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Mál 207

Frá: NASF, Verndarsjóði villtra laxastofna,
Skipholti 35, 105 Reykjavík

Dags: 4. apríl 2017

EFNI: Umsögn NASF,Verndarsjóðs villtra laxastofna um tillögu til þingsályktunar um áætlun um vernd og orkunýtingu landsvæða. Mál 207.

Í upphafi skal tekið fram að faghópur sem skipaður var 22. október 2013 af verkefnisstjórn RÁ3 til að meta helsta ágreiningsefni þessa máls komst að þeirri ótvíræðu niðurstöðu að engri óvissu hefði verið eytt um afdrif laxfiska í Þjórsá ef af virkjunum í neðri hluta árinnar yrði. Frá upphafi þessi máls var algjört skilyrði fyrir framkvæmdum að engin óvissa ríkti um afdrif laxfiska í Þjórsá. Því er með ólíkindum að málið skuli hafa gengið svo langt að nú liggi fyrir tillaga um að setja virkjanir á gönguslóð laxfiska í Þjórsá í nýtingarflokk. Sjá fylgiskjal 1 og kæru til Úrskurðarnefndar umhverfis – og auðlindamála (21. jan 2016) fylgiskjal 2

Að okkar áliti hefur raunverulegt mat á umhverfisáhrifum virkjana í neðri hluta Þjórsár, eins og núgildandi lög kveða á um, aldrei farið fram. Árin 2001–2003 var lagt fram mat sem margir óháðir sérfræðingar hafa talið ófullnægjandi. Sérfræðingar okkar hafa bent á að sama máli gegni um mörg fleiri gögn sem kallað hefur verið eftir og því sé langt í land með að hægt sé að taka ákvarðanir um verkfræðilegar aðgerðir á fyrirhuguðu virkjunarsvæði.

Samantektin frá 2001-2003 er löngu úrelt. Sett hafa verið ný lög um umhverfismat með nýjum áherslum byggðum á nýrri þekkingu og alþjóðakröfum þar sem sett eru ströng skilyrði um verndun náttúruverðmæta, umhverfisvernd og sjálfbærni. Á loftslagsráðstefnunni í París árið 2015 var mjög haldið á loft nýlegum upplýsingum um þann mikla skaða sem vatnsaflsstíflur valda lífríkinu. Þar ber hæst tjón á fiskstofnum vegna búsvæðataps, rennslisbreytinga og setefnisflutninga. Því var lögð höfuðáhersla á að lífríkið yrði undantekningalaust kannað til hins ýtrasta og umhverfisáhrif metin áður en verkfræðingar fengju að hlutast til um mannvirkjagerð í straumvötnum. Nýtt umhverfismat ætti að tryggja möguleika landeigenda til að þeir geti varið sína hagsmuni til framtíðar.

Nær eingöngu hefur verið stuðst við samantekt frá Veiðimálastofnun sem NASF telur vanhæfa, bæði vegna veigamikilla fjárhags- og hagsmunatengsla við Landsvirkjun og þekkingarleysis á því sem máli skiptir í þessu sambandi. Því til stuðnings bendum við á að engin búsvæðadeild er starfrækt á Veiðimálastofnun og því hefur hún ekki á að skipa sérfræðingum á sviði rennslismælinga, frumframleiðslu eða greiningar á lífslíkum fiskistofna. Sérfræðiþekking á áhrifum vatnsaflsvirkjana á þessa mikilvægu þætti er því ekki fyrir hendi á stofnuninni. Sjá fylgiskjal 3.

Fjölmörg grundvallaratriði í lífríki Þjórsár liggja ekki fyrir að mati sérfræðinga sem NASF hefur leitað til um ráðgjöf. M.a.vantar efna- og eðlisfræðigreiningar á vatni og botngróðri Þjórsár og þverám hennar.

Bjartsýni Landsvirkjunar um mögulegan árangur af seiðaveitum til að halda lífi í drjúgum hluta laxastofnsins byggist ekki á neinum reynsluvísindum. Þegar við bætist að rannsóknir á lífríkinu eru ófullnægjandi, eins og rakið er í fylgigögnum blasir við að málið þarfnast miklu betri skoðunar. Sjá fylgiskjal 4. Veiðimálastofnun útbjó samantekt á upplýsingum um ýmiss konar efnisatriði. Margt í samantekt Veiðimálastofnunar hefur töluvert upplýsingagildi en getur varla talist fagleg greining á hugsanlegum áhættuþáttum og mótvægisaðgerðum. Ábyrgir sérfræðingar sem við höfum leitað til, innlendir og erlendir, eru á einu máli um að sú samantekt sé ekki nægjanlegur grunnur að umhverfismati. Ekki nægir að benda á að hugsanlega geti „einhvers konar seiðaveitur“ auðveldað niðurgöngu seiða því að fæstar slíkar „veitur“ hafa komið að gagni þrátt fyrir áratuga tilraunastarfsemi. Eins og segir í einni skýrslu, sjá fylgiskjal 5 bls. 5, sérfæðinga okkar: „There has been

insufficient collection of the appropriate biological data and an insufficient evaluation of the potential impacts using population viability analyses."

Rétt er að vekja athygli á lífslíkum sjóbirtingsstofnins í Þjórsá. Sjóbirtingur getur orðið 10-12 ára og gengur á hverju ári (stundum oftar en einu sinni) til sjávar og aftur í ána. Hvað sem seiðaveitum líður eru allir sérfræðingar sammála um það, hvaða stofnun sem þeir tilheyra, að þetta muni sjóbirtingurinn aldrei geta gert ef af virkjunum verður. Sjóbirtingur í Þjórsá muni því fljótlega líða undir lok.

Í bréfi dagsettu 20. janúar, 2016, sjá fylgiskjal 5, ásamt fylgiskjölum 6 og 7 er ítarleg greinargerð frá Dr. Margaret J. Filardo, Ph.D. Supervisory Fish Biologist, einum helsta sérfræðingi í áhrifum mannvirkja á lífríki vatnasvæða hjá Fish Passage Center í Portland, Oregon. Dr. Filardo fer faglega yfir alla helstu lífríkisþætti er varða áætlanir um Hvammsvirkjun og bendir á upplýsingar sem vantar áður en lengra er haldið, dregur fram óvissuþætti og sýnir fram á ónóga þekkingu þeirra sem að málinu hafa staðið. Lokaorð hennar eru þessi:

> In summary, the process that has occurred thus far regarding the movement of the Hvammur hydroproject to the utilization category and the decision to forgo an updated Environmental Assessment, relies on building the dam and then observing what the effectiveness of the countermeasures are on aquatic life in the Thjórsá River.This approach does not address the substantial information of the impacts of hydro development on aquatic populations from rivers around the world. If that information were taken into consideration the only logical conclusion would be that there is more "certainty" associated the impacts of hydro development than "uncertainty." Regardless of the implementation of countermeasures and monitoring, once Hvammur is built there will be substantial negative impacts to the aquatic life of the Thjórsá.

Niðurstaða faghópsins sem var skipaður til að fara yfir gögn málsins var skýr um að ekki hafi dregið úr neinni óvissu um afdrif laxfiska í ánni, ef af virkjunum verði. Sjá fylgiskjal 1

Sú ótvíræða niðurstaða stendur að engri óvissu um afdrif laxfiska í Þjórsá hefur verið eytt og því eru engar forsendur fyrir hendi til að færa Holta- og Urriðafossvirkjanir í neðri hluta Þjórsár úr biðflokki í nýtingarflokk.

Á seinustu mánuðum hafa fallið hæstaréttardómar í Bandaríkjunum sem styðja þá skoðun að hugmyndir verkefnastjórnar rammaáætlunar vegna afkomu fiskistofna í Þjórsá standast engan veginn. Sjá fylgiskjal 8

Áskilinn er allur réttur til þess að koma á framfæri frekari kröfum, sjónarmiðum og málsástæðum, sem og gögnum, á síðari stigum þessa máls eftir því sem tilefni kann að gefast til.

Virðingarfyllst

Orri Vigfússon formaður
NASF, Verndarsjóðs villtra laxastofna

Þýðingar á enska textanum boðnar verði þeirra óskað.
Fylgiskjöl með kæru til úrskurðarnefndar umhverfis- og auðlindamála fylgiskjal 2, tiltæk verði þeirra óskað.

Fylgiskjal 1	Mat faghóps frá 4. nóvember 2013
Fylgiskjal 2	Kæra til úrskurðarnefndar umhverfis- og auðlindamála
Fylgiskjal 3	Tengsl Landsvirkjunar og Veiðimálastofnunar
Fylgiskjal 4	Fiskvegurinn við Búða – seiðaveitur ofl
Fylgiskjal 5	Bréf frá Margaret Filardo Ph. D. 20. janúar 2016
Fylgiskjal 6	Bréf frá Margaret Filardo Ph. D 15. nóvember 2013
Fylgiskjal 7	Bréf frá Margaret Filardo Ph. D 9. nóvember 2011
Fylgiskjal 8	Dómur fráThe United States District Court - mars 2017

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Reykjavík 04.11.2013

Efni: Mat faghóps á óvissu fyrirliggjandi upplýsinga um áhrif Hvamms-, Holta- og Urriðafossvirkjana í neðri hluta Þjórsár á laxfiska í ánni

Inngangur

Faghópurinn var skipaður 22.10.13 af verkefnisstjórn RÁ3. Samkvæmt skipunarbréfi skyldi faghópurinn „..meta hvort fyrirliggjandi upplýsingar um áhrif virkjananna þriggja á laxfiska í Þjórsá hafi dregið nægjanlega mikið úr þeirri óvissu, sem leiddi til þess að virkjunarkostirnir voru færðir úr nýtingarflokki í biðflokk við endanlega afgreiðslu á tillögum verkefnisstjórnar 2. áfanga rammaáætlunar, til þess að unnt sé að raða einhverjum þeirra eða öllum í nýtingarflokk á nýjan leik."

Í vinnu sinni studdist hópurinn við: 1) Skýrslu Skúla Skúlasonar og Haraldar Rafns Ingvasonar um mat á fyrirliggjandi rannsóknum á laxfiskum í Þjórsá og fyrirhuguðum mótvægisaðgerðum vegna umræddra þriggja virkjana; 2) bréf verkefnisstjórnar til Orkustofnunar dags. 22.10.13; 3) bréf Landsvirkjunar (LV) til Orkustofnunar dags. 31.10.13; 4) ýmsar skýrslur og minnisblöð um fyrirhugaðar framkvæmdir og rannsóknir þeim tengdar; og 5) alþjóðlegar skýrslur og vísindagreinar (nánari upplýsingar um heimildir faghópsins verða veittar sé þess óskað).

Að mati faghópsins liggur fyrir nokkuð skýrt mat á áhrifum hverrar virkjunar á laxfiska með gönguhegðun í Þjórsá. Á undirbúningstíma virkjananna þriggja hafa áætlanir um gerð þeirra breyst nokkuð, t.d. stærð lóna (sjá uppfærðar framkvæmdaáætlanir fyrir hverja virkjun í bréfi LV 31.10.13). Faghópurinn vill taka fram að allar tölur um búsvæði í þessu bréfi byggja á mati sem unnið var árið 2001 og birt í skýrslu Veiðimálastofnunar árið 2002 (Magnús Jóhannsson o.fl. 2002) enda hafa þær ekki verið uppfærðar m.t.t. síðari breytinga á framkvæmdaáætlun.

LV hefur lagt fram formlegar tillögur um mótvægisaðgerðir til að bregðast við neikvæðum áhrifum virkjananna á laxfiskastofna (sjá Hákon Aðalsteinsson o.fl. 2012) og þessar formlegu tillögur voru uppfærðar í bréfi LV 31.10.13. Auk þess hafa mótvægisaðgerðir, áætlanir um vöktun stofna laxfiska, og viðbragðsáætlanir ef mótvægisaðgerðir brygðust, verið ræddar í ýmsum skýrslum, minnisblöðum og síðast í bréfi LV 31.10.13.

Forsendur faghópsins hvað snertir þá spurningu sem honum var falið að svara varða fyrst og fremst stofna laxfiska með gönguhegðun. Í því sambandi gerir faghópurinn greinarmun á þeim svæðum í Þjórsárkerfinu þar sem útbreiðsla göngufiska er náttúruleg og þeim svæðum þar sem útbreiðslan er vegna atbeina mannsins. Þessi svæði eru öll ofan fossins Búða sem var gerður fiskgengur árið 1991. Þá er mikilvægt að taka tillit til þess að laxastofninn í Þjórsá er með þeim stærstu á landinu og að laxastofnum er víða ógnað.

Samkvæmt upplýsingum LV er bygging virkjana við Holt og Urriðafoss háð því að fyrst sé virkjað við Hvamm (tölvupóstur frá LV til verkefnisstjórnar RÁ 02.11.13). Því er ljóst að ef af þessum virkjunum verður mun Hvammsvirkjun rísa á undan hinum tveimur.

Hvammsvirkjun

Virkjunin hefur fyrst og fremst áhrif utan náttúrulegs útbreiðslusvæðis göngufiska. Þó verður að hafa í huga að svæðið ofan Búða er nú áætlað vera um 48% af útbreiðslu laxa í Þjórsárkerfinu og um 10% af framleiðslusvæði fyrir laxa. Áætlað lón og skerðing á rennsli án mótvægisaðgerða eru talin raska um 68% af þessum búsvæðum. Áhrif vikjunarinnar á náttúruleg búsvæði göngufiska neðan Búða yrðu lítil. Áhrif á staðbundna stofna urriða og bleikju yrðu talsverð, líkt og eldri virkjanir í kerfinu hafa haft.

Uppfærðar formlegar mótvægisaðgerðir (bréf LV 31.10.13, bls. 12) gera ráð fyrir seiðafleytu og laxastiga við þessa virkjun sem byggja á mikilli undirbúningsvinnu og nýlegum rannsóknum. Augljóst er að reynsla af mótvægisaðgerðum við Hvammsvirkjun, m.a. hvað snertir starfsemi seiðafleytu, virkni laxastiga, áhrif skerts rennslis á búsvæði og nauðsyn þess að endurbæta búsvæði, mundi draga umtalsvert úr óvissu um virkni mótvægisaðgerða fyrir mögulegar virkjanir neðar í Þjórsá, sem og annars staðar í landinu. Í þessu sambandi er rétt að benda á að þetta yrði í fyrsta skipti sem seiðafleyta yrði notuð við vatnsaflsvirkjun á Íslandi.

Niðurstaða:
Af ofangreindu telur faghópurinn réttlætanlegt að færa Hvammsvirkjun úr biðflokki í nýtingarflokk.

Holtavirkjun

Virkjunin hefur áhrif á náttúrulegu útbreiðslusvæði laxfiska en á svæðinu eru mikilvægustu hrygningar- og uppeldissvæði laxa í ánni. Virkjunin hefur augljóslega einnig áhrif á svæðið fyrir ofan Búða. Án mótvægisaðgerða er áætlað að virkjunin raski

um 72% búsvæða fyrir laxfiska í Þjórsárkerfinu í heild og um 46% búsvæða á náttúrulegu útbreiðslusvæði göngufiska fyrir neðan Búða.

Áhrif virkjunarinnar á laxfiska eru að miklum hluta vegna rennslisskerðingar á búsvæði þeirra og varða hrygningu, klak og uppeldi seiða. Þetta á sérstaklega við um Búðakvísl í Þjórsá, en snýst auk þess um aðgengi fullorðinna fiska að Kálfá. Við teljum að formleg tillaga LV að mótvægisaðgerðum (sjá lið A LV 30.10.13, bls. 12) sé í rétta átt, en dragi ekki úr óvissu. Rannsóknir Veiðimálastofnunar (Magnús Jóhannsson o.fl. 2002, 2008) á búsvæðagerð og göngumynstri á þessu svæði, sem og upplýsingar í bréfi LV 31.10.13, eru aftur a móti mikilvægar grunnforsendur mótvægisaðgerða, en nauðsynlegt er að betrumnæta áætlanir um rennslisstýringu (sérstaklega í Búðakvísl og Murneyrarkvísl) sem taki tillit til þarfa laxfiska á mismunandi ævistigum. Jafnframt er nauðsynlegt að setja fram formlegar áætlanir um búsvæðagerð og breytingar á farvegum. Hvað snertir rennslisáhrif og búsvæðamál á þessu svæði er ljóst að meiri rannsókna og áætlana er þörf, t.d. rannsóknir á hrygningarsvæðum og -tímum lax og sjóbirtings. Þá ber að nefna að á grundvelli búsvæðamats og ætlaðra áhrifa rennslisskerðingar lagði Veiðimálastofnun til að lágmarksrennsli í Búðakvísl yrði ekki minna en 30 m^3/sek. (Magnús Jóhannsson o.fl. 2002). Nákvæm útfærsla formlegra mótvægisaðgerða er sérstaklega mikilvæg hér vegna þess að mikið af náttúrulegum búsvæðum laxfiska skerðist varanlega vegna lóna Holta-, og Urriðafossvirkjanna.

Laxastigi við Búða hefur reynst vel. LV hefur að okkar mati gert fullnægjandi áætlanir um aðlögun laxastigans sem nefndur er í formlegum mótvægsisaðgerðum, komi til byggingar Holtavirkjunar (sjá LV 30.10.13).

Gert er ráð fyrir seiðafleytu í formlegum mótvægisaðgerðum við Holtavirkjun, en óákveðið er um staðsetningu og útfærslu hennar (LV 31.10.13). Þessari óvissu þarf að eyða.

Niðurstaða:

Af ofangreindu telur faghópurinn ekki réttlætanlegt að færa Holtavirkjun úr biðflokki í nýtingarflokk.

Urriðafossvirkjun

Virkjunin hefur áhrif á nánast öllu útbreiðslusvæði laxfiska í Þjórsá. Stífla vegna lóns við Heiðatanga mundi án mótvægisaðgerða taka fyrir alla fiskgengd í Þjórsá og hindra aðgang að 78% náttúrulegra búsvæða og 88% allra búsvæða laxfiska.

Áhrif rennslisbreytinga neðan virkjunar á göngur og búsvæði laxfiska eru enn nokkuð óljós (LV 31.10.13) og nauðsynlegt er að gera nákvæmari athuganir og áætlanir þar að lútandi. Formlegar mótvægisaðgerðir myndu miðast við þær athuganir og áætlanir.

Áætlanir um byggingu laxastiga og seiðafleytu við Urriðafossvirkjun byggja á ítarlegum rannsóknum og reynslu sem einnig nýtast við slík mannvirki við efri virkjanirnar. Þó ber að hafa í huga að virkni þessara mannvirkja er forsenda þess að stofnar göngufiska lifi af ef kemur til byggingar Urriðafossvirkjunarinnar. Í þessu sambandi leggjum við áherslu á að nánari upplýsingar séu veittar um virkni seiðafleyta fyrir mismunadi stærðir laxfiska (þ.m.t. fullorðinn sjóbirting). Í bréfi LV 31.10.13 koma fram mikilvægar upplýsingar um rennslishraða í lónum sem myndast við virkjanirnar þrjár. Nauðsynlegt er að meta nánar mögulega göngutöf og gönguhegðun seiða í lónunum, sérstaklega í Heiðarlóni þar sem þessi atriði varða grundvallarafkomu fiskistofnanna í Þjórsá vegna legu virkjunarinnar neðarlega í vatnakerfinu. Mikilli óvissu væri eytt ef rannsóknarsniðurstöður lægju fyrir um niðurgönguatferli seiða við sambærilegar aðstæður. Slíkt tækifæri gæfist ef ráðist yrði í Hvammsvirkjun. Þetta mundi einnig gefa mikilvægar upplýsingar um straumakerfi í lónunum og tengsl þess við atferli laxfiska.

Niðurstaða:

Af ofangreindu telur faghópurinn ekki réttlætanlegt að færa Urriðafossvirkjun úr biðflokki í nýtingarflokk.

Nokkur almenn atriði

Byggt á þeim upplýsingum sem liggja fyrir teljum við að áætlanir LV um vöktun á fiskstofnum Þjórsár eftir mögulega byggingu virkjana þurfi að vera skýrari. Slík vöktun þarf að ná til stofna laxfiska, gönguhegðunar þeirra, hrygningar, klaks og seiðauppeldis, sem og vistfræði búsvæða. Ekki liggur fyrir skipuleg viðbragðsáætlun ef einhver mótvægisaðgerða reynist illa eða mistekst (sbr. bls. 11 LV 31.10.13), en slík áætlun er nauðsynleg.

Faghópurinn lýsir ánægju sinni með val LV á fiskvænum Kaplan hverflum (LV 30.10.13)

Faghópurinn telur nauðsynlegt að formlegar mótvægisaðgerðir LV vegna virkjananna þriggja (sbr. bls. 12 LV 31.10.13) þurfi að vera mun ítarlegri og hver aðgerð verði sérstaklega rökstudd í greinargerð um framkvæmd með tilvísun í viðeigandi rannsóknargögn og heimildir. Þessi tillaga er í samræmi við skýrslu Skúla og Haraldar og bréf verkefnisstjórnar RÁ3 til Orkustofnunar 22.10.13.

Faghópurinn hefur áhyggjur af lítilli þekkingu á göngu- og staðbundnum stofnum urriða og bleikju í Þjórsá og hvetur til að rannsóknir á þeim verði stórauknar.

Að lokum viljum við þakka fyrir samvinnuna við verkefnisstórnina og traustið sem okkur er sýnt

Reykjavík, 04.11.2013

Skúli Skúlason, Háskólinn á Hólum

Hilmar J. Malmquist, Náttúruminjasafn Íslands

Sigurður Már Einarsson, Auðlindasvið Veiðimálastofnunar

Sigurður S. Snorrason, Líf- og umhverfisvísindadeild Háskóla Íslands

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101 Reykjavík

21. janúar 2016

EFNI: Krafa um að felldur verði úr gildi sá þáttur ákvörðunar Skipulagsstofnunar, dags. 16. desember 2015, að óska ekki eftir endurskoðun á matsskýrslu um Hvammsvirkjun samkvæmt 12. gr. laga nr. 106/2000 hvað varðar áhrif á vatnalíf og vatnafar.

Vísað er til erindis NASF Verndarsjóðs villtra laxastofna til Skipulagsstofnunar frá 28. september 2015 um endurskoðun á mati á umhverfisáhrifum Hvammsvirkjunar. Sjá fylgiskjöl 5-12.

