Jim Lichatowich, Biologist and Author, Receives Highest Honor from Oregon Chapter of American Fisheries Society

At its 2016 Annual Meeting in Seaside, Oregon on March 3rd, the Oregon Chapter of the American Fisheries Society presented Jim Lichatowich with its highest honor, the prestigious Lifetime Achievement Award. Jim was honored for substantial lifetime contributions during his 46-year career toward halting the decline in wild salmon and steelhead populations in the Pacific Northwest.

Jim’s contributions to Oregon’s fisheries resources have been monumental. After serving in the United States Marine Corps and earning Bachelor and Master’s Degrees in Fisheries Science from Oregon State University, Jim went to work for the Oregon Department of Fish and Wildlife. He rose from the Rogue Basin Evaluation Project Leader in 1973 to Assistant Chief of Fisheries for Oregon in 1983. During his 15 years of state service, Jim evaluated the effects of Lost Creek Dam and other dams in the Rogue River system on wild salmon and steelhead populations, oversaw fish research studies, and developed fish species management plans, including Oregon’s first coho plan. Jim was also a proponent for wild anadromous fish stocks in the Northwest, and became more and more aware of the inherent conflict of interest within government agencies that, during that era, maintained large salmon and steelhead hatchery programs and yet also had responsibility to protect distinct wild populations of salmon and steelhead for the future use and enjoyment of the state’s citizens. In 1988 he left state employment and the security of a government wage for more independence to pursue his passion; the protection and recovery of wild salmon and steelhead populations; and to write about the subject….and write he did.

Publications include coauthoring the most influential salmon protection paper ever written: Pacific salmon at the crossroads: Stocks at risk from California, Oregon, Idaho, and Washington. The Crossroads paper in 1991 demonstrated for the first time that salmon population decline was not merely a local phenomenon restricted to a few scattered drainages, but rather a systemic fish management failure that had coalesced at a regional scale. This paper, coauthored by Willa Nehlsen and Jack Williams, ultimately changed the conservation priorities for harvest, water, and habitat management, fish protection at hydroelectric dams, and salmon and steelhead hatchery programs.

Jim formed Alder Fork Consulting in 1990, and developed “conceptual frameworks” of how fish resources and habitats interrelate. He and coauthors published dozens of scientific papers in peer-reviewed journals, and at least ten book chapters highlighting the plight of Northwest salmon populations. Because of his scientific and salmon expertise, Jim was appointed to serve on three independent scientific review teams between 1991 and 2001 to help ensure that salmon studies and recovery programs met high scientific standards: Independent Multidisciplinary Scientific Team (1991-2001), Independent Scientific Advisory Board (1991 to 2001), and the Independent Scientific Review Panel (1997 to 1999).

In 1999, Jim’s first book, Salmon Without Rivers: A History of the Pacific Salmon Crisis was greeted with broad acclaim. Salmon Without Rivers exposed myths and clearly explained the difficult choices facing the citizens of the region. His second book, Salmon, People and Place: A Biologist's Search for Salmon Recovery, published in 2013, described misconceptions underlying many salmon management programs that have allowed major declines in Northwest salmon populations. Jim’s ability to translate complex issues for a general audience offers all of us a hopeful guidance toward a better future for salmon and their natural ecosystems. Members of the Oregon Chapter of the American Fisheries Society
A single generation of domestication can translate into heritable differences in expression at hundreds of genes.


“The genetic underpinnings associated with the earliest stages of plant and animal domestication have remained elusive. Because a genome-wide response to selection can take many generations, the earliest detectable changes associated with domestication may first manifest as heritable changes to global patterns of gene expression.

“Despite the long period of domestication typically required to detect signatures of artificial selection at the genomic level, recent work has revealed that genetic adaptation to captivity can occur exceptionally quickly, sometimes within only a handful of generation. For example, fish reared in hatcheries can show substantial adaptation to captivity after just a single generation of selection.

