February 11, 2014

State Water Resources Control Board
Division of Water Rights
Amanda Montgomery, Manager
Permitting and Licensing Section
P.O. Box 2000
Sacramento, CA 95812

Dear Ms. Montgomery:

EXTERNAL PEER REVIEW OF DRAFT VOLUME DEPLETION APPROACH STUDY

This letter responds to the attached October 16, 2013 request for external scientific peer review for the subject noted above. The review process is described below. All steps were conducted in confidence. Reviewers' identities were not disclosed.

To begin the process for selecting reviewers, I contacted the University of California, Berkeley (University) and requested recommendations for candidates considered qualified to perform the assignment. The University was provided with the October 16, 2013 request letter to me, and attachments, and no additional material was asked for, nor forwarded to augment the request. This service by the University includes interviews of each promising candidate and is supported through an Interagency Agreement co-signed by Cal/EPA and the University.

Each candidate who was both interested and available for the review period was asked to complete a Conflict of Interest (COI) Disclosure form and send it to me for review, with Curriculum Vitae. The cover letter for the COI form describes the context for COI concerns that must be taken into consideration when completing the form. "As noted, staff will use this information to evaluate whether a reasonable member of the public would have a serious concern about [the candidate's] ability to provide a neutral and objective review of the work product."

In subsequent letters to candidates approved as reviewers, I provided the attached January 7, 2009 Supplement to the Cal/EPA Peer Review Guidelines, which, in part serves two purposes: a) it provides guidance to ensure confidentiality through the course of the external review, and, b) it notes reviewers are under no obligation to discuss their comments with third-parties after reviews have been submitted. We recommend they do not. All outside parties are provided opportunities to address a proposed regulatory action, or potential basis for such, through a well-defined rulemaking process.

Later, I sent each reviewer the material to be reviewed and a detailed cover letter to initiate the review (examples attached).

Also attached to the cover letter was the October 16, 2013 request for reviewers to me. Its Attachment 2 was highlighted as the focus for the review. Each reviewer was asked to address each topic, as expertise allows, in the order given. Thirty days were provided for the review. I also asked reviewers to direct enquiring third-parties to me after they have submitted their reviews.

Reviewers' names, affiliations, curriculum vitae, and reviews are being sent to you now with this letter. All attachments can be electronically accessed through the bookmark icon at the left of the screen.

Approved reviewers are as follows:

1) Jeffrey McDonnell, Ph.D.
Professor and Director, Global Institute for Water Security
School of Environment and Sustainability
University of Saskatchewan
11 Innovation Boulevard
Saskatoon, SK S7N 3H5

Telephone: (306) 966-8529
Facsimile: (306) 966-1193
Email: jeffrey.mcdonnell@usask.ca

2) Julian Olden, Ph.D.
Associate Professor
School of Aquatic and Fishery Sciences
University of Washington
1122 NE Boat Street
Seattle, WA 98195

Telephone: (206) 616-3112
Facsimile: (206) 685-7471
Email: olden@u.washington.edu

3) Matthew Reidenbach, Ph.D.
Associate Professor
Department of Environmental Sciences
356 Clark Hall
University of Virginia
291 McCormick Road
Charlottesville, VA 22904

Telephone: (434) 243-4937
Facsimile: (434) 982-2137
Email: Reidenbach@virginia.edu

If you have questions, or require clarification from the reviewers, please contact me directly.

Regards,

Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 “I” Street, 16th Floor
Sacramento, California 95814

Telephone: (916) 341-5567
Fax: (916) 341-5284
Email: GBowes@waterboards.ca.gov

Attachments

1) October 16, 2013 Request by Amanda Montgomery for Scientific Peer Review

2) Example of Letter to Reviewer Initiating the Review
   a) Jeffrey McDonnell, Ph.D., University of Saskatchewan
   b) Julian Olden, Ph.D., University of Washington
      (includes instructions for accessing FTP site)
   c) Matthew Reidenbach, Ph.D., University of Virginia

3) January 7, 2009 Supplement to Cal/EPA Peer Review Guidelines

4) Curriculum Vitae:
   a) Jeffrey McDonnell, Ph.D., University of Saskatchewan
   b) Julian Olden, Ph.D., University of Washington
   c) Matthew Reidenbach, Ph.D., University of Virginia

5) Reviews:
   a) Jeffrey McDonnell, Ph.D., University of Saskatchewan
   b) Julian Olden, Ph.D., University of Washington
   c) Matthew Reidenbach, Ph.D., University of Virginia

ec: Barbara Evoy, Deputy Director
Division of Water Rights
Barbara.Evoy@waterboards.ca.gov

Jim Kassel, Assistant Deputy Director
Division of Water Rights
Jim.Kassel@waterboards.ca.gov

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SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

TO: Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
OFFICE OF RESEARCH, PLANNING AND PERFORMANCE

FROM: Amanda Montgomery
Senior Environmental Scientist
DIVISION OF WATER RIGHTS

Katherine Mrowka
Acting Manager, Permitting and Licensing Section
DIVISION OF WATER RIGHTS

DATE: OCTOBER 16, 2013

SUBJECT: REQUEST FOR EXTERNAL PEER REVIEW OF DRAFT VOLUME DEPLETION APPROACH STUDY

The Division of Water Rights (Division) requests that reviewers be identified and assigned to provide an external peer review of a technical study, hereafter referred to as the "volume depletion approach study". While the study is not required to be peer reviewed per the requirements of Health and Safety Code section 57004, we feel that this study falls within the peer review category, per the Interagency Agreement between Cal/EPA and the University of California, of "scientific products that support regulations, standards, or rules e.g., Critical technical guidance documents for the regulated community".

On May 4, 2010, the State Water Resources Control Board (State Water Board) adopted a Policy for Maintaining Instream Flows in Northern California Coastal Streams (hereafter, referred to as "Policy"), as required by Water Code Section 1259.4. The Policy is administered by the Division, and is applicable to water diversions in a 3-million acre geographic area encompassing coastal watersheds from the Mattole River in Humboldt County southward through Mendocino, Sonoma, Napa, and Marin Counties, and ending at San Francisco Bay in Marin County and San Pablo Bay in Napa County. The Policy contains regional criteria for protection of instream beneficial uses, with emphasis on anadromous fish, and is applied to the administration of water right applications; small domestic use and livestock stockpond registrations; and change petitions.

The purpose of the volume depletion approach study is to provide scientific evaluation of the protectiveness of alternate criteria to the Policy's regional criteria for season of diversion, minimum bypass flow and maximum cumulative diversion. The draft Policy was peer reviewed in February 2008, and included the regional criteria. Approximately one month prior to State Water Board adoption of the Policy, a group of joint stakeholders proposed alternate regional criteria for onstream reservoirs in non-fish bearing streams. The State Water Board included

this alternate regional criteria in the Policy as Sections A.1.8.3, but use of the criteria was generally restricted until: "The State Water Board has completed a study consistent with the language in section 10.4.1 to determine whether or not additional conditions are necessary to protect fisheries resources from the effects of diversion and the applicant agrees to those conditions." Thus, peer review of the volume depletion approach study is warranted, as the conclusions of the study allow use of an alternate regional criteria that was not previously peer reviewed, yet part of the adopted Policy.

A draft volume depletion approach study will be ready for peer review by December 15, 2013. The State Water Board has a contract with Stetson Engineers, Inc. to provide the study. The contract schedule allows for a peer review beginning at the date identified above. Following peer review, the contract schedule provides the contractor a period of time to review and respond (including revision of the report as necessary) to the peer review comments, with the final report due March 31^{t}, 2014. Because of the limited time provided by the contract for completion of the report, we request that the peer reviewers provide comments within 30 days of receipt of the documents.

We recommend that peer reviewers be solicited who have the following essential expertise: fisheries biology, instream flow evaluations, hydrology, and hydrologic modeling. Technical knowledge in the following areas would be helpful: aquatic and terrestrial resources, ecology, and geographic information systems (GIS).

Additional background information for the draft volume depletion approach study is provided in Attachment 1. Scientific issues to be addressed by the peer reviewers are listed in Attachment 2. Attachment 2 will be updated to include study conclusions prior to providing the volume depletion approach study (and references) to peer reviewers. Individuals involved in the development of the volume depletion approach study are identified in Attachment 3. Attachment 4 provides a list of documents to be peer reviewed.

If you have any questions regarding this request, please contact me at (916) 341-5289, or via e-mail at Amanda.Montgomery@waterboards.ca.gov.

Cc: Barbara Evoy, DWR Deputy Director
Jim Kassel, DWR Assistant Deputy Director

Attachment 1
Draft Volume Depletion Approach Study
Summary of Proposed Action

I. Summary

The State Water Board has hired a contractor, Stetson Engineers, Inc. under Contract #11-130-300, to complete a volume depletion approach study. The study is required in the State Water Board's (State Water Board) Policy for Maintaining Instream Flows in Northern California Coastal Streams (Policy). The Policy, approved by State Water Board Resolution No. 2010-0021 on May 4, 2010, contains principles and guidelines for maintaining instream flows for the protection of fishery resources, while minimizing water supply impacts on other beneficial uses of water, such as irrigation, municipal use, and domestic use. The geographic scope of the Policy encompasses coastal streams from the Mattole River to San Francisco and coastal streams entering northern San Pablo Bay, and extends to five counties: Marin, Sonoma, and portions of Napa, Mendocino, and Humboldt Counties. The Policy applies to applications to appropriate water, small domestic use and livestock stockpond registrations, and water right petitions.

Policy section 10.4.1 requires the State Water Board to commence and complete as soon as possible, but within no more than 5 years (from May 2010), a study to determine whether the volume depletion approach described in Policy section A.1.8.3 effectively protects fishery resources. The volume depletion approach is applicable only to onstream reservoirs on Class II and III (non-fish bearing) streams. The criteria in section A.1.8.3 allow diversion to occur without (or with limited) restrictions regarding minimum bypass flow, rate of diversion, or season of diversion, depending on the extent of change in seasonal flow volume in downstream fish bearing streams.

II. Rationale

The Policy did not establish specific instream flow requirements for particular rivers or streams. Nor did it approve any particular water diversion projects, or specify the terms and conditions that will be incorporated into water right permits, licenses, or registrations. Instead, it established guidelines for evaluating the potential impacts of water diversion projects on stream hydrology and biological resources. It included principles to ensure that new water appropriations and changes to existing water right permits and licenses will not affect the instream flows needed for fish spawning, migration and rearing, or the flows needed to maintain natural flow variability, which protects the various biological functions that are dependent on that variability.

