PIT tags)

*As written, this proposal describes two tagged release groups of 15,000 summer steelhead (total n = 30,000). However, meaningful results could be obtained from a single tagged release group in 2015 (from South Santiam Hatchery), if full project funding were not available. R&E funding request for a single tagged release in 2015 would total $24,160 = ((15,000 tags x $2.43/tag) - $5000 match from OHRC).

Fishery Benefits:

Techniques that demonstrably reduce genetic impacts of hatchery-origin fish on wild fish populations will serve to safeguard the future of hatchery operations and associated angler opportunities. Our work will be developed primarily in the Upper Willamette River basin, where recreational anglers will have the opportunity to harvest study fish. Also, although our research is focused on upper Willamette hatchery programs, results may be applicable to other systems and provide long-term angler benefits with minimal genetic risk to native fish populations.

Watershed Benefits:

The first goal of ODFW hatchery management policy is to "foster and sustain opportunities for sport, commercial and tribal fishers consistent with the conservation of naturally produced native fish" (ODFW 2010). Our project is designed to develop a fisheries management tool that will reduce the genetic impact (reduced fitness through introgression) from the Upper Willamette River summer steelhead hatchery program on native winter steelhead. At the same time, fish produced and released for this study will be available for harvest by recreational anglers. Ultimately, this work is intended to provide a management tool for fisheries enhancement that may be used in select Oregon watersheds.

This project has been identified as an ODFW priority at Regional and District levels.

Current Situation:

The proposed work is not intended to physically alter any site conditions. Work will be carried out with support and infrastructure of the Oregon Hatchery Research Center (pressure treatments, some rearing), Oregon State University (flow cytometry for triploid induction rate estimates), and existing infrastructure, operations and personnel at South Santiam and Willamette hatcheries (juvenile rearing, tagging and release).

Alternatives:

Other tagging or marking techniques (fin clips, CWTs, elastomer tags) represent alternatives to PIT tags for this study. While these alternatives may be less expensive at time of tagging, they require some form of active collection (e.g. creel, recovery at traps), which can be expensive and will not provide the robust data expected from 100% detection of adult returns at Willamette Falls. Ultimately, PIT tags provide the most cost-effective method for this study at $2.42/tag and negligible tag data recovery costs afforded by the PIT interrogation site currently in place at Willamette Falls.

Other methods of triploid induction (e.g. heat shock) are significantly less effective than the pressure shock protocol we have optimized, which achieved 92-100% (median 99%) triploid induction in the first year of our study (2013).

Designer: This project will be designed by Dr. Marc Johnson (OHRC and ODFW Corvallis Research), Dr. David L. G. Noakes (OHRC and OSU), Thomas A. Friesen (ODFW Corvallis Research) and Ryan Couture (OHRC).

Methods: Task 1) Production of triploid summer steelhead and diploid controls

We will use standard 1:1 (male:female) spawning practices to produce approximately 52,500 fertilized eggs from fifteen families of South Santiam stock (STS 024 stock) summer steelhead. Fertilized eggs from each family will be halved to provide paired treatment and control groups. Half of the eggs from each of the fifteen families will be exposed to 10,000 psi for 5 minutes at 22 minutes after fertilization. We will estimate egg loss rates for the triploid treatment and diploid control groups for subsequent analyses. All spawning and triploid induction will be performed at South Santiam Hatchery by ODFW staff. Except for 120 eggs from each family that will be transferred to the Oregon Hatchery Research Center (OHRC) for flow cytometry analysis (evaluate treatment efficacy), all steelhead for this study will be incubated and hatched at South Santiam Hatchery, then reared at and released by South Santiam and Willamette Hatcheries.

Task 2) Quantify triploid induction rates

We will use flow cytometry (Thorgaard et al. 1982) to measure triploid induction rates from pressure treatments on fertilized summer steelhead eggs. A sample of 120 fish from each family will be analyzed by ODFW Fish Health Services.