“Here, to test this hypothesis, we measured differential gene expression in the offspring of wild and first-generation hatchery steelhead trout (Oncorhynchus mykiss) reared in a common environment. Remarkably, we find that there were 723 genes differentially expressed between the two groups of offspring. Reciprocal crosses reveal that the differentially expressed genes could not be explained by maternal effects or by chance differences in the background levels of gene expression among unrelated families. Gene-enrichment analyses reveal that adaptation to the novel hatchery environment involved responses in wound healing, immunity and metabolism. These findings suggest that the earliest stages of domestication may involve adaptation to highly crowded conditions.

“To test whether we could identify incipient domestication at the mRNA transcript level, we compared patterns of gene expression in offspring of first-generation hatchery fish (that is, hatchery-origin) and wild (that is, wild-origin) steelhead trout collected directly from the Hood River, Oregon. Previous work in this system revealed that first-generation hatchery fish averaged 85% of the lifetime reproductive success of wild fish when spawning in the wild, but nearly twice the lifetime reproductive success of wild fish when spawned in captivity.

“First-generation hatchery fish had wild-origin parents and only spent their first year in the hatchery before being released into the wild. A series of crosses involving two first-generation hatchery fish (HxH), two wild fish (WxW) or one hatchery and one wild fish (HxW and WxH reciprocal crosses) were performed at the Parkdale hatchery.

“The offspring were reared in an identical environment at the hatchery until the swim-up fry stage (yolk sac absorption), at which point the fry were collected for RNA-Seq. If incipient domestication is occurring in this system, then we expected to find two patterns: (i) there should be greater differences in gene expression between the offspring of two first-generation hatchery fish (HxH) and two wild fish (WxW) than between the offspring of an equal number of families having equal hatchery ancestry and (ii) any differences in gene expression should not be solely due to maternal effects, which could be an environmental effect and not necessarily due to domestication selection.

“We find that there are hundreds of genes that are differentially expressed (DE) between the offspring of wild fish (WxW) and of the offspring of hatchery fish (HxH) reared in a common environment. By using reciprocal crosses, we further show that these differences in gene expression cannot be explained as maternal effects, sampling noise, or false discovery. Thus, our data suggest that the very first stages of domestication are characterized by massive, heritable changes to gene expression.

“That the DE genes were dominated by pathways in wound repair, immunity and metabolism adds to growing evidence that adaptation to crowded conditions is an important early stage of domestication.

“Main effects. Remarkably, we found that there were 723 genes DE between the offspring of wild fish (WxW) and the offspring of first-generation hatchery fish (HxH), where the offspring represent 70 individuals from each of the 24 unrelated families.
“If siblings were randomly removed such that a single individual represented each family, we still detected an average of 579 DE genes (95% confidence interval = 390–770).

“Out of the 723 DE genes, substantially more genes were upregulated in the offspring of the hatchery fish in comparison with the offspring of wild fish (458 vs 265, $X^2 = 50.18; P<0.001$) perhaps because the common environment was a hatchery.

“This result clearly illustrates that there are differences in gene expression between the offspring of hatchery and the offspring of wild fish that are substantially beyond the level expected between two groups of unrelated families having equivalent amounts of hatchery ancestry (that is, the results cannot be explained by sampling noise or false discovery).

“…across all matrices, we observed nearly additive effects, where the normalized gene counts for both HxW and WxH fish were intermediate between the gene counts for the HxH and WxW offspring (Fig. 2b). This result strongly suggests that the differences in gene expression between the HxH and WxW offspring are not due to the different environments experienced by their mothers. Although one can find a handful of genes consistent with purely maternal effects, the vast majority of DE genes did not show this pattern.

“The large extent of divergence that occurs at the gene-expression level, but not at the genomic level, suggests that selection and not genetic drift is responsible for the large differences in expression detected between the offspring of wild and first-generation hatchery fish.

“The fact that hatchery fish are reared in closed confines and at high densities relative to wild fish may also play a role in immune related processes, where diseases are known to increase in prevalence in crowded vs uncrowded conditions. Taken together, these results suggest that rearing density may play an important role in facilitating genetic adaptation to captivity, and that adjusting to large numbers of conspecifics may be an important first step towards domestication.

“O. mykiss are one of the few fish species considered to have been fully domesticated. Phenotypic responses to selection routinely occur in this species with less than ten generations of captive breeding. However, this is the first study to demonstrate that the earliest stages of domestication are characterized by large changes in heritable patterns of gene expression. As subsequent generations of domestication accrue, we speculate that the regulatory changes to expression become codified with gradual and more targeted shifts in allele frequencies (for example, selective sweeps). We hypothesize that adaptation to crowded conditions may drive much of this early domestication. Regardless of the mechanism, it is remarkable that a single generation of domestication can translate into heritable differences in expression at hundreds of genes.

Comments:

Jim Myron: Now that the scientists finally agree that hatchery fish are genetically different than wild fish. It’s only a matter of time until they also conclude that they can’t make hatchery fish to mimic what nature does for free. At some point the hatchery system will become such a financial burden that the public will revolt and refuse to pay for it. Now that the science has been decided it’s time to go after the policy implications of this massive public subsidy to the fishing interests. Put that on the list of challenges for NFS to overcome in the coming years. Good luck.

Jack Stanford: Well this adds another very big nail in what should be the coffin for hatchery salmonids. Came out this am and shows definitively that a single generation of domestication can translate into heritable differences in expression at hundreds of genes.

Matt Stoecker: “New study by Oregon State University, Oregon Department of Fish and Wildlife and Bonneville Power Administration shows that “a single generation of adaptation to the hatchery resulted in observable changes at the DNA level that were passed on to offspring”.

“Unfortunately, and maybe not surprisingly considering that study partners have invested billions into failed hatcheries, the write up here by OSU concludes:
"When the genetic changes that occur in a hatchery environment are better understood, it could be possible to change the way fish are raised in order to produce hatchery fish that are more like wild fish. This research is a first step in that direction."

“Dumping more of our tax dollars into trying to make harmful hatchery fish more like wild fish is deserving of another quote: "Insanity: doing the same thing over and over again and expecting different results." - Albert Einstein

"It's time to invest in restoring the self-sustaining fisheries habitat and access needed for wild fish to make more wild fish in perpetuity."

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**Resilience and Anadromous Fish Restoration**


“Resilience is a population’s capacity to deal with environmental change.

“Resilience represents a philosophy about conservation and restoration that guides and organizes planning and action (Folke et al. 2010) rather than any specific set of actions. Individual restoration plans may adopt different steps to foster resilience, but clear differences in action will result from extant conservation- and resilience-based approaches. For example, both resilience-based and extant management approaches to anadromous fish restoration seek healthy populations, but extant approaches might strive to attain a large numerical target achieved through hatchery stocking of fish with homogeneous life histories, whereas a resilience approach might prioritize a numerically smaller population composed of diverse life histories that can respond to unanticipated changes and make fuller use of habitats within a watershed.

“Common restoration strategies (e.g., stocking, fishways, habitat improvements) that attempt to simply reverse impairments will not be enough to revitalize anadromous fish populations if a state change has occurred. Consequently, the same restoration intervention may succeed or fail depending on ecosystem state.

“Human impacts are the most commonly cited cause of ecosystem degradation, including anadromous fish declines. Proponents of resilience theory often argue that separating consideration of social aspects from the ecological has prevented resource managers from dealing effectively with human impacts. Consequently, the non-interdisciplinary nature of most management or restoration plans has likely contributed to population declines and ecosystem degradation. Although most fish biologists do not seek to function as social scientists, this SES perspective is important to embrace because “many of the serious, recurring problems in natural resource use and management stem precisely from the lack of recognition that ecosystems and the social systems that use and depend on them are inextricably linked”

“A third focus of resilience thinking emphasizes the need to integrate research with management. Adaptive management (learning while doing) was an early part of the resilience perspective (Holling 1978) because most resilience problems are too complex to be addressed as controlled laboratory or reductionistic field experiments. As such, integrating management and research is essential for a resilience approach. Much of the resilience thinking literature advocates actions as experiments. For example, determining how much disturbance a system can absorb without switching to a new state and whether interventions will be needed to assist a recovering ecosystem are outcomes of resilience research that are integrally connected to management.

“A resilience approach builds on, but is philosophically different from, most ongoing anadromous fish restoration efforts. Although resilience-based and extant fish restoration approaches share the recognition of a common conservation problem..."
and embrace the benefits of established fisheries tools and techniques, the goals, reference states, and targets of the two approaches are fundamentally different.

“Typically, the resilience approach will prioritize maintaining diverse life histories within a watershed to allow a variety of anadromous fish populations to withstand environmental change. In contrast, many extant restoration approaches seek to achieve numerical fish or habitat targets based on historical references such as data on earlier run sizes or number of kilometers of previously unimpeded rivers in a watershed. Large numbers of hatchery salmon, for example, might result in a larger population size initially (achieving an extant restoration goal), but the resulting homogeneity in life histories might reduce a population’s ability to respond to a variety of future changes (failing to achieve a restoration-theory goal).

“Given the current realities of institutional and geopolitical systems that usually seek to optimize the gain in one objective rather than the best tradeoff among competing objectives (Hermoso et al. 2012), it is understandable how (and why) the role of disturbance and uncertainty has been downplayed. The dismal present state of most anadromous fish populations makes an effective argument that a resilience-based approach is worth exploring even if it requires a more complex, politically difficult, socioecological strategy.

“Life history diversity (within and across populations) has historically contributed to resilience of anadromous fish through varying functional traits, discrete life histories, multiple year classes of spawners, and pulsed spawning. In the past, for many anadromous fish populations, rivers were utilized more fully in time and space by a broader range of life histories.

“These life history variants may be the raw material of population recovery, and they need to be preserved.

“The “portfolio effect,” or coexistence of multiple life history strategies within a population, is an important example of how diversity in life history can increase resilience and stability. Within populations, variation increases resilience by making fuller use of a watershed’s potential life history circuits.

“For example, annual Sockeye Salmon Oncorhynchus nerka returns over five decades in diverse Bristol Bay, Alaska, drainages helped buffer any negative environmental conditions that occurred in individual tributaries. Thus, in a variable environment, life history diversity increases the probability that recruitment will be successful somewhere within the system, leading to greater numbers or population persistence.

“Functional complexity in life history also can be increased through the “storage effect” and “split cohorts.” The storage effect that results from multiple-spawner year classes promotes resilience by accumulating spawning stock biomass annually so that when environmental conditions are favorable, the consequent high egg production can result in rapid population growth.

“Pulsed reproductive efforts that result in temporally split cohorts are a form of bet-hedging that is more likely to result in at least one cohort, and possibly two or more cohorts, that contributes to recruitment. Thus, the storage effect and pulsed spawning can enhance diversity in reproduction and contribute to persistence in anadromous fish, increasing the likelihood that at least some individuals from a spawning season ultimately contribute to the pool of adult spawners.

“Habitat heterogeneity also promotes resilience of anadromous fish. Historically, rivers displayed more complex morphologies, including multiple channels that made floodplains more accessible. Habitat mosaics (adjacent habitats that support different functions) provide environments for life stages from multiple life histories. Before dams, “open” or effective distances of rivers were greater and included an array of diverse habitats. Healthy, forested riparian corridors provided temperature control by shading, bank stability with root strength, and recruitment of large wood, which drives the scouring of pools and sorting of bed sediment vital to fish habitat quality (e.g., Bisson et al. 2009; Beechie et al. 2010). Although these habitat alteration issues affect a variety of fish, a critical advantage of habitat complexity for anadromous fish is that multiple life history forms (Schindler et al. 2010) may persist and coexist by spawning in spatially and temporally specialized conditions.
Free movement adds resilience to anadromous fish populations. For movement to confer an advantage, suitable habitats must exist and be connected, but natural and anthropogenic changes often isolate patches from one another. The ability to move within and across localized habitats and connectivity across movement corridors are defining features of populations and habitats when anadromous fish were historically abundant. Such dispersal is an important way to resist disturbance and promote resilience. For example, being able to access refuges during times of drought or floods is important if anadromous fish populations are to survive large-scale disturbances. In addition, large systems can be critical sources both for individuals and genetic diversity; populations in smaller rivers may rely on the ongoing dispersal of individuals from adjacent larger rivers to maintain their populations.

Many anadromous fish can also be viewed as occurring in metapopulations, which are characterized by the interaction between demographic connectedness (in which populations are strongly dependent on local demographic processes) and dispersal (a nontrivial element of external replenishment that can serve as a hedge against local population extinction). Substantial stability of a metapopulation can be maintained in fluctuating environments at low and even moderate levels of connectivity. Thus, resilience requires some degree of connectivity, but too much connectivity results in high synchrony between components, which can reduce stability.

Within anadromous fish species, diversity in migration strategies was likely more common when anadromous fish were abundant. Currently, some species are still plastic in their migrations and exhibit a suite of movement patterns.

Mobile species such as anadromous fish can aggregate in time and space in relation to their abundances. Populations, which normally enter rivers to spawn over a period of weeks to months, can contract their distributions within rivers spatially and temporally. Thus, flexibility in movements that facilitate concentrations of individuals can sustain reproduction and mitigate against extirpation at low (and even relict) population levels by increasing the chances of sheer persistence (compared to disaggregated spawning).

Atlantic Salmon

The U.S. federally endangered Atlantic Salmon is another classic example of a species with an anadromous life history that has declined dramatically (Figure 2C), falling from high total adult populations in U.S. rivers (as many as 500,000 in Colonial times) to just 611 in 2013.

Historically, Atlantic Salmon populations displayed functional diversity within and across populations for many life history traits, including juvenile residence time in freshwaters, adult time at sea, and age at first reproduction. Stocking of hatchery-produced individuals, commercial and recreational fishing, and other human impacts have reduced this life history variation.

Atlantic Salmon can spread risk across many spawning locations, and run sizes correlate positively with habitat heterogeneity. However, human-related habitat changes reduce these advantages of using diverse habitats. For example, dams and ineffective passage diminish the proportion of the population that reaches diverse upriver historical spawning reaches.

Variation in movement patterns historically existed within and across populations. Atlantic Salmon enter and ascend rivers from as much as a year to shortly before spawning season (Thorstad et al. 2008), thereby dispersing potential spawners temporally while helping to ensure that individuals will be present to reproduce at the appropriate time. Migration allows this species to aggregate in response to good feeding conditions in the North Atlantic Gyre and previously successful freshwater spawning locations. This aggregation that is an advantage under pristine conditions can also make these fish more vulnerable to site specific disturbances (e.g., fishing).

The three examples above illustrate how characteristics that conferred resilience on anadromous fish historically make them especially vulnerable to human impacts. Extant restoration approaches are often inadequate to recover what has been lost. However, a resilience-based approach may provide successful restoration by seeking to rebuild suites of disturbance-resistant characteristics that were historically present.
Maintain Diversity to Restore Resilience

“Resilience theory embodies a different way of thinking about disturbance and uncertainty and the role of variability as a source of resilience. This variability, including life history variants, multiple populations, and repeat or pulsed spawning cohorts, can help restore resilience. Historically, maintaining diversity in life histories and spawning year classes has not been a goal in anadromous fish management and restoration, largely because of the substantial difficulty in on-the-ground implementation.

“Operationally, a resilience-based strategy emphasizes the diversification of life history portfolios and enlargement of storage effects via increased numbers of spawning cohorts.

“Functional life history diversity may not be a high priority for extant restoration approaches because all life history variants may not contribute equally to population dynamics or be equally desirable as sport fish.

“However, a resilience approach would seek to preserve this diversity, even at the cost of lower returns, in order to ensure a population’s ability to respond to future disturbances. In the same way, a resilience approach would seek to maintain a diversity of habitat types, including less productive habitats that may have primary importance only as refugia or alternate spawning habitat during disturbances.

Integration of Habitat Complexity

“Habitat complexity was once strongly connected with life history diversity of anadromous species, and both are still needed for resilience. Allowing the elaboration of a suite of within-species variations in life history strategies through restoration of an appropriate mosaic of connected habitats for an entire watershed will form the basis of a resilience-based approach.

Socioecological Integration and Implementation

“A resilience approach does recommend that socioecological integration be a priority when planning and setting goals. Integrating humans into the management process is essential in moving forward. Administrators and policy makers will play a key role in these challenges in that they need to seek mechanisms by which synthesis across disciplines and other divisions will be supported and even rewarded.

“A resilience approach also encourages stakeholder participation, in contrast with extant approaches that considers stakeholders as external drivers of environmental problems for whom managers and other experts make management recommendations.

“Better monitoring of the population and stressors will allow environmental professionals to assess whether the system is able to respond to disturbance. An important question upon implementation of a resilience approach is how to measure success. One obvious but coarse measure is sheer population persistence. But more sensitive metrics are needed, such as the elaboration of alternative life histories and their expansion in numbers.

“We propose that one underlying principle may be that increased habitat diversity in conjunction with increased life history diversity will yield increased resilience and more robust abundances.

Ecologically Effective Populations as a Recovery Criterion Conservation researchers and practitioners often distinguish between recovery criteria defined strictly by demographic considerations, such as minimum viable population sizes, and criteria defined by ecologically functional roles, such as ecologically effective population sizes. An ecologically effective population size for a species is the population size below which the species is so rare that it cannot perform one or more ecosystem functions, such as predation or seed dispersal. Without ecologically effective populations in ecosystems, critical interactions among species are lost, and overall
biodiversity can decline. This is especially true for highly interactive species, such as top predators like wolves. Setting recovery criteria to achieve ecologically effective population sizes departs from how the Services have historically administered the ESA, and it could be politically controversial. Moreover, quantifying such criteria might be difficult because it would require extensive ecological analysis. Nonetheless, scientists generally agree that conserving ecosystems that support endangered and threatened species requires conserving ecologically effective populations of species that have key functional roles in those ecosystems. To conserve ecologically effective populations of listed species, recovery plans would need to address the species’ functional roles in ecosystems as well as the genetic diversity, resilient population sizes, and geographic distributions needed to sustain those functional roles.

Ecological Society of America


Training Hatchery Sturgeon to Avoid Predators


Hatchery salmonids are more vulnerable to predators therefore their survival when released into rivers is lower than wild salmon that have been well educated. Unfortunately, it has been found that hatchery salmonids also have smaller brains than wild salmon due to the lack of problem solving in the captive environment and that also contributes to their poor survival. The result is that hatchery salmonids, and now sturgeon, are unable to replace wild fish sending a shock wave through the fish managers that have been advocates for hatchery replacement of wild fish on the West Coast for 141 years. It is also worth noting that the pounds of smolts released from hatcheries can be 12 to 20 times greater than the weight of hatchery adults that return, making the whole hatchery replacement strategy of state, tribal and federal fishery agencies a cost inefficient program. BMB

“Of the 27 species of paddlefish and sturgeons recognized worldwide, most are currently viewed as extinct, endangered, or threatened (Birstein 1993). Harvesting bans on caviar and meat fisheries, in addition to sport-fishing bans, have been imposed in many regions to protect populations. However, these management actions have often been futile in slowing population declines. The life history attributes of sturgeon present a particular challenge to conservation managers. Traits such as late age at maturity, infrequent periodic reproduction, and long life expectancy make population assessment and management challenging (Birstein et al. 1997).

“The success of most fish stocking programs is thought to be hampered by low postrelease survival resulting from the failure of the released fish to recognize predators.

“Juvenile Chinook Salmon, that were raised in enriched hatchery environments and then trained to recognize a predatory Cutthroat Trout, had higher survival upon release into natural rivers than those that did not undergo the training (Berejikian et al. 1999). Similarly, Brook Trout stocked into stream enclosures with Chain Pickerel had higher survival if they underwent predator training.

“We observed an antipredator response to predator odor, regardless of whether the fish were conditioned or not. The reduction in activity was comparable in magnitude to that of the learned recognition… and suggests the possibility of innate recognition of pike by this population of sturgeon. Regardless of whether there was innate recognition, our single
conditioning trial did not influence the intensity of the antipredator response the fish exhibited upon exposure to pike odor. It is possible that multiple instances of conditioning could enhance innate predator recognition or could trigger learning. Therefore, in our last experiment, we conditioned fish multiple times and looked for responses to pike odor. In this experiment, we had no evidence that Wolf River fish exhibit innate predator recognition, but we were able to show that multiple conditioning resulted in learned predator recognition. Fish conditioned multiple times fled into the water column in response to pike odor, while those that were pseudo-conditioned did not.