Appendix A of the Policy contains guidance for performing a Cumulative Diversion Analysis, which evaluates whether a proposed water diversion, in combination with existing diversions in a watershed, may affect instream flows needed for the protection of fishery resources. Appendix A describes two approaches, (1) a daily flow study, applicable to any type of diversion, that examines the frequency at which instream flows meet or exceed the minimum bypass flows and maximum cumulative diversion criteria established for a particular fish bearing stream; and (2) a second approach, applicable only to onstream reservoirs on Class II and III streams, which allows diversion to occur without (or with limited) restrictions regarding minimum bypass flow, rate of diversion, or season of diversion, depending on the extent of change in seasonal flow volume in downstream fish bearing streams.

The second (alternate) approach, which is detailed in Policy section A.1.8.3, was proposed during the 2010 policy adoption proceedings with limited discussion regarding the

approach's protectiveness on a regional basis. Policy section 10.4.1 requires the State Water Board complete a study to determine whether the volume depletion approach described in Policy section A.1.8.3 effectively protects fishery resources. Use of the alternate approach (section A.1.8.3) is generally restricted until, and based upon, results of the volume depletion approach study.

III. Methodology

The State Water Board administers water rights for a wide variety of applications. Persons requesting water rights can vary from vineyard owners and municipalities, to small diverters, such as people who divert water for domestic or livestock watering use. Because the Policy affects a large geographic area, the volume depletion approach study scope is to evaluate protection of fishery resources impacts of onstream reservoir on Class II and III streams throughout the Policy area.

The volume depletion approach analysis utilized new field data that was collected during 2012 and 2013 and evaluated in combination with hydrologic modeling to complete the assessment of the protectiveness of the alternate criteria in regards to season of diversion, minimum bypass flow and maximum cumulative diversion.

Attachment 2
Draft Volume Depletion Approach Study

Description of Scientific Conclusions to be addressed by Peer Reviewers

The statutory mandate for external scientific peer review (Health and Safety Code Section 57004) states that the reviewer's responsibility is to determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.

We request that you make this determination for each of the following conclusions that constitute the scientific basis of the volume depletion approach study. An explanatory statement is provided for each issue to focus the review.

The State Water Board Division of Water Rights requests that reviewers be identified and assigned to provide an external peer review of a single report (the volume depletion approach study). While the study is not required to be peer reviewed per the requirements of Health and Safety Code section 57004, we feel that this study falls within the peer review category, per the Interagency Agreement between Cal/EPA and the University of California, of "scientific products that support regulations, standards, or rules e.g., Critical technical guidance documents for the regulated community".

The purpose of the volume depletion approach study is to provide scientific evaluation of the protectiveness of alternate criteria to the State Water Board Policy for Maintaining Instream Flows in Northern California Coastal Streams regional criteria for season of diversion, minimum bypass flow and maximum cumulative diversion. The draft Policy was peer reviewed in February 2008, and included the regional criteria. Approximately one month prior to State Water Board adoption of the Policy, a group of joint stakeholders proposed alternate regional criteria for onstream reservoirs in non-fish bearing streams. The State Water Board included this alternate regional criteria in the Policy as section A.1.8.3, but use of the criteria was generally restricted until: "The State Water Board has completed a study consistent with the language in section 10.4.1 to determine whether or not additional conditions are necessary to protect fisheries resources from the effects of diversion and the applicant agrees to those conditions." Thus, peer review of the volume depletion approach study is warranted, as the conclusions of the study allow use of an alternate regional criteria that was not previously peer reviewed, yet part of the adopted Policy.

1. Allowing no restrictions on season of diversion
Freshwater life stages for anadromous fish consist of upstream migration, spawning, incubation, emigration, and rearing. These life stages occur at various times of the year, and are specific to the type of fish. Stream flows needed for adequate life stage development can be different for each life stage, and minimum stream flows needs for one life stage might not be adequate for another. Stream flows naturally vary over the course of the year. In order to maintain instream flows that are protective of anadromous fish life stage development, the regional criteria of the Policy contains seasonal limits on diversion that were derived to be protective throughout the policy area.

Policy section A.1.8.3. allows an onstream project to operate on a Class II or III stream without a limitation on season of diversion, where the project, when considered with other diversions, has a limited impact on downstream streamflow. Use of the criteria is limited to where the

cumulative depletion of the project when considered with other senior projects in the watershed is not more than 10% of the seasonal (November 1 to March 31) volume measured in the downstream fish bearing stream(s). The volume depletion approach study evaluates the protectiveness of this Policy section in regards to season of diversion, and may recommend further conditions, including those on season of diversion, for use in the alternate criteria. This conclusionwill be revised prior to peer review to include the conclusion of the study regarding season of diversion: that is, either supporting the requirements of Policy Section A.1.8.3 as provided; or proposing modifications to the alternative criteria in Policy Section A.1.8.3; or documenting that section A.1.8.3 is not protective of fisheries in regards to season of diversion. Reviewer should determine if these conclusions are based on sound scientific principles.

2. Allowing limited or no restrictions on minimum bypass flow requirements
Adequate sustained stream flows are needed to protect anadromous fish passage and spawning. The regional criteria in the Policy contains minimum bypass flow criteria, which is the minimum instantaneous flow rate of water at any location in a stream that is adequate for fish spawning and passage. The minimum bypass flow is the minimum instantaneous flow rate of water that must be moving past the point of diversion before water may be diverted under a permit. The Policy's minimum bypass flow criteria were derived to be protective of anadromous fish passage and spawning within Policy area.

Policy section A.1.8.3. allows an onstream project to operate on a Class III stream without a minimum bypass flow, where the cumulative depletion of the project when considered with other senior projects in the watershed is less than 5% of the seasonal (November 1 to March 31) volume measured in the downstream fish bearing stream(s). Section A.1.8.3 also allows projects on Class II streams with depletions below 10% and projects on Class III streams with depletions from 5-10% to operate with the February median flow. Calculation of February median flow is less complicated and generally results in a less restrictive value than use of the minimum bypass flow generated by the Policy's regional criteria per Policy section 2.2.1.2. The volume depletion approach study evaluates the protectiveness of this Policy section in regards to minimum bypass flow, and may recommend further conditions, including those on bypass, for use in the alternate criteria. This conclusion will be revised prior to peer review to include the conclusion of the study regarding minimum bypass flow: that is, either supporting the requirements of Policy section A.1.8.3 as provided; or proposing modifications to the alternative criteria in Policy section A.1.8.3; or documenting that section A.1.8.3 is not protective of fisheries in regards to minimum bypass flow. Reviewer should determine if these conclusions are based on sound scientific principles.

3. Allowing no restrictions on maximum cumulative diversion
Adequate magnitude and variability in peak stream flows are needed to meet the habitat needs of anadromous salmonids, including maintaining stream channel geometry, vegetative structure and variability, gravel and wood movement, and other channel features. Channel maintenance is a long-term process in which the basic habitat structure of a stream is formed and maintained by multiple, variable high flow events recurring on a periodic basis.

The Policy established a maximum cumulative diversion regional criterion that was derived to be protective of channel maintenance flows throughout the policy area. The maximum cumulative diversion is the largest value that the sum of the rates of diversion of all diversions upstream of a specific location in the watershed can be so that channel maintenance flows are protected. The maximum cumulative diversion criterion limits cumulative diversion to 5 percent of 1.5-year recurrence flow. Absent site-specific study, the Policy requires that this criterion be met at the proposed point of diversion and certain downstream locations where fish are present. Proposed

points of diversion may be located on a range of stream types, including small headwater drainages.

Policy section A.1.8.3. allows an onstream project to operate on a Class II or III stream without a limitation on maximum cumulative diversion, where the project, when considered with other diversions, has a limited impact on downstream streamflow. Use of the criteria is limited to where the cumulative depletion of the project when considered with other senior projects in the watershed is not more than 10% of the seasonal (November 1 to March 31) volume measured in the downstream fish bearing stream(s). The volume depletion approach study evaluates the protectiveness of this Policy section in regards to maximum cumulative diversion, and may recommend further conditions, including those on maximum cumulative diversion, for use in the alternate criteria. This conclusion will be revised prior to peer review to include the conclusion of the study regarding maximum cumulative diversion: that is, either supporting the requirements of Policy section A.1.8.3 as provided; or proposing modifications to the alternative criteria in Policy section A.1.8.3; or documenting that section A.1.8.3 is not protective of fisheries in regards to maximum cumulative diversion. Reviewer should determine if these conclusions are based on sound scientific principles.

The Big Picture

Reviewers are not limited to addressing only the specific conclusions presented above, and are asked to contemplate the following questions.

(a) In reading the staff technical reports and proposed implementation language, are there any additional scientific conclusions that are part of the scientific basis of the proposed rule not described above? If so, please comment with respect to the statute language given above.

(b) Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?

Reviewers should also note that some proposed actions may rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statute requirement for absolute scientific rigor. In these situations, the proposed course of action is favored over no action.

The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the scientific basis of the proposed Board action. At the same time, reviewers also should recognize that the Board has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rule. Because of this obligation, reviewers are encouraged to focus feedback on the scientific conclusions that are relevant to the central regulatory elements being proposed.

Attachment 3
Draft Volume Depletion Approach Study
Individuals Involved in Volume Depletion Approach Study

1. Individuals Involved in Preparation of Volume Depletion Approach Study

Consultants
Stetson Engineers Inc. (San Rafael, CA) – James Reilly, Ali Shahroody, Tracey Kenward, Curtis Lawler, Molly Palmer
R2 Resource Consultants Inc. (Redmond, WA) – Paul DeVries, Dudley Reiser
S2S Environmental Resource Management (Danville, CA) – Elizabeth Frantz
Ted Grantham, consultant (Davis, CA)

State and Federal Agencies
State Water Resources Control Board (Sacramento, CA) – Amanda Montgomery, Phil Crader, Katy Lee, Matt McCarthy

2. Individuals Involved in Development of the Policy for Maintaining Instream Flows in Northern California Coastal Streams (adopted by State Water Board in 2010), who either proposed the Volume Depletion Approach or were involved in review of proposal to include the approach in Policy[1].

Joint Stakeholder Group that proposed Volume Depletion Approach
Trout Unlimited (Berkeley, CA) - Brian Johnson
McBain & Trush, Inc. (Arcata, CA) - William Trush
Wagner & Bonsignore (Sacramento, CA) – Bob Wagner, John Faux
Ellison, Schneider & Harris law firm (Sacramento, CA) - Peter Kiel

Consultants
Stetson Engineers Inc. (San Rafael, CA) – Oliver Page
R2 Resource Consultants Inc. (Redmond, WA) –Tim Nightengale
North State Resources Inc. (Sacramento, CA) – Tim Reilly, Bruce Kemp, Kerri Mikkelsen-Rose, Wirt Lanning, Steven Towers

State and Federal Agencies
State Water Resources Control Board (Sacramento, CA) – Steve Herrera, Eric Oppenheimer, Karen Niiya, Aaron Miller.

Peer reviewers of draft Policy (conducted from December 2007 to February 2008)
Dr. Laurence Band University of North Carolina (Chapel Hill, NC)

1. [1] Parties already named in #1 (Individuals Involved in Preparation of Volume Depletion Approach Study) are not repeated when the party also participated in #2 (development of Policy).

Dr. Charles M. Burt California Polytechnic State University (San Luis Obispo, CA)
Dr. R.A. Gearheart Humboldt State University (Arcata, CA)
Dr. Margaret Lang Humboldt State University (Arcata, CA)
Dr. Thomas E. McMahon Montana State University (Bozeman, Montana)
Dr. Richard T. Woodward Texas A&M University (College Station, TX)

Attachment 4
Draft Volume Depletion Approach Study
List of Documents to Be Reviewed

1. The draft Volume Depletion Approach Study. *Status:* In development by consultant team lead by Stetson Engineers Inc. Length of draft study report is estimated at 100 pages, inclusive of attachments. Draft report will be provided to reviewers as a hard copy. In addition to the draft study, the following reference documents will be provided:

    a. All references used in the volume depletion approach study. References will be provided to reviewers on CD.

    b. State Water Board's Policy for Maintaining Instream Flows in Northern California Coastal Streams (adopted by State Water Board in 2010), with particular emphasis on the portion of the Policy providing the requirement to conduct the volume depletion approach study (Policy section 10.4.1) and the section providing the alternate criteria (Policy section A.1.8.3). These sections are also provided as an excerpt below:

10.4.1 State Water Board study of volume depletion approach to permitting of small reservoirs on Class II and III streams
The State Water Board will commence and will complete as soon possible, but within no more than 5 years, a study to determine whether the volume depletion approach described in Appendix A section A.1.8.3 effectively protects fishery resources. The evaluation will include assessing the effects on the fishery and aquatic habitat of diversions upstream of anadromy where the cumulative diversion rate is greater than 5 percent but no more than 10 percent by volume of the unimpaired seasonal flow volume between November 1 and March 31 as measured at the upper limit of anadromy.

A.1.8.3 Alternate evaluation criteria for onstream reservoirs on Class II and Class III Streams
The alternate regional criteria described below can be used to measure the cumulative effects of onstream reservoir projects on Class II or Class III streams. These criteria measure cumulative effects in percent change to seasonal flow volume.

Class III Streams
Projects located on Class III streams may be allowed to operate without a minimum bypass flow, maximum rate of diversion, or season of diversion if the cumulative depletion of the project and all senior projects is not more than 5 percent of the seasonal (November 1 to March 31) volume measured downstream at the upper limit of anadromy and points of interest below. Projects located on Class III streams that contribute to a cumulative depletion greater than 5 percent but not more than 10 percent of the seasonal volume measured at the upper limit of anadromy and points of interest below may be allowed to operate with only a February median bypass flow and without a rate of diversion limitation or season of diversion limitation provided either:

1. The DFG and NMFS concur that the proposed diversion will not adversely affect fishery resources, or
2. The applicant prepares a study acceptable to the DFG and NMFS that demonstrates the diversion will not adversely affect fishery resources, and the
DFG and NMFS concur that the study demonstrates the proposed project will not adversely affect fishery resources. If the applicant and DFG or NMFS do not agree on the study design or results, the applicant may utilize the Pre-decisional
Review Trial Program described in section 3.4.3; or
3. The State Water Board has completed a study consistent with the language in section 10.4.1 to determine whether or not additional conditions are necessary to protect fishery resources from the effects of diversion and the applicant agrees to those conditions.

Class II Streams
Projects located on Class II streams may be allowed to operate with a bypass flow equal to the February median flow and without a maximum rate of diversion or season of diversion if the cumulative depletion of the project and all senior projects is not more than 5 percent of the seasonal (November 1 to March 31) volume measured downstream at the upper limit of anadormy and points of interest below.
Projects located on Class II streams that contribute to a cumulative depletion greater than 5 percent but not more than 10 percent of the seasonal volume measured at the upper limit of anadromy and points of interest below may be allowed to operate with only a February median bypass flow and without a rate of diversion limitation or season of diversion limitation provided either:

1. The DFG and NMFS concur that the proposed diversion will not adversely affect fishery resources, or
2. The applicant prepares a study acceptable to the DFG and NMFS that demonstrates the diversion will not adversely affect fishery resources, and the DFG and NMFS concur that the study demonstrates the proposed project will not adversely affect fishery resources. If the applicant and DFG or NMFS do not agree on the study design or results, the applicant may utilize the Pre-decisional Review Trial Program described in section 3.4.3; or
3. The State Water Board has completed a study consistent with the language in section 10.4.1 to determine whether or not additional conditions are necessary to protect fishery resources from the effects of diversion and the applicant agrees to those conditions.

Where the cumulative depletion is found to be greater than 10 percent, the applicant may evaluate the cumulative effects of diversion by referring to the criteria described in sections A.1.8.1 and A.1.8.2 above with completion of a daily flow study, as described in Appendix B Section 5; or the applicant may proceed to site-specific studies to further evaluate the cumulative effects of diversion as described in Appendix C.

CALIFORNIA Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 9, 2014

Jeffrey McDonnell, Ph.D.
Professor and Director, Global Institute for Water Security
School of Environment and Sustainability
University of Saskatchewan
11 Innovation Boulevard
Saskatoon, SK S7N 3H5

Dear Professor McDonnell,

REQUEST FOR EXTERNAL PEER REVIEW OF DRAFT VOLUME DEPLETION APPROACH STUDY

I have been asked by the State Water Resources Control Board, Division of Water Rights (DWR) to continue managing the external scientific peer review of the subject noted above. DWR will not communicate with the approved reviewers, such as yourself, nor know their identities, until I send the reviews to DWR.

My letter today is intended to initiate the next phase of the external review – the actual reviews themselves.

Included with this letter are the following key documents:

1. Memo dated October 16, 2013, from Amanda Montgomery to Gerald Bowes, "Request for External Peer Review of Draft Volume Depletion Approach Study," which included the following attachments:

   Attachment 1: Summary of Proposed Action
   Attachment 2: Description of Scientific Conclusions to be addressed by Peer Reviewers
   Attachment 3: Individuals Involved in Volume Depletion Approach Study
   Attachment 4: List of Documents to be Reviewed (Attachment 4 describes the documents to be reviewed, and provides background for them)

2. December 30, 2013 Two Volume Draft Report for Peer Review: "Protectiveness of Alternative Guidelines in North Coast Instream Flow Policy Section A.1.8.3," which includes the following:

   Volume 1
   January 6, 2014 Final Memorandum from Molly Palmer. This memorandum contains notes and corrections to provide clarify of the contents of the report.
   Revised List of Appendices (page viii), reproduced here:

Appendix A Final Draft Field Study Report

Appendices to the Final Draft Field Study Report

Appendix A Raw Datalogger Records
Appendix B Surveyed Cross-sections at Datalogger Transects
Appendix C Corrected Datalogger Records
Appendix D Rating Curves at Datalogger Transects
Appendix E Flow Time Series
Appendix F Photos of Benthic Macroinvertebrates
Appendix G Rating Curves at Habitat Transects
Appendix H Velocity Simulation Results Based on Measured Velocity Distribution for Each Spawning Habitat Transect
Appendix I Velocity Simulation Results Based on Manning's Equation Prediction at High Flow for EachSpawning Habitat Transect

Appendix B Final Draft Hydrologic Modeling Report

Appendices to the Final Draft Hydrologic Modeling Report

Appendix A Precipitation and Potential Evapotranspiration Time Series
Appendix B Flow Time Series Used for Calibration
Appendix C HSPF Model Files
Appendix D HSPF Results: Unimpaired Flow Time Series

Volume 2

Appendix C Habitat Flow Curves
Appendix D Flood Frequency Results
Appendix E Passage and Spawning Day Results

3. January 7, 2009 Supplement to the Cal/EPA Peer Review Guidelines.

Comments on the foregoing:

1. You have been sent the October 16, 2013 request letter during the solicitation process for reviewer candidates conducted by the University of California, Berkeley's Institute of the Environment.

2. Attachment 2 to the request letter provides focus for the review. I ask that you address all scientific conclusions, as expertise allows, in the order listed.

3. The January 7, 2009 Supplement – you received this earlier when I approved you as a reviewer. I am sending it again to make certain that you have it. In part, it provides guidance to ensure the review is kept confidential through its course. The Supplement notes reviewers are under no obligation to discuss their comments with third-parties after reviews have been submitted. We recommend they do not. All outside parties are provided opportunities to address a proposed regulatory action through a well-defined regulatory process. Please direct enquiring parties to Ms. Amanda Montgomery (Amanda.Montgomery@waterboards.ca.gov).

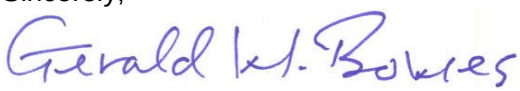
The reports to be reviewed, including appendices and CDs, were prepared by a contractor for the Division of Water Rights. If you have any clarification questions about this material, especially about how it relates to your review, please contact me as soon as possible.

The contractor's reports, including appendences, can be accessed at a FTP site. Please see attached instructions. Please use username (reviewer) and password (swrcb01/14) given.

Please return your review directly to me, on Wednesday, February 5, 2014, and not before. Questions about the review, or review material, should be for clarification, in writing – email is fine, and addressed to me. My responses will be in writing also. DWR should not be contacted. I will subsequently forward all reviews together to Ms. Amanda Montgomery with reviewers' Curriculum Vitae. All this information will be posted at the appropriate DWR program web site.

Your acceptance of this review assignment is most appreciated.

Sincerely,



Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567
Facsimile: (916) 341-5284
Email: GBowes@waterboards.ca.gov

Attachments

CALIFORNIA Water Boards

EDMUND G. BROWN JR. GOVERNOR

MATTHEW RODRIQUEZ SECRETARY FOR ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 14, 2014

Julian Olden, Ph.D.
Associate Professor
School of Aquatic and Fishery Sciences
University of Washington
1122 NE Boat Street
Seattle, WA 98195

Dear Professor Olden,

REQUEST FOR EXTERNAL PEER REVIEW OF DRAFT VOLUME DEPLETION APPROACH STUDY

I have been asked by the State Water Resources Control Board, Division of Water Rights (DWR) to continue managing the external scientific peer review of the subject noted above. DWR will not communicate with the approved reviewers, such as yourself, nor know their identities, until I send the reviews to DWR.

My letter today is intended to initiate the next phase of the external review – the actual reviews themselves.

Included with this letter are the following key documents:

1. Memo dated October 16, 2013, from Amanda Montgomery to Gerald Bowes, "Request for External Peer Review of Draft Volume Depletion Approach Study," which included the following attachments:

   Attachment 1: Summary of Proposed Action
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   Attachment 4: List of Documents to be Reviewed (Attachment 4 describes the documents to be reviewed, and provides background for them)

2. January 7, 2009 Supplement to the Cal/EPA Peer Review Guidelines.

Comments on the foregoing:

1. You have been sent the October 16, 2013 request letter during the solicitation process for reviewer candidates conducted by the University of California, Berkeley's Institute of the Environment.

2. Attachment 2 to the request letter provides focus for the review. I ask that you address all scientific conclusions, as expertise allows, in the order listed.

3. The January 7, 2009 Supplement – you received this earlier when I approved you as a reviewer. I am sending it again to make certain that you have it. In part, it provides guidance to ensure the review is kept confidential through its course. The Supplement notes reviewers are under no obligation to discuss their comments with third-parties after reviews have been submitted. We recommend they do not. All outside parties are provided opportunities to address a proposed regulatory action through a well-defined regulatory process. Please direct enquiring parties to Ms. Amanda Montgomery (Amanda.Montgomery@waterboards.ca.gov).

The reports to be reviewed, including appendices and CDs, were prepared by a contractor for the Division of Water Rights. The contractor's reports, including appendences, can be accessed at a FTP site. See attached instructions. Use username (reviewer) and password (swrcb01/14) given. If you have any clarification questions about this material, especially about how it relates to your review, contact me as soon as possible.

The information at the FTP site also is produced in two hard copy volumes arranged according to the following table of contents. The FTP site format differs from that used for the hard copies. The information at the site and in the copies is identical. The attached FTP site instructions describe what you will locate in the links. At your request, hard copies are not being sent to you because of your sabbatical location in Australia.

Table of Contents for hard copies:

Two Volume Draft Report for Peer Review (Dated December 30, 2013): "Protectiveness of Alternative Guidelines in North Coast Instream Flow Policy Section A.1.8.3," which includes the following:

Volume 1
January 6, 2014 Final Memorandum from Molly Palmer. This memorandum contains notes and corrections to provide clarify of the contents of the report.
Revised List of Appendices (page viii), reproduced here:

Appendix A Final Draft Field Study Report

Appendices to the Final Draft Field Study Report

Appendix A Raw Datalogger Records
Appendix B Surveyed Cross-sections at Datalogger Transects
Appendix C Corrected Datalogger Records
Appendix D Rating Curves at Datalogger Transects
Appendix E Flow Time Series
Appendix F Photos of Benthic Macroinvertebrates
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Appendix B Final Draft Hydrologic Modeling Report

Appendices to the Final Draft Hydrologic Modeling Report

Appendix A Precipitation and Potential Evapotranspiration Time Series
Appendix B Flow Time Series Used for Calibration
Appendix C HSPF Model Files
Appendix D HSPF Results: Unimpaired Flow Time Series

Volume 2

Appendix C Habitat Flow Curves
Appendix D Flood Frequency Results
Appendix E Passage and Spawning Day Results

Please return your review directly to me, on Wednesday, February 5, 2014, and not before. Questions about the review, or review material, should be for clarification, in writing – email is fine, and addressed to me. My responses will be in writing also. DWR should not be contacted. I will subsequently forward all reviews together to Ms. Amanda Montgomery with reviewers' Curriculum Vitae. All this information will be posted at the appropriate DWR program web site.

Your acceptance of this review assignment is most appreciated.

Sincerely,

Gerald W. Bowes

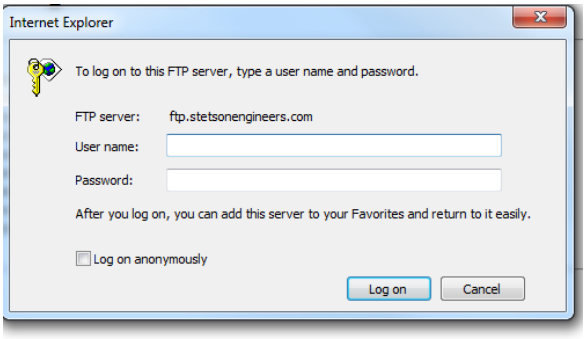
Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567
Facsimile: (916) 341-5284
Email: GBowes@waterboards.ca.gov

Attachments

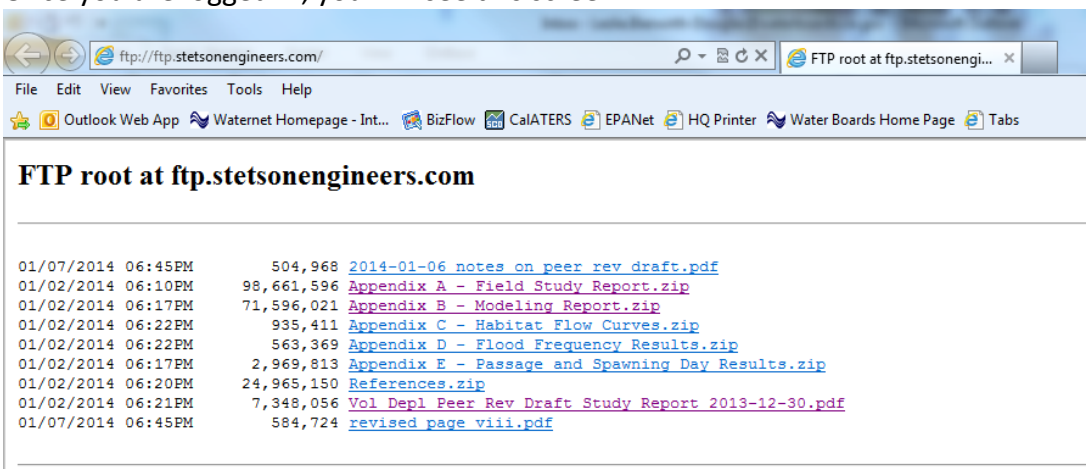
FTP Site Instructions

Go to the FTP website:
ftp://ftp.stetsonengineers.com/



username – reviewer
password – swrcb01/14

Once you are logged in, you will see this screen.



Here is what you'll find in each of the links.

<u>Relates to Hard Copy Volume 1 of 2</u>

2014-01-06 notes on peer rev draft.pdf – This is a memorandum from Molly Palmer the contractor; this memorandum contains notes and corrections to provide clarification of the contents of the report.

Revised page viii.pdf – this page was revised to show in more detail what is included in Appendix A through E of the Draft Report.

Vol Depl Peer Rev Draft Study Report 2013-12-30.pdf – This is the Draft Report for Peer Review.

References.zip – This is a list of references used for this report.

Appendix A – Field Study Reprot.zip – This is the field study report along with its supporting appendances A through I and references.

Appendix B – Modeling Report.zip – This is the modeling report along with its supporting appendences A through D and references.

Relates to Hard Copy Volume 2 of 2

Appendix C – Habitat Flow Curves.zip – This is the habitat flow curves graphs and charts.

Appendix D – Flood Frequency Results.zip – This is the flood frequency result graphs and charts.

Appendix E – Passage and Spawning Day Results.zip – This is the passage and spawning day results graphs and charts.

CALIFORNIA Water Boards

EDMUND G. BROWN JR. GOVERNOR

MATTHEW RODRIQUEZ SECRETARY FOR ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 9, 2014

Matt Reidenbach, Ph.D.
Associate Professor
Department of Environmental Sciences
356 Clark Hall
University of Virginia
291 McCormick Road
Charlottesville, VA 22904

Dear Professor Reidenbach,

REQUEST FOR EXTERNAL PEER REVIEW OF DRAFT VOLUME DEPLETION APPROACH STUDY

I have been asked by the State Water Resources Control Board, Division of Water Rights (DWR) to continue managing the external scientific peer review of the subject noted above. DWR will not communicate with the approved reviewers, such as yourself, nor know their identities, until I send the reviews to DWR.

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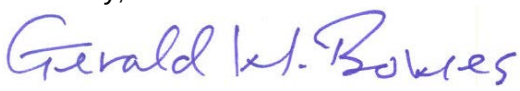

Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 "I" Street, MS-16B
Sacramento, California 95814

Telephone: (916) 341-5567
Facsimile: (916) 341-5284
Email: GBowes@waterboards.ca.gov

Attachments

January 7, 2009

Supplement to Cal/EPA External Scientific Peer Review Guidelines – "Exhibit F" in Cal/EPA Interagency Agreement with University of California Gerald W. Bowes, Ph.D.

Guidance to Staff:

1. Revisions. If you have revised any part of the initial request, please stamp "Revised" on each page where a change has been made, and the date of the change. Clearly describe the revision in the cover letter to reviewers, which transmits the material to be reviewed. The approved reviewers have seen your original request letter and attachments during the solicitation process, and must be made aware of changes.

2. Documents requiring review. All important scientific underpinnings of a proposed science-based rule must be submitted for external peer review. The underpinnings would include all publications (including conference proceedings), reports, and raw data upon which the proposal is based. If there is a question about the value of a particular document, or parts of a document, I should be contacted.

3. Documents not requiring review. The Cal/EPA External Peer Review Guidelines note that there are circumstances where external peer review of supporting scientific documents is not required. An example would be "A particular work product that has been peer reviewed with a known record by a recognized expert or expert body." I would treat this allowance with caution. If you have any doubt about the quality of such external review, or of the reviewers' independence and objectivity, that work product – which could be a component of the proposal - should be provided to the reviewers.

4. Implementation review. Publications which have a solid peer review record, such as a US EPA Criteria document, do not always include an implementation strategy. The Cal/EPA Guidelines require that the implementation of the scientific components of a proposal, or other initiative, must be submitted for external review.

5. Identity of external reviewers. External reviewers should not be informed about the identity of other external reviewers. Our goal has always been to solicit truly independent comments from each reviewer. Allowing the reviewers to know the identity of others sets up the potential for discussions between them that could devalue the independence of the reviews.

6. Panel Formation. Formation of reviewer panels is not appropriate. Panels can take on the appearance of scientific advisory committees and the external reviewers identified through the Cal/EPA process are not to be used as scientific advisors.

7. Conference calls with reviewers. Conference calls with one or more reviewers can be interpreted as seeking collaborative scientific input instead of critical review. Conference calls with reviewers are not allowed.

Guidance to Reviewers from Staff:

1. Discussion of review.

   Reviewers are not allowed to discuss the proposal with individuals who participated in development of the proposal. These individuals are listed in Attachment 3 of the review request.

   Discussions between staff and reviewers are not permitted. Reviewers may request clarification of certain aspects of the review process or the documents sent to them.

   Clarification questions and responses must be in writing. Clarification questions about reviewers' comments by staff and others affiliated with the organization requesting the review, and the responses to them, also must be in writing. These communications will become part of the administrative record.

   The organization requesting independent review should be careful that organization-reviewer communications do not become collaboration, or are perceived by others to have become so. The reviewers are not technical advisors. As such, they would be considered participants in the development of the proposal, and would not be considered by the University of California as external reviewers for future revisions of this or related proposals. The statute requiring external review of science-based rules proposed by Cal/EPA organizations prohibits participants serving as peer reviewers..

2. Disclosure of reviewer Identity and release of review comments.

   Confidentiality begins at the point a potential candidate is contacted by the University of California. Candidates who agree to complete the conflict of interest disclosure form should keep this matter confidential, and should not inform others about their possible role as reviewer.

   Reviewer identity may be kept confidential until review comments are received by the organization that requested the review. After the comments are received, reviewer identity and comments must be made available to anyone requesting them.

   Reviewers are under no obligation to disclose their identity to anyone enquiring. It is recommended reviewers keep their role confidential until after their reviews have been submitted.

3. Requests to reviewers by third parties to discuss comments.

   After they have submitted their reviews, reviewers may be approached by third parties representing special interests, the press, or by colleagues. Reviewers are under no obligation to discuss their comments with them, and we recommend that they do not.

   All outside parties are provided an opportunity to address a proposed regulatory action during the public comment period and at the Cal/EPA organization meeting where the proposal is considered for adoption. Discussions outside these provided avenues for comment could seriously impede the orderly process for vetting the proposal under consideration.

4. Reviewer contact information.

The reviewer's name and professional affiliation should accompany each review. Home address and other personal contact information are considered confidential and should not be part of the comment submittal.

JEFFREY J. MCDONNELL, Ph.D., D.Sc.
Professor of Hydrology, School of Environmental Sustainability, University of Saskatchewan
Associate Director, Global Institute for Water Security, University of Saskatchewan
6th Century Chair in Hydrology, University of Aberdeen
University Distinguished Professor of Hydrology (Adjunct), Oregon State University
11 Innovation Boulevard, Saskatoon SK S7N 3H5 Canada
Tel: +1-306-966-1990; Lab URL: http://www.usask.ca/watershed/
Google Scholar page: http://scholar.google.ca/citations?user=EkZl9xkAAAAJ&hl=en

EDUCATION

1989 Ph.D., **Forest Hydrology**, University of Canterbury, Christchurch, New Zealand. Dissertation: "The age, origin and pathway of subsurface stormflow in a steep humid headwater catchment", 270p.

1985 M.Sc., **Watershed Ecosystems**, Trent University, Peterborough, Canada. Thesis: "Snowcover ablation and meltwater runoff on a small Precambrian Shield watershed", 127p.

1983 B.Sc. (Honors), **Physical Geography**, University of Toronto, Toronto, Canada. Thesis: "Storm waves, sediment flux and beach morphodynamics in a barred nearshore zone, Wymbolwood Beach, Ontario", 110p.

REGISTRATION

1999- P.H., Registered Professional Hydrologist (reg'n #1506), American Institute of Hydrology.

PROFESSIONAL EXPERIENCE

2012 Associate Director, Global Institute for Water Security, University of Saskatchewan, Saskatoon.

2012 Professor of Hydrology, Global Institute for Water Security and School of Environment and Sustainability, University of Saskatchewan, Saskatoon.

2009-11 Director, Institute for Water and Watersheds, Oregon State University; Distinguished Professor of Hydrology, Oregon State University, Corvallis Oregon.

1999-2011 Professor and Richardson Chair in Watershed Science, Department of Forest Engineering, Resources and Management, Oregon State University, Corvallis, Oregon.

1993-99 Professor of Hydrology (1997-99), Associate Professor (1993-97), State University of New York (SUNY), College of Environmental Science and Forestry, Syracuse, New York.

1989-93 Assistant Professor of Forest Hydrology, Watershed Science Unit, Department of Forest Resources, Utah State University (adjunct Dept. Civil & Env. Engineering; adjunct Dept of Geography; Coordinator, NASA Earth System Science Education Program 1991-93)

1989-90 Research Hydrologist, NASA Marshall Space Flight Center, Universities Space Research Assoc., Huntsville, Alabama.

MAJOR AWARDS

2011 Birdsall-Dreiss Distinguished Lecturer Award, Geological Society of America

2011 EPA Scientific and Technological Achievement Award

2009 University Distinguished Professor, Oregon State University
2009 John Dalton Medal, European Geosciences Union
2009 Fellow, American Geophysical Union
2009 Doctor of Science (D.Sc)., University of Canterbury
1998 Gordon Warwick Award, British Geomorphological Research Group
1990 Warren Nystrom Award, Association of American Geographers

OTHER RECOGITION

2012 Highest cited paper in Hydrological Processes, John Wiley and Sons
2008 Teaching and Mentoring Award, College of Forestry, Oregon State University
2005 Fellow and Life Member, International Water Academy, Oslo Norway
1995 Scientific Literacy and Information Scholar Award, State University of New York
1987 Horton Research Grant Award, American Geophysical Union
1987 Canterbury Earth Science Prize, Geological Society of New Zealand
1986 Commonwealth Scholarship and Research Fellowship, New Zealand/Canada
1985 John B. Webb Memorial Trophy, Canadian Society of Petroleum Geologists

NAMED LECTURES

2013 Nannerl Keohane Distinguished Lecture, UNC Chapel Hill, NC.
2012 Borland Lecture, Hydrology Days, Colorado State University, For Collins CO
2011 Birdsall-Dreiss Distinguished Lecturer, Geological Society of America
2009 Woo Lecture, Canadian Geophysical Union
2006 Boussinesq Lecture, The Boussinesq Society, TU Delft, The Netherlands
2006 Frontier Lecture, American Geophysical Union
2006 Penman Lecture, British Hydrological Society, Durham, UK

OTHER PROFESSIONAL DISTINCTIONS

Named and Visiting Appointments and Fellowships:

2013 Nannerl Keohane Distinguished Visiting Professor, University of North Carolina at Chapel Hill and Duke University.
2012- Distinguished Professor of Hydrology (Adjunct), Oregon State University, Corvallis
2009 6th Century Chair of Hydrology, University of Aberdeen, Scotland
2009-2013 Invited Visiting Professor, Hohai University, Nanjing China
2008-2013 Invited Visiting Professor, Nanjing Hydraulic Research Institute, China
2009 Visiting Project Scientist, Isotope Hydrology Division, International Atomic Energy Agency, Vienna, Austria
2006-07 Fellow and Visiting Professor, Dept. Civil Engineering, Delft, The Netherlands
2006 DIG Scholar, Dept. of Geography, University of Durham.
2005 STINT Fellow, Swedish National Science Foundation, University of Stockholm.
2004 Institute for the Study of Planet Earth Speaker, University of Arizona.
2003 Gledden Fellow, Center for Environmental Fluid Dynamics, University of Western Australia.
2000 Visiting Professor, Institute of Hydrology, Freiburg University.
1999 Named Chair, Richardson Chair in Watershed Science, Oregon State University
1999 Leverhulme Trust Visiting Professor, Institute for Advanced Studies, Bristol University.
1998 Hayward Fellow, LandCare New Zealand Ltd.

1997 Invited Visiting Hydrologist, LandCare New Zealand.

1997 STA Fellow, Japan Science and Technology Agency, Japan Forestry and Forest Products Research Institute

1989 Invited Fellow, Universities Space Research Association (USRA), NASA Marshall Space Flight Center.

Current Journal Editorships:

2013 Associate Editor, Journal of Hydrology and Hydromechanics, Open access journal.

2012 Editorial Board, Journal of Hydrogeology and Hydrologic Engineering, Sci-Technol.

2012 Editorial Board, Riparian Ecology and Conservation, Versita and Springer.

2012 Editorial Board, Water, MDPI Publishers, Switzerland.

2011 Editorial Board, Advances in Water Science (China), UNESCO

2011 Editorial Board, International Journal of Hydrology Science and Technology, Inderscience Enterprises Ltd (UK).

2007 Editorial Board, Ecohydrology, John Wiley and Sons.

2004 Editorial Advisory Board, Forest Science and Technology, Taylor and Francis Ltd

2004 Editor-in-Chief, Benchmark Papers in Hydrological Sciences, Book Series, IAHS Press.

2004 Senior Advisory Editor, Encyclopedia of Hydrology, John Wiley and Sons.

1994 Editorial Board Member, Hydrological Processes, John Wiley and Sons.

TRAINING OF HIGHLY QUALIFIED PERSONNELL

55 Post Docs, PhD students and MSc students; supervised also 11 technicians and 20 undergrad lab workers

KEY PAPERS (out of ~200; >9000 citations in total; h-index 55; i10-index 119; 2 papers in Nature)

Laudon, H, D. Tetzlaff, C. Soulsby, S. Carey, J. Seibert, J. Buttle, J. Shanley, J.J. McDonnell and K. McGuire, 2013. Change in winter climate will affect dissolved organic carbon and water fluxed in mid-to-high latitude catchments, Hydrological Processes, 27(5): 700-709. DOI: 10.1002/hyp.9686.

Ali, G., Tetzlaff, D., Soulsby, C. & McDonnell, J.J., 2012. Topographic, pedologic and climatic interactions influencing streamflow generation at multiple catchment scales. Hydrological Processes, 26 (25): 3858-3874. DOI: 10.1002/hyp.8416.

Wohl, E., A. Barros, N. Brunsell, N. Chappell, M. Coe, T. Giambelluca, S. Goldsmith, R. Harmon, J. Hendrickx, J. Juvik, J.J. McDonnell, F. Ogden, 2012. A research vision for hydrology of the humid tropics: Balancing water, energy, and land use. Nature (Climate Change), 2: 655-662.

Brooks, R., R. Barnard, R. Coulombe and J.J. McDonnell, 2010. Two water worlds paradox: Trees and streams return different water pools to the hydrosphere. Nature-Geoscience, 3: 100-104, doi: 10.1038/NGEO722.

McDonnell, J., K. McGuire, P. Aggarwal, K. Beven, D. Biondi, G. Destouni, S. Dunn, A. James, J. Kirchner, P. Kraft, S. Lyon, P. Maloszewski, B. Newman, L. Pfister, A. Rinaldo, A. Rodhe, T. Sayama, J. Seibert, K. Solomon, C. Soulsby, M. Stewart, D. Tetzlaff, C. Tobin, P. Troch, M. Weiler, A. Western, A. Wörman , S. Wrede, 2010. How old is the water? Open questions in catchment transit time conceptualization, modelling and analysis. Hydrological Processes, 24(12): 1745-1754.