Task 3) Measure survivorship of triploid steelhead at all stages of juvenile development and compare with diploid controls

Steelhead will be reared at South Santiam and Willamette hatcheries, according to standard hatchery production protocols. Control and treatment groups will be reared separately until tagging. We will clip the adipose fin and PIT tag all juvenile steelhead when they reach six months of age (estimated minimum n = 30,000, after early mortality). Thereafter, treatment and control groups will be combined and reared in a single raceway at each hatchery. We will collect mortality data for triploid and control steelhead at regular intervals during all stages of juvenile development. These data will be used to produce survivorship curves for comparison between treatment and control groups.

Task 4) Measure growth and morphology of triploid steelhead during the parr to smolt stage of juvenile development and compare with appropriate diploid controls.

We will sample and measure the lengths of treatment and control steelhead (identified by PIT tag after common ponding) to estimate growth rates during the parr to smolt stage of development.

Task 5) Compare juvenile outmigration success and rate of travel to Willamette

Falls between triploid and diploid steelhead

PIT-tagged treatment and control steelhead smolts will be released from South Santiam and Willamette hatcheries and we will monitor the Columbia Basin PIT Tag Information System (PTAGIS) for tag detections at Willamette Falls and other interrogation sites to describe outmigration success (proportion of release group detected at Willamette Falls) and rate of travel (total distance/day post-release) for treatment and control groups.

Task 6) Estimate the smolt to adult return rate for triploid steelhead and compare with that of diploid controls.

In subsequent years we will monitor PTAGIS for detections of tagged fish that return to freshwater as adults. We will calculate the proportion of each release group (diploid and triploid) that are detected as adults for subsequent comparison. Adult steelhead with PIT tags that enter the Foster or Dexter fish traps (South Santiam and MF Willamette rivers) will be measured for length and a genetic (fin tissue) sample will be collected. Tag detections at locations other than Willamette Falls and the South Santiam and MF Willamette rivers may provide some information for stray rates by both diploid and triploid hatchery summer steelhead.

Task 7) Report development.

Findings from our research will be described in a detailed report, provided to ODFW Fish Propagation management, hatchery staff and Restoration and Enhancement Board members.

Citations

Chourrout, D. Pressure-induced retention of second polar body and suppression of first cleavage in rainbow trout: Production of all-triploids, all-tetraploids, and heterozygous and homozygous diploid gynogenetics. Aquaculture 36:111-126.

NMFS. 2008. Endangered Species Act 7(a)(2) Consultation Biological Opinion & Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation: Consultation on the “Willamette Basin Flood Control Project”. NOAA-Fisheries F/NWR/2000/02117.

ODFW (Oregon Department of Fish and Wildlife). 2013. Fish Propagation Annual Report for 2012. 153 pp. Available (May 2013) at: http://www.dfw.state.or.us/fish/hatchery/docs/2012_Fish_Propagtion_Annual_Report.pdf

ODFW (Oregon Department of Fish and Wildlife). 2010. Fish Hatchery Management Policy. Available at http://www.dfw.state.or.us/fish/hatchery/docs/hatchery_mgmt.pdf (November 2013).

Thorgaard, G. H., M. E. Jazwin, and A. R. Stier. 1981. Polyploidy induced by heat shock in rainbow trout. Transactions of the American Fisheries Society 110:546-550.

Thorgaard, G. H., P. S. Rabinovitch, M. W. Shen, G. A. E. Gall, J. Propp, and F. M. Utter. 1982. Triploid rainbow trout identified by flow cytometry. Aquaculture 29:305-309.

Utter, F. M., O. W. Johnson, G. H. Thorgaard, and P. S. Rabinovitch. Measurement and potential applications of induced triploidy in Pacific salmon. Aquaculture 35:125-135.

Inspector: Kelly Moore, Director of ODFW Western Oregon Fish Research Program

Funding Elements: R&E funds will be used to purchase a portion of the PIT tags used in the second year of this ongoing study. Work will be performed by existing ODFW staff, as well as STEP and other volunteers.

Partners: No

Existing Plan: No

Affected Contacted: Yes

Affected Supportive: Yes

Affected Comments: District Biologists, Dr. Elise Kelley and Jeff Ziller, have been contacted about this project and are very supportive. Southern Willamette Watershed Manager, Steven Marx, has been contacted and is supportive of this project.

Please see letters of support, as linked attachments in Additional Materials.

Project Schedule/Participants/Funding

Activity	Date	Participants
Year 1: Produce triploid and diploid steelhead	1/22/2013	Ryan Couture; Marc Johnson
Year 1: Estimate triploid induction rates with flow cytometry	4/15/2013	Ryan Couture; Craig Banner (ODFW Fish Health)
Year 1: PIT tag triploid and diploid steelhead at South Santiam Hatchery	7/15/2013	Marc Johnson; Tom Friesen
Year 1: Release PIT-tagged steelhead smolts from South Santiam Hatchery	3/31/2014	Marc Johnson; Brett Boyd (Hatchery Manager)
Year 2: Produce triploid and diploid steelhead	2/26/2014	Ryan Couture; Marc Johnson
Year 2: Estimate triploid induction rates with flow cytometry	4/15/2014	Ryan Couture; Craig Banner (ODFW Fish Health)
Year 2: PIT tag triploid and diploid steelhead at S. Santiam and Willamette hatcheries	8/25/2014	Marc Johnson; Tom Friesen
Year 2: Release PIT-tagged steelhead smolts from S. Santiam and Willamette hatcheries	3/31/2015	Marc Johnson; Brett Boyd (Hatchery Manager)
Monitor PTAGIS for detections of juvenile outmigrants (2014, 2015) and adult returns (2016, 2017)	3/31/2014	Marc Johnson; Tom Friesen
Develop final report (progress reports will be developed annually)	12/31/2017	Marc Johnson; Tom Friesen
Both Years: OHRC oversight and project design	1/1/2013	David Noakes

Affected Species: Steelhead

Project Permits

This project has no permits.

Project Monitoring

Project Maintenance

This project has no maintenance plans.

This project has no monitoring.

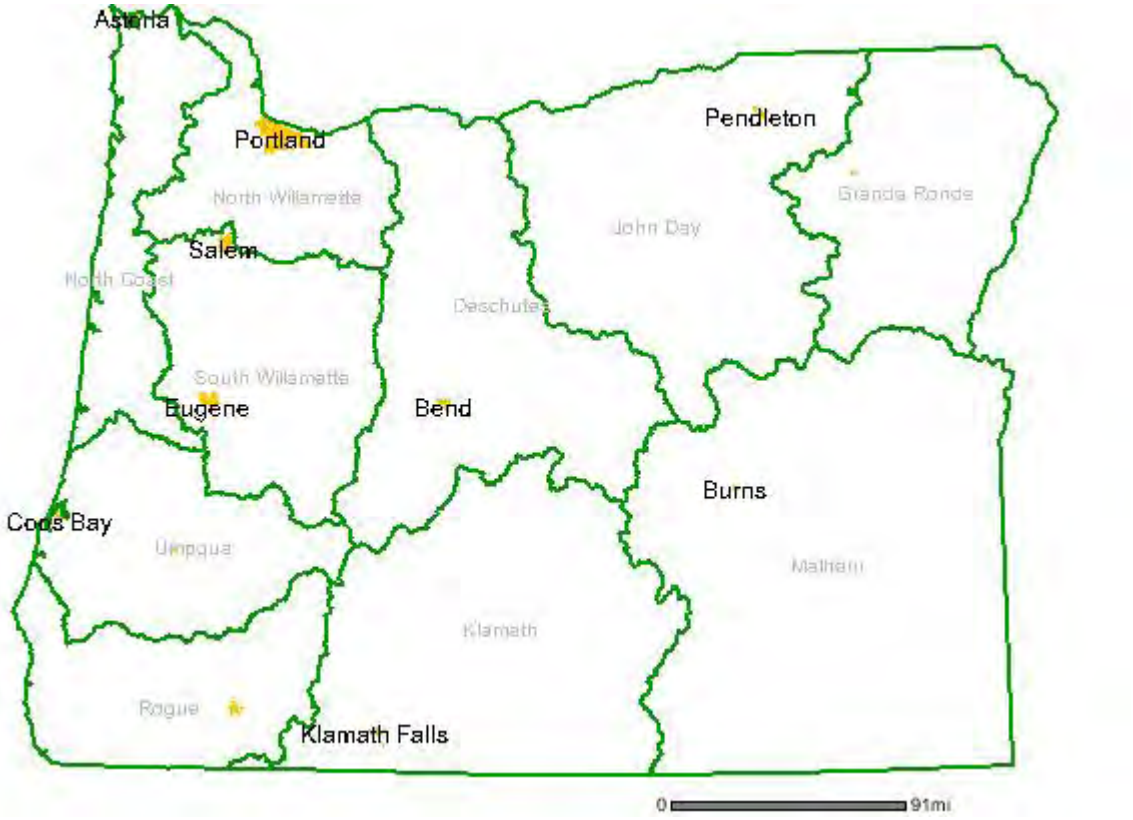
Project Match Funding

Funding Source	Cash	In-Kind	Other	Description	Total	Secured?	Conditions?	Comments
R&E Request	$60,610.00	$0.00	$0.00	Year 2 (2014): PIT tags	$60,610.00	No	No	
Oregon Hatchery Research Center	$0.00	$5,000.00	$0.00	Year 2 (2014): PIT tags	$5,000.00	Yes	No	
Oregon Hatchery Research Center	$0.00	$14,456.00	$0.00	Year 1 (2013): PIT tags	$14,456.00	Yes	No	
ODFW South Willamette Watershed District	$0.00	$7,885.00	$0.00	Year 1 (2013): PIT tags	$7,885.00	Yes	No	
ODFW Fish Propagation Program	$0.00	$18,969.00	$0.00	Year 1 (2013): PIT tags	$18,969.00	Yes	No	
ODFW/Oregon Hatchery Research Center	$0.00	$2,650.00	$0.00	Flow cytometry supplies and services (both years)	$2,650.00	Yes	No	
Oregon Hatchery Research Center	$0.00	$9,900.00	$0.00	Egg incubation and rearing (both years)	$9,900.00	Yes	No	
Oregon Hatchery Research Center	$0.00	$5,310.00	$0.00	OHRC Labor (both years)	$5,310.00	Yes	No	
Oregon Hatchery Research Center	$0.00	$285.00	$0.00	Feed (both years)	$285.00	No	No	
				Total Match Funding:	$125,065.00			

Project Budget

Item	Item Type	Units	Unit Cost	R&E Funds	Match Funds	Total
Year 1 (2013): Egg incubation at OHRC	Contracted Services	3	$300.00	$0.00	$900.00	$900.00
Year 1 (2013): OHRC Rearing - 12 Tanks	Contracted Services	6	$600.00	$0.00	$3,600.00	$3,600.00
Year 2 (2014): Egg incubation at OHRC	Contracted Services	3	$300.00	$0.00	$900.00	$900.00
Year 2 (2014); OHRC Rearing - 15 Tanks	Contracted Services	6	$750.00	$0.00	$4,500.00	$4,500.00
Year 1 (2013): OHRC Labor	Personnel	1	$2,655.00	$0.00	$2,655.00	$2,655.00
Year 2 (2014): OHRC Labor	Personnel	1	$2,655.00	$0.00	$2,655.00	$2,655.00
Year 1 (2013): Starter feed	Production Costs	1	$95.00	$0.00	$95.00	$95.00
Year 2 (2014): Feed	Production Costs	1	$190.00	$0.00	$190.00	$190.00
PIT tags (2013)	Supplies/Materials /Services	17000	$2.43	$0.00	$41,310.00	$41,310.00
PIT tags (2014)	Supplies/Materials /Services	27000	$2.43	$60,610.00	$5,000.00	$65,610.00
Year 1 (2013): Flow cytometry supplies and service	Supplies/Materials /Services	1	$1,000.00	$0.00	$1,000.00	$1,000.00
Year 2 (2014): Flow cytometry supplies and service	Supplies/Materials /Services	1	$1,650.00	$0.00	$1,650.00	$1,650.00
					Total Budget:	$125,065.00

Project Map



Additional Files

Click a link to view that particular file.

Letter of Support

Letter of Support

Letter of Support

Signature Authorization Page

Applicant Signature Page
Fish Restoration and Enhancement Program
(Oregon Department of Fish and Wildlife Applicants)

I hereby make an application for financial assistance under the terms and conditions of the Fish Restoration and Enhancement Program as described in my project application. I acknowledge that:

- This proposal is an identified priority at the ■ district, ■ region, and/or □ state level and has been identified as such in the application (**check box** for appropriate level).
- This proposal is consistent with any applicable goals, policies, rules, species or basin management plans adopted by the F&W Commission and this has been explained in the application.
- This proposal will not be used to cover, back fill, or fund shift elements that have been cut or defunded as part of agency budget reductions. Approved deferred maintenance or projects with division approval are exceptions.

I understand that if my project proposal is approved for Restoration and Enhancement (R&E) Program funding, the following will apply:

- Applicants must sign an agreement containing the terms and conditions for the project implementation, release of funds, and documentation of completion. Non-compliance may impact future funding opportunities.
- The R&E Program will not pay for expenses which occur before the approved start date or after the end date.
- Funding is available one biennium only without prior authorization by the R&E Board.
- Applicant agrees to notify the R&E Program of all funds not needed for the project upon determination.
- Any inappropriate expenses using R&E funds will be corrected by the applicant immediately. By the close of the biennium any expenses exceeding, or not identified in, the grant approval will be reverted to a local cost code.
- Copies of all landowner, monitoring and maintenance agreements must be submitted to the R&E Program.
- Educational products resulting from projects are public domain.
- Information collected is subject to Oregon Public Records Law.
- As applicable, the project will be consistent with all federal, state, and local regulations, including the State Land Use Planning Goals & Local Land Use Plans, prior to any on the ground work.

By signing this application, I certify to the best of my knowledge that the information contained in the application are true, complete and accurate. If awarded funding the applicant agrees to follow all terms and conditions outlined in the agreement.

Project Title: Performance of triploid summer steelhead

Applicant Name: MARC A. JOHNSON Title: TECHNICAL ANALYST

Applicant Signature: [redacted] Date: APRIL 3, 2014

Manager Certification:
To be completed by Watershed Manger, Hatchery Coordinator, Program Manager, or higher level manager.

- I concur with the statements above and the applicant has permission to request these funds.

Manger Name: Steven Marx Title: South Willamette Watershed Manager

Manager Signature: [redacted] Date: April 3, 2014

Ver. 3-18-2014

Oregon
John A Kitzhaber MD., Governor

Department of Fish and Wildlife
SPRINGFIELD FIELD OFFICE
3150 Main Street
Springfield, OR 97478
(541) 726-3515
FAX: (541) 726-2505
Internet: www.dfw.state.or.us/

April 4, 2014

Oregon Department of Fish and Wildlife
Restoration and Enhancement Board
4034 Fairview Industrial Dr. SE
Salem OR 97302

RE: Performance of triploid summer steelhead

Dear Restoration and Enhancement Board and Review Committee,

The Oregon Department of Fish and Wildlife (ODFW) Springfield Field Office is very supportive of Marc Johnson's request for Restoration and Enhancement Board funds to support his proposed project "Performance of triploid summer steelhead". This project will provide needed data that will assess the contribution of sterilized Skamania summer steelhead to Willamette Basin fisheries.

Although not included as match in the proposed budget, ODFW Fish Staff in the Springfield Office are committed to providing volunteers and our own time to get the tags into these fish.

Thank you for your consideration of this proposal.

Sincerely,

[redacted]

Jeff Ziller
South Willamette Watershed District Fish Biologist
Oregon Department of Fish and Wildlife
541-726-3515 x26
Jeffrey.S.Ziller@state.or.us

Oregon
John A Kitzhaber MD., Governor

Department of Fish and Wildlife
South Willamette Watershed District Office
7118 NE Vandenberg Avenue
Corvallis, OR 97330
(541) 757-4186
FAX (541) 757-4252

April 3, 2014

Dear Restoration and Enhancement Board,

The project funding requested by Marc Johnson, Tom Friesen, and others would support the development of a potentially potent ODFW management tool in the issue of crossbreeding between summer and winter steelhead. The development of a summer triploid stock for release would nullify arguments against summer steelhead stocking because of hybridization, and contribute to conservation of the wild, winter steelhead genome.

Marc Johnson and Tom Friesen have successfully obtained the first year of funding for this project, and their request is for assistance to finish the second year. They have been cost-conscious and efficient in conducting this project. The assistance from the Northwest Steelheaders with tagging in this second year of the project will save money and provide an opportunity for networking and collaboration between ODFW's Lab and anglers. One question I received from anglers just this year is, "What studies is ODFW conducting that benefit us?" This project is a solid, productive answer to that question.

If these trial triploid summer steelhead return in similar numbers to diploid summer steelhead, it would mean a huge gain for ODFW in terms of fish management.

Thank you for your consideration of this project, and I hope you lend it your support.

Sincerely,

[redacted]

Elise Kelley, Ph.D.
District Fish Biologist

Association of Northwest Steelheaders

6641 SE Lake Rd. • Milwaukie OR 97222 503-653-4176 • 503-653-8769 (fax)

office@anws.org • www.nwsteelheaders.org Established 1960

Anglers dedicated to enhancing and protecting fisheries and their habitats for today and the future.

April 2, 2014

To whom it may concern:

One of the oldest and most-cherished conservation organizations in the Pacific Northwest, the Association of Northwest Steelheaders was founded in 1960. ANWS currently has 1,500 active members and 11 chapters in Oregon and SW Washington. The Steelheaders mission is “anglers dedicated to enhancing and protecting fisheries and their habitats for today and the future.” Our vision is "responsible and enjoyable sport angling with good access to healthy, abundant and sustainable fisheries in the Northwest's healthy watersheds." ANWS became an affiliate of the National Wildlife Federation in 2007. We have been involved through funding and on-the-ground volunteer effort of fish monitoring for many years on many different watersheds.

The Mid-Valley Chapter of the Northwest Steelheaders has approximately 150 members and the South Santiam River is one of their home rivers. They have been actually engaged in fisheries enhancement on the South Santiam River for decades. The Mid-Valley Chapter of the Association of Northwest Steelheaders strongly endorses the funding of Steelhead Triploid Performance study and the associated pit-tagging. This study is exactly what is needed to answer the question of whether triploids can be used as a tool to reduce or eliminate the concerns over hatchery and wild steelhead interaction. We, as a long-time ally of ODFW, also commit to providing volunteer labor from our membership ranks to help accomplish the tagging and other tasks necessary in 2015.

Restoration, enhancement and even maintaining some of our sport fisheries could depend on funding projects such as this. In our minds, it is an excellent place for R&E funds to be spent. Please give this project your strong consideration.

Bill Nyara
On behalf of
Mid-Valley Steelheaders Board of Directors

Bill Kremers
President
Association of NW Steelheaders