Hér á eftir munum við sýna fram á veigamikla galla og rangfærslur í málsmeðferðinni og færa rök fyrir því að ýmis atriði í ákvörðun Skipulagsstofnunar standist ekki vísindalegt mat. Þá munum við setja fram fram aðrar athugasemdir sem NASF vill koma á framfæri.

Í upphafi viljum við taka fram að faghópur sem skipaður var 22. október 2013 af verkefnisstjórn RÁ3 til að meta helsta ágreiningsefni þessa máls komst að þeirri ótvíræðu niðurstöðu að engri óvissu hefði verið eytt um afdrif laxfiska í Þjórsá ef af virkjunum í neðri hluta árinnar yrði.Sjá fylgiskjal 13. Hugmynd hópsins um að skipta Þjórsá upp í náttúruleg og ónáttúruleg búsvæði laxfiska og réttlæta þannig að gera tilraun með Hvammsvirkjun til að sjá hvernig til tækist, breytir engu um þá meginniðurstöðu. Um þetta er fjallað hér að neðan og rakið hvernig ótvíræð niðurstaða faghópsins hefur verið affærð og misnotuð með ósannindum í málflutningi verkefnastjórnar Rammaáætlunar og Landsvirkjunar. Við teljum að þessi blekkingaleikur hafi slegið ryki í augu Skipulagsstofnunar.

Að okkar áliti hefur raunverulegt mat á umhverfisáhrifum virkjana í neðri hluta Þjórsár, eins og núgildandi lög kveða á um, aldrei farið fram. Árin 2001–2003 var lagt fram mat sem margir óháðir sérfræðingar hafa talið ófullnægjandi. Sérfræðingar okkar hafa bent á að sama máli gegni um mörg fleiri gögn sem kallað hefur verið eftir og því sé langt í land með að hægt sé að taka ákvarðanir um verkfræðilegar aðgerðir á fyrirhuguðu virkjunarsvæði.

Í málsmeðferðinni hefur nær eingöngu verið stuðst við samantekt frá Veiðimálastofnun sem NASF telur vanhæfa, bæði vegna veigamikilla fjárhags- og hagsmunatengsla við Landsvirkjun og þekkingarleysis á því sem máli skiptir í þessu sambandi. Því til stuðnings bendum við á að engin búsvæðadeild er starfrækt á Veiðimálastofnun og því hefur hún ekki á að skipa sérfræðingum á sviði rennslismælinga, frumframleiðslu eða greiningar á lífslíkum fiskistofna. Sérfræðiþekking á áhrifum vatnsaflsvirkjana á þessa mikilvægu þætti er því ekki fyrir hendi á stofnuninni. Sjá fylgiskjal 4.

Gerð er athugasemd við ákvörðun Skipulagsstofnunar, eftir að tímamörk runnu út í september 2015, að leyfa aðeins Landsvirkjun að færa fram viðbótarútskýringar og athugasemdir – en ekki öðrum hagsmunaaðilum. Okkur er tjáð að Landsvirkjun hafi skilað 86 síðna viðbótarskýrslu með úskýringum sínum. Við óskum því vinsamlegast eftir að fá fund og leiða fram helstu sérfræðinga okkar (sem eru erlendir ríkisborgarar, búsettir erlendis) til að útskýra

og svara spurningum Úrskurðarnefndar til að tryggja að málflutningur fyrir nefndinni verði ekki jafn einhliða og við afgreiðslu Skipulagsstofnunar.

Samantektin frá 2001-2003 er löngu úrelt. Sett hafa verið ný lög um umhverfismat með nýjum áherslum byggðum á nýrri þekkingu og alþjóðakröfum þar sem sett eru ströng skilyrði um verndun náttúruverðmæta, umhverfisvernd og sjálfbærni.Á loftslagsráðstefnunni í París í desember sl. var mjög haldið á loft nýlegum upplýsingum um þann mikla skaða sem vatnsaflsstíflur valda lífríkinu. Þar ber hæst tjón á fiskstofnum vegna búsvæðataps, rennslisbreytinga og setefnisflutninga. Því var lögð höfuðáhersla á að lífríkið yrði undantekningalaust kannað til hins ýtrasta og umhverfisáhrif metin áður en verkfræðingar fengju að hlutast til um mannvirkjagerð í straumvötnum.

Margt í samantekt Veiðimálastofnunar hefur töluvert upplýsingagildi en getur varla talist fagleg greining á hugsanlegum áhættuþáttum og mótvægisaðgerðum. NASF telur að ekki sé nægjanlegt að benda á að hugsanlega geti einhvers konar „seiðaveitur“auðveldað niðurgöngu seiða þar sem flestar seiðaveitur í veröldinni hafa í reynd komið að litlu gagni þrátt fyrir áratuga tilraunastarfsemi. Eins og segir í einni skýrslu, sjá fylgiskjal 1a bls 5, sérfæðinga okkar: „ There has been insufficient collection of the appropriate biological data and an insufficient evaluation of the potential impacts using population viability analyses.“

Ekki verður séð að samantekt Veiðimálastofnunar hafi verið gerð í samráði við landeigendur og heimafólk. Nokkur hundruð aðilar eiga land að Þjórsá og nýta hlunnindi vatnasvæðisins með margvíslegum hætti. Veiðimálastofnun og Landsvirkjun leggja þá alla að jöfnu og hunsa sjónarmið margra þeirra að því er virðist til þess eins að þjóna hagsmunum Landsvirkjunar. Hér er um að ræða þrjú til fjögur hundruð einstaklinga með ólíka hagsmuni eftir því hvar land þeirra liggur að vatnakerfinu.

Fjölmörg grundvallaratriði er varða lífríki Þjórsár liggja ekki fyrir að mati sérfræðinga sem NASF hefur leitað til um ráðgjöf. Vísað er til umsagnar NASF til Skipulagsstofnunar frá 29. september 2015, m.a. um að gera þurfi efna- og eðlisfræðigreiningar á vatni og botngróðri Þjórsár og þverám hennar. Athygli vekur að faghópurinn tekur ekki fram að gera þurfi slíkar grunnrannsóknir af fagfólki – sem stangast á við það sem einn þátttakandi í faghópnum benti á í rannsóknaráætlunum vegna virkjunaráætlana í Hvammsá í Vopnafirði frá því í mars 2006. Sjá fylgiskjal 3.

Ekki verður séð hvers vegna Skipulagsstofnun vill ekki fá fram allar grunnupplýsingar um lífríkið svo hægt sé að greina til fulls tiltekna þætti í vistkerfinu áður en lengra er haldið. Ef af framkvæmdum verður er stofnunin að torvelda að landeigendur geti komið að nauðsynlegum nýtingarreglum og takmörkunum er varða nauðsynleg umsvif, m.a. reglum um lágmarksrennsli. Nýtt umhverfismat ætti að tryggja möguleika landeigenda til að þeir geti varið sína hagsmuni til framtíðar.

Veiðimálastofnun útbjó samantekt á upplýsingum um ýmiss konar efnisatriði. Ábyrgir sérfræðingar sem við höfum leitað til, innlendir og erlendir, eru á einu máli um að sú samantekt sé ekki nægjanlegur grunnur að umhverfismati. Margt í samantektinni hefur upplýsingagildi en er ekki fagleg greining á hugsanlegum áhættuþáttum og mótvægisaðgerðum. Ekki nægir að benda á að hugsanlega geti „einhvers konar seiðaveitur“ auðveldað niðurgöngu seiða því að fæstar slíkar „veitur“ hafa komið að gagni þrátt fyrir áratuga tilraunastarfsemi.

Rétt er að vekja athygli á lifslíkum sjóbirtingsstofnins í Þjórsá. Sjóbirtingur getur orðið 10-12 ára og þarf á hverju ári (stundum oftar en einu sinni) að komast út í sjó og ganga aftur í ána. Hvað sem seiðaveitum líður eru allir sérfræðingar sammála um það, hvaða stofnun sem þeir tilheyra, að þetta mun aldrei takast í reynd ef af virkjunum verður og að sjóbirtingur í Þjórsá muni því fljótlega líða undir lok.

Bjartsýni Landsvirkjunar um mögulegan árangur af seiðaveitum við að halda lífi í drjúgum hluta laxastofnsins byggist ekki á neinum reynsluvísindum. Þegar við bætist að rannsóknir á lífríkinu eru ófullnægjandi, eins og rakið er í fylgigögnum þessarar kæru blasir við að málið þarfnast miklu betri skoðunar. Sjá fylgiskjal 2.

Í bréfi dagsettu 20. janúar, 2016, sjá fylgiskjal 1a, ásamt fylgiskjölum 1b og 1c er ítarleg greinargerð frá Dr. Margaret J. Filardo, Ph.D. Supervisory Fish Biologist, einum helsta sérfræðingi í áhrifum mannvirkja á lífríki vatnasvæða hjá Fish Passage Center í Portland, Oregon. Dr. Filardo fer faglega yfir alla helstu lífríkisþætti er varða áætlanir um Hvammsvirkjun og bendir á upplýsingar sem vantar áður en lengra er haldið, dregur fram óvissuþætti og sýnir fram á ónóga þekkingu þeirra sem að málinu hafa staðið. Lokaorð hennar eru þessi:

> In summary, the process that has occurred thus far regarding the movement of the Hvammur hydroproject to the utilization category and the decision to forgo an updated Environmental Assessment, relies on building the dam and then observing what the effectiveness of the countermeasures are on aquatic life in the Thjórsá River.This approach does not address the substantial information of the impacts of hydro development on aquatic populations from rivers around the world. If that information were taken into consideration the only logical conclusion would be that there is more "certainty" associated the impacts of hydro development than "uncertainty." Regardless of the implementation of countermeasures and monitoring, once Hvammur is built there will be substantial negative impacts to the aquatic life of the Thjórsá.

Eins og fram kom í upphafi bréfs þessa kærum við úrskurð Skipulagsstofnunar ekki síst vegna þess að hann byggist á fölskum forsendum og misvísandi málatilbúnaði, allt frá því að verkefnastjórn Rammaáætlunar skilaði inn tillögum um að færa Hvammsvirkjun úr biðflokki í nýtingarflokk til þess að Landsvirkjun skilaði inn síðustu athugasemdum sínum til Skipulagsstofnunar.

Þegar Alþingi samþykkti að færa virkjanir í neðri hluta Þjórsár úr nýtingarflokki, eins og verkefnastjórn hafði í fyrstu lagt til, í biðflokk var það vegna óvissu um afdrif laxfiska í ánni, ef af virkjunum yrði.

Það hefur alla tíð verið forsenda fyrir því að ljá máls á þessum virkjunum í ánni að tryggt væri að þær hefðu ekki verulega neikvæð áhrif á laxfiska. Þegar verkefnastjórn lagði fram tillögu sína hið fyrra sinn hafði Landsvirkjun í samvinnu við Veiðimálastofnun talið stjórnarmönnum trú um að óvissu um afdrif laxfiska í Þjórsá hefði verið eytt með mótvægisaðgerðum, einkum seiðaveitum og laxastigum. Í athugasemdaferlinu, áður en Alþingi samþykkti Rammaáætlun, kom í ljós að það var langur vegur frá því að þeirri óvissu hefði verið eytt. Þvert á móti voru lögð fram gögn sem sýndu að sambærilegar mótvægisaðgerðir hefðu litlum sem engum árangri skilað þar sem þær hefðu verið reyndar í Bandaríkjunum - en þær aðgerðir voru helsta fyrirmynd Landsvirkjunar og

Veiðimálastofnunar í málinu. Því mætti búast við algjöru hruni laxfiskastofna í ánni ef ráðist yrði í virkjanir, þrátt fyrir allar boðaðar mótvægisaðgerðir sem ættu kannski möguleika á að halda lífi í 10-15% af laxastofninum. Eins og áður sagði var alltaf vitað að sjóbirtingur myndi alveg þurrkast út.

Alþingi brást við þessum athugasemdum með því að samþykkja að virkjanir í neðri hluta Þjórsár skyldu settar í biðflokk á meðan farið yrði betur yfir hættuna sem villtum laxfiskum í Þjórsá stafaði af virkjunum. Þegar þarna var komið í málsmeðferðinni var ljóst að Veiðimálastofnun var orðin vanhæf til að fjalla um málið og því var skipaður faghópur óháðra líffræðinga, undir forystu Skúla Skúlasonar, sem skyldi fara yfir gögn um virkjanir og mótvægisaðgerðir með tilliti til möguleika laxfiska í Þjórsá að lifa af í ánni ef af virkjunum yrði. Með Skúla í hópnum voru Hilmar Malmquist, Sigurður Már Einarsson og Sigurður S. Snorrason. Hópnum var falið að meta „óvissu fyrirliggjandi upplýsinga um áhrif Hvamms-, Holta- og Urriðafossvirkjana í neðri hluta Þjórsár á laxfiska í ánni“ eins og segir í efnisfyrirsögn á lokaskýrslu faghópsins sem send var verkefnastjórn Rammaáætlunar hinn 4. nóvember 2013.

Niðurstaða hópsins er skýr um að ekki hafi dregið úr neinni óvissu um afdrif laxfiska í ánni, ef af virkjunum verði. Sjá fylgiskjal 13

Hins vegar býr hópurinn til það nýmæli í allri umfjöllun um málið að setja svæðið ofan Hvammsvirkjunar skör lægra en önnur svæði árinnar vegna þess að það sé „utan náttúrulegs útbreiðslusvæðis göngufiska“. Vegna þessarar heimatilbúnu flokkunar á mikilvægi búsvæða laxfiska í Þjórsá ályktar hópurinn að óhætt sé að gera tilraun með Hvammsvirkjun og sjá hvernig til tekst. Þannig kemst faghópurinn að þeirri niðurstöðu að það sé „réttlætanlegt að færa Hvammsvirkjun úr biðflokki í nýtingarflokk.“

Faghópurinn var ekki spurður að því í hvaða flokk ætti að skipa virkjunum í Þjórsá. Hópurinn átti að meta hvort óvissu um afdrif laxfiska í Þjórsá hefði verið eytt með boðuðum mótvægisaðgerðum við óhjákvæmileg áhrif virkjana. Mat hópsins var ótvírætt um að þeirri óvissu hefði ekki verið eytt.

Þessa niðurstöðu faghópsins, sem leidd var af vangaveltum hans um náttúruleg búsvæði í Þjórsá, tekur verkefnastjórn Rammaáætlunar síðan og notar sem röksemd fyrir því að leggja til við Alþingi að Hvammsvirkjun verði færð úr biðflokki í nýtingarflokk. Í *Greinargerð verkefnisstjórnar rammaáætlunar 21. mars 2014* til Alþingis segir um starf faghópsins og ályktanir verkefnisstjórnar af niðurstöðum hans (undirstrikun er okkar:

> *„Eina verkefni faghópsins felst í því að meta hvort fyrirliggjandi upplýsingar um áhrif virkjananna þriggja á laxfiska í Þjórsá hafi dregið nægjanlega mikið úr þeirri óvissu, sem leiddi til þess að virkjunarkostirnir voru færðir úr nýtingarflokki í biðflokk við endanlega afgreiðslu á tillögum verkefnisstjórnar 2. áfanga rammaáætlunar, til þess að unnt sé að raða einhverjum þeirra eða öllum í nýtingarflokk á nýjan leik.“*
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> Faghópurinn taldi að nokkuð skýrt mat lægi fyrir á áhrifum hvers virkjunarkosts um sig á laxfiska með gönguhegðun í Þjórsá og komst að þeirri niðurstöðu að óvissa varðandi áhrif Hvammsvirkjunar á laxfiska hefði minnkað nægjanlega til að réttlætanlegt væri að færa virkjunina í nýtingarflokk á nýjan leik. Hins vegar hefði ekki verði dregið nægjanlega úr óvissu hvað varðar Holtavirkjun og Urriðafossvirkjun. Faghópurinn gerði

> greinarmun á þeim svæðum í Þjórsárkerfinu þar sem útbreiðsla göngufiska er náttúruleg og þeim svæðum þar sem útbreiðslan er vegna atbeina mannsins. Skýrsla faghópsins er aðgengileg á vef rammaáætlunar.

Eins og rakið er hér að ofan er það ekki satt að faghópurinn hafi talið óvissu hafa „minnkað nægjanlega til að réttlætanlegt væri að færa virkjunina í nýtingarflokk á nýjan leik."

Við hjá NASF mótmæltum þessum ósannindum verkefnisstjórnar strax en stjórnin lagði síðan eftirfarandi svar fram með gögnum málsins til Alþingis:

> Því er mótmælt harðlega að **Hvammsvirkjun** verði reist sem eins konar tilraunastofa til að kanna virkni mótvægisaðgerða í virkjunum neðar í ánni
>
> Verkefnisstjórn telur að í þessum umsögnum komi ekki fram nýjar upplýsingar sem gefi tilefni til að endurskoða fyrri afgreiðslu verkefnisstjórnarinnar.

Þetta „svar" verkefnisstjórnar tekur ekki tillit til þess að það er ósatt að faghópurinn hafi komist að þeirri niðurstöðu að óvissu hafi verið eytt. Það er erfitt að koma með nýjar upplýsingar til að hrekja það. Það stendur og blasir við í skýrslu faghópsins.

Hin upphaflegu ósannindi um niðurstöðu faghópsins hafa gengið aftur í allri meðferð málsins og eru síðast ítrekuð í lokaskýrslu Landsvirkjunar, sem hún lagði fyrir Skipulagsstofnun eftir að allar athugasemdir höfðu komið fram:

> **1.7.10. Áhrif á fiskstofna - samantekt**
>
> Tekið var á öllum ofangreindum atriðum í mati á umhverfisáhrifum 2003. Sú viðbótarþekking sem komið hefur fram á sl. árum er í samræmi við úrskurð og skilyrði Skipulagsstofnunar vegna matsins, þar sem farið var fram á þær viðbótarrannsóknir, útfærslu mótvægis- og vöktunaraðgerða sem lagðar voru til af Veiðimálastofnun. Þess má einnig geta að í tengslum við 3. áfanga Rammaáætlunar hafa áhrif Hvammsvirkjunar á lífríki Þjórsár farið í gegnum rýnivinnu margra sérfræðinga, innlendra og erlendra, og var það niðurstaða þeirra vinnu að dregið hefði nægilega úr óvissu varðandi áhrif virkjunarinnar til að unnt væri að raða henni í nýtingarflokk á nýjan leik. Nánar er fjallað um þróun framkvæmdartilhögunar, mótvægis- og vöktunaraðgerðir í 10. kafla rýniskýrslu, þar sem tekin eru saman gögn.

Eftir stendur að niðurstaða hins óháða faghóps sem var falið að leggjast yfir fyrirliggjandi gögn var ótvíræð um að óvissu um afdrif laxfiska í Þjórsá hefði ekki verið eytt. Sú leið sem faghópurinn bauð verkefnastjórn upp á um að greina á milli náttúrulegra og ónáttúrulegra búsvæða í Þjórsá, og ályktа síðan sjálfur um flutning Hvammsvirkjunar úr biðflokki í nýtingarflokk, var algjörlega utan verksviðs hópsins. Ályktunin byggði að auki ekki á neinu fordæmi í mati á umhverfisáhrifum mannvirkja. Ekki er hægt að meta slík áhrif nema út frá núverandi ástandi umhverfisins. Ekki er í boði að reyna að ímynda sér hugsanleg áhrif á umhverfi eins og það var á ótilgreindum tíma í fortíðinni, til dæmis við landnám áður en maðurinn hóf að láta til sín taka í umhverfinu á Íslandi. Laxastiginn við fossinn Búða hefur nú í hartnær mannsaldur opnað laxfiskum gönguleið á frjósöm búsvæði í Þjórsá. Stiginn er því

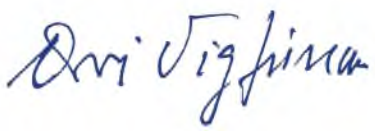
fyrir löngu orðinn hluti af umhverfinu og þeir fiskar sem um hann ganga eru á engan hátt ónáttúrulegri en aðrir fiskar.

Það er ótækt að í úrskurði sínum hafi Skipulagsstofnun látið blekkjast af þessum málatilbúnaði og rangfærslum í endursögnum verkefnastjórnar og Landsvirkjunar á þeim niðurstöðum sem faghópurinn komst að og greindi frá í skýrslu sinni hinn 4. nóvember 2013.

Sú ótvíræða niðurstaða stendur að engri óvissu um afdrif laxfiska í Þjórsá hefur verið eytt. Og það er sú niðurstaða sem hefði með réttu átt að liggja til grundvallar úrskurði Skipulagsstofnunar en ekki rangfærslur þeirra sem hafa hagsmuni af því að reisa virkjanir á svæðinu – og vakta áhrif þeirra.

Áskilinn er allur réttur til þess að koma á framfæri frekari kröfum, sjónarmiðum og málsástæðum, sem og gögnum, á síðari stigum þessa máls eftir því sem tilefni kann að verða til. Sérstaklega er áskilinn réttur til að krefjast úrskurðar um stöðvun framkvæmda til bráðabirgða séu þær hafnar eða yfirvofandi, sbr. 5. gr. laga nr. 130/2011.

Virðingarfyllst



Orri Vigfússon formaður
NASF, Verndarsjóðs villtra laxastofna

Þýðingar á enska textanum boðnar verði þeirra óskað.

Fylgiskjal 1a	Bréf frá Margaret Filardo Ph. D. 20 janúar 2016
Fylgiskjal 1b	Bréf frá Margaret Filardo Ph. D 15. óvember 2013
Fylgiskjal 1c	Bréf frá Margaret Filardo Ph. D 9. nóvember 2011
Fylgiskjal 2	Fiskvegurinn við Búða – seiðaveitur ofl.
Fylgiskjal 3	Lífríki Hvammsár í Vopnafirði-Kynning á rannsóknarhugmyndum
Fylgiskjal 4	Tengsl Landsvirkjunar og Veiðimálastofnunar
Fylgiskjal 5	Endurskoðun á mati á umhverfisáhrifum Hvammsvirkjunar sept2015
Fylgiskjal 6	Haesker et al 2012
Fylgiskjal 7	Scheuerell et al 2009
Fylgiskjal 8	Petrosky & Schaller EFF_2010
Fylgiskjal 9	Delayed Mortality paper0503106FDcphs
Fylgiskjal 10	Schaller& Petrosky_NAJFM_2007
Fylgiskjal 11	Budy et al NAJFM_2002
Fylgiskjal 12	cjfas2014Schaller
Fylgiskjal 13	Mat faghóps frá 4. nóvember 2013

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Landsvirkjun

OPINN FUNDUR Á GRAND HÓTEL
Miðvikudagur 20. janúar kl. 8:30-10:00
Morgunkaffi frá kl. 08:00

Fiskar og vatnsaflsvirkjanir

Verið velkomin á opinn morgunverðarfund Landsvirkjunar sem er haldinn í samstarfi við **Veiðimálastofnun** um áhrif vatnsaflsvirkjana á fiskistofna. Kynntar verða rannsóknir Veiðimálastofnunar og rætt um þann lærdóm sem við getum dregið af reynslunni. Fundinum verður streymt beint á landsvirkjun.is.

Ábyrgð Landsvirkjunar
Ragna Árnadóttir, *aðstoðarforstjóri Landsvirkjunar og fundarstjóri*

Virkjanir og áhrif þeirra í Sogi og Laxá
Magnús Jóhannsson, *fiskifræðingur og sviðsstjóri á Veiðimálastofnun*

Virkjun og fiskistofnar Blöndu
Sigurður Guðjónsson, *fiskifræðingur og forstjóri Veiðimálastofnunar*

Áhrif Kárahnjúkavirkjunar á fiskistofna Lagarfljóts og Jökulsár á Dal
Ingi Rúnar Jónsson, *fiskifræðingur á Veiðimálastofnun*

Þjórsár- og Tungnaársvæði, fiskistofnar og virkjanir
Benóný Jónsson, *líffræðingur á Veiðimálastofnun*

Að loknum erindum stýrir **Guðni Guðbergsson**, fiskifræðingur og sviðsstjóri á Veiðimálastofnun, umræðum.

Skráning á fundinn fer fram á landsvirkjun.is

Fylgiskjal 2
Fiskvegurinn við Búða – verndun eignaverðmæta – þjóðnýting - seiðaveitur ofl.

Fiskvegur var gerður við fossinn Búða 1991 sem skaðabætur fyrir þau neikvæðu áhrif sem virkjanir í efri hluta árinnar höfðu valdið. Áin hafði verið fiskgeng upp fyrir Búða fram að 1896 þegar farvegur hennar breyttist í jarðskjálfta. Ofan Búða eru búsvæði góð og aðstæður ákjósanlegar til hrygningar fyrir bæði lax og sjóbirting. Fiskvegurinn við Búða getur ekki á neinn hátt talist mótvægisaðgerð vegna fyrirhugaðra virkjana í neðri hluta Þjórsár. Framkvæmdin er þegar farinn að virka og skila afrakstri í tekjum og eignaverðmætum.

Síaukin laxgengd vegna fiskvegarins mun til lengri tíma auka verðmæti jarða við ána ofanverða. Þar sem ekki sér fyrir endann á þessari aukningu má gera ráð fyrir að verðmæti lögbýla muni varla koma að fullu í ljós fyrr en að nokkrum áratugum liðnum. Því er varað við valdbeitingu stjórnvalda á borð við þjóðnýtingu.

Ef af áætlunum um Hvammsvirkjun verður mun rennsli árinnar minnka stórlega á löngum kafla með afdrifaríkum afleiðingum fyrir búsvæði bæði lax og sjóbirtings. Í svari Landsvirkjunar til Skipulagsstofnunar í október sl. segir að flóð muni verða á hverju ári og í rýniskýrslu Eflu fyrir Landsvirkjun frá því í júlí 2015 segir að ekki verði hægt að tryggja stöðugt rennsli og það muni aukast um 50-100 rúmmetra sem er 1000% aukning frá nefndu lágmarksrennsli 10 rúmmetrum. Sérfræðingar NASF telja yfir höfuð upplýsingar um rennslismælingar ótrúverðugar.

Það mun taka landeigendur áratugi að fá það sem þeim ber í afrakstur af fiskveginum frá 1991. Meta má eignaverðmæti laxveiðihlunninda á kr. 1.4 milljónir fyrir hvern veiddan lax sem árlega veiðist á svæðinu. Samkv. veiðitölum sumarið 2015 var skráð veiði í Þjórsá 2.417 laxar sem þýðir að meta má hlunnindin á kr. 3.383.800.000. Í ljósi þeirra fjárhagslegu hagsmuna sem þarna eru í húfi er afar brýnt fyrir viðkomandi landeigendur að allar vistfræðiupplýsingar liggi fyrir til að þeir geti varið þá gríðarlegu hagsmuni sem liggja í búsvæðunum ofan og neðan við fyrirhugaða Hvammsvirkjun. Komi á einhverjum tímapunkti til þess að stífla eða stíflur af þessu tagi verði settar í Þjórsá þurfa landeigendur að fá tækifæri til að gera ítarlegar tillögur um alla rekstrarþætti hugsanlegs raforkuvers til að bjarga því sem bjargað verður. Tryggja verður lágmarksrennsli, viðunandi endurkomuhlutfall seiða og fullorðinna fiska sem ganga aftur í ána til að hrygna. Hjáveitukerfi framhjá virkjuninni, ef til hennar kemur, verður að vera af fullkominni gerð og viðurkennt af færustu sérfræðingum svo það hamli ekki för laxfiska í ánni. Stöðuga vöktun á ástandi fiskstofna árinnar ætti að setja sem skilyrði. Fulltrúar NASF fylgjast grannt með þróun mála á svona svæðum í mörgum löndum. Þeir ætla að þarna geti orðið um mörg þúsund laxa veiði að ræða, auk sjóbirtings, og verðmætin geti því hlaupið á tugum milljarða. Í íslensku samhengi má benda á þróunina í Selá í Vopnafirði, Langá í Borgarfirði og Rangánum þar sem stækkun mögulegra búsvæða hefur stóraukið laxagengd og mun halda áfram að aukast um áratugi.

Krafa okkar og landeigenda um fullkomnari lífríkisgögn er til komin til að geta mótað tillögur sem hníga m.a. að eftirfarandi og fleiri reglum:

1. Guaranteed seasonal flows during the juvenile fish migration that are sufficiently high to maintain WTT to the same level it was pre hydro development
2. Identify needed flows to prevent adult passage barriers from forming and implement these flows as a minimum during adult passage times.
3. Maintain juvenile fish protection throughout the entire juvenile fish migration period to protect the tails of the run distribution and genetic diversity
4. Provide routine monitoring at all fish facilities and routine provision of predator deterrents
5. Determine kelt migration periods. Design and implement kelt passage systems that maximize survival
6. Monitor water quality – temperature and dissolved gas levels throughout the migration period
7. Cessation of hourly or daily load following during spawning and rearing
8. Maintain spawning flow levels and elevations to keep redds covered through incubation and emergence
9. Operate Kaplan turbine units during the fish migration season within a very narrow efficiency range, which is well below the maximum energy output of each turbine. Operation outside of this range imposes additional mortality on juvenile migrants.
10. Monitoring program should include smolt to adult survival rate determinations

Ekkert hefur komið fram sem dregið hefur úr óvissunni um afdrif fiskstofna í Þjórsá ef til frekari virkjana kemur og þekking sérfræðinga Landsvirkjunar virðist takmörkuð. Má t.d. benda á bréf Helga Bjarnasonar yfirverkfræðings frá 31.10. 2013

http://www.landsvirkjun.is/Media/svarbreflandsvirkjunarasamtfylgigognumtilverkefnisstjornarrammaaaetlunar31.okt2013opt.pdf

þar sem fram koma áform um að hafa seiðaveitu opna í aðeins fjórar vikur af þeim 16–18 vikum sem vitað er að sjóganga seiða stendur yfir. Réttilega kemur fram þar að engar hugmyndir liggja fyrir um staðsetningu slíkrar seiðaveitu. Til að slík veita geti yfirleitt virkað þarf her sérfræðinga í áratugi til að gera víðtækar tilraunir og prófanir - sem tryggir þó ekki að dæmið gangi upp. Það er næsta víst að það mat á töfum við niðurgöngu seiða sem Landsvirkjun kynnti og byggði á setflutningalíkani er með öllu óraunhæft.

Það eru falsanir hjá Landsvirkjun að halda því fram að þeim komi ekkert við hvernig laxaseiðum reiði af eftir að þau koma niður fyrir stíflur. Sannleikurinn er sá að mörg seiðanna finna aldrei réttar leiðir niður á þeim nauma tíma sem þeim er skammtaður. Þá eru mörg þeirra lemstruð og alvarlega sködduð og drepast að nokkrum dögum eða vikum liðnum. Af öllu þessu verður að taka mið eina of skýrt er tekið fram í greinargerð NASF og í viðhengi til Skipulagsstofnunar frá 28. september 2015.

FISH PASSAGE CENTER

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January 20, 2016

Mr. Orri Vigfússon
North Atlantic Salmon Fund
Skipholti 35
105 Reykjavík, Iceland

Dear Mr. Vigfússon,

In response to your request we have reviewed the English Translation of Section 10 "Effects on Aquatic Life" that was part of the larger document, *Decision by the Planning Authority of the Hvammsvirkjun project in the Lower Thjórsá*. The Planning Authority concludes in Section 10 of the document that an additional environmental impact assessment, beyond that conducted in 2003, is not necessary regarding the decision to move the Hvammsvirkjun to the utilization category of the Master Plan.

The Planning Authority recognizes that hydroproject development will have a significant impact on the biota of the lower Thjórsá River, but accepts that the implementation of countermeasures and monitoring are sufficient to limit the effects on aquatic life. Both the decision to move the Hvammur hydroproject to the utilization category, and the present decision to forgo additional environmental assessment, rely heavily on the development of proposed mitigation and counter-measures to ameliorate the significant impacts imposed by development. A 10- year monitoring period is presented as sufficient to assess the uncertainty of the effects the hydroprojects would have on fish populations, and the ability of the proposed countermeasures to address those effects.

The Planning Authority fails to take into consideration the significant knowledge and studies available from other countries that show that the implementation of countermeasures and monitoring does not equate to viable salmonid populations.

After reviewing Section 10 of the document, as well as past information in the process, we have the following concerns:

- The proposed countermeasures will not prevent the decline of fish populations. The cited estmates of juvenile passage success and survival are overstated. Previously provided comments regarding the efficacy of the countermeasures have been overlooked and ignored.

- Fish behavior is not predictable. Assuming juvenile passage countermeasures implemented at one hydroproject will work the same at another hydroproject is extremely risky.
- No recognition is given to the importance of the viability of Thjórsá River salmon to other Icelandic salmon populations and other Atlantic salmon populations.
- There is no recognition, nor are countermeasures provided, to address the iteroparous (repeat spawning) nature of the Thjórsá fish.
- The proposed measurements for assessing the success of countermeasures are not designed to measure the impacts of hydrosystem development on Thjórsá River salmon population viability.
- If implemented, the proposed 10-year monitoring period is insufficient to assess population viability
- Climate change was not considered in the decision to move the Hvammur hydroproject to the utilization category. Changes in river and ocean conditions associated with increasing global temperatures, and the impact on the salmon population, must be assessed.
- The potential cost of mitigation over time has not been addressed or incorporated into the decision-making process.
- The 2015 responses from Landsvirkjun to questions originally posed in 2012 shows a general lack of understanding regarding the ramifications of hydropower development on natural populations.

The proposed countermeasures will not prevent the decline of fish populations. The cited estmates of juvenile passage success and survival are overstated. Previously provided comments regarding the efficacy of the countermeasures have been overlooked and ignored.

We have previously provided you with extensive comments regarding the effectiveness of the proposed countermeasures. Those comments have been largely overlooked and ignored in the process. The comments were contained in a March 18, 2014, letter (attached) that concluded:

> "that the assumptions made for the success of the engineered mitigation solutions are overly optimistic, given what we know regarding implementation in the Columbia River as well as in other river systems. There is considerable data available to suggest that mitigating for the installation of hydroelectric projects is rarely successful in maintaining naturally spawning, self-sustaining populations of salmon."

Our prior comments stated that there are three reasons why we do not agree that the juvenile passage structures will achieve the high performance suggested by the National Power Company. The reasons are: (1) that due to fish behaviors and variability, it is unlikely that the surface collection outlet systems (SFO) will achieve the assumed 91% efficiency; (2) the assumed 100% survival through the SFO is based on flawed studies; and, (3) the relation between juvenile migration through a hydroproject and the delayed mortality associated with this passage is ignored (see March 18, 2014, letter for more detailed discussion).

Specifics regarding the countermeasures that would be provided at the dams for juvenile passage were provided by Landsvirkjun in a letter dated September 2, 2015. The decision to develop a surface flow outlet (SFO) was based on the use and operation of SFO in the United States. The premise of an SFO is that fish tend to be distributed with a more surface orientation. The basis for the use of a SFO comes from the juvenile bypass system at Wells Dam on the Columbia River. The configuration of this project is unique in that it is a hydrocombine with a spillway that sits over the turbine units. The spillway has been modified to pass juvenile migrants and is considered to be effective at passing juveniles away from the turbine units (Skalski et al., 1996).

While the effectiveness SFO structures at Wells Dam are fairly high there is still considerable concern regarding the optimism of the cited estimates of passage success. The proposed SFO countermeasure for Hvammur is not the same as exists at the Wells Dam. Landsvirkjun contends that dye tests conducted and numerical models confirm the direction of flow and, therefore, gives them the 90%–95% efficiency of the countermeasure that they cite. Caution should be exercised in that, while dye tests and numerical models provide some knowledge, they do not represent fish behavior. Simply stated, scale models using plastic beads or dye do not predict how fish will travel. For example, at Bonneville Dam on the Columbia River, dye traces were observed in a turbine intake model to develop a configuration for a large screen which could be placed into a turbine intake and intercept juveniles passing into the turbines. Based on the modeling results, a configuration was selected where nearly 100% of the dye moved above the screen. On testing the prototype in the field, however, less than 40% of the juveniles migrated above the screen. Inanimate objects do not adequately represent fish with behavior (Gessel et al. 1991).

It is important to note, that all of the countermeasures described by Landsvirkjun, and many more, have been implemented in the Columbia River hydro system. However, in spite of the implementation of these countermeasures, and continued improvement and implementation of additional measures, the Columbia River does not support sustainable natural salmonid populations. Hydroprojects in the Columbia River impose sufficient mortality upon populations such that populations are maintained at levels that warrant their existence as species at risk of extinction. Even when implemented, the countermeasures proposed by Landsvirkjun are insufficient to assure the viability of the fish populations in the Thjorsá.

Fish behavior is not predictable. Assuming juvenile passage countermeasures implemented at one hydroproject will work the same at another hydroproject is extremely risky.

As we stated above, the proposed countermeasures for juvenile passage are premised on the success associated with surface flow outlets at Wells Dam on the Columbia River. However, we caution that this assumption of similar juvenile passage success on the Thjórsá is questionable and uncertain due to the unaddressed question of fish behavior.

Based on the success of the Wells Dam configuration, a second hydrocombine dam, the Cowlitz Falls Dam located on the Cowlitz River, Lewis County, Washington, was built and became operational in 1994. The decision to mimic the unique structure of Wells Dam was based on the success of the surface flow bypass for salmonid smolts. The initial juvenile bypass structures were installed in 1996 and annual estimates of fish passage collection via the surface flow collector have not achieved expectations. Studies have shown that juvenile steelhead

(*Oncorhynchus mykiss*), coho salmon (*Oncorhynchus kisutch*), and Chinook salmon (*Oncorhynchus tshawytscha*) located the collection entrances effectively (discovery rates of the surface collection system routinely exceeded 90 percent), but many of these fish did not pass the dam via the surface flow collector (Hausmann et al., 2001; Farley et al., 2003; Liedtke et al., 2010). Mark-recapture findings indicated that only about 50 percent of juvenile steelhead, 21 percent of juvenile Coho, and 20 percent of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) were bypassed annually during 1996–2012 (Serl and Heimbigner, 2013). Significant modifications have been made to improve passage through the surface passage routes without success.

Similar surface bypass structures implemented on two dams on the Snake River showed different passage results at similar proportions of water passing through the structures. At these dams a proportion of the total river flow is diverted to the spillway where a surface bypass collector is installed in the spillbay nearest the powerhouse. At 20% of the available spillway water passing through the spillbay containing the surface bypass structure at Lower Granite Dam, approximately 70% of Chinook salmon and 75% of steelhead salmon approaching the spillway passed through the surface bypass structure based on mark-recapture experiments. However, at Ice Harbor Dam, located 160 Km downstream, the surface bypass structure passed only 45% of Chinook salmon and 50% of steelhead salmon under the same conditions (Zabel et al., 2008, and http://www.cbr.washington.edu/analysis/compass).

The assumption by the Planning Authority is that if countermeasures do not work as intended, the actions described in the submitted action plan will address all concerns. This assumption appears short sighted.

No recognition is given to the importance of the viability of Thjórsá River salmon to other Icelandic salmon populations and other Atlantic salmon populations.

The Icelandic populations of salmon represent the northern extent of the distribution of salmon. Consequently, these salmon likely have unique adaptations given the unusual geology of Iceland. Given that, the salmon populations of Iceland likely function as metapopulations (Hanski, 1999), where populations are not completely isolated and are connected by the movement of individuals (immigration and emigration) among them, their population viability is extremely important. The Thjórsá salmon populations are considered the largest in Iceland and consequently, increasing the risk to the Thjórsá salmon will likely affect the resiliency of many of the salmon populations in other parts of Iceland. Additionally, impacts to the Thjórsá population, which is likely a unique segment of the population, could also put other Atlantic salmon populations at risk.

There is no recognition, nor are countermeasures provided to address the iteroparous (repeat spawning) nature of the Thjórsá fish.

Kelts (or repeat spawners) are considered to be an important aspect of the overall life history of salmonids. Atlantic salmon, brown trout, and char are all repeat spawners migrating to the sea at various times of the year, various sizes and physical condition. Iteroparous populations generally have higher population abundance and productivity over their lifetime. While repeat spawners comprise a smaller percentage of the population, they represent a significant

contribution to the life history diversity exhibited by these populations. In the Snake and Columbia River systems, fish passage facilities at hydroelectric dams were not designed or constructed to accommodate downstream-migrating, post-spawning adult kelts. From the passage mortality estimated for the few steelhead kelts, it has been established that the mortality on these fish has been very high when migrating downstream to the sea. Estimates of kelt passage survival in the Columbia River have ranged from 4.1 to 6.0 percent in the low flow year 2001 to 15.6 percent in 2002 and 34 percent in 2003 (Boggs and Peery 2004; Wertheimer and Evans 2005). Although some portion of the implied mortality would occur in a free-flowing river, fisheries managers expect that survival is low because turbine bypass systems were not designed to safely pass adult fish. In addition to causing injury and mortality, the mainstem hydro projects delay kelt downstream migrations (Wertheimer and Evans 2005). Thus, while there may be a relatively large number of kelts in Snake River, survival through the FCRPS may limit their contribution to the productivity of their respective populations.

There has been no consideration of kelt passage requirements or needs in this process.

The proposed measurements for assessing the success of countermeasures are not designed to measure the impacts of hydrosystem development on Thjórsá River salmon population viability.

The monitoring of the success of countermeasures focuses on at-structure direct mortality or passage sucess. There appears to be a lack of concern for measuring the indirect effects of structure passage, or the delayed effects of hydrosystem passage. Indirect mortality is mortality that occurs within the hydrosystem as a result of hydroproject passage, but are not measured in at-project mortality eestimates. Delayed mortality is directly related to hydrssytem passage, but is expressed at a later life stage. The factors believed to contribute to delayed mortality include: delayed arrival timing in the estuary and ocean (the series of dams and reservoirs increases juvenile travel time through the migration corridor); sublethal injuries or stress incurred during migration through juvenile bypass systems, turbines, or spillways; disease transmission or stress resulting from the artificial concentration of fish in bypass systems; and the depletion of energy reserves from prolonged migrations. This mortality is often comingled with the measurement of ocean mortality.

The assumptions made by Landsvirkjun for juvenile survival ignore indirect mortality as well as delayed mortality by assigning it to ocean mortality. The implication made by Landsvirkjun is that there is no relation between in-river and ocean processes. This is incorrect. The monitoring that will be conducted will prove insufficient for measuring the actual impacts imposed by hydroproject development over the entire life cycle.

If implemented, the 10 year monitoring period is insufficient.

The Atlantic salmon life cycle is comprised of one to five years spent in fresh water and one to four years spent at sea. In order to have an adequate understanding of the efficacy of the proposed countermeasures it is absolutely necessary to measure the impacts in terms of survival of fish to adulthood. Given the life cycle of Atlantic salmon it would be imperative to continue monitoring significantly longer than ten years and include a smolt-to-adult survival metric. Focusing on the success of a ladder, or juvenile bypass system, on the basis of only one life stage

is not sufficient to assess the actual impacts of the new hydro projects on the Thjórsá River salmon population. Again, it is extremely important to evaluate the effects of countermeasures over the entire life cycle.

To illustrate the potential failure associated with focusing on one life stage when measuring the effects of countermeasures, after more than 35 years of developing and implementing state-of-the-art countermeasures and focusing on success at a specific life stage, Pacific salmon stocks remain endangered and remain at risk of extinction.

Climate change was not considered in the decision to move the Hvammur hydroproject to the utilization category. Changes in river and ocean conditions associated with increasing global temperature, and the potential impact on the salmon population, must be assessed.

Salmon populations all across the northern hemispheres are challenged and stressed by the impacts of climate change. The variability in environmental conditions is increasing for salmon populations across the northern hemisphere for both ocean and freshwater environments. These variable conditions are stressing the resiliency of numerous salmon populations; in particular the populations that are impacted by anthropogenic development. The decision to move the Hvammur hydroproject to the utilization category and the present decision to forgo additional environmental assessment appears to ignore the projections that future environmental conditions will greatly increase in variability and along with further development of the Thjórsá River likely impact the resiliency of salmon populations.

Salmon recruitment success in the ocean environment is generally believed to occur largely during the first critical months at sea (Ricker 1976; Mueter et al. 2002; Pyper et al. 2005). Salmon exhibit complex life histories and variable levels of survival rates as a result of conditions in freshwater and ocean environments. For many of the salmon populations along the west coast of North America, overall life-cycle survival appears to be regulated by conditions of both the freshwater and marine environments (Bradford 1995; Bisbal and McConnaha 1998; Lawson et al. 2004). The Northwest Power and Conservation Council highlighted the need to identify the effects of ocean conditions on anadromous fish survival so that broad conservation and management actions taken inland will provide the greatest benefit in terms of improving the likelihood that Columbia River basin salmon can survive varying ocean conditions (NPCC 2009). While distinguishing between the influence of ocean and freshwater factors on salmon survival is difficult and requires long time series of life-stage-specific demographic data because of possible confounding factors, the knowledge is critical to predict best what potential inland protection and restoration actions are needed to conserve and recover depressed populations of salmon (Schaller et al. 2014).

With the prospect of changing climate, migratory temperate zone animals could be pressured into smaller geographic ranges, making conservation initiatives and planning efforts even more important, and requiring more aggressive protective actions than are currently planned. Maintaining the resiliency within metapopulations, such as Thjórsá River salmon, demands a broad scale suite of protective actions within their inland freshwater environment that considers the effects over entire life cycle.

The potential cost of mitigation over time is not addressed or incorporated into the decision-making process.

We do not believe that the actual cost of countermeasures, in terms of the real amount of money that will be spent on mitigation and success, have been fully incorporated into the decisions made thus far regarding hydropower development. Countermeasures to protect fishery resources cost significant amounts of money and are rarely successful. Countermeasures, monitoring, research and state-of-the-art improvements have been implemented in the Columbia River since the late 1970s. In spite of these countermeasures there was a continued decline of salmon viability causing a listing under the United States Endangered Species Act in the early 1990s. Salmon stocks remain on the endangered species list and do not meet viability standards for producing self-sustaining populations over time.

In 1980 a federal law (the Northwest Power Act) was passed in the United States to address the impact of hydroelectric dams on the Columbia River in the Pacific Northwest. The act established the Northwest Power and Conservation Council, which is responsible for the development of a Fish and Wildlife Program to be implemented in the Columbia River. That Program is funded through ratepayer dollars from hydrosystem operation. In fiscal year 2014 (NPCC 2015) the total fish and wildlife costs were estimated at approximately $782.3 million U.S. dollars. The $782.3 million U.S. dollars was used for: investments in fish passage and fish production, funding the Northwest Power and Conservation Council; paying the fixed costs (interest, amortization, and depreciation) of capital investments for facilities such as hatcheries, fish-passage facilities at dams, and some land purchases for fish and wildlife habitat; offsetting forgone hydropower sales revenue that results from dam operations that benefit fish but reduce hydropower generation; and, in making power purchases during periods when dam operations to protect migrating fish reduce hydropower generation, such as by spilling water over dams in the spring or storing it behind dams in winter months in anticipation of required spring spill.

In spite of substantial modifications to flow and spill in the hydrosystem, both within and outside of the fish passage season, as well as the installment of surface flow outlets, most fish populations are not viable. The *2015 Comparative Survival Study (CSS) of PIT-tagged spring/summer/fall Chinook, Summer Steelhead and Sockeye* (McCann et al., 2015) found that smolt-to-adult return rates (SARs) for most species are not meeting regional goals for salmon and steelhead recovery. Fish remain in danger of extinction.

The 2015 responses from Landsvirkjun to questions originally posed to in 2012 show a general lack of understanding regarding the ramifications of hydro development on natural populations.

In January of 2012, we provided you a list of questions that you might pose to Landsvirkjun regarding the hydro development of the lower Thjórsá River in Iceland. The list was based on our experience of the factors that have the most effect on salmonid survival. A response to those questions was received from the Power Company in September of 2015. We have not yet responded to the Landsvirkjun response, but have some preliminary concerns that we can share here regarding the response to several of the questions originally posed.

We asked about the impact that hydro development in the Thjórsá has already had on the natural hydrograph. We were concerned that the hydro development of the Thjórsá River had already

significantly affected the river's flow regime. Typically, in a hydro-developed river, with seasonal flows, water is stored in upstream reservoirs during periods of high runoff or melt and used to produce power when flows would typically be low (i.e., during the winter). The information provided confirmed that the annual hydrograph has been considerably altered by hydro development. Historically (pre-development) flow was low during the winter period and high during the spring and early summer period. Post hydro development (2001–2009), higher flows now occur during the winter period and flows during the spring and early summer period (the juvenile fish migration period) are lower than pre-hydro development.

Presently, since the river is free flowing and no reservoirs exist, the shape of the river channel assures that there is little variation in water speed that occurs over a range of flows. This is why the hydro development in the upper Thjórsá has had little impact on the juvenile migratory populations. With the addition of reservoirs in the fish migration corridor, it is anticipated that due to the shape of the reservoirs there will be a change in the speed at which juvenile fish migrate to the sea, as demonstrated by changes in water transit time.

Water transit time does not equate to fish migration speed and the Landsvirkjun conclusion that the addition of three hydroelectric projects will only delay the juvenile migration by a total of 30 hours is completely erroneous.

The exercise does show that the change in water transit time pre-development in the lower Thjórsá to post development can effectively be more than doubled after development of the three hydro projects. This suggests there will be a significant impact on the amount of time it takes for juvenile migrants to reach the sea. During this increased time period, juvenile migrants are exposed to increased predation and other issues associated with the migration corridor. The relation between flow (or water transit time) and juvenile survival through the migration corridor has long been demonstrated. A longer juvenile migration time translates to a lower juvenile survival through the migration corridor.

We asked about an objective for a smolt-to-adult survival rate. There is no objective anywhere in this process for maintaining a juvenile (or smolt) to adult survival rate. This is extremely short sighted. Landsvirkjun concludes that such an objective is not necessary when they wrote, "Since almost all losses (99%) happens in the ocean outside the river, no target objective in terms of maintaining a specific smolt to adult survival has been specified."

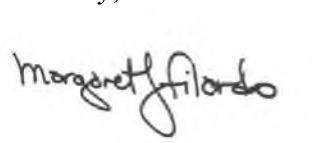
The assumption that a good deal of mortality takes place in the ocean, where there is no control, is true. However, the assumption that there is no impact of the hydro development on the juvenile life stage is incorrect on two counts:

1) If the percent of juveniles surviving the migration to the sea is decreased due to hydro development, then the number of adult fish returning decreases, since a dead juvenile cannot translate to a live adult.

2) There have been numerous studies demonstrating the existence of delayed mortality associated with juvenile passage through the hydrosystem. This mortality occurs during the ocean phase, but is directly attributable to the juvenile hydro system passage experience.

In summary, the process that has occurred thus far regarding the movement of the Hvammur hydroproject to the utilization category and the decision to forgo an updated Environmental Assessment, relies on building the dam and then observing what the effectiveness of the countermeasures are on aquatic life in the Thjórsá River. This approach does not address the substantial information of the impacts of hydro development on aquatic populations from rivers around the world. If that information were taken into consideration the only logical conclusion would be that there is more "certainty" associated the impacts of hydro development than "uncertainty." Regardless of the implementation of countermeasures and monitoring, once Hvammur is built there will be substantial negative impacts to the aquatic life of the Thjórsá.

Sincerely,



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March 18, 2014

Mr. Orri Vigfússon
North Atlantic Salmon Fund
Skipholti 35
105 Reykjavík, Iceland

Dear Mr. Vigfússon,

We understand that pursuant to our last correspondence relative to the 2011 Master Plan Review, the Ministry for the Environment and Natural Resources appointed a Specialist Group to provide an evaluation of the impact of development on salmonids in the Thjorsa River, stemming from the proposed Hvammur, Holt and Urridafoss hydro-electric plants in the lower reaches of the river. The group was charged with assessing the uncertainty associated with existing information. The draft recommendation of the Specialist Group (December 19, 2013), now in consultation, is to re-classify the Hvammur hydroelectric plant from the "on hold" category to the "utilization" category, while retaining the Holt and Urridafoss plants in the "on hold" category.

It has been duly recognized that hydro development has significant impacts on the survival of fish stocks in the Thjorsa. Skulason and Ingvason (2013) conducted an independent evaluation of available research on the ecology of Atlantic salmon (*Salmo salar*) in the Thjorsa in relation to the proposed hydroelectric power plants and dams in the lower part of the river and concluded that "the overall impact of the hydroelectric power plan in the lower Thjorsa system would have significant and irreversible negative effects on their populations." The question remains whether the proposed mitigation and countermeasures presented can ameliorate the significant impacts imposed by development. It appears that by recommending the re-classification of the Hvammur project, the Specialist Group accepts that the countermeasures offered can address the impacts of the development and maintain fish stocks in the Thjorsa.

The justification for the mitigation and countermeasures offered appears to rely heavily on the research conducted on the Columbia River in the USA. However, based on the experience of the efficacy of the mitigation measures implemented on the Columbia River, it must be cautioned that the assumptions made for the success of the engineered mitigation solutions are overly optimistic, given what we know regarding implementation in the Columbia River as well as in other river systems. There is considerable data available to suggest that mitigating for the

installation of hydroelectric projects is rarely successful in maintaining naturally spawning, self-sustaining populations of salmon. We have previously stated, and will reiterate here, that in spite of an estimated 11.9 billion U.S. dollars spent between 1979 and 2008 attempting to recover Columbia River salmon stocks by implementing, and continuing to modify mitigation efforts, we have failed to recover natural populations that remain as endangered species and are at risk of extinction.

These comments focus on the recommended development of the Hvammur project, but recognize that one of the primary justifications for developing the Hvammur plant is to research the proposed mitigation using this plant for future application to the other two proposed hydroelectric projects. We received several specific questions from you relative to these documents. To facilitate our review you provided an English translation of the following documents:

> *Skulason, S and H.R. Ingvason. Evaluation of Available research on salmonids in the river Thjorsa in S-Iceland and proposed countermeasures and mitigation efforts in relation to three proposed hydroelectric power plants in the lower part of the river. October, 2013.*
>
> *Specialist evaluation of uncertainty of existing information on the impact of salmonids in the Thjorsa River, stemming from the proposed Hvammur, Holt and Urridafoss hydro-electric plants in the lower reaches of the river. Report to the Master Plan Steering Committee, November 4, 2013.*
>
> *Response from the National Power Company regarding the October 22, 2013 request. Letter Dated October 31, 2013.*

In general, the documents seem to suggest that mitigation for the presence of a Hvammur hydroelectric project will successfully mitigate the damage caused from hydro development. The National Power Company offers limited details, but suggests that mitigation is simple and can be very effective. This is an overly optimistic stance and is based on many questionable assumptions with large uncertainties. In response to your request we have the following answers to your questions.

Is the juvenile passage structure proposed for installation at Hvammur likely to meet the passage and survival estimates proposed by the National Power Company?

No, it is highly unlikely that the juvenile passage structures will meet the suggested passage and survival estimates provided by the National Power Company. In the October 31, 2013, letter from Landsvirkjun it is stated that a juvenile fish bypass structure will be included at Hvammur with a design similar to that proposed for Urridafoss. The National Power Company projects that based on their studies 91% of fish will pass the project via the surface flow bypass, with nearly 100% survival. The remaining 9% of fish are predicted to pass through the turbine units. The proposed Kaplan turbines are "fish friendly" turbines that have minimum gap runners, and a higher juvenile fish survival rate. Consequently, one is led to believe that the installation of the hydro project will be benign to the passage of juvenile and adult migrants.

There are three reasons why we do not agree that the juvenile passage structure will achieve the high performance suggested by the National Power Company: (1) Due to fish behaviors and variability, it is unlikely that the surface collection outlet systems (SFO) will achieve the assumed 91% efficiency; (2) the assumed 100% survival through the SFO is based on flawed studies; and, (3) the relation between bypass and powerhouse passage to latent mortality associated with these passage routes is ignored.

Assumption of 91% Fish Passage via Surface Flow Bypass

Surface collection outlet systems (SFO) are effective because juvenile salmonids typically migrate near the surface. However, in order to collect and pass fish, conditions in a dam forebay must be favorable to fish discovering, entering, and being retained in the system (Coutant and Whitney, 2000; Johnson and Dauble, 2006). The National Power Company expects that 91% of the juvenile fish approaching the project will pass via the surface flow bypass system. This assumption is based on two Master of Science theses (Gunnarsson, 2012; Gudmundsson, 2013) that have been completed developing either a physical model (Hvammur) or a physical model with validation using a numerical model (Urridafoss). The concept of a surface bypass collector for fish passage is based on the hydro-combine dam arrangement at Wells Dam on the Columbia River, USA. At Wells Dam the juvenile bypass system sits on top of the turbine units and has been very effective in passing juvenile migrants. Consequently, given the success at Wells Dam, this arrangement has been proposed for consideration as mitigation at other dams. What has been found from these other applications is that each project is unique and what works well in the case of Wells Dam, may not be applicable at other projects. For example, the Urridafoss thesis mentions the SFO at the Cowlitz Falls Dam, and recognizes that it has not worked as expected. It is a good illustration, since even with knowledge of juvenile fish behavior, this surface collection system has not worked as predicted.

The Cowlitz Falls Dam, located on the Cowlitz River in Washington State, is a concrete gravity dam with spill bays located directly above the generating units. Two Kaplan turbines are located below the two center spillways in a hydro-combine design. The initial juvenile bypass structures were installed in 1996 and annual estimates of fish passage collection via the surface flow collector has been less than stellar over those years. Studies have shown that discovery rates of the surface collection system routinely exceed 90 percent at Cowlitz Falls Dam (Hausmann et al., 2001; Farley et al., 2003; Liedtke et al., 2010). However, mark-recapture findings indicate that only about 50 percent of juvenile steelhead, 21 percent of juvenile coho, and 20 percent of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) were bypassed annually during 1996–2012 (Serl and Heimbigner, 2013). Significant modifications have been made to improve passage through the surface passage routes, but as recently as 2013 turbine passage was the most common route for fish passage at this project.

Estimates of 100% juvenile survival through Surface Flow Bypass Structures

The near 100% juvenile survival estimates are derived from performance standards testing studies conducted in the Columbia River. While performance standards tests conducted at Columbia River dams often report survival estimates near 100%, both the applicability and development of these estimates has been in question. Acoustic tag studies provide only short-

term survivals for specific projects, and current performance testing does not include important metrics such as forebay residence time, travel time, or indirect mortality expressed a short distance below the dam. The location of juvenile bypass exits and the environmental conditions can greatly affect survival below the hydroelectric project. Increased avian and piscivorous predation can contribute to mortality at the juvenile exit location if conditions are not sufficient in terms of flow and hydrology.

In addition to the inappropriate use of these limited application performance standards estimates, there have been serious questions raised regarding the study design and conduct for these experiments. These concerns include the high-grading of the sample population, artificial inflation of estimates through the use of multiple control groups, effects of handling and tag burden, and the lack of assessment of long-term or delayed mortality (Fish Passage Center, January 4, 2013).

Due to size and fish condition, not all smolts can be tagged with the JSATS tags used in the survival studies. The number of fish rejected indicates that the study fish do not represent the population in the river, and so the results may not be applicable to estimating population survival. Rejection rates as high as 18% have been reported for these studies.

The virtual/paired-release design used in most of the tests utilizes two control groups, one released in the tailrace of the dam and one released further downstream. The further downstream group is intended to account for any handling mortality experienced by the tailrace group, which could inflate survival estimates. Under this experimental design, however, upward biasing of survival estimates could be caused by high mortality in the tailrace group. It is unlikely that tagged fish in both stretches of river encounter the same environmental conditions, especially since predation rates are higher in the forebay and tailrace than mid-reservoir at many projects (Petersen 1994, Ward et al. 1995). If survival in the tailrace group is lower than survival in the further downstream group, the ratios of survivals artificially increase estimates of dam survival.

Survival estimates generated with this multiple-release design may further increase dam survival estimates due to random sampling effects. If there is limited handling and transportation mortality, the use of the further downstream group will introduce additional variation to the study. Beeman et al. (2011) concluded that this result is "contrary to the goal of adjusting a paired-release estimate downward to account for handling mortality."

In addition, in the Virtual-Paired Release design, fish are released upstream of the dam so they achieve a distribution through passage routes that reflects the run at large. Fish that die between tagging and the forebay of the dam are not included in the study. However, this means that fish that have lower survival through the reaches will not be included in the study. Mortality between tagging and detection was as high as 12.5% in yearling Chinook in 2012. As with the effects of tagging only healthy fish, this means that only the healthiest of tagged fish are included in the dam survival estimates.

Given all of these limitations associated with the studies, it is unlikely that actual survivals through the bypass systems are actually anywhere near 100%.

Failure to Incorporate Delayed Effects of Dam Passage

Similar to the link between cigarette smoking and subsequent development of cancer at a later life stage, the long-term effects of hydro project passage routes for juvenile fish have been well documented in recent years. It has been demonstrated that fish that survive juvenile bypass systems or powerhouse passage are less likely to survive the first ocean year, and less likely to return as adults (Haeseker et al., 2012; Petrosky and Schaller, 2010; Tuomikoski et al., 2010; Fish Passage Center Memos October 6, 2010, January 19, 2011, and July 14, 2011; Schaller and Petrosky, 2007).

Reservoir mortality in the Columbia River can be significant after fish have experienced bypass passage though hydroelectric dams. The cumulative effect of passing through dams and reservoirs can also have direct and delayed impacts on salmon survival (Schaller and Petrosky 2007, Tuomikoski et al. 2012, 2013). The delayed mortality from the accumulation of dam and reservoir passages can manifest into poor survival during estuary and marine life stages (Budy et al. 2002, Schaller & Petrosky 2007, and Schaller et al. 2014).

Has adequate pre-development baseline data been collected to allow accurate monitoring of the impacts of development to all species at risk?

The fact that the development of the Thjorsa will have impact to salmonid and other species survival is not disputed. The question is how large an impact and whether that impact can be mitigated. The ability to determine the magnitude of an impact is only as good as the information available before the perturbation. There has been insufficient collection of the appropriate biological data and an insufficient evaluation of the potential impacts using population viability analyses. The previous focus of the agencies that operate the Columbia River hydrosystem has been to approach mitigation as addressing the immediate impact of the structure. What we have learned over years of research is that, while the at-dam survival is important, the latent effects, which can be greater than direct effects, must be addressed if the viability of the population over the long term is of interest. As we have learned through recent research, the link between the routes by which juvenile fish migrate through hydro projects and subsequent survival to adulthood is extremely important.

Previous guidance according to the US National Marine Fisheries Service (NMFS 2008) at a minimum the following biological information should be provided for the development of the preliminary design for hydro-development:

1. Type, life stage, run size, period of migration, and spawning location and timing for each life stage and species present at the site.
2. Other species (including life stage) present at the proposed fish passage site that also require passage.
3. Predatory species that may be present.
4. High and low design passage flow for periods of upstream fish passage. The design streamflow range for fish passage, bracketed by the designated fish passage design high and low flows, constitutes the bounds of the fish passage facility design where fish

passage facilities must operate within the specified design criteria. Within this range of streamflow, the fishway design must allow for safe, timely, and efficient fish passage.

5. Any known fish behavioral aspects that affect salmonid passage.
6. What is known and what needs to be researched about fish migration routes approaching the site.
7. Document, or estimate, minimum streamflow required to allow migration around the impediment during low water period.
8. Poaching/illegal trespass – describe the degree of human activity in the immediate area and the need for security measures to reduce or eliminate illegal activity.
9. Water quality factors that may affect fish passage at the site. Fish may not migrate if water temperature and quality are marginal, instead seeking holding zones until water quality conditions improve.

Biological data has been collected by the Institute for Freshwater Fisheries (IFF) that address some of the items listed above relative to life stage, timing of juvenile salmon migration, and abundance. However, several of the listed information needs appear insufficiently addressed based on the available information reviewed.

Additionally, as we have stressed repeatedly, newer research has clearly demonstrated the link between hydro project passage and its effect on salmon survival at a later life stage. Consequently, it is of extreme importance to collect a significant time series of smolt-to-adult return rates (SARs) and conduct a Population Viability Analysis (PVA). It is impossible to apply a risk assessment without some measurement of life cycle survival, like SARs. The PVA will likely identify critical uncertainties associated with the potential impacts of dams over variations in marine conditions and climate change. This analysis would provide a risk assessment of hydro development for Thjorsa populations, while considering the variation in marine conditions and the impacts of climate change.

Are the countermeasures and emergency plan described in the Oct. 31, 2013, letter from the National Power Company likely to protect anadromous species in the Thjorsa and mitigate for the hydropower development?

Based on the information provided in the October 31 letter and the experience in the Columbia River, it is unlikely that the proposed countermeasures and emergency plan will mitigate for the hydro power development. In general, the proposed countermeasures include: constructing juvenile bypasses and adult fishways; providing managed and minimum flows in parts of the riverbed with reduced flow and avoidance of sudden flow fluctuations; opening up new habitat for migrating fish; and designing structures and turbines to avoid the oversaturation of dissolved gasses or death of fish. In addition, the National Power Company recommends additional research on (1) the effects of hydro projects and results of countermeasures, (2) the downstream and upstream migration of fish in Thjorsa, and (3) the effects of Hvammur on bottom fauna in Thjorsa.

All of the countermeasures described by the National Power Company, and more, are presently implemented in the Columbia River hydro system. However, in the Columbia River these countermeasures do not provide for sustainable natural populations. Hydro projects in the Columbia impose sufficient mortality upon populations such that populations are maintained at a level that warrants their existence as species at risk of extinction.

Additionally, the proposed countermeasures and emergency plan specifics are poorly defined and/or rely on future research. For example, the National Power Company recommends "providing managed and minimum flows in parts of the riverbed with reduced flow and avoidance of sudden flow fluctuations," without specifically defining operations beyond establishing a minimum flow below each of the projects. In the Columbia River extensive modifications and restrictions on flow regimes are used. Fall Chinook salmon (*Oncorhynchus tshawytscha*) have suffered severe impacts from the hydroelectric development. Fall Chinook salmon rely heavily on mainstem habitats for all phases of their life cycle, and mainstem hydroelectric dams have inundated or blocked areas that were historically used for spawning and rearing (Dauble et al., 2003, Anglin et al., 2006). The natural flow pattern that existed in the historic period has been altered by the dam development, and the operation of the dams to produce power to meet short-term needs in electricity (termed power peaking) produces unnatural fluctuations in flow over a 24-hour cycle. These flow fluctuations alter the physical habitat and disrupt the cues that salmon use to select spawning sites, as well as strand fish in near-shore habitat that becomes dewatered. Furthermore, the quality of spawning gravels has been affected by dam construction, flood protection, and agricultural and industrial development. In some cases, the riverbed is armored such that it is more difficult for spawners to move, while in other cases the intrusion of fine sediment into spawning gravels has reduced water flow to sensitive eggs and young fry. To address some of the impacts of development in the Columbia significant restrictions on seasonal and daily flow variations have been established. These restrictions are in place throughout spawning, incubation, emergence and juvenile rearing; often extending over a six month period.

The National Power Company also mentions a commitment to ten years of monitoring, but does not specify the extent and funding level of commitment. In the Columbia River the operation of the dams requires continued real-time monitoring throughout the lifetime operation of the hydro project. In addition, millions of dollars are annually committed to fund research for the protection, mitigation, and enhancement of fish and wildlife affected by the construction and inundation impacts of the Federal Columbia River Power System (FCRPS).

Are there any additional concerns that you would like to indicate at this time?

There are several additional concerns that warrant comment at this time. The most serious additional concern is the complete lack of information or attention that has been given to the iteroparous nature of the fish stocks in the Thjorsa. Unlike Pacific salmon, Atlantic salmon, brown trout, and char are all repeat spawners migrating to the sea at various times of the year, sizes and physical condition. Iteroparous populations generally have higher population abundance and productivity over their lifetime. All of the proposed countermeasures and mitigation address only the seaward migration of juveniles, primarily based on information collected in the Columbia River where fish only spawn once. The exception to salmon spawning

once in the Columbia is a small portion of the steelhead salmon. In the Snake and Columbia River systems, fish passage facilities at hydroelectric dams were not designed or constructed to accommodate downstream-migrating, post-spawning steelhead adults (kelts). From the passage mortality estimated for the few steelhead kelts it has been established that the mortality on these fish has been very high when migrating downstream to the sea. Given that the overall productivity of the Thjorsa population is dependent on kelts, and what information exists suggests that considerable mortality is incurred during downstream kelt passage, it is of significant concern that they are not considered or addressed.

The Icelandic populations of salmon represent the northern extent of the distribution of salmon. Consequently, these salmon likely have unique adaptations given the unusual geology of Iceland. Given that, the salmon populations of Iceland likely function as metapopulations (Hanski, 1999), where populations are not completely isolated and are connected by the movement of individuals (immigration and emigration) among them. The Thjorsa salmon populations are considered the largest in Iceland and consequently, increasing the risk to the Thjorsa salmon could affect many of the salmon populations in other parts of Iceland. Additionally, impacts to the Thjorsa population, which is likely a unique segment of the population, could also put other Atlantic salmon populations at risk.

The Specialist Group makes a differentiation between natural distribution areas of migratory fish in the Thjorsa river system, and distribution areas arising from human intervention. The Thjorsa is already a perturbed river system. Significant modification to seasonal and annual river flow has occurred as a result of the building of storage projects above the range of salmonid passage. Currently there are six hydroelectric power plants in the upper parts of the system. Due to this development the peak river flows that historically occurred during May through July have been reduced. That change in flow regime and development was partly mitigated by the installation of the fish ladder at Buddafoss. The installation of this fish ladder significantly increased the available range and habitat for anadromous species. However, the present range reflects the viable population. Reduction of this range could impact the viability of the population. Consequently, the reflection that the population above the historic range of the species is not vital to the continued viability of this population is premature and not based on any specific data.

Water quality can likely be an issue at the project, related primarily to temperature and changes in levels of dissolved gases. The Columbia River is managed to both national and state criteria for these potential pollutants. There have been no studies provided detailing the expected changes in total dissolved gases or temperature, water quality standards, and proposed mitigation for the Thjorsa River. Based on the predicted flows and the size of the power station, there are periods of the year when flow in excess of the hydraulic capacity of the proposed hydro project will occur and water will be spilled over the spillway. While the National Power Company says they will "Design structures and turbines to avoid oversaturation of dissolved gasses or death of fish," no information is available as to how they will accomplish that goal and whether, for example, they will design the project to include spill deflectors at the base of the spillways or construct gas dissipating tailraces below the project.

There is no mention of the restriction of operating turbines to a specific efficiency range to maximize fish survival. Kaplan turbine operating efficiency has a relatively direct effect on fish

passage survival where the relationship between survival of juvenile fish passing through Kaplan turbines is positively correlated and roughly linear to the efficiency at which the turbines are operated. Bell (1981) recommended making every effort to operate turbines at best efficiency at a given head during periods of peak fish passage to minimize fish mortality. Turbine units at Columbia River projects are operated within 1% of peak efficiency, less than maximum rated output. This restriction on turbine energy production remains in effect throughout the juvenile fish migration period.

The National Power Company has suggested that a buy-out of net fishers will provide increased angling upstream and overall increases in numbers of fish returning. While it is true that decreasing fishing pressure in the lower river will lead to an immediate increase in the numbers of fish migrating through the river, the long-term sustainability of these increased numbers depends on the ability of the proposed mitigation to address the impacts of the projects.

Fishery impacts and adult passage are fairly established for anadromous salmon species, but very little information is available for arctic char and brown trout, or eels. Unlike salmon species that are anadromous, eels are catadromous where the adults migrate downstream to the ocean and juvenile migrate upstream from the ocean. In addition to migrating at different life stages, eels also tend to exhibit demersal behavior, while juvenile salmon are located in the upper parts of the water column. The passage countermeasures applied to the anadromous model of fish mitigation may not be at all applicable to this species. Arctic char populations, similar to bull trout in the Columbia River basin, (Anglin et al. 2010; Budy et al. 2005 and 2009) may migrate at multiple ages. Therefore, fish much larger than salmon smolts migrating to sea may be attempting to negotiate downstream passage structures designed for fish of different sizes. In addition, the time period during which juvenile migration takes place is different than observed for salmon smolts.

We realize that there are many more facets to each of the discussed issues, but we hope that we have addressed your questions adequately. Please feel free to contact us if you need additional information.

Sincerely,

Margaret J. Filardo, Ph.D.
Fishery Biologist

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MEMORANDUM

TO: Mr. Orri Vigfusson

FROM: Margaret Filardo, Ph.D.

DATE: November 15, 2013

RE: Review of Further Scientific Information on the Thjorsa River Hydro-development

In response to your request, we have reviewed the document "Evaluation of available research on salmonids in the river Thjorsa in S-Iceland and proposed countermeasures and mitigation efforts in relation to three proposed hydroelectric power plants in the lower part of the river". Attached are our comments.

An independent evaluation of "Evaluation of available research on salmonids in the river Thjorsa in S-Iceland and proposed countermeasures and mitigation efforts in relation to three proposed hydroelectric power plants in the lower part of the river" was conducted for the Steering Committee of the Icelandic Master Plan for Conservation and Development of Hydro- and Geothermal Energy sites.

- This evaluation in very comprehensive and well done. There are several warnings included in this report that must be given full consideration. Of particular importance is the emphasis that there is considerable data available to suggest that mitigating for the installation of hydroelectric projects is rarely successful in maintaining naturally spawning, self-sustaining populations of salmon.

- In this context it should be recognized that when the Columbia River hydrosystem was developed it was never intended to drive Columbia River salmon to near extinction. Regional intent was to preserve the ecosystem and the Native American, sport, and commercial economies that relied upon the fisheries.

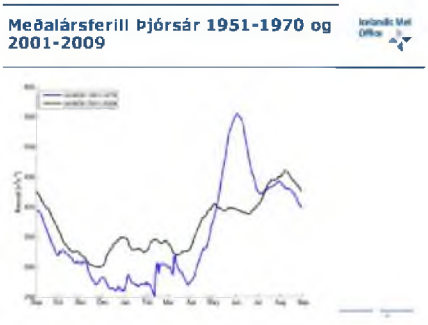
- An estimated 11.9 billion U.S. dollars* were spent between 1979 and 2008 attempting to recover Columbia River salmon stocks (*Northwest Power and Conservation Council, 2010). At present, a minimum of 250 million dollars, derived from power revenues, are spent annually relative to fish and wildlife mitigation. Additional monies are spent relative to operations, maintenance, and development of fish facilities.

- An estimated 10 to 16 million naturally produced salmon returned to the Columbia River annually pre-development, and in spite of over 35 years of implementing, and continuing to modify mitigation efforts, we have failed to recover natural populations that remain as endangered species and are at risk of extinction.

The following information is provided to support, complement, and augment the information provided in the review.

Flow Alteration

- From the graph below it is obvious that the natural flow of the Thjorsa has been significantly altered by the hydro development already in place. Further modification could place undue stress on natural populations of Atlantic salmon, and likely other species, below the present development by further altering the seasonal flow pattern.



- In addition to the seasonal flow alteration that has already taken place due to hydro development, the addition of reservoirs in the lower Thjorsa would have significant impacts on fish survival.

- Based on the experience in the Columbia River in the United States, juvenile fish migration time would increase with the development of reservoirs in the Thjorsa. Increasing the time it takes for juvenile fish to migrate to sea decreases juvenile survival and subsequently, the survival of returning adults. This reduction in survival is due to increased exposure time to predation and increased temperature, and by altering timing of seawater entry.

- To put it into perspective the Columbia River pre-development fish migration time from the Snake River to the present day site of Bonneville Dam (the lowest mainstem dam in the system) was estimated at 2 days whereas post development, the fish migration over the same distance now averages 19 days.

- Water particle transit time is the amount of time it takes for a water particle to travel from across a distance and is a function of volume (WTT = volume/flow). The addition of reservoirs to a free flowing river increases water particle transit time by increasing the cross-sectional area of the river, significantly increasing the volume of water.

- Because of the high correlation observed between WTT and juvenile fish migration speed, water particle transit time in the Columbia River is used as a surrogate for fish migration time.

- Using a series of hydrologic assumptions it was estimated that the free flowing WTT from the point on the Thjorsa that coincides with the proposed upstream end of the reservoir above the proposed Hvammur hydroproject to point downstream of the Urridafoss project would be near 0.14 days under all flow conditions. If development takes place the resulting WTT are estimated in the following table under a range of flow conditions:

Flow (m^3sec^{-1})	**WTT** (days)
Mean Flow*	1.69
Summer Flow**	8.99
Minimum Flow***	48.21

*Mean Flow (m^3sec^{-1}) Hvammur = 310; Holt = 330; Urridafoss = 370
**Summer Flow (m^3sec^{-1}) Hvammur = 60; Holt = 60; Urridafoss = 60
***Minimum Flow (m^3sec^{-1}) Hvammur = 10; Holt = 15; Urridafoss = 10

- The proposed 1-meter reduction in reservoir volume would have a minimal effect on the WTT and consequently, fish migration time. Consequently, even with this proposal a significant adverse impact on fish migration time would occur.

Flow (m^3sec^{-1})	WTT (days)	WTT (1M Urridafoss and Holt)
Mean Flow*	1.69	1.61
Summer Flow**	8.99	8.52
Minimum Flow***	48.21	45.72

*Mean Flow (m^3sec^{-1}) Hvammur = 310; Holt = 330; Urridafoss = 370
**Summer Flow (m^3sec^{-1}) Hvammur = 60; Holt = 60; Urridafoss = 60
***Minimum Flow (m^3sec^{-1}) Hvammur = 10; Holt = 15; Urridafoss = 10

- Experience in the Columbia has shown that after a river has been harnessed into a series of reservoirs and impoundments, flow cannot be increased sufficiently to return to pre-development water transit times or fish travel times.

Habitat Alteration

- Changes in habitat availability for spawning and interference with incubation, emergence and early life stages of juveniles have all been observed in the Columbia and are related to daily and seasonal flow fluctuations. These impacts to spawning, incubation, emergence and early life stages of juveniles have contributed to the decline in salmonid survival.

- Operation of projects can cause daily and seasonal flow fluctuations which can affect suitable spawning habitat by limiting by either dewatering these areas or by varying velocities over spawning habitat so that redd construction is discouraged during the nest building period (Hatten et al. 2009). Daily and seasonal flow fluctuations also can decrease connectivity of spawning habitat to foraging nursery areas and may entrap fish in pools that become separated from the main channel or strand fish on the substrate (Anglin et al. 2006).

- In addition to seasonal flow variations, daily flow fluctuations at each of the projects due to daily load following could have serious implications to survival in spawning and rearing areas downstream. In the Columbia River there are two locations where both daily flow and hourly flows are regulated over long periods of time (up to five and six months). Both minimum flow levels that allow for sufficient spawning and hourly flow fluctuations are minimized and evaluated daily by interagency committees during that time period. Flow levels are established following twice weekly spawning ground surveys conducted by foot, by boat or by helicopter.

Juvenile Passage

- The estimates for survival through Kaplan turbines are very optimistic. Performance standard testing of juvenile survival via passage routes conducted at six different Columbia River dams (2009–2012) showed a range of turbine survival estimates between 80% and 97%.

- Performance standard tests have utilized radio and acoustic tags, which do not fully represent the juvenile population. Smolts are rejected from test groups due to size and condition and, therefore, represent survival only of the healthiest smolts in the population. Recorded rejection rates have ranged from 3.2% to 16.4% of the population collected for tagging. Therefore, survival estimates for these fish are considerably higher than the general population that migrates past the Columbia River mainstem dams.

- The test group is further affected because smolts included in the dam-passage treatment group are released at multiple locations upstream, and some pass through several projects before being included in the test group. This process may eliminate from the sample weaker fish more susceptible to mortality due to tag burden; so only tagged fish most likely to survive dam passage are included in the test group. The inclusion of multiple control groups for each performance test raises concerns that dam passage survival estimates may be artificially inflated. This inflation can be caused by random effects or the unequal mortality between groups from factors such as predation in the tailrace.

- Kaplan turbines on the Columbia River operate during the fish migration season within a very narrow efficiency range, which is well below the maximum energy output of each turbine. Operation outside of this range imposes additional mortality on juvenile migrants.

- Furthermore, turbine survival estimates underestimate the impact of dams on fish. At-project estimates do not capture the indirect effects of project passage, primarily delayed or latent mortality associated with bypass system passage. Delayed mortality is the mortality associated with passage through the hydrosystem that is expressed during later life stages in the estuary or ocean (Budy et al. 2002, Schaller & Petrosky 2007, and Schaller et al. in press).

- The location of juvenile bypass exits and the environmental conditions can greatly affect survival below the hydroelectric project. Increased avian and piscivorous predation can contribute to mortality at the juvenile exit location if conditions are not sufficient in terms of flow and hydrology.

- Reservoir mortality in the Columbia River can be significant after fish have experienced multiple bypasses though hydroelectric dams. The cumulative effect of passing through multiple dams and reservoirs can have direct and delayed impacts on salmon survival (Schaller et al. 2007, Tuomikoski et al. 2012, 2013). Again, the delayed mortality from the accumulation of multiple dam and reservoir passages can manifest into poor survival during estuary and marine life stages (Budy et al. 2001, Schaller & Petrosky 2007, and Schaller et al. In Press).

Evaluation of Proposed Development and Fishery Impacts

- In order to evaluate if the Thjorsa River population can be a natural spawning and self-sustaining population, after hydroelectric project development in the lower river, a

Population Viability Analysis must be conducted. The analysis could be conducted using life stage estimates from those available from the Thjorsa and Atlantic Salmon population estimates from other river systems (possibly available for the Alta River in Norway). These type of viability analyses have been conducted for Columbia River salmon (Kareiva et al. 2000, Wilson 2003), and proved useful in evaluating population sustainability and recovery strategies. When conducting these type of population viability assessments a full range of assumptions for life stage survival rates and impacts of project development should be considered, in order to evaluate the efficacy of countermeasures and mitigation.

- Juvenile survival rates should be empirically estimated through mark/recapture techniques for repeated years through those sections of the river that are planned to be developed. Simulation modeling, using a full range of assumptions for juvenile survival impacts from development through the lower river, should be compared to empirical estimates of juvenile survival rates without development. The model predictions must consider cumulative passage impacts from the proposed projects including reservoir passage and delay, and the associated delayed mortality effects from project passage.

- The single most important step is to obtain empirical estimates of smolt-to-adult survival rates for the Thjorsa River population. Given the potential for delayed mortality the ultimate impacts of the proposed hydrosystem development would need to evaluate success in terms of smolt-to-adult survival. The most recent evidence (Schaller et al. 2013 In Press) suggests that a high percentage (76%) of Snake River juvenile salmon that survived the migration through the hydrosystem subsequently died in the marine environment due to their juvenile migration experience. Accurately simulating post development smolt-to-adult survival rates and comparing those to the present estimates is important information to evaluate the efficacy of countermeasures and mitigation.

- Fishery impacts and adult passage are fairly established for anadromous salmon species, but very little information is available for Arctic Char, brown trout or eels. Unlike salmon species that are anadromous, eels are catadromous where the adults migrate downstream to the ocean and juvenile migrate upstream from the ocean. In addition to migrating at different life stages, eels also tend to exhibit demersal behavior, while juvenile salmon are located in the upper parts of the water column. The passage countermeasures applied to the anadromous model of fish mitigation may not be at all applicable to this species.

- Arctic Char populations, similar to Bull Trout in the Columbia River basin, (Anglin et al. 2010; Budy et al. 2004 and 2009) may migrate at multiple ages. Therefore, fish much larger than salmon smolts migrating to sea may be attempting to negotiate downstream passage structures designed for fish of different sizes. In addition, the time period during which juvenile migration takes place is different than observed for salmon smolts.

- The type of juvenile passage facilities located at Lower Granite and Bonneville Dam proposed for implementation at Urridafoss (removable spillway weirs or side channel collectors) are used to augment passage accomplished with other juvenile fish passage

facilities at these dams. These are both impoundment type dams and are not similar to the diversion type (penstock) dam proposed at Urridafoss.

- Dye studies conducted on a model of the proposed Urridafoss project suggests that a very high proportion of the colored water can be diverted to the bypass collector. Dye tests (colored water) are indicators of the hydraulic conditions encountered by fish approaching a project, but due to fish avoidance behavior are not used to determine the proportions of fish that pass via a specific route. Consequently, the efficiency estimate of 90–95% for fish passage through the bypass channel is likely overly optimistic.

- The location of juvenile bypass exit and the water velocity at the outfall location are important considerations in determining predation mortality after passing the juvenile facility. Any delay due to eddy formation can increase exposure time to predators and increase mortality.

- Plunging water (over a juvenile bypass as proposed for Urridafoss) can entrain atmospheric gases and increase the saturation of total dissolved gases in the water column. Research from the Columbia conducted since 1995 suggests that there can be a detrimental effect of total dissolved gases if the levels are greater than 135% supersaturation. The effect is lessened in the Columbia due to water depth and consideration of the total dissolved gas levels produced and the depth of the water where juveniles are exposed must be considered in determining overall impacts to survival.

- The assumptions made are that adult passage facilities can be built that will be effective at passing adult migrants around the dam. There is certainly much knowledge and experience associated with adult passage. However, there is no consideration of the fact that when rivers are dammed and flows through a reach are significantly reduced, low flow barriers to the adult salmon migration can be created. There is literature to support the concept that barriers to adult migration are created when the water depth is significantly decreased due to hydro development. (Thompson, 1972; Reiser and Bjorrn, 1979). In many rivers of the Pacific Northwest of the United States, dams and water withdrawals reduce flows to a level where significant numbers of passage barriers are created to adult salmon and bull trout migration (Anglin 2012).

- It would be important to evaluate how many low-flow instream barriers would be created in Thjorsa River by the placement of the three hydro dams. To estimate the potential extent of these barriers a survey to measure the bathymetry of the river between and below the dams should be made. Then a physical model of the river could be built to determine how many and the location of all the low flow barriers to migration that are created. This evaluation would be a critical element in determining the overall impact of the dams to the salmon population productivity.

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November 9, 2011

Mr. Orri Vigfússon
North Atlantic Salmon Fund
Skipholti 35
105 Reykjavík, Iceland

Dear Mr. Vigfússon,

We have received your request to provide responses to questions based on our experience regarding juvenile and adult salmon passage through the Columbia River system of hydro power projects. We understand that three hydro power stations have been proposed for construction in the Thjorsa River, South Iceland and that you are concerned that the combined effects of the three proposed power projects will dramatically change the present river and have impacts on the future survival of North Atlantic Salmon (*Salmo salar*) in the Thjorsa River. The Fish Passage Center has compiled the following information to address your questions:

We have been provided with the following information: "Example of places where bypass channels have provided good results in coloured water are Bonneville Dam and Lower Granite Dam in the Columbia River in USA where the survival estimate of smolts that go through bypass channels is 98-99% according to measurements." Are there any studies that have been conducted that explain what percentage of juvenile salmon smolts passing these projects would be expected to enter these surface bypass channels?

Yes, many studies have been conducted on the Columbia River hydroelectric project system. Bonneville Dam is located in the lower Columbia River and is the last project encountered by all smolts migrating through the hydro system on the way to the estuary, while Lower Granite Dam is located in the lower Snake River and is the first project that smolts originating in the Snake and Clearwater rivers pass on their way downstream through the hydro system. Not all fish that pass a project will pass through surface bypass channels. The fate of fish passing a hydro project is dependent on installed structures and river flow operations. Dye tests (coloured water) are indicators of the hydraulic conditions encountered by fish approaching a project, but are not used to determine the proportions of fish that pass via different routes.

Passage studies are conducted on juvenile yearling Chinook and steelhead and other salmonid species when available. The data for yearling Chinook and steelhead are most comparable to Atlantic salmon and we will present those here.

Lower Granite Dam is equipped with a mechanical bypass system comprised of fish screens that divert fish away from turbine units. The Dam is also equipped with a removable spillway weir (RSW) in one spill bay that is designed to pass surface flow and would be analogous to a surface bypass channel. Conventional spill is also provided at the project. Beeman et al., 2008 conducted a series of experiments using radio tagged fish to determine their route of migration through the Lower Granite Project. Based on their data, at Lower Granite Dam approximately 39% of the yearling Chinook entering the project passed through the powerhouse (8% through the turbines and 31% through the bypass), while 33% of fish passed over the spillway, and 28% passed through the removable spillway weir (surface bypass channel). For steelhead, 48% passed through the powerhouse (6% through the turbines and 42% through the bypass), while 28% passed over the spillway and 25% through the removable spillway weir (surface bypass channel).

The Bonneville second powerhouse is equipped with a surface bypass channel that is known as the corner collector. The corner collector facility includes a 2,800-foot long transportation channel, a 500-foot long outfall channel, a plunge pool, and modification of the ice and trash chute. Data (Ploskey et al., 2011) at Bonneville Dam indicate that 46% of the yearling Chinook and 57% of the steelhead passing the Bonneville second powerhouse passed via the corner collector.

It is important to note that both Lower Granite Dam and Bonneville Dam do not rely solely on the operation of surface bypass routes during the juvenile migration. Passage routes over conventional spill bays, along with surface bypass channels, are provided to pass juvenile salmonids at the hydro project via routes other than entering the powerhouse. The use of surface bypass channels alone does not provide adequate bypass passage. In addition, concern has been expressed based on data collected through 2007 suggesting that survival to adulthood for fish passing through the corner collector was not as high as for those passing in spill. In March 2004, the U.S. Fish and Wildlife Service (FWS) released over 220,000 sub-yearling fall Chinook from Spring Creek National Fish Hatchery (NFH) with coded wire tags (CWT) to evaluate smolt-to-adult return rates (SAR) back to the hatchery under two operations at Bonneville Dam. Tagged fish were released in two groups: one group released during four days of spill operation at Bonneville Dam and one group released during four days of corner collector operation at Bonneville Dam. Results from this single year of study showed that the overall smolt–to-adult return (*SAR)* was 0.118% for the fish released during the spill operation and 0.100% for fish released during the corner collector operation. The overall *SAR* for fish released during the spill operation was 18% higher than the *SAR* for fish released during the corner collector operation; however this difference was not statistically significant. Using Bayesian statistical methods, FWS estimated an 80% probability that the *SAR* for the spill operation release was higher than the *SAR* for the corner collector operation release. Applying the results from the 2004 March release operations to the March releases from Spring Creek NFH over 2005-2007, FWS estimated that a foregone loss of 15,200 adults (range 2,400-38,900) may have occurred due to corner collector-only operations during 2005-2007.

Can we expect that the juvenile survival estimates calculated at the dam bypass structure of 98-99%, and through Kaplan Turbines of 85-90%, to be sufficient to describe the total

effects of these hydro power projects on salmon survival? Would there be additional effects of hydro power project passage on survival to the adult return stage?

No, the direct juvenile survival estimates you describe are not sufficient to describe the effects of dam bypass passage on salmonid survival. The dam bypass estimates of 98-99% are measured from the forebay of a dam to the tailrace of a dam. The Kaplan Turbine estimates of 85 – 90 % translate to 51 – 85% over all three projects. Again, these estimates only include the "direct" mortality from turbine passage. These "direct" estimates do not include any mortality that occurs outside these zones, nor do they take into account the complete impacts of mechanical injury, large pressure changes, stress related mortality and mortality caused by increased predation rates associated with dam passage.

Juvenile survival through river reaches includes the mortality due to dam passage, as well as the mortality due to the alteration of river flow from impoundments. This survival estimate captures some, but not all, of the mortality that is expressed subsequent to leaving the immediate area of the hydro project. Evidence for delayed mortality associated with powerhouse passage was found by Ferguson et al., (2006). Their analysis showed that fish passing through turbines have a lower survival rate when survival was measured over a longer reach than when measured over a short reach. Fish released into turbines had relatively high survival to the tailrace of McNary Dam (0.93 to 0.946) as measured by balloon tags. Survival to arrays located 45 km downstream was between 0.814 and 0.858 and was found to be significantly lower. Ferguson et al., (2006) concluded that direct mortality (mortality to the tailrace of the dam such as the estimates you quote) made up 30% to 54% of total mortality. In this case delayed juvenile mortality was up to 70% of total mortality estimated in this study.

In addition, several independent studies have indicated that delayed and latent mortality occurs in fish passing the powerhouse collection bypass systems (Budy et al., Buchanan et al., 2010; Schaller and Petrosky, 2007; Petrosky and Schaller, 2010; Tuomikoski et al., 2011; Scheurell and Zabel, 2006: Ham et al., 2009; Marsh et al., 2009; McMichael et al., 2010). These various analyses indicate that delayed or latent mortality is occurring due to powerhouse passage and that the impact of powerhouse passage is not fully manifested until later in the migration. This delayed mortality reduces adult return. This implies that the site specific project and powerhouse and short reach survival estimates that are generated to assess juvenile survival through hydro projects are likely to be underestimates of the actual impact of the dams on salmon and steelhead.

The effects of bypass systems on juvenile salmon and steelhead travel times and smolt-to-adult return were analyzed in the Comparative Survival Study Annual Status Report for 2010. Three sets of analyses were conducted:

a. The first set of analyses evaluated the effects of bypass systems on fish travel time from Lower Granite Dam to Bonneville Dam.
b. The second set of analyses evaluated the effects of bypass history on SARs from Bonneville outmigration as juveniles to return to Bonneville as adults.
c. The third set of analyses examined the effect of cumulative bypass passages during the juvenile outmigration, on smolt-to-adult return rate.

The methods for these analyses are described in Chapter 7 of the CSS Annual Status Report for 2010 available on the FPC website http://www.fpc.org/documents/CSS.html .

The analyses of bypass passage on fish travel time identified significant migration delays for juvenile Chinook salmon and steelhead that were bypassed, relative to non-bypassed fish. The average magnitude of the delay among the significant cases was 0.69 days (16.6 hours) for Chinook and 0.73 days (17.5 hours) for steelhead. Significant migration delays for bypassed fish were identified in the majority of the year-dam combinations for Chinook (67%) and a large proportion of the cases for steelhead (23-33%). The lower percentage of significant migration delay identified for steelhead was likely due to the smaller sample sizes available for steelhead.

The analyses of effects of bypass on post-Bonneville smolt-to-adult return (SAR) indicated that post-Bonneville SARs are lower for bypassed Chinook and steelhead smolts than non-detected smolts. These analyses indicate that subsequent downstream passage experience may further influence smolt-to-adult return rate, with the smolts that pass undetected through the dams expected to have higher smolt-to-adult return rates than those smolts that are bypassed one or more times. Model estimates for Chinook salmon showed a 10% reduction in post-Bonneville SAR per bypass experience at upstream dams. Steelhead showed a 6% reduction in SAR per bypass experience at Snake River dams and a 22% reduction in post-Bonneville SARs per bypass experience at Columbia River dams. For Chinook estimates of bypass effects were similar across Columbia and Snake River dams. For steelhead bypass effects were more severe at McNary and John Day dams.

The analyses of cumulative bypass effects showed that non-bypassed yearling Chinook LGR-LGR SARs averaged 52% higher, and non-bypassed steelhead SARs averaged 91% higher, than smolts that were bypassed at one or more of the collector facilities.

The results of the CSS analyses indicate that route specific estimates of juvenile survival rate underestimate project impacts because they do not account for the mortality associated with migration delay or the latent mortality associated with project passage. Additionally, in spite of the existence of mechanical bypass systems and surface bypass channels, goals for smolt to adult return rates in the Columbia River are not being met, and fish stocks remain on the endangered species list.

Downstream of the Urridafoss project there will be a reduced water flow, down to only 10 m^3/s, which is a dramatic decrease from the 360 m^3/s which is the natural average stream flow of the river. These lower flows will continue over natural barriers, such as the Uridafoss waterfall. Have you observed any similar situations on the Columbia River and do you have any information describing potential impacts to adult salmon migrants? Will this create low flow barriers to fish passage? Can you estimate the potential extent of these barriers?

When rivers are dammed and flows through a reach are significantly reduced, low flow barriers to the adult salmon migration can be created. There is literature to support the concept that barriers to adult migration are created when the water depth is significantly decreased due to hydro development. (Thompson, 1972; Reiser and Bjorn, 1979). In many rivers of the Pacific Northwest of the United States, dams and water withdrawals reduce flows to a level where significant numbers of passage barriers are created to adult salmon migration (Figure 1).

It would be important to evaluate how many low-flow instream barriers would be created in Thjorsa River by the placement of the three hydro dams. To estimate the potential extent of these barriers a survey to measure the bathymetry of the river between and below the dams should be made. Then a physical model of the river could be built to determine how many and the location of all the low flow barriers to migration that are created. This evaluation would be a critical element in determining the overall impact of the dams to the salmon population productivity.

Figure 1. The following photos are examples of low-flow instream barriers that were encountered in dammed Pacific Northwest rivers.

Are the numbers of salmon caught (here by both net and rod) an appropriate way to monitor salmon abundance?

No, catch data, the numbers of salmon caught, are not usually used as estimates of salmon abundance, since fishing effort is not constant. Catch estimates can vary according to the amount of effort and, consequently, increases in catch attributed to increases in effort may be mis-interpreted as increases in abundance. The more accepted way of using catch data is to estimate the catch per unit of effort (CPUE). Effort can be expressed in terms of nets or rods used, and a time is associated with the effort.

There are several other methodologies available to estimate adult salmonid abundance. Annual counts of spawning adults returning to rivers and the redds constructed during spawning can be used to track annual changes in the salmonid breeding population size. Rivers may be monitored for overall adult abundance using equipment such as sonar to count targets of specific sizes. Side beam split-beam sonar technology has been used effectively to estimate salmon abundance

in the Kenai River, Alaska (Miller et al., 2004). Other methodologies may include mark recapture studies, where a portion of adult salmonids entering a river may be marked and subsequently recaptured upstream. This type of methodology is also applied to juvenile salmonids in the Columbia River, primarily through the Comparative Survival Study (Tuomikoski, 2011).

Given the concern regarding the impact of hydro power project development of the Thjorsa River it would seem prudent to include a population viability analysis (PVA) as part of a biological assessment. Population viability analysis is a technique to estimate the probability of a stock attaining given sizes, usually zero or very low, sometime in the future (Gilpin and Soulé, 1986). PVA is a stochastic modeling technique predicting changes in population abundance given uncertain biological parameters (Beissinger 2002). PVA models use a detailed life history cycle incorporating uncertainty in juvenile and adult survival rates, and the inter-relation between the two due to delayed mortality associated with juvenile hydro project passage. A PVA model could be used to estimate the probability of causing extinction over a given number of life-cycles based on the range of uncertainty associated with the survivability of juvenile and adult salmonids under the proposed hydro project development in the Thjorsa River.

We hope that we have addressed your questions adequately. Please feel free to contact us if you need additional information.

Sincerely,

Margaret Filardo

Margaret Filardo, Ph.D.
Fishery Biologist

Michele DeHart

Michele DeHart
Fish Passage Center Manager

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DATA REQUEST FORM

Request Taken By: M. Filardo **Date:** 11/8/2011

Data Requested By:

Name: Orri Vigfusson **Phone:**

Address: Skipholt 35 **Fax:**

105 Reykjavik, Iceland **Email:** nasf@vortex.is

Data Requested:

Request to answer questions in attached letter.

Data Format: Hardcopy ☐ Text ☐ Excel ☐

Delivery: Mail ☐ Email ☒ Fax ☐ Phone ☐

Comments:

Data Compiled By: Margaret Filardo **Date:** 11/9/2011

Request # 85

The Fish Passage Center
Fish Passage Center
1827 NE 44th Avenue, Suite 240
Portland, OR 97213
USA

November 8, 2011

Three hydro power stations have been proposed for construction in the Thjorsa River, South Iceland. The combined effects of the three proposed power projects will dramatically change the present river and, therefore, we are concerned regarding the potential impacts on the future survival of North Atlantic Salmon (*Salmo salar*). There are some questions that we have regarding the impact of these power stations on our salmonid species and were hoping you could address the following questions based on your experience with hydro power stations on the Columbia River.

1. We have been provided with the following information: "Example of places where bypass channels have provided good results in coloured water are Bonneville Dam and Lower Granite Dam in the Columbia River in USA where the survival estimate of smolts that go through bypass channels is 98-99% according to measurements." Are there any studies that have been conducted that explain what percentage of juvenile salmon smolts passing these projects would be expected to enter these bypass channels?

2. Can we expect that the juvenile survival estimates calculated at the dam bypass structure of 98-99%, and through Kaplan Turbines of 85-90%, to be sufficient to describe the total effects of these hydro power projects on salmon survival? Would there be additional effects of hydro power project passage on survival to the adult return stage?

3. Downstream of the Urridafoss project there will be a reduced water flow, down to only 10 m^3/s, which is a dramatic decrease from the 360 m^3/s which is the natural average stream flow of the river. These lower flows will continue over natural barriers, such as the Urridafoss waterfall. Have you observed any similar situations on the Columbia River and do you have any information describing the potential impacts to adult salmon migrants? Will this create low flow barriers to fish passage? Can you estimate the potential extent of these barriers?

Are the numbers of salmon caught (here by both net and rod) an appropriate way to monitor salmon abundance?

Sincerely,

Orri Vigfússon

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

NATIONAL WILDLIFE FEDERATION, ***et al.***,

Plaintiffs,

v.

NATIONAL MARINE FISHERIES SERVICE, ***et al.***,

Defendants.

Case No. 3:01-cv-0640-SI

OPINION AND ORDER

Todd D. True and Stephen D. Mashuda, EARTHJUSTICE, 705 Second Avenue, Suite 203, Seattle, WA 98104; Daniel J. Rohlf, EARTHRISE LAW CENTER, Lewis & Clark Law School, 10015 S.W. Terwilliger Boulevard, MSC 51, Portland, OR 97219. Of Attorneys for Plaintiffs.

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Michael H. Simon, District Judge.

Intervenor-Plaintiff State of Oregon ("Oregon") and Plaintiffs (collectively, "Spill Plaintiffs") move under the Endangered Species Act ("ESA") for an injunction requiring the Federal Defendants to provide spring spill beginning in 2017 for each remaining year of the remand period at the maximum spill level that meets, but does not exceed, total dissolved gas ("TDG") criteria allowed under state law ("spill cap") as follows: (1) from April 3 through June 20 at Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams; and (2) from April 10 through June 15 at Bonneville, The Dalles, John Day, and McNary dams. The Spill Plaintiffs request this spill be on a 24-hour basis using the most advantageous pattern to reduce TDG. The requested injunction, however, would allow for reductions in spill below the spill cap by the Army Corps of Engineers ("Corps") under certain involuntary spill conditions or to address specific biological constraints, provided there is no objection from any member of the Fish Passage Advisory Committee ("FPAC"). The Spill Plaintiffs also move for an injunction requiring the Federal Defendants to operate the juvenile bypass and related Passive Integrated Transponder ("PIT") tag detection system beginning March 1 of each year, commencing in 2017. Currently, this system begins in mid- to late March. The Nez Perce Tribe supports both motions.

Plaintiffs also move under the National Environmental Procedure Act ("NEPA") for an injunction prohibiting the Corps from expending any additional funds on: (1) two planned projects at Ice Harbor Dam, expected to cost approximately $37 million; and (2) any new capital improvement projects or expansion of existing projects at any of the four Lower Snake River dams that would cost more than one million dollars, in the absence of prior approval from the Court. Oregon and the Nez Perce Tribe also support this motion. For the following reasons, both motions are granted in part and denied in part.

STANDARDS

A. Permanent or Preliminary Injunction

Plaintiffs and Oregon explain that they seek "permanent" injunctions until the Federal Defendants comply with the ESA and NEPA. The Federal Defendants, Intervenor-Defendants, and the *Amici Curiae* who oppose the requested injunctions (collectively, "Defendants") variously discuss both preliminary and permanent injunction standards.

A plaintiff seeking a permanent injunction must show:

> "(1) that it has suffered an irreparable injury; (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) that considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction."

Cottonwood Envt'l Law Ctr v. U.S. Forest Svc., 789 F.3d 1075, 1088 (9th Cir. 2015) (quoting *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006)).

When seeking a preliminary injunction, a plaintiff must show that: (1) he or she is likely to succeed on the merits; (2) he or she is likely to suffer irreparable harm in the absence of preliminary relief; (3) the balance of equities tips in his or her favor; and (4) that an injunction is in the public interest. *Winter v. Nat. Res. Defense Council, Inc.*, 555 U.S. 7, 20 (2008). In the Ninth Circuit, a plaintiff seeking a preliminary injunction alternatively may show "'serious questions going to the merits' and a hardship balance that tips sharply toward the plaintiff, assuming the other two elements of the *Winter* test are also met." *All. for the Wild Rockies v. Cottrell,* 632 F.3d 1127, 1132 (9th Cir. 2011). The standard for a permanent injunction is similar, but not identical, to the standard required for a preliminary injunction. *See Amoco Prod. Co. v. Vill. of Gambell*, 480 U.S. 531, 546 n. 12 (1987) ("The standard for a preliminary injunction is

essentially the same as for a permanent injunction with the exception that the plaintiff must show a likelihood of success on the merits rather than actual success.").

Injunctions, such as those sought by Plaintiffs and Oregon, are not preliminary in the conventional sense because the Court has already decided the merits of this case. The relief now being sought, however, also is not permanent in the conventional sense because it may be lifted after the Federal Defendants comply with the Court's remand order by preparing a new biological opinion and following NEPA. *See S. Yuba River Citizens League v. Nat'l Marine Fisheries Serv.*, 804 F. Supp. 2d 1045, 1052 (E.D. Cal. 2011). Thus, in practical effect, Plaintiffs seek "interim injunctive measures." *Id.* Because the Court has already decided the merits of the ESA and NEPA claims in this case, the Court finds the factors for granting permanent injunctive relief to be more appropriate in considering the pending motions, but notes that the requested injunctions will be in place only for a limited duration.[1]

B. Injunction Under the ESA

When considering a motion for an injunction under the ESA, "the ESA strips courts of at least some of their equitable discretion in determining whether injunctive relief is warranted." *Cottonwood*, 789 F.3d at 1090. In *Cottonwood*, the Ninth Circuit discussed the Supreme Court's decision in *Tennessee Valley Authority v. Hill*, 437 U.S. 153 (1978), and explained how Congress in that case "remove[d] several factors in the four-factor test from a court's equitable jurisdiction." The Ninth Circuit stated:

[1] Many Defendants also argue that the Court should apply the heightened standard for a "mandatory" injunction because the Spill Plaintiffs request the Corps to take affirmative action that is different from the "status quo." The states of Idaho and Montana, however, concede that the "law of the case" requires application of the regular, or "prohibitory," injunction standard because that is the standard that Judge Redden and the Ninth Circuit previously used in this case. In addition, it is the "status quo" that is alleged to be harming the listed species, which is the harm to be mitigated. *See Wash. Toxics Coal. v. Envtl. Prot. Agency*, 413 F.3d 1024, 1035 (9th Cir. 2005).

> *Hill* held that courts do not have discretion to balance the parties' competing interests in ESA cases because Congress "afford[ed] first priority to the declared national policy of saving endangered species." 437 U.S. at 185. *Hill* also held that Congress established an unparalleled public interest in the "incalculable" value of preserving endangered species. *Id.* at 187-88. It is the incalculability of the injury that renders the "remedies available at law, such as monetary damages . . . inadequate." *See eBay*, 547 U.S. at 391.

Cottonwood, 789 F.3d at 1090 (alterations in original). The Ninth Circuit concluded that although three of the four injunction factors are presumed in an ESA case, "there is no presumption of irreparable injury where there has been a procedural violation in ESA cases." *Id.* at 1091. The Ninth Circuit noted, however, that "in light of the stated purposes of the ESA in conserving endangered and threatened species and the ecosystems that support them, establishing irreparable injury should not be an onerous task for plaintiffs." *Id.*

If a court determines that injunctive relief is warranted, such relief must be tailored to remedy the specific harm. *Melendres v. Arpaio*, 784 F.3d 1254, 1265 (9th Cir. 2015) ("We have long held that injunctive relief must be tailored to remedy the specific harm alleged." (quotation marks omitted)). "Nevertheless, the district court has broad discretion in fashioning a remedy." *Id.* Further, an "enjoined party's history of noncompliance with prior orders can justify greater court involvement than is ordinarily permitted." *Id.* (quotation marks omitted).

C. Injunction Under NEPA

In considering injunctions under NEPA, a court applies the normal four-factor test. The Supreme Court has clarified, however, that courts may not put their "thumb on the scales" in considering injunctive relief under NEPA and may not presume any factor as being met or that an injunction is the proper remedy. *Monsanto Co. v. Geertson Seed Farms*, 561 U.S. 139, 157 (2010).

BACKGROUND

This case has a long history.[2] Its background is well known to the parties and was discussed in the Court's most recent Opinion and Order, which resolved the parties' cross-motions for summary judgment ("2016 Opinion"). *See NMFS V*, 184 F. Supp. 3d at 869-72, 879-83. Six biological opinions and supplemental biological opinions[3] relating to the operation of the Federal Columbia River Power System ("FCRPS") have been invalidated in this case by three different federal district judges. Throughout the history of this litigation, the Court has expressed significant concern regarding the harm caused to ESA-listed species of salmonids by the operation of the dams on the lower Columbia and Snake rivers.

As relevant here, in its 2016 Opinion, the Court concluded that NOAA Fisheries violated the ESA by adopting the 2014 Biological Opinion ("2014 BiOp"), in part because the 2014 BiOp: (1) relied on an unsound methodology for evaluating whether operations of the FCRPS would jeopardize the continued existence of the listed species; (2) did not adequately take into account ongoing low abundance levels; (3) did not rationally address recovery; (4) did not adequately consider declining recruits-per-spawner (or returns-per-spawner); (5) relied on immediate, specific numeric survival improvements from uncertain habitat improvement actions with uncertain benefits, without allowing any "cushion" in case all of the actions or their

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[2] Several previous court opinions from this case will be discussed in this Opinion and Order. They are: *Nat'l Wildlife Fed. v. Nat'l Marine Fisheries Serv.*, 2005 WL 1398223, at *3 (D. Or. June 10, 2005) (granting in part preliminary injunction regarding spill) ("*NMFS I*"), *aff'd in part by* 422 F.3d 782, 788-93 (9th Cir. 2005) ("*NMFS II*"); *Nat'l Wildlife Fed. v. Nat'l Marine Fisheries Serv.*, 524 F.3d 917, 924 (9th Cir. 2007) (invalidating 2004 BiOp) ("*NMFS III*"); *Nat'l Wildlife Fed. v. Nat'l Marine Fisheries Serv.*, 839 F. Supp. 2d 1117 (D. Or. 2011) (invalidating 2008 and 2010 BiOps) ("*NMFS IV*"); *Nat'l Wildlife Fed. v. Nat'l Marine Fisheries Serv.*, 184 F. Supp. 3d 861, 869-72, 879-83 (D. Or. 2016) (invaliding 2014 BiOp) ("*NMFS V*").

[3] These biological and supplemental biological opinions were issued in 1993, 2000, 2004, 2008, 2010, and 2014.

expected benefits were not realized during the BiOp period; and (6) did not adequately consider the effects of climate change. *Id.* at 898-923. The Court also concluded that the Corps and the Bureau of Reclamation ("BOR") violated NEPA by failing to prepare a single (or comprehensive) environmental impact statement ("EIS"). The Court sought further briefing on the appropriate timing for NEPA compliance and ultimately ordered a five-year schedule, as requested by the Federal Defendants.

DISCUSSION

A. Federal Rule of Civil Procedure 60(b)

Defendants argue that Plaintiffs' and Oregon's motions must be denied because they fail to meet the requirements of Federal Rule of Civil Procedure Rule 60(b). Plaintiffs and Oregon dispute that Rule 60(b) even applies. The Court need not determine whether Rule 60(b) applies because even if it does, the Court would allow Plaintiffs and Oregon to proceed with their motions under Rule 60(b)(6).

In the 2016 Opinion, the Court invited supplemental briefing on "proposed timing for a reasonable NEPA process and other arguments regarding the scope of appropriate injunctive relief relating to NEPA." *NMFS V*, 184 F. Supp. 3d at 948. Although the Court was aware that in the past there had been allegations that the Federal Defendants had not complied with agreed-upon spill, no issue related to spill was before the Court, and to the Court's knowledge no such problems had occurred in recent years. Thus, the Court was not immediately concerned with crafting an injunction relating to spill, but was instead focused on an appropriate NEPA injunction and its timing.

In responding to the Federal Defendants' proposal regarding the timing of NEPA compliance, Plaintiffs and Oregon (in a joint brief) raised the possibility of requesting the

injunctions they seek in the pending motions. ECF 2074 at 23-26. In response, the Federal Defendants stated:

> Plaintiffs devote over three pages to pondering whether injunctive relief may be appropriate. *Plaintiffs are free to move the Court for relief if at some future point they deem it necessary.* But they have not done so now, and the Court should not delay entering an order providing a deadline for completing the NEPA process so that the parties and region can move forward in addressing the Court's May 4, 2016 Opinion.

ECF 2078 at 34-35 (emphasis added).

The Court and the parties then focused their immediate efforts on finalizing a remand order that established the timing for NEPA compliance, instead of briefing the additional injunctions now sought by Plaintiffs and Oregon. The Federal Defendants expressly acknowledged that Plaintiffs and Oregon could move the Court at a later time for such injunctions rather than slowing down the process of completing the Court's order establishing the NEPA deadlines.

Additionally, the Court expressly retained jurisdiction over this case to ensure that the Federal Defendants: (1) develop appropriate mitigation measures to avoid jeopardy (which could potentially include additional spill); (2) produce and file a biological opinion that complies with the ESA and APA; and (3) prepare an EIS that complies with NEPA (which could potentially include requiring that the agencies avoid limiting the choice of reasonable alternatives and committing resources that prejudice the selection of alternatives). *NMFS V*, 184 F. Supp. 3d at 950. Accordingly, assuming without deciding that Rule 60(b) applies, the Court finds that these reasons constitute "other reason[s] that justif[y] relief." Fed. R. Civ. P. 60(b)(6).

B. Whether the Corps and BOR violated the ESA

In the 2016 Opinion, the Court did not expressly address Plaintiffs' Second Claim for Relief in their Seventh Amended Complaint, which alleges that the Corps and BOR violated

Section 7 of the ESA by relying on the 2008, 2010, and 2014 BiOps without conducting an independent analysis to ensure that their activities did not jeopardize the listed species. Defendants argue that this means that Plaintiffs did not prevail on this claim.[4] Plaintiffs argue that it can be implied that they did prevail because these BiOps have been invalidated by the Court, and if it cannot be so implied, the Court should now so find.

In the conclusion of the 2016 Opinion, the Court stated that Defendants' "motions are granted with respect to the claims that NOAA Fisheries did not violate the ESA and the APA in determining in the 2014 BiOp that the RPA does not adversely modify critical habitat and is not likely adversely to affect endangered Southern Resident Killer Whales, *and are denied in all other respects*." *NMFS V*, 184 F. Supp. 3d at 950 (emphasis added). Thus, it cannot reasonably be interpreted that in the 2016 Opinion, the Court ruled for the Federal Defendants on this claim and found that the Corps and BOR did not violate the ESA.

In the 2016 Opinion, the Court invalidated the 2014 BiOp, on which the Corps and BOR relied in issuing their 2014 Records of Decision. Notably, in granting Plaintiffs' motions for summary judgment, the Court did not include any similar limitation as it did in granting the Defendants' motions. The Court described the motions it was granting without denying Plaintiffs' motions in all other respects. Thus, even though the Court did not expressly grant Plaintiffs' motion that the Corps and BOR violated the ESA, that conclusion is reasonably implied from the 2016 Opinion.

To the extent it cannot reasonably be implied from the 2016 Opinion, the Court now so finds. The evidence shows that in reaching their 2014 Records of Decision, the Corps and BOR did not conduct any independent analysis but solely relied on the now-invalidated 2014 BiOp.

[4] The Court focused on the arguments emphasized by the parties in their summary judgment briefs. Any failure specifically to address this claim was inadvertent.

This is a violation of the ESA, for the same reasons previously described by Judge Redden regarding an earlier biological opinion:

> In my May 2005 opinion, I found the 2004 BiOp violates the ESA. I now conclude that, in light of their reliance on the 2004 BiOp, the Record of Consultation and Statement of Decision (ROD) issued by the Corps on January 3, 2005, and the ROD issued by the BOR on January 12, 2005, also violate the ESA . . . . The RODs provide no specific analysis nor point to any record evidence to support the assertion that the action agencies conducted independent assessments and reached independent and rational conclusions in adopting them. The RODs reveal that these agencies embraced the same fundamental legal flaws that NOAA attempted to use to justify its circumscription of the action subject to jeopardy analysis. I find, therefore, that in substance the RODs relied on the no-jeopardy finding of the 2004 BiOp without an independent rational basis for doing so.

NMFS I, 2005 WL 1398223, at *3.

C. Spill Injunction

1. Irreparable Harm

The Federal Defendants repeatedly have concluded that the operations of the FCRPS jeopardize the listed species—thus the need for reasonable and prudent alternatives ("RPA") in the biological opinions. In the 2016 Opinion, the Court emphasized that despite the 73 RPAs from the 2008 and 2014 BiOps, the most recent data shows that the listed species remain in a "precarious," "imperiled," and "perilous" state. *See NMFS V*, 184 F. Supp. 3d at 872, 876, 879, 890, 892, 918, 947 (citing relevant data); *see also NMFS III*, 524 F.3d at 933 (emphasizing the "highly precarious status" of the species at issue in this case).

In light of the ongoing imperiled status of the listed species, the Court does not find any reason to disturb the following finding of Judge Redden in his 2011 Opinion and Order:

> As I have previously found, there is ample evidence in the record that indicates that the operation of the FCRPS causes substantial harm to listed salmonids. . . . NOAA Fisheries acknowledges that the existence and operation of the dams accounts for most of the

> mortality of juveniles migrating through the FCRPS. As in the past, I find that irreparable harm will result to listed species as a result of the operation of the FCRPS.

NMFS IV, 839 F. Supp. 2d at 1131. Accordingly, continuation of the status quo is likely to result in irreparable harm to the listed species.[5]

The Federal Defendants and some intervenors argue that the Spill Plaintiffs must prove that operating with Court-ordered spill during the next two years will pose an imminent threat at the species level. This is not the appropriate standard. As the Ninth Circuit discussed in affirming Judge Redden's previous spill order, after the Court has found that the operation of the FCRPS causes irreparable harm to the species and has invalidated the governing biological opinion, the Court is faced with the choice of either allowing an operation that violates the ESA to continue or ordering modifications. *NMFS II*, 422 F.3d at 796. The Ninth Circuit gave no indication that to order modifications would require a separate finding that during the time remaining in the remand period the species is in imminent danger of becoming extinct or that only the operations relating to the proposed modification (*e.g.*, spill) must be causing the irreparable harm.[6] To do so runs contrary to the ESA. *See Nat'l Wildlife Fed. v. Burlington N. R.R.*, 23 F.3d 1508, 1512 n. 8

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[5] Defendant-Intervenor RiverPartners argues that the Spill Plaintiffs must connect any harm to the species to themselves and that they have failed to do so. RiverPartners cites in their brief, and relied on at oral argument, *Idaho Rivers United v. United States Army Corps of Engineers*, 156 F. Supp. 3d 1252 (W.D. Wash. 2015), for this proposition. *Idaho Rivers*, however, is inapposite. In that case, the court found that the plaintiffs had adequately shown that harm to the species, the lamprey, would affect the Nez Perce Tribe. *Id.* at 1260-61. What the plaintiffs did not show was that the lamprey was at risk of irreparable harm. *Id.* at 1261-62. Thus, because the plaintiffs' harm was derivative of the lamprey's harm, and harm to the lamprey was not shown, harm to the plaintiffs was not shown. *Id.* Here, the Court has found harm to the listed species. Thus, *Idaho Rivers* is distinguishable. The Court also finds that the Spill Plaintiffs have adequately shown how harm to the listed species will affect the Spill Plaintiffs.

[6] To the contrary, even though the injunction at issue involved only spill, Judge Redden and the Ninth Circuit considered the harm caused by the full operation of the FCRPS, not just spill or lack thereof.

(9th Cir. 1994) ("We are not saying that a threat of extinction to the species is required before an injunction may issue under the ESA. This would be contrary to the spirit of the statute, whose goal of preserving threatened and endangered species can be achieved through incremental steps."). Additionally, as the Court has already found, operation of the FCRPS jeopardizes the listed species at a species level—the dams are the largest source of mortality of juveniles. Moreover, even if the operation of the FCRPS did not jeopardize the species, proving harm to the entire species is not necessary for an injunction under ESA Section 7, rather "[e]vidence that the [listed] salmon will suffer imminent harm of any magnitude is sufficient to warrant injunctive relief." *Yurok Tribe v. United States Bureau of Reclamation*, 2017 WL 512845, at *24 (N.D. Cal. Feb. 8, 2017) (citing *Big Country Foods, Inc. v. Bd. of Educ.,* 868 F.2d 1085, 1088 (9th Cir. 1989); *Nat'l Wildlife Fed. v. Burlington N. R.R.*, 23 F.3d 1508, 1512 n.8 (9th Cir. 1994); *Marbled Murrelet v. Babbitt*, 83 F.3d 1060, 1066 (9th Cir. 1996)). This is not a case where the court is considering the loss of only a small number of animals within the listed species. *See, e.g.*, *Defenders of Wildlife v. Salazar*, 812 F. Supp. 2d 1205, 1209-10 (D. Mont. 2009) (concluding that the loss of a few individual wolves did not constitute irreparable harm when there was no evidence that the loss "would be significant for the species as a whole").

2. Other Injunction Factors

The ESA "strips" the Court of the equitable discretion to weigh the other traditional factors relating to injunctive relief. *Cottonwood*, 789 F.3d at 1090. The Court does, however, consider Defendants' arguments relating to the potential harm to the listed species and to human life versus the benefits asserted by the Spill Plaintiffs in evaluating the appropriate injunctive relief. As instructed by the Supreme Court and the Ninth Circuit, however, the Court does not weigh the public interest or balance the equities, for example by weighing any potential

implications on the power system or costs to the Federal Defendants. *Id.* And the Court presumes that monetary damages are insufficient. *Id.*

3. Whether Injunctive Relief is Appropriate

The current situation is similar to the situation that was before the Ninth Circuit when it affirmed in part Judge Redden's previous injunction in this case relating to spill. *See NMFS II*, 422 F.3d at 795-99. The Court has invalidated the 2014 BiOp, found that the listed species remain in an imperiled state, and concluded that continued operation of the FCRPS is likely to result in irreparable harm to the listed species. The question now before the Court is "what interim remedy [is] appropriate to redress the ESA violations." *Id.* at 795. As before, one of the "primary complications of this case is that the operations in question are, by necessity, ongoing." *Id.* This means that the Court is

> faced with a continuing operation that it had concluded would cause irreparable harm to threatened species. Thus, the district court [is] confronted with two choices: (1) continue the status quo, the foundation of which the court had rejected as violative of the ESA and the continuation of which it had concluded [is likely to] irreparably harm listed species, or (2) order modifications.

Id. at 796.

The Court intends to order modifications. As discussed in the 2016 Opinion, the listed species are highly vulnerable for many reasons, including because they have precariously remained at low abundance for some time, are susceptible to devastating effects from climactic events, such as occurred in 2015, and are without any survival "cushion" in the 2014 BiOp and its RPAs.

4. Whether Additional Spill is Supported

All parties agree that previously-ordered spill has generated survival benefits and has been good for salmonid survival. The current dispute lies in whether the benefits of *additional*

spill has undergone sufficient study and is sufficiently supported. The parties, intervenors, and *amici* provide competing expert declarations discussing the purported benefits and potential downsides of additional spill. Additionally, the Spill Plaintiffs primarily rely on the Comparative Survival Study ("CSS") annual reports, workshops, and other analyses that study and hypothesize that additional spill will provide significant increased juvenile survival and adult returns, and Defendants primarily rely on the Independent Scientific Advisory Board's ("ISAB")[7] February 20, 2014, review of a spill experiment proposal based on a 2013 CSS study.

The spill experiment proposal reviewed by ISAB involved spill at higher levels than requested in the current injunction—125 percent of TDG in the tailrace of each dam. The current request is for 115 percent in the forebay and 120 percent in the tailrace. As the Spill Plaintiffs point out, the Corps itself has explained that spill at this level is safe:

> The GBT monitoring program has consistently shown over the years of implementation that signs of GBT are minimal when TDG is managed to the criteria levels of 115/120 percent TDG. Historically signs of GBT do not approach the action criteria until TDG levels are near 130 percent supersaturation levels in the tailraces, or forebays, of dams. The 2013 TDG was managed close to the 115/120 percent criteria, and the low incidence of signs of GBT observed this year reflects that management.

ECF 2165-4 at 14 (Bowles Reply Decl. Ex. 8 at 14).

Additionally, a close review of ISAB's critique shows that ISAB's primary concern was that the spill experiment proposal was not a detailed study with a hypothesis, study design, consideration of various approaches, updated data, monitoring, and adaptive management. *See* ECF 2146 (ISAB report). ISAB concluded that it lacked sufficient information to answer basic questions regarding the study, such as whether it had an adequately researched hypothesis. *Id.*

[7] ISAB serves NOAA Fisheries and others by providing independent scientific advice and recommendations regarding relevant scientific issues.

at 97 (report at 4). The underlying concept that increased spill may well benefit salmonids, however, was not rejected. To the contrary, ISAB noted:

> Despite these concerns with the statistical analyses used to support implementation of the spill test, it appears that the increased spill hypothesis stands as a possible candidate for testing. Other changes to hydrosystem operations have so far been inadequate to meet SAR targets required to conserve endangered salmon populations, even with structural changes that have been made at the dams such as surface spill weirs. It appears that increasing the amount of water spilled at lower Columbia and Snake River dams has merit as a hypothesis to test, but additional review of literature and analysis of data would be worthwhile.
>
> Increasing spill is expected to allow a greater proportion of migrants to avoid the powerhouse intakes and speed their migration through forebays.

Id. at 98 (ISAB report at 5). ISAB also stressed the importance of monitoring and adaptive management in this type of experiment. *Id.* at 100-101 (ISAB report at 7-8).

Thus, ISAB concluded that additional spill appears to have merit and is worth testing. ISAB is not alone in this conclusion. Others, in addition to the CSS, have similarly called for increasing spill, or at least for testing increased spill. *See* Howard A. Schaller, *et al.*, *Evaluating River Management During Seaward Migration to Recover Columbia River Stream-type Chinook Salmon Considering the Variation in Marine Conditions*, Can. J. Fish. Aquat. Sci. Vol. 71 (2014) ("Our study highlights the importance of considering river management options in face of variable ocean conditions for Snake River Chinook salmon. In particular, our retrospective SRI [survival rate index] regression results, and those of Petrosky and Schaller (2010) and Haeseker et al. (2012) suggest that hydrosystem-related direct and delayed mortality may be reduced substantially through actions (e.g. spill, surface passage, increases in water velocity through drawdown, or dam removal) that reduce the number of powerhouse passages, speed water velocity, and juvenile migrations, as well as reduce reliance on juvenile collection and

transportation. . . . A practical management experiment would be to evaluate increasing managed spill levels at the dams during the spring migration period and evaluate the population responses on the results of empirical survival estimates (Haeseker et al. 2012).") (NMFS037802); Steven L. Haeseker, *et al.*, *Assessing Freshwater and Marine Environmental Influences on Life-Stage-Specific Survival Rates of Snake River Spring-Summer Chinook Salmon and Steelhead*, Transactions of the American Fisheries Society, 141:1, 121-38 (2012) ("In conclusion, the models that were developed for characterizing variation in overall life cycle morality rates indicate that increases in spill levels and reductions in water transit times are expected to increase stage-specific survival rates . . . as well as cumulative smolt-to-adult survival rates. Across a range of ocean conditions, higher spill levels and reductions in water transit time are expected to result in higher SARs than would occur with lower spill levels and higher water transit times. . . . These predictions would provide quantitative, testable hypotheses on the predicted survival responses that could occur under a true adaptive management experiment conducted within the FCRPS, where spill and water transit times are extended beyond the range of available data and the resulting survival rates are monitored to determine whether the expected increases are realized.") (NMFS012460); C.E. Petrosky and H.A. Schaller, *Influence of River Conditions During Seaward Migration and Ocean Conditions on Survival Rates of Snake River Chinook Salmon and Steelhead*, Ecology of Freshwater Fish 19:520-36 (2010) ("Given projections for degrading ocean conditions (i.e., global warming), our analysis suggests that a precautionary management approach would focus on improving in-river migration conditions by reducing WTT [water travel time], relying on increased spill to reduce passage through powerhouse turbines and collection/bypass systems, or other actions that would increase water

velocity, reduce delay at dams and substantially reduce FTT [fish travel time] through the FCRPS.") (NMFS035961).

Despite these widespread calls for testing increased spill, the Federal Defendants do not appear to have crafted any such experiment. At oral argument, counsel for the Federal Defendants indicated that in response to the 2016 Opinion, they "heard the Court," are moving forward to "solve these issues," have been "prodded" in the direction of additional spill, and thus additional spill may be considered as an action for the next biological opinion. But, as the Court has repeatedly found over the last 20 years, the listed species are in need of additional survival protections now. "Kicking the can down the road" after invalidating each of the FCRPS biological opinions, although necessary under the circumstances of this case, provides little protection to the listed species that are in an ongoing state of peril. As Judge Redden found in 2005, however,—over the Federal Defendants, intervenors, and *amici's* vigorous objections—spill is something that can offer immediate survival benefit and is worth trying. That conclusion by Judge Redden has proven accurate, as all parties now agree. The Court finds it similarly applicable today, if implemented appropriately.

The Court also finds particularly instructive the Declaration of Bill Tweit, submitted in support of the State of Washington's *opposition* to the requested injunction. Mr. Tweit states that "there is a growing scientific body of evidence from the decades of data on the beneficial value of spill at the higher levels seen in recent in years in promoting juvenile survivals and subsequent adult returns." ECF 2137 at 2 (Decl. ¶ 2). He continues, noting that "[c]onducting effective scientific investigations, while also allowing operators and fish managers the latitude to make in-season modifications as necessary to protect out-migrating and returning salmonids from unforeseen circumstances, is complex and requires flexibility." *Id.* (Decl. ¶ 3). Mr. Tweit

recognizes the "increasing consensus among federal, state, and tribal researchers and fish managers that increased spill has the *potential* to appreciably increase the probability that Snake River spring/summer Chinook and steelhead" will attain significant survival improvement. *Id.* at 10 (Decl. ¶ 15). He notes that Oregon's proposal of additional spring spill "is credible, and deserving of further scientific investigation." *Id.* at 10 (Decl. ¶ 16). He adds, however, that it is problematic in "that it treats spill as a uniform variable at each of the FCRPS dams, but it is well known that each dam must also be considered individually in designing spill operations, particularly at the higher levels of spill proposed by Oregon." *Id.* He concludes by stating that "[i]t is prudent to take the time necessary to craft a spill experiment . . . to maximize benefits [and] minimize costs and impacts" and that "[i]deally, the work to develop a new spill regime would be scheduled with a goal to implement by the 2018 migration season and carried forward into a the new bridge biological opinion beginning in 2019[.]" *Id.* at 13 (Decl. ¶ 23). Thus, Mr. Tweit (and the State of Washington) did not dispute the science behind the Spill Plaintiffs' request, only the timing and specific method of implementation.

The concerns expressed by Mr. Tweit are not unique to him. In reviewing the voluminous record relating to this motion, the Court notes that much of the opposition to the injunction is not based on a concern that increased spill at the requested level will necessarily harm salmonids, but instead on "rushing" the process, treating spill at all eight dams the same, and changing the adaptive management process to one that allows Oregon an operational "veto." As Ritchie J. Graves, Chief of the Columbia Hydropower Branch for the NMFS West Coast Region (Interior Columbia Basin Office) states in his Reply Declaration, he is not opposed to operational studies to reduce mortality; he is "opposed to 'rushing' into an action that could be detrimental to fish or that would provide no ability to scientifically assess the effectiveness of the action." ECF 2181

at 2 (Reply Decl. ¶ 2); *see also* ECF 2139 at 31 (Graves Decl. ¶ 71) (noting that NMFS is "prepared to engage our partners through the regional forum process" and others as needed regarding testing increased spill in a "rigorous" and "thoroughly vetted" manner).

There is nothing in the record to indicate that the current spill level is the precise or "magic" level that achieves all the possible survival benefits with the minimum of risk. The CSS analyses support that there will be beneficial effects of increasing spill to the spill caps. Defendants do not offer similarly scientific studies showing that the CSS analyses are wrong. Rather they challenge whether the proof relied on by CSS is good enough, properly vetted, or in the correct format. As the court in *Yurok Tribe* concluded, however, in response to similar arguments that evidence of flushing flows was not certain to reduce harm to listed salmon in the Klamath River and had not been "properly tested through a comprehensive scientific process," the ESA does not require perfect knowledge to support an injunction to protect a listed species, rather it requires action to protect a species consistent with the best available scientific information. *Yurok Tribe*, 2017 WL 512845, at *29.

The CSS has studied and described the benefits of increased spill. ISAB and others have encouraged testing of increased spill. Oregon's experts describe the benefits of increased spill. Further, as the State of Washington has acknowledged, there is a growing scientific body of evidence and growing consensus supporting higher levels of spill. Although Defendants provide expert testimony expressing concerns regarding increased spill, most of these concerns can be addressed with an appropriately-tailored injunction. Other expressed concerns are not appropriate in the context of an injunction under the ESA or the Court finds not as compelling as the evidence supporting additional spill. Accordingly, the Court concludes that there is sufficient scientific support for a limited injunction requiring increased spill to benefit the listed species.