McDonnell, J.J., M. Sivapalan, K. Vaché S. Dunn, G. Grant, R. Haggerty, C. Hinz, R. Hooper, J. Kirchner, M. L. Roderick, J. Selker and M. Weiler, 2007. Moving beyond heterogeneity and process complexity: A new vision for watershed hydrology. Water Resources Research, 43, W07301, doi:10.1029/2006WR005467.

Julian David Olden

School of Aquatic & Fishery Sciences
University of Washington, Seattle, WA 98195
e-mail: olden@uw.edu
phone: (206) 616-3112
web: http://fish.washington.edu/olden/

Expertise

Dr. Julian Olden is an Associate Professor at the University of Washington whose research explores the ecology of freshwater ecosystems with a focus on species interactions, ecohydrology, climate change and invasive species. Dr. Olden has an international record of publication excellence represented by 140+ scientific papers in the peer-reviewed literature, which have collectively received 4,500 citations+ and reflected in an h-index of 37 (a bibliometric measure of productivity based on a scientist's publication activity and citation impacts). Dr. Olden is actively involved in the development of regional, national, and international research focusing on native species responses to invasive species and global climate change, with regular conference and workshop participation and presentations. His expertise on invasive species ecology lead Dr. Olden to be an invited member of the esteemed Independent Scientific Advisory Board which recently published a report on non-native species impacts in the Columbia River Basin. In addition, he recently participated in a working group "Assessing gaps and needs for invasive species management in a changing climate" (funded by the EPA and hosted by the Environmental Law Institute, Washington, DC). As a member of the Global River Sustainability Project, Dr. Olden has been heavily involved in a series of international workshops in the United States and Australia seeking to identify and model critical hydrological parameters for river basins across the globe. In addition, he is leading an expert working group examining the success of large-scale experiment flows for riverine restoration at the National Centre for Ecological Analysis and Synthesis. Dr. Olden was a former David H. Smith Conservation Science Fellow supported by the Society for Conservation Biology and the TNC.

Current Position

Associate Professor, School of Aquatic & Fishery Sciences, University of Washington (2011-present)

Education

Ph.D. in Ecology, Colorado State University (2000-2004). Dissertation title "Fish fauna homogenization of the United States, life-history correlates of native extinctions and non-native invasions in the American Southwest, and the bi-directional impacts of dams in the American Southeast"

M.Sc. in Zoology, University of Toronto (1998-2000). Thesis title "Predictive models for freshwater fish community composition"

B.Sc. in Zoology, University of Toronto (1994-1998)

Recent Positions

Assistant Professor, School of Aquatic & Fishery Sciences, University of Washington (2006- 2011)

Adjunct Research Fellow, Australian Rivers Institute, Griffith University (2006-)

David H. Smith Postdoctoral Conservation Fellowship, Center for Limnology, University of Wisconsin (2005-2006). Title "Conservation planning and prioritization for invasive species: Forecasting invasions and their impacts in freshwater systems using process-based modeling"

Publications

Published

2013 (and in press)

Olden, J.D., C. Konrad, T. Melis, M. Kennard, M. Freeman, M. Mims, E. Bray, K. Gido, N. Hemphill, D. Lytle, L. McMullen, M. Pyron, C. Robinson, J. Schmidt and J. Williams. In press. Are large-scale flow experiments informing the science and management of freshwater ecosystems? *Frontiers in Ecology and the Environment*.

Gibson, P.R. and J.D. Olden. In press. Ecology, management, and conservation implications of North American beaver (*Castor canadensis*) in dryland streams. *Aquatic Conservation.*

Pool, T.K., and J.D. Olden. Accepted. Assessing the long-term influence of an impoundment on the biogeography of an arid river basin's fish fauna. *Ecology of Freshwater Fish*.

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Olden, J.D., Poff, N.L. and B.P. Bledsoe. 2006. Incorporating ecological knowledge into ecoinformatics: An example of modeling hierarchically structured aquatic communities with neural networks. *Ecological Informatics* 1:33-42.

Olden, J.D., McCarthy, J.M., Maxted, J.T., Fetzer, W.W., and M.J. Vander Zanden. 2006. The rapid spread of rusty crayfish (*Orconectes rusticus*) with observations on native crayfish declines in Wisconsin (U.S.A.) over the past 130 years. *Biological Invasions* 8: 1621-1628.

Mercado–Silva, N., Olden, J.D., Maxted, J.T., Hrabik, T.R., and M.J. Vander Zanden. 2006. Forecasting the spread of invasive rainbow smelt (*Osmerus mordax*) in the Laurentian Great Lakes region of North America. *Conservation Biology* 20:1740-1749.

Neff, B.D., and J.D. Olden. 2006. Is peer review a game of chance? *Bioscience* 56: 333-340.

Poff, N.L., Olden, J.D., Pepin, D.M, and B.P. Bledsoe. 2006. Placing global streamflow variability in geographic and geomorphic contexts. *River Research and Applications* 22:149-166.

Vander Zanden, M.J., Olden, J.D., and C. Gratton. 2006. Food-web approaches in restoration ecology. Pages 165-189 in *Foundations of Restoration Ecology* (Falk, D, Palmer, M. and J. Zedler, editors).

Poff, N.L., Olden, J.D., Vieira, N.K.M., Finn, D.S., Simmons, M.P. and B.C. Kondratieff. 2006. Functional trait niches of North American lotic insects: traits-based ecological applications in light of phylogenetic relationships. *Journal of the North American Benthological Society* 25: 730-755.

Hoffman, A.L., Olden, J.D., Monroe, J.B., Poff, N.L., Wellnitz, T.A, and J.A. Wiens. 2006. Current velocity and habitat patchiness shape stream herbivore movement. *Oikos* 115: 358-368.

McCarthy, J.M., Hein, C.L., Olden, J.D., and M. J. Vander Zanden. 2006. Coupling long-term studies with meta-analysis to investigate impacts of non-native crayfish on zoobenthic communities. *Freshwater Biology* 51: 224-235.

Cucherousset, J., Paillisson, J.-M., Carpentier, A., Eybert, M.-C., and J.D. Olden. 2006. Habitat use of an artificial wetland by the invasive catfish *Ameiurus melas*. *Ecology of Freshwater Fish* 15: 589-596.

Lawler, J.J., Aukema, J.E., Grant, J., Halpern, B., Kareiva, P., Nelson, C.R., Ohleth, K., Olden, J.D., Schlaepfer, M.A., Silliman, B., and P. Zaradic. 2006. Conservation science: a 20-year report card. *Frontiers in Ecology and the Environment* 4:473-480.

2005

Olden, J.D., and N.L. Poff. 2005. Long-term trends in native and non-native fish faunas of the American Southwest. *Animal Biodiversity and Conservation* 28:75-89.

Olden, J.D., Douglas, M.E., and M.R. Douglas. 2005. The human dimensions of biotic homogenization. *Conservation Biology* 19:2036-2038.

Stoltz, J.A., Neff, B.D., and J.D. Olden. 2005. Allometric growth and sperm competition in fishes. *Journal of Fish Biology* 67:470-480.

Oakes, R.M. Gido, K.B., Falke, J.A., Olden, J.D., and B.L Brock. 2005. Modelling of stream fishes in the Great Plains, USA. *Ecology of Freshwater Fish* 14:361-374.

2004

Olden, J.D., Schooley, R.L., Monroe, J.B., and N.L. Poff. 2004. Context-dependent perceptual ranges and their relevance to animal movements in landscapes. *Journal of Animal Ecology* 73:1190-1194.

Olden, J.D., Hoffman, A.L., Monroe, J.B., and N.L. Poff. 2004. Movement behaviour and dynamics of an aquatic insect larva in a stream landscape. *Canadian Journal of Zoology* 82:1135-1146.

Olden, J.D., and N.L. Poff. 2004. Ecological mechanisms driving biotic homogenization: Testing of a mechanistic model using fish faunas. *Ecology* 85:1867-1875.

Olden, J.D., Joy, M.K., and R.G. Death. 2004. An accurate comparison of methods for quantifying variable importance in artificial neural networks using simulated data. *Ecological Modelling* 178:389-397.

Olden, J.D., Poff, N.L., Douglas, M.R., Douglas, M.E., and K.D. Fausch. 2004. Ecological and evolutionary consequences of biotic homogenization. *Trends in Ecology and Evolution* 19:18-24.

Olden, J.D. and N.L. Poff. 2004. Clarifying biotic homogenization. *Trends in Ecology and Evolution* 19:283.

Vander Zanden, M.J., Olden, J.D., Thorne, J.H., and N.E. Mandrak. 2004. Predicting the occurrence and impact of bass introductions on temperate lake food webs. *Ecological Applications* 14: 132-148.

2003

Olden, J.D. and N.L. Poff. 2003. Toward a mechanistic understanding and prediction of biotic homogenization. *American Naturalist* 162:442-460.

Olden, J.D. 2003. A species-specific approach to modeling biological communities and its potential for conservation. *Conservation Biology* 17:854-863.

Olden, J.D. and N.L. Poff. 2003. Redundancy and the choice of hydrologic indices for characterizing streamflow regimes. *River Research and Applications* 19:101-121.

2002

Olden, J.D. and D.A. Jackson. 2002. A comparison of statistical approaches for modeling fish species distributions. *Freshwater Biology* 47:1976-1995.

Olden, J.D. and D.A. Jackson. 2002. Illuminating the "black box": Understanding variable contributions in artificial neural networks. *Ecological Modelling* 154:135-150.

Olden, J.D., Jackson, D.A., and P.R. Peres-Neto. 2002. Predictive models of fish species distributions: A comment on proper validation and chance predictions. *Transactions of the American Fisheries Society* 131:329-336.

2001

Olden, J.D. and D.A. Jackson. 2001. Fish-habitat relationships in lakes: Gaining predictive and explanatory insight using artificial neural networks. *Transactions of the American Fisheries Society* 130:878-897.

Olden, J.D. and B.D. Neff. 2001. Cross correlation bias in lag analysis of aquatic time series. *Marine Biology* 138:1063-1070.

Olden, J.D., Jackson, D.A., and P.R. Peres-Neto. 2001. Spatial isolation and fish communities in drainage lakes. *Oecologia* 127:572-585.

Peres-Neto, P.R., Olden, J.D., and D.A Jackson. 2001. Environmentally constrained null models: Site suitability as occupancy criterion. *Oikos* 93:110-120.

Peres-Neto, P.R. and J.D. Olden. 2001. Assessing the robustness of randomization tests: Examples from behavioural studies. *Animal Behaviour* 61:79-86.

