

## PART I - ADMINISTRATIVE

### Section 1. General administrative information

<b>Title of project</b>	
Gas bubble disease research and monitoring of juvenile salmonids	
<b>BPA project number</b>	9602100
<b>Contract renewal date (mm/yyyy)</b>	04/2000
<b>Multiple actions? (indicate Yes or No)</b>	yes
<b>Business name of agency, institution or organization requesting funding</b>	
US Geological Survey-Biological Resources Division, Columbia River Research Lab.	
<b>Business acronym (if appropriate)</b>	USGS-BRD, CRRL
<b>Proposal contact person or principal investigator:</b>	
<b>Name</b>	Dr. Alec G. Maule
<b>Mailing address</b>	CRRL, 5501A Cook-Underwood Rd.
<b>City, ST Zip</b>	Cook, WA 98605
<b>Phone</b>	(509) 538-2299 x 239
<b>Fax</b>	(509)538-2843
<b>Email address</b>	alec_maule@usgs.gov
<b>NPPC Program Measure Number(s) which this project addresses</b>	
5.6.E.1	
<b>FWS/NMFS Biological Opinion Number(s) which this project addresses</b>	
RPA 16; RPA 17	
<b>Other planning document references</b>	
Proposed Recovery Plan for Snake River Salmon (March 1995): Task 2.2d	
<b>Short description</b>	
Provide support for the Smolt Monitoring Program monitoring juvenile salmonids for signs of gas bubble disease. Activities include (1) care and maintenance of equipment, (2) training, and (3) QA/QC.	
<b>Target species</b>	
Pacific salmon, <i>Oncorhynchus</i> spp.	

### Section 2. Sorting and evaluation

<b>Subbasin</b>
Mainstem

#### Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories
X	Anadromous fish	X	Multi-year (milestone-based evaluation)	Watershed councils/model watersheds
	Resident Fish		Watershed project eval.	Information dissemination
	Wildlife			Operation & maintenance
				New construction

	X	Research & monitoring
		Implementation & mgmt
		Wildlife habitat acquisitions

### Section 3. Relationships to other Bonneville projects

***Umbrella / sub-proposal relationships.*** List umbrella project first.

Project #	Project title/description
20552	Smolt monitoring projects
8401400	Smolt monitoring at Federal dams
8712700	Smolt monitoring by non-federal agencies

***Other dependent or critically-related projects***

Project #	Project title/description	Nature of relationship

### Section 4. Objectives, tasks and schedules

***Past accomplishments***

Year	Accomplishment	Met biological objectives?
1995	Established monitoring protocol	yes
1997	Chart progression of signs of GBD	yes
1997	Develop depth-sensitive radio tag	yes
1999	Describe depth behavior of emigrants	anticipated in 1999

***Objectives and tasks***

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine significance of GBD in juvenile salmonids migrating in the Snake and Columbia rivers.	a b	TASKS (a and b) HAVE BEEN COMPLETED OR TRANSFERED TO THE SMOLT MONITORING PROGRAM
		c	Provide support for monitoring for GBD, including care and maintenance of equipment, training, and QA/QC.
2	Determine optimal method for detecting and assessing GBD in juvenile salmonids	a b c d	ALL TASKS ASSOCIATED WITH OBJECTIVE 2 HAVE BEEN COMPLETED OR DEEMED UNNECESSARY BY REGIONAL MANAGERS.
3	Determine in-situ vertical distribution of individual juvenile salmonids migrating in water with high total dissolved gas	a b c	ALL TASKS WITHIN THIS OBJECTIVE WILL BE COMPLETED UNDER FY99 FUNDING
4	Determine sublethal effects of exposure to gas supersaturated water on juvenile	a b	ALL TASKS UNDER THIS OBJECTIVE HAVE BEEN DEEMED UNNECESSARY

Obj 1,2,3	Objective	Task a,b,c	Task
	salmonids	c d	BY REGIONAL MANAGERS.

**Objective schedules and costs**

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1C	04/1999	03/2004	Insure that equipment is functional; train those monitoring for GBD; provide QA/QC.		100%
				<b>Total</b>	100%

<b>Schedule constraints</b> This project will continue each year that monitoring for signs of GBD is conducted . If monitoring is terminated, the project will end.
<b>Completion date</b> This project will continue each year that monitoring for signs of GBD is conducted . If monitoring is terminated, the project will end.

**Section 5. Budget**

<b>FY99 project budget (BPA obligated):</b>	ca. <b>\$500,000</b>
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**FY2000 budget by line item**

Item	Note	% of total	FY2000 (\$)
Personnel		48.5	21,170
Fringe benefits		14.5	6,351
Supplies, materials, non-expendable property		2.3	1,000
Operations & maintenance			
Capital acquisitions or improvements (e.g. land, buildings, major equip.)			
NEPA costs			
Construction-related support			
PIT tags	# of tags:		
Travel		7.2	3,154
Indirect costs	(38% of direct costs)	27.5	12,036
Subcontractor			
Other			
<b>TOTAL BPA REQUESTED BUDGET</b>			<b>43,711</b>

**Cost sharing**

Organization	Item or service provided	% total project cost (incl. BPA)	Amount (\$)
<b>Total project cost (including BPA portion)</b>			43,711

**Outyear costs**

	FY2001	FY02	FY03	FY04
<b>Total budget</b>	45,022	46,373	47,764	49,197

## Section 6. References

Watershed?	Reference

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## PART II - NARRATIVE

### Section 7. