153 Jack Havens – Attachment

Subject **Scoping recommendations**
From [redacted]
To EIS <comment@CapitolLakeWatershedEIS.org>
Date 2018-10-24 11:52

- Position Statements Regarding Our Hatchery Chinook Run in Capitol Lak1.docx (~75 KB)
- Beecher CV.doc (~70 KB)

Dear EIS personnel,

Attached is a report on Chinook juveniles in Capitol Lake. The information has been taken from research and opinions derived from those whom I deem as qualified professionals. The report has been reviewed by Dr. Hal Beecher, noted fisheries biologist and WDFW researcher (retired). His CV is also attached.

My scoping suggestions are as follows:

Determine how the information in the attached report affects the disposition of removing or maintaining of Capitol Lake.

Determine which of the recommendations below (taken from the attached report) should be adopted.

Recommendations:

What can we do long term?

Determining which rearing environment is best for Deschutes River Chinook salmon will require a **serious commitment of time and money to reduce uncertainties to a desirable level**. "Studies to provide actual data to inform these uncertainties would require a series of years, as annual variation in most of the factors in the Capitol Lake-Budd Inlet area, not to mention the Pacific

Ocean feeding and growing areas, can be considerable, with numerous factors interacting in complex ways."[1]

What can we do now?

. Certainly, resumption of water quality sampling could and should be accomplished relatively quickly and inexpensively.

. Dredging the northern basin and strategically harvesting aquatic plants in the northern and middle basins could be performed to better assess the effects of those neglected improvements.

. Obtain neutral, third party reviews of the Coho Restoration Project and Percival Creek Extension Project.

. Increase efforts to further restore the systemic health of the Deschutes River and Percival Creek.

Thank You,

Jack Havens [redacted]

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[1] Beecher, Hal, personal written communication

A Valuable State Asset

Washington State possesses one of the most iconic state capitol landmarks in the United States - Capitol Lake. The Lake lends a unique beauty to the state capitol campus, city and county, literally reflecting and enhancing the magnificence of all. Tens of thousands love to visit and use this area annually.

The positive effects of Capitol Lake extend beyond the aesthetic and social. They also include economic, recreational, sediment control efficiencies, bat sustenance, sea level rise flooding mitigation, and Chinook salmon production. Chinook salmon - the preferred food for our Southern Resident endangered orca pods.

Very little has been written regarding the Lake's hidden value as a salmon rearing system. Such a system was not possible before the Lake and its associated salmon ladder systems were created. Through the work of many scientists, we now have a better understanding as to why this system works so well and why it works even better when the Lake is properly maintained. A purpose of this paper is to explain why some scientists think this is the case.

Capitol Lake or Estuary Habitat Strengths Appear To Be Equal For Our Hatchery Chinook Run.

October 6, 2018,

Jack Havens

Introduction

For decades an abundance of information regarding the fall hatchery Chinook run in the Deschutes River has circulated through our community. Much of this information appears to be questionable as it has inferred that Capitol Lake has a deleterious effect on this salmon run when compared to an estuary. Many community members and public officials have been led to believe these unsubstantiated claims are factual.

The purpose of this paper is to provide the community and elected officials with well researched information regarding the relationship between Capitol Lake and its hatchery Chinook run. We believe that objective readers will conclude that Capitol Lake has little or no net deleterious effect on its Chinook run. Although not a claim of this paper, when predation on these fish is considered, Capitol Lake could be considered advantageous when compared to riverine and estuarine conditions.

Focus has been given to the Chinook species here because of its critical importance (80%) to the diet of Puget Sound's ESA endangered Orcas . Chinook salmon are the preferred prey of Southern Resident Killer Whales.[1]

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[1] NOAA Fisheries, www.fisheries.noaa.gov/species.killerwhales

Brief Background:

In 1954, the State and Olympia community modified the Deschutes watershed to create the first salmon run above Tumwater Falls, producing more salmon than at any time throughout recorded history. The introduction of fish ladders, concrete baffles, electric motors, steel fences, piping, pens and pumps provided the infrastructure for the highly successful hatchery Fall Chinook run. About 4 years before these modifications were made Capitol Lake had been created primarily for its aesthetic and recreational value to the community as a whole. Both of these amenities – the infrastructure for the new hatchery Chinook run and Capitol Lake itself - have worked in concert to make the Deschutes urban watershed area exceedingly valuable to virtually everyone in the Thurston County community.

More recently, proponents of an estuary have claimed that Capitol Lake is harmful to our hatchery Chinook salmon run and have demanded that the Lake be re-converted to an estuary. We find their reasoning to be lacking in factual support.

The fishing community (gillnetters and non-tribal sport fisherpersons) has been and is currently benefitting from the salmon run utilizing Capitol Lake as a rearing habitat and an in-migrating escapement conduit. "Returns to the river of marked and unmarked hatchery fish have been exceptionally good."[2]
Importantly, but not part of this paper, the entire community and state are benefitting from the vast array of other qualities of the Lake - aesthetic, social cohesion, economic, financial, etc. The Lake appears to have served as an optimizing management strategy for all. By sharing the Lake with everyone, the strategy serves the fishing community and the entire community in a balanced fashion.

[2] Engstrom-Heg R. T. 1955, *Environmental relationships of young Chinook Salmon in Capitol Lake and the Deschutes River System.* Washington Department of Fisheries, Olympia, Washington. pp76

Current knowledge regarding rearing juvenile Chinook in a lake environment is incomplete:

Some proponents of the elimination of Capitol Lake have claimed that lakes in general are harmful to Chinook salmon production. However, according to Koehler and other researchers, "Little is known about use of lacustrine (lake) habitats by juvenile ocean-type Chinook salmon…..To better manage existing populations and aid in designing recovery strategies for ocean-type Chinook salmon using lacustrine environments, basic information on the ecology of juvenile Chinook salmon rearing in this habitat is needed." [3]

Note the plural nature of "populations" and "environments", which suggests the applicability of these research findings to other lakes nurturing juvenile Chinook salmon.

Juvenile Chinook can and do thrive in a lake environment:

The above study concluded the following: "Lake residence is a rare life history for ocean-type Chinook salmon (e.g. Burger et. al. 1985) but our results suggest that the juvenile Chinook salmon can feed and grow well in this habitat."[4]

"Further east, Chinook are a particularly important game fish in the Great Lakes, where their abundance is maintained by large-scale artificial propagation."[5]

The following excerpt is from "Diet and Bioenergetics of Lake-Rearing Chinook Salmon in Lake Washington". "Despite the heavily altered nature of Lake Washington and the relatively short time Chinook salmon have used this system, feeding and growth performance of juvenile salmon in littoral habitats of Lake

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[3] M. Koehler, K. Fresh, D. Beauchamp, J. Cordell, C. Simenstad, D. Seiler *Diet and Bioenergetics of Lake-Rearing Juvenile Chinook Salmon in Lake Washington,* 2006. Transactions of the American Fisheries Society 135: 1580-1591. 1581 pp) 1581 pp

[4] (Koehler and others, 1587 pp.)

[5] Behnke, Robert. Trout and Salmon of North America, 2002, Chanticleer Press.

Washington were comparable to those for Chinook salmon rearing in estuarine and riverine environments. (e.g. Healey 1982; Simenstad et. al. 1982; Rondorf et. al. 1990; Miller and Simenstad et. al. 1997; Duffy 2003)….."[6]
Similarities should be noted: Capitol Lake like Lake Washington, has been used for only a short time by chinook salmon. Both are urbanized lakes. Juvenile Chinook populations in both lakes enter and leave within similar seasons (approximately March –July). Both Chinook juvenile populations predominately consume chironomid pupae and Daphnia spp. Thus, findings by Koehler et al. regarding juvenile Chinook in Lake Washington could well be relevant to this species in Capitol Lake. (Engstrom-Heg 1955, Koehler et al. (2006).

According to Thurston County Health Department data, bottom water in Capitol Lake is well oxygenated throughout the year, this includes April – July (the Chinook juvenile rearing period) and during the return period, July through September, when these fish return (mostly September).[7] "The deep portions of the lake are kept well aerated by the inflow of river water which, being colder and heavier than the lake water, follows the bottom of the old channel during the summer months."[8]
It should be noted that maintenance dredging of the Lake as well as riparian planting along the Deschutes River will further improve temperature and oxygen conditions in Capitol Lake.[9]

Aquatic insects, an important source of food for juvenile Chinook (and our community's iconic Yuma and Little Brown bat population), thrive in conjunction

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[6] Koehler, 1589 pp
[7] Milne, D. H. 2015 Capitol Lake: The Healthiest Lake in Thurston County. 17 pp. Available on CLIPA's website, www.savecapitollake.org/documents/healthiest-lake.html

[8] Engstrom-Heg. 4 pp
[9] Capitol Lake Alternatives Analysis, 31 -32 pp http://des.wa.gov/sites/default/files/public/documents/About/CapitolLake/21-CapitolLake AlternativesAnalysisFinalReport(July200.pdf

with Capitol Lake in great part due to the freshwater Lake's uniquely high benthic (bottom) oxygen content. According to both Koehler and Engstrom-Heg, juvenile Chinook reared in Lake Washington and Capitol Lake prefer Chironomidae and Daphnia sp. as primary food sources. Capitol Lake, of course, has significant populations of both.[10]
It is interesting to note that (regarding coho salmon) "The contents of the stomachs of 38 silver [coho] of the 1953 and 1954 broods, mostly from the Percival Cove area, revealed the diet of these fish to be substantially the same as that of the Chinook salmon."[11] This observation may have important ramifications for establishing a future sustainable coho run.

Regarding the release of juvenile Chinook salmon into Capitol Lake, Robert Enstrom-Heg, fisheries biologist, has stated "The data do not indicate that the conversion of Capitol Lake to freshwater had any great effect on survival, either for better or worse."[12] (The lower Deschutes River just above Tumwater Falls was used as a brood stream from 1946-1950, thereby allowing comparison of survival rates before and after construction of Capitol Lake.[13])

Engstrom-Heg continues, "The data…show growth of Chinook salmon in Capitol Lake to be extremely rapid, greatly exceeding that attained by fish of the same stock held in hatcheries."[14] These conclusions appear to corroborate the conclusions of M. Koehler and others.

According to Mr. Wayne Daley, Sr. Fisheries biologist, "I do not believe that turning the lake into a mudflat will enhance or improve the existing salmon and trout populations of the watershed. The restricted flow of water into the area

[10] Engstrom-Heg, 38 pp
[11] Engstrom-Heg 39 pp
[12] Engstrom, Heg 11pp
[13] Engstrom-Heg, 7pp
[14] *Engstrom-Heg,77 pp*

above 4th street will not provide the typical flushing that would occur in an undisturbed estuary."[15]

Interestingly, Deschutes River Fall Chinook escapement for 2017 numbered over 30,000 (probably 33,000). This compares favorably with averages of about 10,000 over the last several years.[16]

Removing the tide-lock will allow toxins now in Budd Inlet to infiltrate Capitol Lake basin.

Budd Inlet has furans, dioxin, and likely other toxic hydrocarbons which are currently prevented from infiltrating Capitol Lake basin by the tide-lock.[17] Cautionary and advisory warning signs issued by the Thurston County Health Department populate the shores of lower Budd Inlet warning humans to keep themselves and pets away from the water. Thus, sensitive juvenile Chinook salmon that spend April, May, June and possibly July developing in this Lake basin are spared exposure to these toxins during that time period. It seems logical that harbor seals, sea otters, cormorants, (ESA endangered) orcas, and other predators benefit from this.

Cost benefit ratios for the tide lock removal project appear to be relatively poor.

Engstrom-Heg's assessment that "The data do not indicate that the conversion of Capitol Lake to freshwater had any great effect on survival, either for better or worse." is important for this reason: Although not a controlled experiment, the assessment suggests that (unlike removal of the Elwha dams) removing the tide

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[15] Daley, Wayne, Sr. Fisheries Biologist. Opinion letter, March 21, 2011. http://www.savecapitollake.org/documents/impact-on-fisheries.html

[16] Pylon, Lee. Washington Department of Fish and Wildlife. Pers. Comm. May, 2018

[17] Capitol Lake Alternatives Analysis. http://des.wa.gov/sites/default/files/public/documents/About/CapitolLake/21-CapitolLake AlternativesAnalysisFinalReport(July200.pdf

lock would likely yield no significant increase in fish production. The hundreds of millions of dollars saved by retaining the Lake and continuing with the Lake Management Plan could protect funding to improve other more productive rearing and spawning areas in Puget Sound. For example, according to Thurston County Commissioner Bud Blake, Thurston County-owned fish barrier culverts total 336 and block many miles of natural spawning grounds. It is possible that most or all of these spawning grounds could be recovered using money from the above savings. Note, these culvert restorations will likely benefit coho, chum, cutthroat and perhaps steelhead. Less likely Chinook.

This cost benefit position is reportedly supported by the PSNERP decision of March, 2013 to de-couple (remove) the Deschutes Estuary Restoration Project from its funding list.[18] [19] [20](Various emails from WDFW managers Margen Carlson and Theresa Mitchell) and Washington State Senator Karen Fraser. The last two persons had verbal contact with Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) administrators regarding this decision. (Available upon request, Jack Havens, bikeandfish@comcast.net).

Predation on Juvenile Chinook in an estuary appears to have been inadequately researched.

The importance of predation on Chinook juveniles in Lake Washington has been stressed by researchers as follows: "….increasing the amount of food available to the juvenile Chinook salmon in Lake Washington will not materially contribute to improve the status of this population. Efforts to rebuild Chinook salmon

[18] Carlsen, Margen, Deputy Assistant Director – Habitat, Washington Department of Fish and Wildlife pers. communication email April 24, 2015. (Available by contacting Jack Havens at [redacted]

[19] Mitchell, Theresa C., Puget Sound Nearshore Ecosystem Restoration Project, Washington Department of Fish and Wildlife – Habitat Program. Pers. Communication April 27, 2015

[20] Fraser, Senator Karen [redacted] email July 9, 2015. http//sdc.wastateleg.org/fraser/contact/

populations in this basin should therefore focus on the influence of other lake related factors, such as predation, disease, and other life stages."[21]

Regarding Capitol Lake, marine predation below the 5th Avenue tide gate is recognized as a problem for migrating salmon in this run.[22] However, re-converting Capitol Lake to an intertidal mudflat will quadruple the number of marine water compression points (bottlenecks caused by the railroad trestle, Deschutes Parkway bridge, I-5 bridge and fish ladder at Tumwater Falls) available to predators such as harbor seals, otters, herons and cormorants. Regarding predation in Capitol Lake itself, Engstrom-Heg states the following: "Predation upon young salmon in the lake is probably negligible".[23] It should be noted that Capitol Lake lacks northern pikeminnow (Ptychocheilus oregonensis) which is a significant predatory fish in Lake Washington.[24]

Fifth Avenue salmon viewing platform: a valuable, unique outreach investment not easily replicated with an estuary.

The Fifth Avenue salmon viewing platform is close to downtown and spans the narrow outflow and fish ladder from Capitol Lake into Budd Inlet. The popular viewing platform represents a valuable outreach investment for community education and enrichment, recognized as an integral part of salmon enhancement. Each year, thousands of pedestrians walking to and from the Olympia downtown use this structure to learn about salmon life history and predation. A close-up, bird's eye view of returning Chinook in a populated area would not be easily replicated with an estuary.

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[21] Koehler and others, 1589 pp

[22] Capitol Lake Alternatives Analysis, June, 2009, 21, 23, 25 pp http://des.wa.gov/sites/default/files/public/documents/About/CapitolLake/21-CapitolLake AlternativesAnalysisFinalReport(July200.pdf

[23] Engstrom-Heg, 42 pp and 78pp

[24] Beecher, Hal. Personal written communication.

Capitol Lake removal represents questionable planning philosophy:

In addition to the already existing fish producing infrastructure as mentioned above, concrete and steel buildings and pond infrastructure for a new fish hatchery is being funded for the riparian area of the Deschutes River at Pioneer Park independently of the Capitol Lake issue "including whether or not the Fifth Avenue dam is removed."[25] Biological waste nutrients will likely enter this watershed from this hatchery to some degree. Funding is being requested and supported by WDFW and the Squaxin Island Tribe.

Community members must ask why we should accept the man-made hatchery structures while the major proponents of the new hatchery oppose Capitol Lake in no small part because it is "not natural". This begs the question, Should the demands of the fishing community take priority over the needs and values of the community at large?

Estuary advocates have opposed dredging and plant harvesting Capitol Lake:

According to the Capitol Lake Alternatives Analysis – Public Review Draft and other experts, these fish would unquestionably benefit from dredging and aquatic plant harvesting Capitol Lake because of:

a) cooler temperatures contributing to higher Lake and Budd Inlet DO (dissolved oxygen),

b) fewer aquatic weeds and algae thus higher subsequent DO in Budd Inlet,

With these findings in mind, it would seem beneficial to our Chinook juveniles if Capitol Lake would be dredged according to the original plan of every 5-10 years. The Lake was last dredged partially in 1986 and is at least 3 decades overdue. The most recent claim is that dredging must be matched with the management plan selected. However, dredging the Lake must occur under <u>any</u> management scenario. It does seem likely that the lack of dredging (and harvesting aquatic

[25] Unsworth, Jim, PhD, Director Washington Department of Fish and Wildlife, letter of April 18, 2017.

weeds) reduces aesthetic appeal to most and contributes to an impression that "the Lake must be unhealthy".
Strategic harvesting of aquatic plants is performed in many lakes but has been rejected for Capitol Lake. Adequate explanation for this rejection using documented and verified facts have not been made available to the public.

Other Assertions Which Lack Factual Support

Assertion: The dam kills fish:

Fact: The 5th Avenue tide-lock is not a dam and does not have either a turbine or spillway, characteristics considered almost totally responsible for juvenile salmon mortality in the nine Columbia River and Snake River dams.[26]

Assertion: The Lake produces directional disorientation for the salmon:
Fact: Dams of the Snake and Columbia are accused by some of reducing river current speed causing salmon juveniles to become directionally disoriented over the course of hundreds of miles. Such claims that Capitol Lake is similarly detrimental appear to be without foundation. The two mile stretch from Tumwater Falls to the 5th Avenue tide lock has a relatively high flow which technically qualifies it as a river.[27] "Exchange of water {in Capitol Lake} is much more rapid than in most lakes." (brackets added).[28]

Assertion: Stray juveniles are excluded from rearing in Capitol Lake:
Fact: Seining studies performed by the Squaxin Island Tribe have shown that a relatively high percentage of Chinook juveniles residing in Budd Inlet in the summer originate in watersheds other than the Deschutes and Nisqually and

[26] Montgomery, David R. *King of Fish – The Thousand Year Run of Salmon,* 2003. Westview Press. 186 pp
[27] Personal communication with Robert Holman and John DeMeyer
[28] Engstrom-Hegg 4pp

might use estuarine waters extended into Capitol Lake basin. This is an interesting finding and must be acknowledged.
The following must be considered: 1.The relative numbers of these stray juveniles would likely be exceedingly small compared to the relatively large numbers rearing in Capitol Lake. Also, we don't know what percentage of their natal run these fish represent. That percentage is likely to be relatively small. 2. If our goal is to increase absolute numbers of Chinook, this could be accomplished by increasing fry numbers placed in Capitol Lake (assuming rearing capacity will allow). 3. If our goal is to increase genetic diversity, adding fry from the remote watersheds to Capitol Lake would help to accomplish that outcome. 4. We must consider that should an estuary be re-established, the number of stray juveniles who might use it may be smaller than the increased number of juvenile deaths brought about by the increased compression points of the estuary (discussed on page 9) reducing total juvenile Chinook numbers. (More research is needed.)
5. Employing the Percival Creek Extension (discussed on page 16) could facilitate the movement of these "foreign" Chinook juveniles into a smaller estuary which the extension would create.
Noted researcher Dr. Hal Beecher, PhD fisheries biologist, has stated regarding the issue of fish from other rivers, "I think that (stray juveniles from other watersheds) is a really weak argument for removing the lake."

Assertion: "High temperatures" in the Lake are harmful to salmon:
Fact: Regarding temperature in Capitol Lake, the following findings are revealing: "In general, lake temperatures are similar to river temperatures throughout fall, winter and spring months. In the summer, however, only those temperatures at the bottom of the lake in the river channel remained synonymous with river temperatures above, which reached a maximum of 63 degrees F."[29]. This suggests that a properly maintained Lake, periodically dredged, provides cool water for juvenile Chinook and access to cool channel water for returning adults.

[29] Engstrom-Heg, 13 pp

Note: Under any proposed management plan, temperature elevations in the Capitol Lake basin will occur due to the effects of the Deschutes River and Black Lake. Both water bodies are listed for temperature violations under the Department of Ecology 303 (d) list. Capitol Lake is not.

Assertion: The "steep salinity gradient" is a problem for the Chinook:
Fact: With regard to the salinity gradient experienced by Chinook juveniles as they travel from freshwater of Capitol Lake to more brackish estuarial waters of Budd Inlet (and the reverse for returning adults), we must be reminded of Engstrom-Heg's findings following the conversion of the intertidal mudflat to Capitol Lake: "The data do not indicate that the conversion of Capitol Lake to freshwater had any great effect on survival, either for better or worse."[30]
It must be recognized that with dam removal, Chinook juveniles released from the planned hatchery at Pioneer Park or elsewhere on the Deschutes River will experience essentially the same salinity gradient at the base of Tumwater Falls.
It is noteworthy that neither Koehler et. al. or Engstrom-Heg or Beecher mention a steep salinity gradient as a physiological problem for these juveniles.

The following table has been compiled by Hal Beecher, PhD Fisheries biologist to more easily understand relative advantages for Chinook of each management system, Capitol Lake or estuary.[31]

Chinook salmon life-stage & season	Factor influencing salmon survival, growth, and production	Capitol Lake	Unimpounded estuary
Juvenile – Jan-Jun	Food supply	Chironomids. Engstrom-Heg (1955) indicated early Capitol Lake provided food supply that	Some chironomids in upper reach and Percival Cove; replaced by marine plankton in marine water.

[30] Engstrom-Heg 11pp
[31]

		supported very good growth compared to other Puget Sound systems. Koehler et al. (2006) indicates high value of chironomids as food for young Chinook in Lake Washington. Chironomid population might have adjusted as Capitol Lake aged, so current data on Chinook salmon growth and/or chironomid abundance would be informative, but in absence of new data, the best information seems to suggest favorable feeding conditions in the lake.	
	Predation	Fish-eating birds, cutthroat trout (relatively few)	Fish-eating birds, staghorn sculpin (*Leptocottus armatus*), dogfish shark (*Squalus acanthias*),
	Dissolved oxygen (DO)	Tumwater Falls ensures near saturation.	Tumwater Falls ensures near saturation.
	Temperature	Temperature very similar under either management option.	Temperature very similar under either management option.
	Salinity	Fresh water	Salinity transition fluctuates with tide, but at highest extent only moves about a mile upstream, so that this is unlikely to be a physiological factor. It could be an ecological factor in influencing food supply and predators.
	Pollutants	Pollutants from automotive and other sources in the urban environment of Capitol Lake as well as agricultural inflow from the Deschutes watershed may be present, but data are needed to answer this. Pollutants from Budd Inlet are blocked.	Pollutants in sediments in Budd Inlet might be washed farther upstream with the tide, depending on the degree to which those pollutants are dissolved or suspended and moved into the estuary. Sampling the distribution and concentration of sediment pollution in different parts of Budd Inlet would be informative as would more detailed consideration of the chemistry and adsorption of the pollutants.
Juvenile – Jul-Aug	Food supply	*Daphnia* replace chironomids as a high-quality food for juvenile Chinook (Engstrom-Heg 1955;	*Daphnia* in Percival Cove and closer to Tumwater Falls in pools; replaced downstream in tidal

		Koehler et al. 2006)	reach by other arthropods
	Predation	See above (Jan-Jun)	See above (Jan-Jun)
	Dissolved oxygen (DO)	See above (Jan-Jun). Higher temperature can reduce DO. DO is influenced positively by ratio of surface area to volume (S:V), which is high in the relatively shallow Capitol Lake.	See above (Jan-Jun). Higher temperature can reduce DO.
	Temperature	Although high S:V favors DO, it can also lead to greater heating when air temperature and direct solar radiation are a major factor in the hot months. Data from Engstrom-Heg (1955) suggest that temperatures remain acceptable for salmonids, with more preferred temperatures in the channel. Deposition and shallowing of Capitol Lake could have changed the temperature and DO conditions in Capitol Lake. Current data would be informative.	Temperature would change little from Tumwater Falls.
	Salinity	See above (Jan-Jun)	See above (Jan-Jun)
	Pollutants	See above (Jan-Jun)	See above (Jan-Jun)
Returning adult – Aug-Sep	Food supply	NA	NA
	Predation	Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are excluded from Capitol Lake but prey on Chinook salmon waiting to enter the lake. Once in the lake, adult salmon are safe from these larger predators while the salmon try to find the entrance to the Tumwater Falls fishway. River otters (*Lutra canadensis*) could get access to salmon at the base of the falls, but I have not seen them there.	Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) could have access to the base of the falls where salmon aggregate in high density. Seals and sea lions often ascend rivers many miles in pursuit of salmon – I have seen them far up the Fraser, they are well-known at Bonneville Dam, and they have been reported well up the Nisqually River. This could be a major predation opportunity where salmon have much less opportunity to avoid predators than they have in Budd Inlet below the bridges. River otters could also access salmon, but may be deterred by larger seals and sea lions.

	Dissolved oxygen (DO)	See above (Jul-Aug)	See above (Jul-Aug)
	Temperature	See above (Jul-Aug)	See above (Jul-Aug)
	Salinity	See above (Jan-Jun)	See above (Jan-Jun)
	Pollutants	See above (Jan-Jun)	See above (Jan-Jun)

CLIPA's Managed Lake Options For Consideration

Coho Restoration Project:

With the exception of modest spawning in Percival Creek, there has likely never been significant sustainable spawning of native or wild salmon in the entire Deschutes River watershed, including the Capitol Lake basin. Again, this is primarily due to the existence of Tumwater Falls as an upstream migration barrier. (With the exception of limited numbers of chum, salmon do not spawn in saltwater.) Although Percival Creek's spawning habitat has been seriously harmed by human development in its upper reaches, CLIPA's proposed "Coho Habitat Restoration Project" in lower Percival Creek could help to provide a modest sustainable fishery for wild coho, and possibly steelhead and chum in this watershed. The plan is simple: provide ample woody debris and engineered log jams strategically in Percival Creek. WDFW should decide if adequate spawning habitat still exists in Percival Creek to support the cost of this project.

Percival Creek Extension Plan:

Percival Creek currently empties into Capitol Lake. Some have speculated that a direct access from Percival Creek to Budd Inlet could possibly benefit easier passage of juveniles and adults into and out of this waterway. A sinuous,

meandering channel just west of the current north basin of Capitol Lake and emptying into the southwest corner of Budd Inlet could accomplish this.
Tidal flows for improved ingress of stray juvenile salmon (from watersheds other than the Deschutes) for rearing might possibly be increased by this re-channeling. WDFW should evaluate the wisdom of this strategy.

A Community Dilemma

Our community is faced with the following dilemma: Much of the above information has not been shared with community members through the media or public forums.
This author and others have heard the following scientifically unsupported claims at public meetings, discussions with estuary advocates, and interviews with citizens, including elected officials. These claims illustrate mischaracterization of Capitol Lake: “Capitol Lake dam is just like the Elwha dams.”, “Capitol Lake is suffocating our salmon.”, “Capitol Lake is the cause of the recent downturn of Chinook numbers in South Sound.”, “All dams are bad! They kill fish!”, “Capitol Lake is starving our salmon.”, “The toxicity of Capitol Lake has prevented the Tundra swans from returning.”, “The en masse die-off of sticklebacks is due to Capitol Lake.”, “Capitol Lake’s is a cesspool.” “Get rid of that Lake, it spews its toxins into Budd Inlet every second!” “Cost is irrelevant!” These claims have circulated throughout our community for years.
The claims have been detrimental to the attainment of a well-reasoned decision on this issue. Obviously, when repeated enough times, they tend to become accepted as fact.

Summary

This report does not propose that either management system, lake or estuary is superior in providing rearing for juvenile Chinook salmon. However, based upon the above findings, the following statements appear to be true:

"Little is known about use of lacustrine habitats by juvenile ocean-type Chinook salmon." Juvenile Chinook can and do thrive in a lake environment (Lake Washington and Capitol Lake). Juvenile Chinook reared in Lake Washington and Capitol Lake prefer Chironomidae and Daphnia sp. as primary food sources - Capitol Lake has significant populations of both due to its exceedingly high benthic (bottom) oxygen content. "The data…. show growth of Chinook salmon in Capitol Lake to be extremely rapid, greatly exceeding that attained by fish of the same stock held in hatcheries." "The data do not indicate that the conversion of Capitol Lake to freshwater had any great effect on survival either for better or worse." Removing the tide lock will allow toxins now in Budd Inlet to infiltrate Capitol Lake basin likely adversely affecting young juvenile Chinook salmon. Predation on juvenile Chinook salmon in an estuary's intertidal mudflat apparently has never been adequately researched in the Capitol Lake – estuary issue. Re-converting Capitol Lake to an estuary will likely quadruple the number of marine water compression points which are advantageous to predators of Chinook. Despite almost universal understanding that juvenile Chinook (and community aesthetics) would benefit from the

strategic dredging and plant harvesting in Capitol Lake, such efforts have been opposed for decades by those who prefer an estuary.

Many of these facts have not been shared with community members and public officials. These omissions and others may be contributing to a higher probability for poor decision-making.

Recommendations:

What can we do long term?

Determining which rearing environment is best for Deschutes River Chinook salmon will require a serious commitment of time and money to reduce uncertainties to a desirable level. "Studies to provide actual data to inform these uncertainties would require a series of years, as annual variation in most of the factors in the Capitol Lake-Budd Inlet area, not to mention the Pacific Ocean feeding and growing areas, can be considerable, with numerous factors interacting in complex ways."[32]

What can we do now?

1. Certainly, resumption of water quality sampling could and should be accomplished relatively quickly and inexpensively.
2. Dredging the northern basin and strategically harvesting aquatic plants in the northern and middle basins could be performed to better assess the effects of those neglected improvements.

[32] Beecher, Hal, personal written communication

3. Obtain neutral, third party reviews of the Coho Restoration Project and Percival Creek Extension Project.
4. Increase efforts to further restore the systemic health of the Deschutes River and Percival Creek.

References

1.Behnke, Robert. *Trout and Salmon of North America,* 2002, Chanticleer Press.

2. Beecher, Hal, PhD Fisheries Biologist Washington State Department of Fish and Wildlife, retired. Personal written communication.

3. Carlsen, Margen, Deputy Assistant Director – Habitat, Washington Department of Fish and Wildlife pers. communication email April 24, 2015. (Available by contacting Jack Havens at [redacted]

4. Daley, Wayne, Sr. Fisheries Biologist. Opinion letter, March 21, 2011. http://www.savecapitollake.org/documents/impact-on-fisheries.html

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6.Fraser, Senator Karen [redacted] email July 9, 2015. http//sdc.wastateleg.org/fraser/contact/

7.M. Koehler, K. Fresh, D. Beauchamp, J. Cordell, C. Simenstad, D. Seiler *Diet and Bioenergetics of Lake-Rearing Juvenile Chinook Salmon in Lake Washington,* 2006. Transactions of the American Fisheries Society 135: 1580-1591. 1581 pp) Corresponding author: https://onlinelibrary.wiley.com/doi/abs/10.1577/To5-178.1

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9. Mitchell, Theresa C., Puget Sound Nearshore Ecosystem Restoration Project, Washington Department of Fish and Wildlife – Habitat Program. Pers. Communication April 27, 2015

10. Montgomery, David R. *King of Fish – The Thousand Year Run of Salmon,* 2003. Westview Press.

11. NOAA Fisheries, www.fisheries.gov/species/killer whale

12. Pylon, Lee. Washington Department of Fish and Wildlife. Pers. Comm. May, 2018

13. Unsworth, Jim, PhD, Director Washington Department of Fish and Wildlife, letter of April 18, 2017.

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Citations from Quotes

Citation #6 contains a quote from a secondary publication. The author did not read this entire publication but relied on the quote.

Review

[redacted]

2 October 2018

Dr. Jack Havens

Dear Dr. Havens:

A major focus of your paper is how Capitol Lake affects Chinook salmon (*Oncorhynchus tshawytscha*) in the Deschutes River (and, secondarily, in Percival Creek). A number of factors have been suggested as influencing Chinook salmon survival, growth, and production, and the paper addresses these and how they are influenced by Capitol Lake or estuarine habitat conditions. I suggest it might be useful to put these in table form, separating outmigrant (fry-juvenile-smolt) from returning adults.

Chinook salmon life-stage & season	Factor influencing salmon survival, growth, and production	Capitol Lake	Unimpounded estuary
Juvenile – Jan-Jun	Food supply	Chironomids. Engstrom-Heg (1955) indicated early Capitol Lake provided food supply that supported very good growth compared to other Puget Sound systems. Koehler et al. (2006) indicates high value of chironomids as food for young Chinook in Lake Washington. Chironomid population might have adjusted as Capitol Lake aged, so current data on Chinook salmon growth and/or chironomid abundance would be informative, but in absence of new data, the best information seems to suggest favorable feeding conditions in the lake.	Some chironomids in upper reach and Percival Cove; replaced by marine plankton in marine water.

	Predation	Fish-eating birds, cutthroat trout (relatively few)	Fish-eating birds, staghorn sculpin (*Leptocottus armatus*), dogfish shark (*Squalus acanthias*),
	Dissolved oxygen (DO)	Tumwater Falls ensures near saturation.	Tumwater Falls ensures near saturation.
	Temperature	Temperature very similar under either management option.	Temperature very similar under either management option.
	Salinity	Fresh water	Salinity transition fluctuates with tide, but at highest extent only moves about a mile upstream, so that this is unlikely to be a physiological factor. It could be an ecological factor in influencing food supply and predators.
	Pollutants	Pollutants from automotive and other sources in the urban environment of Capitol Lake as well as agricultural inflow from the Deschutes watershed may be present, but data are needed to answer this. Pollutants from Budd Inlet are blocked.	Pollutants in sediments in Budd Inlet might be washed farther upstream with the tide, depending on the degree to which those pollutants are dissolved or suspended and moved into the estuary. Sampling the distribution and concentration of sediment pollution in different parts of Budd Inlet would be informative as would more detailed consideration of the chemistry and adsorption of the pollutants.
Juvenile – Jul-Aug	Food supply	*Daphnia* replace chironomids as a high-quality food for juvenile Chinook (Engstrom-Heg 1955; Koehler et al. 2006)	*Daphnia* in Percival Cove and closer to Tumwater Falls in pools; replaced downstream in tidal reach by other arthropods
	Predation	See above (Jan-Jun)	See above (Jan-Jun)
	Dissolved oxygen (DO)	See above (Jan-Jun). Higher temperature can reduce DO. DO is influenced positively by ratio of surface area to volume (S:V), which is high in the relatively shallow Capitol Lake.	See above (Jan-Jun). Higher temperature can reduce DO.
	Temperature	Although high S:V favors DO, it can also lead to greater heating when air temperature and direct solar radiation are a major factor in the hot months. Data from Engstrom-Heg (1955) suggest that temperatures remain acceptable for	Temperature would change little from Tumwater Falls.

		salmonids, with more preferred temperatures in the channel. Deposition and shallowing of Capitol Lake could have changed the temperature and DO conditions in Capitol Lake. Current data would be informative.	
	Salinity	See above (Jan-Jun)	See above (Jan-Jun)
	Pollutants	See above (Jan-Jun)	See above (Jan-Jun)
Returning adult – Aug-Sep	Food supply	NA	NA
	Predation	Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are excluded from Capitol Lake but prey on Chinook salmon waiting to enter the lake. Once in the lake, adult salmon are safe from these larger predators while the salmon try to find the entrance to the Tumwater Falls fishway. River otters (*Lutra canadensis*) could get access to salmon at the base of the falls, but I have not seen them there.	Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) could have access to the base of the falls where salmon aggregate in high density. Seals and sea lions often ascend rivers many miles in pursuit of salmon – I have seen them far up the Fraser, they are well-known at Bonneville Dam, and they have been reported well up the Nisqually River. This could be a major predation opportunity where salmon have much less opportunity to avoid predators than they have in Budd Inlet below the bridges. River otters could also access salmon, but may be deterred by larger seals and sea lions.
	Dissolved oxygen (DO)	See above (Jul-Aug)	See above (Jul-Aug)
	Temperature	See above (Jul-Aug)	See above (Jul-Aug)
	Salinity	See above (Jan-Jun)	See above (Jan-Jun)
	Pollutants	See above (Jan-Jun)	See above (Jan-Jun)

In most cases, what can be said is qualitative, not quantitative. There is nothing you have mentioned that makes a strong case that salmon production would increase significantly, if at all, with the conversion of Capitol Lake to a free-flowing estuary. Likewise, there is no clear case that salmon production would decrease. Studies to provide actual data to inform these uncertainties would require a series of years, as annual variation in most of the factors in the Capitol Lake-Budd Inlet area, not to mention in the Pacific Ocean feeding and growing areas, can be considerable, with numerous factors interacting in complex ways. By making conditions as favorable as possible in the terminal area, the fish will be in the best condition to survive the marine years, and allowing as many returning adults to spawn

as there is suitable spawning (and subsequent incubation and rearing) habitat will increase the probability of good return. However, it is noteworthy that natural conditions did not allow a population of Chinook salmon to live in the Deschutes River, and only human intervention in our lifetime established this population.

In the Introduction, you mentioned the critical importance of Chinook salmon in the diet of the resident orcas (*Orcinus orca*). Wikipedia cites National Marine Fisheries Service (2008). "Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*)" (PDF). National Marine Fisheries Service, Northwest Region, Seattle, Washington as a source for diet information.

Note that mustelid predation is from river otters (*Lutra canadensis*), which I have watched catching adult steelhead and which, despite the name, occur in Puget Sound and Straits (abundant in San Juan Islands). Sea otters (*Enhydra lutris*) live on the outer coast and the most inland I have seen one was Neah Bay; they eat mollusks, crustaceans, and echinoderms, although if they found a dying adult salmon they might eat it.

Where discussing a situation with the lower dam removed to make a more connected estuary, I suggest using the term estuary more, as calling it a tidal mudflat sounds more derogatory (e.g, p.3). It's certainly appropriate to state that a significant feature of an estuary is tidal mudflat.

You mentioned tundra swans (*Cygnus columbianus*) on Capitol Lake during winter. My experience with them there is limited even though during much of the 1980s I ran around Capitol Lake regularly (roughly weekly), always watching what waterfowl were present. I do not recall seeing them until quite recently, I believe since 2010, and definitely since 2005.

You also mentioned three-spined stickleback (*Gasterosteus aculeatus*) mortality as being attributed by some to the dam creating Capitol Lake. In Wydoski & Whitney (1979; Inland Fishes of Washington, University of Washington Press, Seattle and London; there is a 21st century edition of this book, but I don't have it) these sticklebacks are reported to die following breeding in the spring. They can be abundant in fresh and saltwater, so a post-spawning mortality might be quite noticeable. Attributing such mortality to blocked migration would require considerable evidence. A quick Google search turned up an article (Jolanta Morozinska-Gogol, 2015, Changes in the parasite communities as one of the potential causes of decline in abundance of the three-spined sticklebacks in the Puck Bay, Oceanologia 57 (3): 280-287) from Poland (this is a circumpolar species) about mortality associated with parasite load. That's a subject where you are the expert.

Other minor comments

On p. 4 in the last full paragraph, delete the "[like Capitol Lake]" and "Brackets added" and instead add a following sentence, such as "Capitol Lake, like Lake Washington, has been used for only short time by Chinook salmon and findings by Koehler et al. (2006) may be relevant to Capitol Lake as well as to Lake Washington, given the similarity of diets in the two lakes (Engstrom-Heg 1955, Koehler et al. 2006)."

On p. 7, the discussion of county-owned fish barrier culverts is relevant to salmon and trout in general (as well as lampreys and sticklebacks), but the preference of Chinook salmon for larger streams, as you mention elsewhere, means that most culvert improvement will benefit coho, chum, cutthroat, and perhaps steelhead, but Chinook are less likely to be benefitted by them. The state and county have legal obligations to improve fish passage at these, so that financial obligation exists.

On p. 8, you cite Engstrom-Heg (1955) as stating predation is negligible in the lake. It might be worth pointing out that Capitol Lake lacks northern pikeminnow (Ptychocheilus oregonensis) that is a significant predatory fish in Lake Washington (Koehler et al 2006) as well as in the Columbia River (where there has been a bounty fishery for this native minnow).

On p. 10, you mention less predator shielding with dredging. Given the scarcity of predators in Capitol Lake, is this relevant. I presume you are referring to sit-and-wait ambush predators (fish), rather than fish-eating waterfowl. If you are talking about waterfowl, then vegetation may shield the young salmon.

On p. 11, Daphne should be *Daphnia*. I suspect that was a spellcheck action. (I always thought that a company based in Washington state should have programmed its spellcheck in WORD to accept Walla Walla!)

On p. 13, you point out that salmon do not spawn in saltwater. Chum salmon are borderline. I see them spawning in areas of Hood Canal streams that are reached by high tides.

On p. 14, you accidentally omitted quotation marks around the sentence about spewing toxins.

(In the same paragraph is the quote about all dams are bad. There was a time in the 1990s when, as a WDFW employee [or WDG or WDW, depending on year], I worked with USFWS, ODFW, NMFS, and Umatillas to consider getting the Corps to add a dam to the Walla Walla basin in Oregon to store water to release for fish when irrigators had taken all the river water. Other solutions were eventually found through extensive negotiations.)

I think trying to put some order instead of just sentiment into the issue is very commendable. Obviously there are a lot of uncertainties. Getting more certainty would be a major undertaking (although some water quality sampling may be relatively inexpensive and quick), but given the costs of existing options, better understanding will certainly improve the discussion and inform the decision-making.

Sincerely,

Hal A. Beecher, Ph.D.

From: Hal Beecher [redacted]
Sent: Wednesday, October 03, 2018 12:09 PM
To: [redacted]
Subject: Capitol Lk

Jack - I think I forgot to address that issue of fish from other rivers. I think that is a really weak argument for removing the lake. The percentage of fish from those rivers (primarily Nisqually, I assume) would be a small percentage of the production of those rivers, with percentage diminishing as distance from Budd Inlet increases.

Hal

CURRICULUM VITAE

Hal Arthur Beecher

Born: 21 April 1948, Budapest, Hungary

Education:

A.B. - Middlebury College, Middlebury, Vermont; Biology, 1970

M.S. - University of West Florida, Pensacola, Florida; Biology and Marine Science, 1973; Dr. Thomas S. Hopkins, major professor

Ph.D. - Florida State University, Tallahassee, Florida; Biological Science (ichthyology), 1979; Dr. Ralph W. Yerger, major professor

Research interests: stream fish ecology, instream flow, fish communities, stream habitat classification, coral reef ecology

1991 Washington Department of Wildlife Research Award
1997 Washington Department of Fish and Wildlife Team Award - Cedar River Team
2002 Washington Department of Fish and Wildlife Best Science Award
2012 nominee – The Leadership Award, State of Washington
2013 Washington Department of Fish and Wildlife Habitat Program – Conservation Legacy Award
2015 Instream Flow Council Lifetime Achievement Award
2016 Washington Department of Fish and Wildlife Habitat Program – Lifetime Achievement Award

2002-2004 Instream Flow Council Regional Director (western states)
2004-2006 Instream Flow Council President-elect
2006-2008 Instream Flow Council President
2008-2010 Instream Flow Council Past-president

Publications, technical:

Rosenfeld, J., H. Beecher, and R. Ptolemy. 2016. Developing bioenergetic-based habitat suitability curves to improve the biological accuracy of instream flow models. North American Journal of Fisheries Management 36 (5): 1205-1219. Doi: 10.1080/02755947.2016.1198285

Vadas, R.L., H.A. Beecher, S.N. Boessow, and J.H. Kohr. 2016. Coastal cutthroat trout redd counts impacted by natural water supply variations. North American Journal of Fisheries Management 36 (4): 900-912. Doi: 10.1080/02755947.2016.1173138

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Vadas, R.L., Jr., H.A. Beecher, S.N. Boessow, and K.A. Ensenat. 2008. Coastal cutthroat trout ecohydrology and habitat use in Irely Creek, Washington. Pages 85-58 in: P.J. Conolly, T.H. Williams, and R.E. Gresswell, editors. The 2005 coastal cutthroat trout symposium: status, manamagement, biology, and conservation. Oregon Chapter, American Fisheries Society, Portland.

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Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth and C. Stalnaker. 2004. Instream Flows for Riverine Resource Stewardship – Revised Edition. Instream Flow Council, Cheyenne, WY.

Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarestad, N. Burkhart, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, C. Stalnaker, and R. Wentworth. 2002. Instream Flows for Riverine Resource Stewardship. Instream Flow Council, Cheyenne, WY.

Beecher, H.A., B.A. Caldwell, and S.B. DeMond. 2002. Evaluation of depth and velocity preferences of juvenile coho salmon in Washington streams. North American Journal of Fisheries Management 22 (3): 785-795.

Beecher, H.A. 1995. Comparison of preference curves and habitat utilization curves based on simulated habitat use. Rivers 5 (2): 109-120. (published February 1996)

Beecher, H.A., T.H. Johnson, and J.P. Carleton. 1993. Predicting microdistributions of steelhead (*Oncorhynchus mykiss*) parr from depth and velocity preference criteria: test of an assumption of the Instream Flow Incremental Methodology. Canadian Journal of Fisheries and Aquatic Sciences 50 (11): 2380-2387.

Beecher, H.A. 1990. Standards for instream flows. Rivers 1 (2): 97-109.

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Beecher, H.A. 1987. Simulating trout habitat in instream flow models, pp. 71-82 in: J.F. Craig and J.B. Kemper (eds.), Regulated Streams: Advances in Ecology. Plenum Press, New York and London. 431 pp.

Beecher, H.A., and R.F. Fernau. 1983. Fishes of oxbow lakes of Washington. Northwest Science 57 (2): 125-131.

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Beecher, H.A. 1979. Comparative functional morphology and ecological isolating mechanisms in sympatric fishes of the genus *Carpiodes* in northwestern Florida. Ph.D. dissertation, Florida State University, Tallahassee. 208 pp.

Beecher, H.A., W.C. Hixson, and T.S. Hopkins. 1977. Fishes of a Florida oxbow lake and its parent river. Florida Scientist 40 (2): 140-148.

Beecher, H.A. 1975. Carotenoids in color change of *Pomacentrus variabilis*. Florida Scientist 38 (2): 106-113.

Beecher, H.A. 1973. Studies on the color phases of the cocoa damselfish, *Pomacentrus variabilis* (Pisces: Pomacentridae). M.S. thesis, University of West Florida, Pensacola. 57 pp.

Published notes:

Beecher, H.A. 2017. Comment 1: Why it is time to put PHABSIM out to pasture. Fisheries 42 (10): 508-510. Doi: 10.1080/03632415.2017.1380985.

Beecher, H.A., J.P. Carleton, and T.H. Johnson. 1997. Testing the independence of microhabitat preferences and flow: Response to Comments. Transactions of the American Fisheries Society 126: 541-542.

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Beecher, H.A. 1980. Review: Inland Fishes of Washington. Copeia 1980 (4): 944-945.

Beecher, H.A., and B.H. Beecher. 1979. First record of *Couesius plumbeus* (Agassiz) (Osteichthyes: Cyprinidae) from Washington. Syesis 12: 175-176.

Beecher, H.A. 1979. Anomalous occurrence of lip projection on *Carpiodes cyprinus*. Florida Scientist 42 (1): 62-63.

Yerger, R.W., and H.A. Beecher. 1975. First records of two percid fishes in Florida freshwaters. Florida Scientist 38 (3): 142-143.

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Beecher, H.A. 1973. Effects of a hurricane on a shallow-water population of damselfish, *Pomacentrus variabilis*. Copeia 1973 (3): 613-615.

Presentations at conferences:

Winkowski, M., N. Kendall, and H. Beecher. 2015. Using PHABSIM to investigate effects of altered streamflow on fish in the Chehalis River, Washington. American Fisheries Society, 2015 annual meeting, Portland, OR.

Beecher, H., and S. Boessow. 2012. Combining scales: instream flow modeling of coastal cutthroat trout spawning habitat. Instream Flow Council Biennial meeting, Omaha, Nebraska.

Beecher, H. 2004. Instream flows – Part III, the future: state perspective. Law Seminars International: Thirteenth Annual Conference on Washington Water Law, Seattle.

Publications, non-technical:

Beecher, H.A. 1995. Elkhorn ruling boosts state authority to set instream flows on federal projects. Fisheries 20 (3): 18-19.

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Agency reports:

Beecher, H., D. Bighouse, B. Vadas, S. Boessow, J. Pacheco, J. Kohr, R. Murphy, P. LaRiviere, A. Wald, T. Hegy, and B. Caldwell. 2008. Wind River Instream Flow Study 2007, Final Report. Washington Department of Fish and Wildlife and Washington Department of Ecology, Olympia. 104 pp.

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Caldwell, B., J. Pacheco, H. Beecher, T. Hegy, and R. Vadas. 2004. Chehalis River Basin, WRIAs 22 and 23, Fish Habitat Analysis Using the Instream Flow Incremental Methodology. Open File Technical Report. Washington Department of Ecology. Publication #04-11-006.

Caldwell, B., K. Ensenat, and H. Beecher. 2003. WRIA 35 Asotin Creek basin fish habitat analysis using the Instream Flow Incremental Methodology. Open File Technical Report. Washington Department of Ecology.

Caldwell, B., J. Shedd, and H. Beecher. 2002. Walla Walla River fish habitat analysis using the Instream Flow Incremental Methodology. Washington State Department of Ecology Open File Technical Report 02-11-009, Olympia. 167 pp.

Ames, J., and H. Beecher. 2001. Incorporating flood risk into controlled spawning flow regimes for Pacific salmon: an example using Cedar River sockeye salmon. Washington Department of Fish and Wildlife, Fish Program, Report #FPT 01-13, Olympia. 123 pp.

Caldwell, B., J. Shedd, and H. Beecher. 1999. Washougal River fish habitat analysis using the Instream Flow Incremental Methodology and the Toe-Width Method for WRIAs 25, 26, 28, and 29. Washington State Department of Ecology Open File Technical Report, Olympia. 60 pp.

Caldwell, B., J. Shedd, and H. Beecher. 1999. Kalama River fish habitat analysis using the Instream Flow Incremental Methodology. Washington State Department of Ecology Open File Technical Report, Olympia. 36 pp.

Caldwell, B., J. Shedd, and H. Beecher. 1999. East Fork Lewis River fish habitat analysis using the Instream Flow Incremental Methodology and the Toe-Width Method for WRIA 27. Washington State Department of Ecology Open File Technical Report, Olympia. 36 pp.

Ames, J., and H. Beecher. 1995. Recommended spawning flows for Cedar River sockeye salmon: with a review of spawning distribution and flood risk studies. A report to The Cedar River Instream Flow Committee. Washington Department of Fish and Wildlife, Olympia. viii+108 pp.

Caldwell, B., H. Beecher, and J. Marti. 1995. Entiat and Mad Rivers: Fish habitat analysis using the Instream Flow Incremental Methodology. Washington Department of Ecology Open File Technical Report #95-166, Olympia.

Peer review of manuscripts for editors:
Fisheries Bioengineering Symposium (American Fisheries Society)
North American Journal of Fisheries Management (American Fisheries Society)
Environmental Management
Canadian Journal of Fisheries and Aquatic Sciences
Florida Scientist (Florida Academy of Science)
New Zealand Journal of Marine and Freshwater Research
U.S. Fish and Wildlife Service
Canada Department of Fisheries and Oceans
Journal of Fish and Wildlife Management (U.S. Fish and Wildlife Service)
River Research and Applications

Invited (but declined) to serve on editorial board for Agriculture, Forestry, and Fisheries

Peer review of aquatic resource management programs:
National Fish Habitat Action Plan, Science and Data Committee, 2005-2012
http://fishhabitat.org/
State of Michigan Water Assessment Tool science review panel, 2006
www.**michigan**.gov/documents/dnr/SciencePanelReport_final_185835_7.pdf

New Hampshire Department of Environmental Services, River Management and Protection Program, 2009 http://des.nh.gov/organization/divisions/water/wmb/rivers/index.htm

National and International Conferences and Workshops

Session chair, American Society of Ichthyologists and Herpetologists annual meeting, Tallahassee, Florida 1983

Plan and chair Instream Flow Council 2006 biennial meeting, Vancouver Island, British Columbia

Preside, chair Awards Committee, member of Planning Committee at FLOW 2008 – Interdisciplinary Solutions to Instream Flow Problems (http://www.instreamflowcouncil.org/flow2008/index.htm), an international conference in San Antonio sponsored by the Instream Flow Council

Invited member of planning committee, 10th International Riversymposium and Environmental Flows Conference, 2007, Brisbane, Australia (http://www.iwsea.org/riversymp07)

Invited speaker, Western Division, American Fisheries Society, Bozeman, Montana, 2006: "Sustaining aquatic life in the west in the face of growth and diminishing water"

Invited speaker, River Network, National River Rally, Skamania Lodge, 2007: "Instream Flows and the Instream Flow Council"

Member, planning committee, FLOW 2015, sponsored by Instream Flow Council in Portland, OR, April 2015. Presented IFC Making A Difference Award to Dr. Angela H. Arthington (Giffith University, Brisbane, Australia).

Invited plenary speaker, Washington-British Columbia Chapter, American Fisheries Society, March 29, 2016, Chelan, WA: "Adequate Water and Aquatic Habitat: An essential component of 'Building a Future for our Fishes'" (wabc-afs.org/w/wp-content/uploads/2016/05/1-Hal-Beecher.pdf)

Invited plenary speaker, Upper Columbia Science Conference, January 24-25, 2018, Wenatchee, WA: "Fitting tools to our understanding of the problem – Habitat Suitability Indices and PHABSIM".

Member, planning committee, FLOW 2018, sponsored by Instream Flow Council in Fort Collins, CO, April 23-25, 2018. Presented IFC Making A Difference Award to Dr. N. Leroy Poff (Colorado State University, Fort Collins).

Experience:

Spring 2018- : Serve on committee established under ESSB 6091 (RCW 90.94) to develop recommendations to Washington Department of Ecology on guidelines for mitigation for new water use where instream flows constrain new use.

May-July 2017: Draft drought response plan for Washington Department of Fish and Wildlife (WDFW) Habitat Program. Review drought response reports and files prepared by WDFW since 2000 and recommend procedures for future drought response, including monitoring plans to evaluate consequences of drought and effectiveness of drought response measures. Presented report to Dr. Kiza Gates, WDFW Water Science Team leader.

January 2009 – January, 2016. Instream Flow Biologist, Water Science Team, Conservation Planning Division and Habitat Science Division, Habitat Management Program, Washington Department of Fish and Wildlife, Olympia (Washington Management Services Band 2). Serve as instream flow specialist. Conduct research on relationships among flow, fish, and habitat and conduct studies to test assumptions of Instream Flow Incremental Method (IFIM). Develop and evaluate instream flow methods. Represent agency in water resource policy and planning, including Habitat Conservation Plans developed under the federal Endangered Species Act. Review instream flow and water legislation. Supervise review of water right applications, recommend conditions to mitigate impacts of water use, and testify as expert witness in appeals of water right decisions. Lead on Water Science Team, conduct instream flow studies using PHABSIM and other tools. Serve on technical team for instream flow management for salmonid fishes listed under Endangered Species Act in Washington. Represent State of Washington on the Instream Flow Council.