Jackson, D.A., Peres-Neto, P.R., and J.D. Olden. 2001. What controls who is where in freshwater fish communities: The roles of biotic, abiotic and spatial factors? *Canadian Journal of Fisheries and Aquatic Science* 58:157-170.

2000

Olden, J.D. 2000. An artificial neural network approach for studying phytoplankton succession. *Hydrobiologia* 436:131-143.

Olden, J.D. and D.A. Jackson. 2000. Torturing the data for the sake of generality: How valid are our regression models? *Écoscience* 7:501-510.

Reports

Olden, J.D., Reidy Liermann, C.A., Pusey, B.J., and M.J. Kennard. 2009. Protocols for hydrologic classification and a review of Australian applications. Chapter 2 in *Ecohydrological regionalisation of Australia: a tool for management and science*. 28 pages. Technical Report PN22591, Land and Water Australia. Online: http://lwa.gov.au/products/pn22591.

Steward, B. and 25 other contributors. 2009. Evolving hazards and emerging opportunities. Chapter 12 in *The 3rd United Nations World Water Development Report: Water in a Changing World (WWDR-3)*. 15 pages. Online: http://www.unesco.org/water/wwap/wwdr/wwdr3/.

Non-refereed publications

Schlaepfer, M., Aukema, J.E., Grant, J., Halpern, B., Hoekstra, J., Kareiva, P., Lawler, J., Manolis, J.C., Nelson, C.R., Olden, J.D., Silliman, B., Stephens, S., Wiens, J. and P. Zaradic. 2005. Re-wilding: A bold plan that needs native megafauna. *Nature* 437:951-951.

Olden, J.D. 2003. Colorado State University Student Subunit. *Fisheries* 28:28.

Presentations (first author only)

Invasive species: Envisioning alternative global futures in the New Pangaea. 2012. Portland State University. [*Keynote*]

Climate change and invasive species in hot pursuit of Pacific salmon. 2012. Annual meeting of the Wildlife Society. Portland, OR. [*invited*]

Invasive species in hot pursuit of Pacific salmon. 2012. Congress of the Iberian Association of Limnology, Guimarães, Portugal. [*Keynote*]

Invasive species: Exonerating crimes to envision a new global future. 2011. University of Washington Dean's Lecture. Seattle, Washington. [*Keynote*]

Invasive species and alternative global futures for freshwater ecosystems. 2011. Fishery Society of the British Isles conference, Bournemouth, UK. [*Keynote*]

Invasive species and alternative global futures for freshwater ecosystems. 2011. Canadian Conference for Fisheries Research, Toronto, Canada. [*Keynote*]

Freshwater protected areas and defining a conservation blueprint for desert fishes. 2011. University of British Columbia, Vancouver, Canada. [*invited*]

Invasive species and alternative global futures for freshwater ecosystems. 2011. Canadian Aquatic Invasive Species Network, Quebec City, Canada. [*Keynote*]

Latent extinction risk of freshwater fishes: a traits-based approach to inform conservation ranking schemes. 2010. Society for Conservation Biology, Edmonton, Alberta. [*invited*]

Freshwaters in the public eye: understanding the role of science and image media in aquatic conservation. 2010. Utah State University. UT (Ecology Center Seminar). [*invited*]

Perceptions and realities of aquatic invasive species. 2010. Utah State University. UT (Ecology Center Seminar). [*invited*]

Species invasions, environmental change and the future biogeography of freshwater fishes. 2009. The 10th International Congress of Ecology. Brisbane, Australia. [*invited*]

The biogeography of nowhere: Species invasions and the fading antiquity of globe fish faunas. 2009. The 10th International Congress of Ecology. Brisbane, Australia. [*invited*]

Turning dreams into reality: challenges to developing flow-ecological relationships to support streamflow management. 2009. North American Benthological Society, Grand Rapids, MI. [*invited*]

Emerging pathways for crayfish invasions in Washington: Recommendations for new regulations. 2008. Washington State Aquatic Nuisance Species Committee, Olympia, WA.

Vulnerability of lake ecosystems to species invasions in Washington. 2008. Washington State Lake Protection Association, WA.

Life history strategies and patterns of fish invasions and extirpations in Lower Colorado River Basin. 2008. Texas State University, San Marcos, TX. [*invited*]

Developing regional environmental flow standards for Washington State. 2008. American Fisheries Society (Western Division), Portland, OR.

Riverine thermal regimes: an integral component of environmental flows. 2007. 3rd International Symposium on Riverine Landscapes (TISORL), Queensland, Australia. [*invited*]

Smart prevention of invasive species in aquatic ecosystems. 2007. Oregon State University, Corvallis, OR. [*invited*]

Smart prevention of invasive species in aquatic ecosystems. 2007. NOAA Northwest Fisheries Science Center, Seattle, WA. [*invited*]

The biogeography of nowhere: Global fish invasions and the re-shuffling of freshwater life. 2006. Macroecological Tools for Global Change Research, Potsham, Germany. [*invited*]

Life-history strategies predict fish invasions and extirpations in the Colorado River Basin. 2006. Kansas State University, Manhattan, KS. [*invited*]

Global pathways of freshwater fish introductions. 2006. American Fisheries Society, Lake Placid, NY.

Living on the edge: trait synergies and the rarity, extirpation, and extinction of endemic desert fishes. 2005. Ecological Society of America, Quebec, Canada.

Comparative life-history strategies of native and non-native fishes in the Colorado River Basin: Using species traits to understand rates of invasions and extirpations over the past century. 2005. North American Benthological Society, New Orleans, LA. [*invited*]

Biotic homogenization – Patterns, processes and the importance of variety in the spice of human life. 2005. International Biogeography Society, West Virginia, USA. [*invited*]

Spatial recovery of warmwater fish assemblages to multiple disturbance gradients caused by river regulation in the eastern United States. 2005. Griffith University, Brisbane, Australia. [*invited*]

Upstream and downstream recovery of fish assemblages to multiple dam disturbance gradients. 2005. American Fisheries Society, Madison, WI.

Forecasting current and future patterns of biotic homogenization in response to urbanization. 2005. Society for Conservation Biology, New York, NY. [*invited*]

A hierarchical understanding and prediction of fish species distributions in Canada. 2004. Massey University, Palmerston North, New Zealand. [*invited*]

Impacts of altered riverine thermal regimes on warmwater fish assemblages – the establishment of productive tailwater trout fisheries, but at what cost? 2004. American Fisheries Society (Southern Division), Oklahoma City, OK.

A hierarchical understanding and prediction of fish species distributions in Ontario. 2003. Canadian Conference for Fisheries Research, Toronto, Ontario, Canada.

Movement mechanics and behaviour of an herbivorous insect larva across complex benthiscapes. 2002. North American Benthological Society, Pittsburg, PE.

Artificial neural networks and the development of predictive models for temperate fish communities. 2001. Canadian Conference for Fisheries Research, Toronto, Ontario, Canada.

Artificial neural networks: New insight in modeling fish-habitat relationships. 2001. International Association for Great Lakes Research, Trois-Rivere, Ontario, Canada.

The use of regression trees and neural networks to model freshwater fish assemblages. 1999. Ecological Society of America, Spokane, WA

Spatial isolation in drainage lakes: Implications for community ecology of fishes. 1998. American Society of Ichthyologists and Herpetologists, Guelph, Ontario, Canada.

Grants and Fellowships

Department of Defense. *Predicting, measuring, and monitoring aquatic invertebrate biodiversity on dryland military bases.* (2012-2016). Co-PI	$1,560,000
Department of Defense. *Hydroecology of intermittent and ephemeral streams: will landscape connectivity sustain aquatic organisms in a changing climate?* (2010-2014). Lead-PI	$1,478,000
U.S. Geological Survey (Aquatic GAP Program). *Conservation planning for fishes in the Upper Colorado River Basin* (2010-2013). Co-PI	$780,000
U.S. Geological Survey (National Fish Habitat Action Plan). *Managing the Nations fish habitat at multiple spatial scales in a rapidly changing climate* (2010-2012). Co-PI	$2,418,000
U.S. Geological Survey (National Fish Habitat Initiative). *Assessing the threats to freshwater fishes in the Lower Colorado River Basin* (2009-2011). Co-PI	$379,000
Oregon Zoo. *Forecasting the potential spread and impacts of invasive crayfish in the northwestern United States* (2009). Co-PI	$4,300
Washington State Department of Ecology. *Prioritizing management efforts for aquatic nuisance species in Washington* (2009-2010). Lead PI	$40,900
U.S. Environmental Protection Agency - STAR Program. *Integrating future climate change and riparian land-use to forecast the effects of stream*	$587,000

warming on species invasions and their impacts on native salmonids (2008-2011). Lead-PI

U.S. Geological Survey (Aquatic GAP Program). *Forecasting fish species invasions in the Lower Colorado River Basin* (2007-2010). Lead-PI	$165,000
National Oceanic and Atmospheric Administration. *Non-native species impacts on threatened and endangered salmonids* (2008-2009). Co-PI	$18,000
National Oceanic and Atmospheric Administration. *Developing tools for estimating salmon population benefits of restoring environmental flows to regulated or diverted tributaries* (2008-2009). Co-PI	$87,000
National Oceanic and Atmospheric Administration. *Ecologically sustainable water management in Washington State: Developing flow management tools for watershed planning* (2007-2008). Co-PI	$84,000
The Nature Conservancy David H. Smith Conservation Postdoctoral Fellowship (2004).	$155,000
National Science Foundation – Dissertation Improvement Grant (2004).	$11,600
Natural Sciences and Engineering Research Council of Canada – Graduate Fellowship PGS B (2001).	$38,200
Natural Sciences and Engineering Research Council of Canada – Graduate Fellowship PGS A (1999).	$34,600

Awards

Ecological Society of America – Early Career Fellow (2013)

Canadian Conference for Fisheries Research, Stevenson Award (2011)

UW College of the Environment, Outstanding Researcher Award (2010)

Society for Conservation Biology, Early Career Conservationist Award (2010)

American Fisheries Society, Skinner Memorial Award (2004)

Society for Conservation Biology, Annual Student Travel Award (2004)

American Fisheries Society, Jimmie Pigg Memorial Outstanding Student Achievement Award (2004)

American Fisheries Society, Colorado State University Outstanding Contribution Award (2003)

American Museum of Natural History, Theodore Roosevelt Memorial Scholarship (2003)

American Fisheries Society Western Division, William Trachtenberg Scholarship (2003)

Cowpasture River Preservation Association, Janice LaRue Grant (2003)

Canadian Conference for Fisheries Research, Clemens, Rigler Travel Award (2003)

Ocean Journal Research Scholarship (2002)

Colorado State University, Ecology Research Grant (2002)

Transactions of the American Fisheries Society, Robert L. Kendall Best Paper Award (2001)

International Association for Great Lakes Research, Presentation Award Honorable Mention (2001)

University of Toronto, Frederick P. Ide Graduate Award (2001)

Outstanding Teaching Assistant Award, University of Toronto (2000)

Outstanding Teaching Assistant Award, University of Toronto (1999)

University of Toronto, Edna Margaret Robertson Scholarship (1999)

University of Toronto Open Fellowship (1998)

Synergistic Activities

Ecological Society of America - Rapid Response Team, 2012 - present

University of Washington Climate Change and Global Health Joint Initiative: Adaptive Solutions for Human Health and the Environment. Faculty Fellow. 2010-present.

International Congress of Ecology, Symposium *Species invasions, environmental change and the future biogeography of freshwater fishes*. Brisbane, Australia. 2009. Organizer.

American Fisheries Society Hutton Scholar Mentor (High School students). Seattle, WA. 2009 & 2011.

Ecological Society of America, First Millennium Conference – Water-Ecosystem Services, Drought, and Environmental Justice (Workshop). Athens, GA. 2009. Participant.

Canadian Aquatic Invasive Species Network (Workshop) – Environmental niche modeling to match invasion habitats between North America and Europe. Halifax, NS. 2008. Participant.

Regional-scale streamflow-ecology relationships (Workshop), TNC/USGS, Seattle, WA. 2008. Participant.

Global Water System Project (Workshop). University of New Hampshire. 2007. Participant.

National Center for Ecological Analysis and Synthesis (Workshop), *Machine Learning for the Environment*. Santa Barbara, CA. 2006. Participant.

Upper Gila River Science Forum for the New Mexico Interstate Stream Commission. New Mexico. 2006. Panel Expert.

Environmental Law Institute (Workshop) – Assessing Gaps and Needs for Invasive Species Management in a Changing Climate. Washington, D.C. 2006. Participant.

National Center for Ecological Analysis and Synthesis (Workshop), *Assessing the Future Research Needs for the USGS Aquatic GAP Program*. Santa Barbara, CA. 2006. Participant.

Global River Sustainability Project (Workshop). Estes Park, CO. 2005. Participant.

Global River Sustainability Project (Workshop). Brisbane, Australia. 2004. Participant.

University Service

Mentorship

Graduate Students
- Polly Gibson, MS (2011-present)
- David Lawrence, PhD (2009-present)
- Lauren Kuehne, MS (2009-2012)
- Eric Larson, PhD (2008-2011)
- Meryl Mims, MS (2009-2010), PhD (2011-present)
- Thomas Pool, PhD (2008-2011)
- Laura Twardochleb, MS (2011-present)

Undergraduate Students
- Phillip Campbell (2008)*
- Ben Clemence (2008)
- Jared Waltz (2009)
- Hannah Darrin (2010)
- Chris Biggs (2010)*
- Kimberly Wood (2011)*
- Sean Luiz (2011)*

* author on publication

Post-doctoral Researchers
- Kristin Jaeger (2010-2012)
- Cathy Reidy Liermann (2008-2010)
- Angela Strecker (2009-2011)
- Ben Stewart-Koster (2011-present)

Research Staff
- Mariana Tamayo (2009-2011)

Committee Member (past and present)

20 graduate students (University of Washington, Rutgers University, Kansas State University)

School and University Committees

Recruiting and Admission School Committee (2008 –)
Quantitative Committee, Ad Hoc member (2009)
Young Investigator Seminar Series, Co-organizer (2008)

Other service

WISC Baseline Assessment of Priority Puget Sound Basin Invasive Species, Participant (2013)

Scholarly and Professional Activities

Professional

Ecological Applications (2013 -)
Frontiers in Ecology and the Environment, Editorial Board (2010 –)
Ideas in Ecology and Evolution, Editorial Board (2008 –)
Conservation Biology, Editorial Board (2010 – 2012)
Global Ecology and Biogeography, Editorial Board (2006 – 2010)
Freshwater Illustrated, Board of Directors (2007 –)

Manuscript Referee for:

American Naturalist
Aquatic Invasions
Archiv für Hydrobiologie
Biological Conservation
Biological Invasions
Canadian J. Fish & Aquatic Sci.
Copeia
Conservation Biology
Diversity and Distributions
Ecology
Ecology Letters
Ecological Applications
Global Ecol. and Biogeography
Hydrobiologia
Journal of Applied Ecology
Journal of Biogeography
Landscape Ecology
Nature
NA J. of Fisheries Management
Northwest Science
Phil. Trans. R. Soc. London
Proc. Nat. Academy of Sciences
River Research & Applications
Science
Trans. American Fisheries Soc.
Western NA Naturalist.

Referee for Granting Agencies

National Science Foundation
National Science and Engineering Research Council
National Fish and Wildlife Foundation
New York Sea Grant
Great Lakes Fisheries Commission

MATTHEW A. REIDENBACH

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(a) Professional Preparation

Cornell University	Civil and Environmental Engineering	B.S. 1997
Stanford University	Civil and Environmental Engineering	M.S. 1998
Stanford University	Civil and Environmental Engineering	Ph.D. 2004
Univ. California, Berkeley	Integrative Biology (post-doc)	2004-2007

(b) Appointments

2013-present	Associate Professor, Department of Environmental Sciences, University of Virginia, Charlottesville, VA
2007-2013	Assistant Professor, Department of Environmental Sciences, University of Virginia, Charlottesville, VA
2004-2007	Post-Doctoral Research Fellow, Miller Institute for Basic Research in Science, University of California, Berkeley, CA
2000-2004	Research Assistant, Department of Civil and Environmental Engineering, Stanford University, Stanford, CA
1998-2000	Teaching Assistant, Department of Civil and Environmental Engineering, Stanford University, Stanford, CA
1996	Teaching Assistant, Department of Civil and Environmental Engineering, Cornell University, Ithaca, NY

(c) Publications (10 most relevant)

1. **Reidenbach M.A.,** Berg P., Hume A., Hansen J.C.R., and Whitman E.R., 2013, "Hydrodynamics of intertidal oyster reefs: the influence of boundary layer flow processes on sediment and oxygen uptake", *Limnology and Oceanography: Fluids and Environments*, 3, 225-239.
2. **Reidenbach, M. A.,** Limm M., Hondzo M., and Stacey M.T., 2010, "The effects of bed roughness on boundary layer mixing and mass flux across the sediment-water interface", *Water Resources Research*, 46, W07530, doi:10.1029/2009WR008248.
3. **Reidenbach M.A.**, Koseff J.R., and Monismith S.G., 2007, "Laboratory experiments of fine-scale mixing and mass transport within a coral canopy", *Physics of Fluids*, 19(7), 075107.
4. **Reidenbach M.A.**, Koseff J.R., Monismith S.G., Steinbuck J.V., and Genin A., 2006, "The effects of waves and morphology on mass transfer within branched reef corals", *Limnology and Oceanography*, 51(2): 1134-1141.
5. **Reidenbach M.A.**, Monismith S.G., Koseff J.R., Yahel G., and Genin A., 2006, "Boundary layer turbulence and flow structure over a fringing coral reef", *Limnology and Oceanography*, 51(5), 1956-1968.

6. **Reidenbach M.A.,** Koseff J.R., and Koehl M.A.R., 2009, "Hydrodynamic forces on larvae affect their settlement on coral reefs in turbulent, wave driven flow", *Limnology and Oceanography,* 54(1), 318-330.
7. Genin A., Monismith S.G., **Reidenbach M.A.,** Yahel G., and Koseff J.R., 2009, "Intense benthic grazing of phytoplankton in a coral reef", *Limnology and Oceanography*, 54(3), 938-951.
8. **Reidenbach M.A.**, George N., and Koehl M.A.R., 2008, "Fluid flow through lobster olfactory organs: the effects of morphology and kinematics on odor sampling by the spiny lobster, *Panulirus argus*", *Journal of Experimental Biology*, 211, 2849-2858.
9. Koehl M.A.R. and **Reidenbach M.A.**, 2007, "Swimming by microscopic organisms in ambient water flow", *Experiments in Fluids*, 43, 755-768.
10. Monismith S.G., Genin A., **Reidenbach M.A.**, Yahel G., and Koseff J.R., 2006, "Thermally driven exchanges between a coral reef and the adjoining ocean", *Journal of Physical Oceanography*, 36(7), 1332-1347.

(d) <u>Awards and Honors</u>

2012 CAREER Award, National Science Foundation (Division of Ocean Sciences)
2011 All-University Teaching Award, University of Virginia
2011 Mead Honored Faculty (for faculty-student interaction), University of Virginia
2010-2011 Distinguished Young Investigator (FEST grant), University of Virginia
2009-2010 University Teaching Fellowship, University of Virginia
2009-2010 Professors as Writers Fellowship, University of Virginia
2010 Seven Society Teaching Recognition, University of Virginia
2004-2007 Miller Institute Post-Doctoral Fellowship, University of California Berkeley
2003 Best Speaker Award, NSF/ONR Physical Oceanography Dissertation Symposium
1997-2000 Stanford Graduate Fellowship, Stanford University

(e) <u>Collaborators and Other affiliations</u>

(a) Collaborators and Co-editors:

Charles Derby (Georgia State University), Amatzia Genin (Hebrew University, Israel), Michael Hadfield (University of Hawaii), James Hench (Duke University), Miki Hondzo (University of Minnesota), Mimi Koehl (U.C. Berkeley), Jeffrey Koseff (Stanford University), DeForest Mellon (University of Virginia), Stephen Monismith (Stanford University), Johanna Rosman (U. of North Carolina, Chapel Hill), Mark Stacey (U.C. Berkeley), Gitai Yahel (Ruppin School of Marine Sciences, Israel)

(b) Graduate Advisors and Post-Doctoral Sponsors-Stephen Monismith and Jeffrey Koseff, Stanford University (PhD thesis co-advisors), Mimi A.R. Koehl and Mark Stacey, U.C. Berkeley (Post-doctoral co-sponsors)

(c) Thesis Advisor and Postgraduate-Scholar Sponsor: all at the University of Virginia: Amy Grady (Ph.D. candidate, 2009-), Swapnil Pravin (Ph.D. candidate, 2009-), Jonathan Stocking (Ph.D. candidate, 2010-), Emily Thomas (M.S. candidate, 2011-), Ross Timmerman (M.S. candidate, 2012-), Elizabeth Murphy (Ph.D. candidate, 2012-), Elizabeth Whitman (M.S.), Jennifer Hansen (Ph.D.), total graduate students advised: 8, post-docs: 0.