5. Tailored Injunctive Relief

a. Timing for additional spill

The Court has found that the ongoing operation of the FCRPS is likely to cause irreparable harm to the listed species. This weighs in favor of granting an immediate injunction. The Court, however, shares many of the concerns raised by Defendants that implementing increased spill beginning April 3, 2017, is too rushed and does not provide sufficient time to ensure that the increased spill will not cause unintended negative consequences.

The Court recognizes that concerns for both human safety and the listed species require calculating appropriate spill patterns in advance of increasing spill. As Defendants describe, the Corps implements spill using particular spill patterns at each dam, and any change to spill can change the spill pattern and result in eddies or other flow issues that might delay or preclude juveniles from downstream migration, prevent adults from upstream migration, and negatively affect navigation through the lock systems.

The Corps has a testing facility in Vicksburg, Mississippi—the Engineer Research and Development Center ("ERDC"). This facility contains scale models of all eight dams and provides the ability to test spill patterns resulting from increased spill. These models also allow testing of spill patterns and flow to determine effects on navigation and the lock systems of the dams, particularly with regard to tug and barge tows. *See* ECF 2154 at 5-6 (Decl. of Robert Rich ¶ 16). Testing at the ERDC can be time-consuming because there are other agencies that use the facility, so one has to get "in the queue;" further, the models have to be repaired or rebuilt, and there are trial-and-error periods of testing spill patterns to find the pattern that is most advantageous. *See id.* at 6 (¶¶ 18-19). Delaying the increase in spill until the 2018 spring migration season provides time for testing and development of appropriate spill patterns that will maximize juvenile migration, minimize harm to juveniles, minimize harm to adult migration, and

protect human life in the navigation system.[8] Intervenor-Defendant Inland Ports and Navigation conceded at oral argument that delaying the increased spill injunction until 2018 would resolve its concerns regarding human safety. The Federal Defendants conceded that delaying until 2018 would resolve concerns regarding having enough time to test for appropriate spill patterns.

The Court also recognizes that each dam is unique and an "across-the-board" approach to spill is likely not the most effective means to increase salmonid survival at each dam. There are specific considerations at each dam that affect both juvenile and adult migration, and providing time to study and prepare for the increase in spill will allow proper analyses on the best methodology for each dam. Additionally, it also allows sufficient time to consider whether there may be other unintended negative consequences unrelated to salmonid survival, such as the concern expressed with erosion relating to Bonneville Dam.

The Spill Plaintiffs have shown a willingness for spill to be tailored to the needs of each dam as Defendants have raised specific concerns (*e.g.*, offering to reduce requested spill at Bonneville to avoid erosion and at John Day to avoid causing an eddy). The problem with this approach is that Defendants have been raising these concerns in a rushed period while briefing the pending motion. There needs to be sufficient time to identify, test, and address the dam-specific spill needs and issues. Although the Court intends to provide for a robust adaptive management program to allow flexibility to respond to such unintended consequences, having adequate time to prepare beforehand should reduce the number and extent of unintended negative consequences and thus will reduce the number of fish that die while awaiting changes to be implemented under adaptive management.

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[8] The Court notes that there must be a way safely to handle navigation during increased spill because there have been times when involuntary spill has been required at levels equal to or greater than those requested by the Spill Plaintiffs.

b. Adaptive management

The Spill Plaintiffs request a new system of adaptive management in which the Corps may make unilateral adjustments to spill under certain involuntary spill conditions and can only make spill adjustment for biological conditions if no member of the FPAC objects. The Court is not inclined at this time to order a new system for implementation, monitoring, and adaptive management of additional court-ordered spill. As explained by Juliet H. Ammann, Chief, Reservoir Control Center, Northwestern Division of the Corps, there is a system currently in place that has been implementing existing court-ordered spill. *See* ECF 2140 at 7-9 (Decl. ¶¶ 16-22). This system includes the Fish Passage Operations and Maintenance group, Technical Management Team ("TMT"), and Regional Implementation Oversight Group ("RIOG"). Specifically, TMT is tasked with recommending real-time operations through monitoring river conditions and provides opportunities for making adjustments. *Id.* at 8 (Decl. ¶ 20). TMT can submit requests to consider changes to planned operations, and if consensus is not reached, RIOG will resolve the issue. *Id.* at 9 (Decl. ¶ 21). The Court also remains available to the parties.

The Spill Plaintiffs offer no evidence that the current system is not sufficiently working to be able to implement additional spill. The Spill Plaintiffs express concern that minority voices need the opportunity to be heard and that current decisionmakers are more policy-focused than science-driven. This latter concern was also echoed by Defendant-Intervenor CSRIA. The Court appreciates that there may be a different system that could be implemented that would include more scientists. But the Court leaves such decisions in the first instance to be made by the experts in the region. Accordingly, at this time, the Court declines to mandate that adaptive management be through a system requiring unanimity among the members of the FPAC. The parties shall confer on an appropriate adaptive management system. If agreement is not reached, the Court will leave the current system (using TMT and RIOG) in place. If, after additional spill

begins, the Spill Plaintiffs or any other party has evidence that the current system is not working, that party may then file a motion with the Court.

c. Spill implementation plan and injunction order

Because the Court is not ordering increased spill to begin until the spring 2018 migration season, the parties and experts in the region have sufficient time to consider an appropriate protocol and methodology for spill at each dam, incorporating the most beneficial spill patterns. Moreover, the Federal Defendants argue that the Spill Plaintiffs' proposed injunction is inappropriate because no shorter-term, within season tests have been performed on any of the dams using increased spill. Now the Federal Defendants have the 2017 spring migration season to conduct short-term tests to consider at least the immediate effects of increased spill. They can evaluate whether unexpected eddies or other problems arise and make immediate adjustments without worrying about being in violation of a court order. These types of tests should inform the experts in the region as they develop appropriate protocols for increased spill in 2018.

The Court will set periodic status conferences to ensure that the parties are making sufficient progress toward a spill implementation plan and proposed injunction order. The Court expects the parties, *amici*, and other regional experts to work together to reach consensus. If the parties cannot reach agreement, the Court will set a briefing schedule and further hearings to resolve any outstanding issues before the 2018 spring migration season.

6. PIT Tag Monitoring

The Spill Plaintiffs assert that there are some indicators that certain listed species are migrating early. The Spill Plaintiffs request that the Federal Defendants begin PIT tag monitoring on March 1 of each year, using established smolt monitoring protocols. The Spill Plaintiffs argue that early monitoring will provide data regarding the important early "tail" of the salmon and steelhead runs, which will help inform future management decisions. The Spill

Plaintiffs offer expert testimony that early monitoring will provide a biological benefit by providing an alternative to turbine passage for outmigrating fish during the pre-spill period and that the early and late tails of a run are particularly important for species diversity. The State of Washington, through its expert Mr. Tweit, agrees that the proposal for earlier PIT tag monitoring "should be considered for immediate implementation. There is strong scientific evidence that the tails of salmon and steelhead runs contain a disproportionate amount of the population traits that support adaptation to environmental changes, such as the conditions witnessed in 2015. Collection of this additional data should begin now . . . ." ECF 2137 at 11 (Decl. ¶ 17).

Defendants do not dispute that early and late tails of a run are important for diversity. Nor do they dispute that there is some evidence that fish are migrating earlier, although they do question the volume of fish that may be migrating early. The primary objections to early PIT tag monitoring are that it is not feasible to begin in 2017 and that Oregon should have made this request through the regional process and not through the Court.

The Court agrees that it is too late this year to begin earlier PIT tag monitoring in 2017. But in light of the importance of the tails of a run for diversity and species adaptation, the Court orders that PIT tag monitoring begin on March 1 of each year of the remand period, beginning in 2018.

D. NEPA Injunction

Plaintiffs argue that the Court should enjoin large capital expenditures at the four Lower Snake River dams because to allow significant sums of money to be spent in long-term investments at the dams for the remaining 4.5 years of the NEPA remand period may result in biased analyses that essentially foreclose the reasonable alternative of breaching, bypassing, or removing dams. Plaintiffs rely primarily on two provisions in NEPA's implementing regulations, 40 C.F.R. §§ 1502.2(f) and 1506.1(a). Section 1502.2(f) provides that: "Agencies shall not

commit resources prejudicing selection of alternatives before making a final decision." Section 1506.1(a) provides that: "Until an agency issues a record of decision as provided in § 1505.2 . . . no action concerning the proposal shall be taken which would: (1) Have an adverse environmental impact; or (2) Limit the choice of reasonable alternatives."

The Court will not enjoin any spending that is necessary for the safe operation of any dam. Regardless of the NEPA process, the Federal Defendants are currently under a statutory obligation to operate the dams and must be allowed to operate them safely. The Court finds that any benefit to the NEPA process in enjoining spending may be outweighed by the risk to human health and safety if dams are not allowed to continue operating in a safe manner. With regard to projects and expenditures that are not required for safe dam operations, however, the Court considers the factors for interim injunctive relief.

1. Success on the Merits

In the 2016 Opinion, the Court found that the Corps and BOR violated NEPA and remanded the case for the agencies to create a single EIS covering FCRPS operations. Thus, Plaintiffs have already succeeded on their underlying NEPA claim.

2. Irreparable Harm

The harm that Plaintiffs seek to redress with this injunction is a biased NEPA process. The Court agrees that generally speaking, this type of harm can be irreparable harm for purposes of a NEPA injunction. The Court is persuaded by the reasoning in *Sierra Club v. Marsh*, 872 F.2d 497, 500 (1st Cir. 1989), which discusses what is sometimes described as the "bureaucratic steamroller" or "bureaucratic momentum" theory, as follows:

> NEPA is not designed to prevent all possible harm to the environment; it foresees that decisionmakers may choose to inflict such harm, for perfectly good reasons. Rather, NEPA is designed to influence the decisionmaking process; its aim is to make government officials notice environmental considerations and take

> them into account. Thus, *when a decision to which NEPA obligations attach is made without the informed environmental consideration that NEPA requires, the harm that NEPA intends to prevent has been suffered*. . . . Moreover, to set aside the agency's action at a later date will not necessarily undo the harm. The agency as well as private parties may well have become committed to the previously chosen course of action, and new information—a new EIS—may bring about a *new* decision, but it is that much less likely to bring about a *different* one. It is far easier to influence an initial choice than to change a mind already made up.
>
> It is appropriate for the courts to recognize this type of injury in a NEPA case, for it reflects the very theory upon which NEPA is based—a theory aimed at presenting governmental decision-makers with relevant environmental data *before* they commit themselves to a course of action. This is not to say that a likely NEPA violation automatically calls for an injunction; the *balance* of harms may point the other way. It is simply to say that a plaintiff seeking an injunction cannot be stopped at the *threshold* by pointing to additional steps between the governmental decision and environmental harm.
>
> In the present case plaintiffs would suffer harm if they were denied an injunction, if the lease sale took place, and if the court *then* held that a supplemental EIS was required. In that event, the successful oil companies would have committed time and effort to planning the development of the blocks they had leased, and the Department of the Interior and the relevant state agencies would have begun to make plans based upon the leased tracts. Each of these events represents a link in a chain of bureaucratic commitment that will become progressively harder to undo the longer it continues. Once large bureaucracies are committed to a course of action, it is difficult to change that course—even if new, or more thorough, NEPA statements are prepared and the agency is told to "redecide." It is this type of harm that plaintiffs seek to avoid, and it is the presence of this type of harm that courts have said can merit an injunction in an appropriate case.

Id. at 500 (quoting *Commonwealth of Massachusetts v. Watt*, 716 F.2d 946, 952-53 (1st Cir. 1983) (emphasis added in *Marsh*)); *see also Friends of the Earth v. Hall*, 693 F. Supp. 904, 913 (W.D. Wash. 1988) (noting that "the risk of bias resulting from the commitment of resources prior to a required thorough environmental review is the type of irreparable harm that results from a NEPA violation"); *cf Calvert Cliffs' Coordinating Comm. v. Atomic Energy*

Comm'n, 449 F.2d 1109, 1128 (D.C. Cir. 1971) (noting that where large investments affect the NEPA analysis, the NEPA process becomes a "hollow exercise").

Although the Ninth Circuit has not yet expressly adopted the "bureaucratic steamroller" theory, other district courts in this circuit have found it persuasive. For example, in *Protecting Arizona's Res. & Children ("PARC") v. Fed. Highway Admin.*, 2015 WL 12618411 (D. Ariz. July 28, 2015), the court concluded that "under *Marsh*, the Court may consider bureaucratic momentum as a factor in assessing whether environmental harm is likely to occur based on failure to comply with NEPA procedures." *Id.* at *5.

Moreover, the Ninth Circuit has found that financial commitment can constitute an irretrievable commitment of resources for purposes of NEPA. *See Wildwest Inst. v. Bull*, 547 F.3d 1162, 1169 (9th Cir. 2008). In *Wildwest*, the Ninth Circuit analyzed what it means for an agency to take an action that limits the agency's choice of alternatives, which is prohibited under 40 C.F.R. § 1506.1(a). *Id.* at 1168-69. The court analogized this provision to the provisions that trigger when an EIS must be completed. *Id.* at 1168. In those cases, the court had interpreted an EIS as being required only when an agency has "irreversibly and irretrievably" committed resources. *Id.* (citing *Metcalf v. Daley*, 214 F.3d at 1143 (9th Cir. 2000).

In *Wildwest*, the Ninth Circuit discussed how, in cases analyzing when the need for an EIS has been triggered, the commitment of resources was generally natural resources. *Id.* at 1168-69 (discussing *Metcalf*, 214 F.3d at 1144; *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1063-64 (9th Cir. 1998); *Conner v. Burford*, 848 F.2d 1441, 1446, 1449 (9th Cir. 1988)). It is not surprising that, in cases addressing when an EIS is triggered, the primary issue would often involve a commitment relating to natural resources. NEPA requires an EIS for major federal actions that significantly affect the quality of the human environment. 42 U.S.C.

§ 4332(2)(C). The Ninth Circuit in *Wildwest* extended this line of reasoning from the cases discussing when an agency commitment is sufficient to trigger the need for an EIS to when an agency commitment is sufficient to limit its alternatives under 40 C.F.R. § 1506.1(a). 547 F.3d at 1168-69. Thus, the Ninth Circuit held that an agency's "irreversible and irretrievable" commitment of resources may limit its alternatives under Section 1506.1(a). *Id.* In doing so, the court concluded that financial investment alone can, in some circumstances, be an irreversible and irretrievable commitment of resources. *Id.* at 1169.

Defendants argue that tens of millions of dollars cannot rise to the level of commitment required by *Wildwest* because the Ninth Circuit mentioned, by way of example, a commitment of all or most of an agency's limited budget in preparation for only one alternative. That is unavailing for two reasons. First, the Ninth Circuit was providing only one example of when a financial commitment may be considered limiting an agency's alternatives, and there is no indication that example was meant to be exclusive.

Second, the discussion by the Ninth Circuit in *Wildwest* does not mean that a similar level of commitment is required under 40 C.F.R. § 1502.2(f), which prohibits agencies from "prejudicing" the selection of alternatives. The Court must give meaning to the fact that the agency used the term "prejudicing" in § 1502.2(f) and "limiting" in § 1506.1(a). *Cf. Nat'l Fed'n of.Indep. Business v. Sebelius*, 132 S. Ct. 2566, 2583 (2012) (noting in the context of statutory interpretation that "[w]here Congress uses certain language in one part of a statute and different language in another, it is generally presumed that Congress acts intentionally"). If "prejudicing" alternatives is construed identically as "limiting" alternatives in § 1506.1(a), then § 1502.2(f) would be superfluous. This is contrary to "the canon of construction that courts interpret statutes so as not to render any section meaningless." *Meng Li v. Eddy*, 324 F.3d 1109, 1110 (9th

Cir. 2003) (citing *Beck v. Prupis*, 529 U.S. 494, 506 (2000)); *see also United States v. Harrell*, 637 F.3d 1008, 1010-11 (9th Cir. 2011) (noting that courts must give effect to each word and "must 'mak[e] every effort not to interpret a provision in a manner that renders other provisions of the same statute inconsistent, meaningless or superfluous'" (alteration in original) (quoting *United States v. Cabaccang*, 332 F.3d 622, 627 (9th Cir. 2003) (en banc))).

The term "limiting" connotes a more definitive restriction than does "prejudicing." *See* BLACK'S LAW DICTIONARY (10th ed. 2014) (defining "limit" as: "1. A restriction or restraint. 2. A boundary or defining line. 3. The extent of power, right, or authority." and defining "prejudice" as "1. Damage or detriment to one's legal rights or claims. . . . 2. A preconceived judgment or opinion formed with little or no factual basis; a strong and unreasonable dislike or distrust. — Also termed *preconception*." (emphasis in original)). Thus, the level of commitment required to "limit" an agency's alternatives is higher than the level commitment required to "prejudice" an agency's alternatives. Accordingly, even if it were required for an agency to spend most or all of its budget on one alternative before it could be found to violate § 1506.1(a) (which the Court does not find is necessitated by the holding in *Wildwest*), the Court holds that a lesser commitment may nonetheless violate § 1502.2(f).

The Court noted in the 2016 Opinion that a compliant NEPA analysis in this case "may well require consideration of the reasonable alternative of breaching, bypassing, or removing one or more of the four Lower Snake River Dams." *NMFS V*, 184 F. Supp. 3d at 942. The "touchstone" of NEPA's alternatives analysis is whether the EIS's "selection and discussion of alternatives fosters informed decision-making and informed public participation." *Headwaters, Inc. v. Bureau of Land Mgmt., Medford Dist.*, 914 F.2d 1174, 1180 (9th Cir. 1990) (quotation marks omitted). The reality is that economic considerations are part of that decisionmaking. In

weighing the environmental benefits of removing, breaching, or bypassing the dams, the costs of such actions also likely will be weighed, as well as the costs of operating the dams. That analysis will be affected if the dams require hundreds of millions in expenditures versus having just had hundreds of millions spent in improvements and maintenance. Considering this fact, the "bureaucratic momentum" theory, the constraints on the Corps dictated by § 1506.1(a), and the limitations on the Corps' actions placed by § 1502.2(f), the Court finds that spending hundreds, tens, or even millions of dollars on the four Lower Snake River Dams during the NEPA remand period is likely to cause irreparable harm by creating a significant risk of bias in the NEPA process. *See, e.g.*, *Wildwest*, 547 F.3d at 1169; *Marsh*, 872 F.2d at 500; *Calvert Cliffs'*, 449 F.2d at 1128; *Hall*, 693 F. Supp. at 913.

3. Balancing the Harms and Considering the Public Interest

a. Current Ice Harbor Projects

Plaintiffs challenge two projects at Ice Harbor Dam: Ice Harbor Turbine Runner Design and Replacement and Ice Harbor Stator Winding Replacement. These projects are estimated to cost $37 million in fiscal years 2018 and 2019. Plaintiffs challenge the replacements at two turbines, Units 1 and 3. Plaintiffs do not challenge improvements being made to Unit 2.

Unit 2, which is not being challenged, is being improved with state-of-the-art nonadjustable blades that are designed to improve fish survival. This design, however, is not suitable at all hydraulic flow levels. Thus, at certain hydraulic flows, Unit 2 cannot operate. Currently, Unit 3 also has nonadjustable blades, due to interim repairs that were previously required. Unit 3 thus cannot be the backup unit when hydraulic flows do not allow Unit 2 to operate.

Unit 1 is the operative adjustable blade unit. Unit 1, however, has had failures in recent years. Thus, if it is not replaced, as currently scheduled, it will at a minimum need repair. The

replacement, however, is with an improved adjustable blade design that is intended to increase juvenile fish survival. If the expected improved fish passage is realized, the Corps intends to implement the new design in other FCRPS dams.

Unit 3 also has had failures in recent years. The interim repairs done to keep the turbine operating potentially increase the harm to fish passage and result in less efficient operation. Additionally, even with interim repairs, the turbine performs poorly and needs replacement.

The Court recognizes the importance of an unbiased NEPA process and the chance for all reasonable alternatives to be considered without undue economic influence. These specific Ice Harbor Dam projects, however, have a primary benefit of increasing fish survival. As the Court has repeatedly noted, including in this Opinion and Order in discussing increased spill, the fish are in need of improved survival now. Improvements at Ice Harbor Dam that result in immediate increased survival of listed species are given great weight in balancing the harms and considering the public interest. *Cottonwood*, 789 F.3d at 1090 (noting that saving endangered species is given the highest priority and is of incalculable public interest). Although the Court has found likely irreparable harm from significant expenditures, in considering these specific projects, the Court finds that the balance of harms and public interest weighs against the specific injunction being requested. *See Marsh*, 872 F.2d at 500 (noting that even when irreparable harm is found, it does not necessitate an injunction because "the *balance* of harms may point the other way" (emphasis in original)).

b. Future Projects

The Court cannot evaluate the balance of harms or public interest in unknown future projects. As the Court has noted, it will not enjoin projects that are needed for the safe operation of the dams. The Court also is not inclined to enjoin projects that provide substantial immediate

survival improvement for the listed species. Thus, the Court does not find a blanket injunction against all future projects of more than $ 1 million to be appropriate.

The Court, however, is concerned with the potential for the irreparable harm that the Court has found likely. Accordingly, the Court will require the Federal Defendants to disclose sufficient information to Plaintiffs regarding the planned projects at each dam during the NEPA remand period, at appropriate and regular intervals. If Plaintiffs believe that a project is not needed for safe operation of the dams and substantially may bias the NEPA process, Plaintiffs may file a new motion with the Court to enjoin any such project.

Within 14 days from the date of this Opinion and Order, the Federal Defendants, after conferring with Plaintiffs, shall submit their proposal for a reasonable process and schedule for providing Plaintiffs the information, including timing (quarterly, annually, etc.) and what information should be included in their disclosure to Plaintiffs. Plaintiffs may, at their discretion, file any response or objection within 14 days. Defendants may then have 14 days to reply.

CONCLUSION

The motions for injunctive relief requested by Plaintiffs, including Oregon, (ECF 2112 and 2114) are GRANTED IN PART, as set forth in this Opinion and Order. The Court intends to hold periodic status conferences regarding the increased spill that must take place in 2018 and its related planning before then. Within 28 days, the parties shall confer and file with the Court their joint or separate recommendations for a schedule of periodic status conferences.

IT IS SO ORDERED.

DATED this 27th day of March, 2017.

/s/ *Michael H. Simon*
Michael H. Simon
United States District Judge