July, 1999 – January 2009. Instream Flow Biologist, Science Division, Habitat Management Program, Washington Department of Fish and Wildlife, Olympia (Fish and Wildlife Research Scientist 2, Washington Management Services Band 2). Serve as instream flow specialist. Conduct research on relationships among flow, fish, and habitat and conduct studies to test assumptions of Instream Flow Incremental Method (IFIM). Develop and evaluate instream flow methods. Represent agency in water resource policy and planning, including Habitat Conservation Plans developed under the federal Endangered Species Act. Review instream flow and water legislation. Review water right applications, recommend conditions to mitigate impacts of water use, and testify as expert witness in appeals of water right decisions. Lead on Instream Flow Team, conduct instream flow studies using PHABSIM and other tools. Serve on technical team for instream flow management for salmonid fishes listed under Endangered Species Act in Washington. Represent State of Washington on the Instream Flow Council, serve as Western Regional Director-elect, Western Regional Director, President-elect, President, and Past-president, and participate as committee member developing North American standards for instream flow studies and management (see Annear et al., 2002, 2004, Locke et al. 2008).

April, 1995 - June, 1999. Instream Flow Biologist, Mitigation and Restoration Division (formerly Mitigation and Water Rights Division, formerly Major Projects Division), Habitat and Lands Program (formerly Habitat Management Program), Washington Department of Fish and Wildlife, Olympia (Resource Program Manager 2; Fisheries Research Scientist 2). Serve as instream flow specialist. Conduct research on relationships among flow, fish, and habitat and conduct studies to test assumptions of Instream Flow Incremental Method (IFIM). Develop and evaluate instream flow methods. Represent agency in consultation for licensing hydroelectric projects and other energy facilities, as well as Habitat Conservation Plans. Represent agency in water resource policy and planning. Review instream flow and water legislation. Review water right applications, recommend conditions to mitigate impacts of water use, and testify in appeals of water right decisions. Serve on Interagency Science Advisory Team for Governor's Salmon Recovery Office. Lead on Instream Flow Team, conduct instream flow studies using PHABSIM and other tools. Serve on technical team for instream flow management for salmonid fishes listed under Endangered Species Act in Washington.

March, 1994 - April, 1995. Hydropower Project Coordinator, Major Projects Division, Habitat Management Program, Washington Department of Fish and Wildlife, Olympia (Resource Program Manager 2). Coordinate agency response to hydroelectric project licensing. Coordinate agency mitigation of nuclear power plants and other energy facilities. Serve as instream flow specialist. Represent agency in water resource policy and planning. Conduct research on relationships among flow, fish, and habitat.

September, 1991 - March, 1994. Hydropower Project Coordinator, Major Mitigation Program, Habitat Management Division, Washington Department of Wildlife, Olympia (Resource Program Manager 2). Coordinate agency response to hydroelectric project licensing. Coordinate agency mitigation of nuclear power plants and other energy facilities. Serve as instream flow specialist. Represent agency in water resource policy and planning. Conduct research on relationships among flow, fish, and habitat and on fish protection screens. Develop and evaluate instream flow methods.

April, 1986 - September, 1991. Manager, Technical Services Section, Habitat Management Division, Washington Department of Wildlife, Olympia (Game Program Manager 2 - 3, Resource Program Manager 3). Develop mitigation policies, oil and toxic spill response program. Serve as instream flow biologist with responsibility for agency water resource policy as well as technical specialist, including research on instream flow and fish. Testified as expert witness on instream flows for fish in trials, including Elkhorn case (Tacoma v. State of Washington) in which U.S. Supreme Court upheld state's position on instream flows as a condition of Water Quality Certification on a FERC license in 1994. Supervise personnel responsible for oil spill response, Habitat Evaluation Procedures (HEP), liaison with Puget Sound Water Quality Authority, Washington Wildlife Rescue Coalition, wildlife economics, wetlands, mitigation banking. Section provides technical assistance to Timber, Fish, and Wildlife.

January, 1983 - March, 1986. Instream Flow Biologist (Wildlife Biologist 4 - Game Program Manager 2), Habitat Management Division, Washington Department of Game, Olympia. Plan and develop Instream Flow Program, including drafting instream flow policies, procedures, and guidelines for IFIM studies. Ensure statewide consistency of Game Department instream flow activities. Provide technical expertise on instream flow. Conduct research on instream flow and fish.

January, 1982 - January, 1983. Mitigation Biologist (Wildlife Biologist 4). Washington Department of Game, Seattle. Develop habitat mitigation, compensation, and protection in relation to water resource development projects in northwest Washington, particularly small hydroelectric projects. Testified in Green River hearings before Pollution Control Hearings Board concerning instream flows for Tacoma Water Department.

November, 1981 - January, 1982. Stream fish ecologist. BioSystems Analysis, Inc., Seattle. Research and develop stream habitat classification for Pacific Northwest.

May, 1981 - October, 1981. Wildlife Biologist 2, Washington Department of Game, Olympia. Draft environmental impact statement section on fish and aquatic habitats for Washington

Department of Natural Resources' Forest Land Management Program, including management of volcano impact zone at Mt. St. Helens.

September, 1979 - April, 1981. Research Analyst 2, Environmentalist 2, Washington Department of Game, Olympia. Conduct instream flow studies to assess Instream Flow Incremental Method (IFIM). Represent Game Department in Department of Ecology's Instream Resources Protection Program to establish instream flows.

February, 1978 - September, 1979. Wildlife biologist and aquatic ecologist, The Nature Conservancy, Washington Natural Heritage Program, Olympia, and Oregon Natural Heritage Program, Portland. Developed classification of Northwest aquatic habitats. Compiled animal species of concern list for Washington and analyzed distribution of listed species. Developed a list of priority lands for acquisition as National Wildlife Refuges in Oregon, based on concentrations of endangered, threatened, and special concern species of wildlife.

April - June, 1977; January - March, 1974, 1975; September - December, 1974. Teaching assistant, Department of Biological Sciences, Florida State University, Tallahassee. Laboratories: Introduction to animal diversity; comparative vertebrate morphology; ichthyology.

January - April, 1975. Ornithologist, Atlantis Scientific, Tallahassee. Assessed impact of federal Clean Water Act upon bird populations in two north Florida estuaries.

April - December, 1974. Environmental Specialist 1, Florida Department of Pollution Control, Tallahassee. Participated in study of impact of channelization on fish and other aquatic vertebrates of Kissimmee-Okeechobee basin.

December, 1972 - December, 1974. Ornithologist, Baseline, Incorporated, Pensacola. Assessed anticipated impacts of proposed projects on birds. Conducted bird surveys throughout Florida.

August - December, 1973. Research assistant, Department of Biological Sciences, Florida State University, Tallahassee. Collected and identified fishes from Apalachicola National Forest.

October, 1971 - October, 1972. Research assistant, Department of Biology and Marine Science, University of West Florida, Pensacola. Conducted baseline biological survey of vertebrates of Escambia River in vicinity of Jay oil field.

September, 1969 - June, 1970. Teaching assistant, Department of Biology, Middlebury College, Middlebury, Vermont. Introductory biology.

Summers, 1964 - 1969. Aquarist, collector, Aquarium-Museum, Scripps Institution of Oceanography, LaJolla, California.

July - August, 1967. Aquarist, Sea World, San Diego.

Professional organizations:

American Association for the Advancement of Science, 1976-1983
American Fisheries Society, 1973- (Chairman, Freshwater Habitat Committee, North Pacific International Chapter, 1979-1980; life member)
American Ornithologists' Union, 1973-1975
American Society of Ichthyologists and Herpetologists, 1972-1985 (Chaired session on Ecology: Life Histories and Population Dynamics at 63rd annual meeting, 1983)
American Water Resources Association, Washington Section, 1979-1981
Ecological Society of America, 1973- (life member)
Florida Academy of Sciences, 1977-1991
Instream Flow Council, 1997-2016 (representing Washington Department of Fish and Wildlife; Western Region director-elect 2000-2002; Western Regional director 2002-2004; member, Methods Committee; president-elect 2004-2006; president 2006-2008; past president 2008-2010; emeritus member 2016-)
Northwest Scientific Association, 1978-1986
Pacific Fishery Biologists, 1984-
Sigma Xi, The Scientific Research Society of North America, 1977-2000
Society for Conservation Biology, 1999-2001