“Our results suggest that life-skills training holds considerable potential for use in sturgeon management plans. However, life-skills training will probably need some considerable development. Unlike most fishes that learn based on skin-derived alarm cues, sturgeon need to be conditioned with whole-body grinds. Attention needs to be given to potential population effects in training programs. In one population, we had no evidence of innate recognition of predators, while in another population we had some evidence of innate recognition.

Hatchery Trophy Trout Program Getting Bigger: Thinking and Acting inside the Box

Thursday, March 3, 2016

SALEM, Ore. – Thousands of extra-large rainbow trout will be released in several Oregon fishing holes this spring as the Oregon Department of Fish and Wildlife rolls out an enhanced “Trophy Trout” program created under a 2015 legislative directive.

More than 10,000 rainbow trout ranging in size from one to three pounds will be released at five locations around the state starting March 7 and continuing through May.

The trophy trout program isn’t new. ODFW has been releasing large trout for years into many lakes around the state. However, during the 2015 legislative session, Representative Greg Smith (R-Heppner) and ODFW came together to discuss the creation of a Trophy Trout Pilot Program that would select a handful of reservoirs to stock with trout in the one to three-pound range. The goal is to help boost economic development opportunities for regions that rely heavily on hunting and fishing tourism.

For 2016, ODFW raised an additional 10,500 large trout that will be will be released in the following five locations: Phillips Reservoir in Baker County, Willow Creek Reservoir in Morrow County, Timothy Lake in Clackamas County, Trojan Pond in Columbia County, and Garrison Lake in Curry County. Releases will start the week of March 7 and take place periodically until June. ODFW plans to further expand trophy trout fishing opportunities next year by producing 25,000 of the larger trout and releasing them in more locations (not yet determined).
“This is a great project that is not only perfect for the Willow Creek Reservoir, but the other locations as well,” said Rep. Smith. “I appreciate ODFW’s leadership and willingness to think outside the box in creating and sustaining economic opportunities in rural Oregon.”

“Fishing has been and continues to be a favorite recreational activity for many Oregonians,” said Curt Melcher, Director of ODFW. “The Trophy Trout Pilot Program will allow us to support the industry, support rural economies, and provide something new and exciting to generate enthusiasm.”

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<th>TROPHY TROUT RELEASE LOCATIONS AND DATES</th>
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Trophy trout, which ODFW defines as those weighing one pound or more, comprise a small portion of the 2 million trout catchable trout that ODFW releases in more than 300 locations around the state every year. The vast majority of these are referred to in the agency’s trout stocking schedules as “legals” – which are released as soon as they are 8 inches long and meet the legal minimum size for retention fishing in Oregon. Fishery managers believe that shifting hatchery production to a higher percentage of larger fish may help spur interest in trout fishing in Oregon, which ODFW is promoting as a family-friendly outdoor activity through its Trout 365 campaign and 36 family fishing events.

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**Estrogen in birth control pills has a negative impact on fish**

March 4, 2016

Lina Nikoleris, Lund University, Sweden

*New research shows that hormones found in birth control pills alter the genes in fish, which can cause changes in their behavior.*

“The hormone ethinyl-estradiol (EE2) is an active substance in many birth control pills which affects aquatic organisms when released as waste into water.

"Even low concentrations of EE2 have an impact on fish -- both their behaviour and their genetics. We have seen a change in the genetic balance in fish, and that they have a harder time catching food. Previous studies have shown that the fish also develop problems with procreation. This can lead to the complete disappearance of an entire fish population, and consequences for entire ecosystems," says Lina Nikoleris.

Fish have more estrogen receptors than humans, which makes them especially vulnerable to estrogen in water. The thesis studies three different fish species: salmon, trout and roach, which are economically important fish that live in both sea and freshwater.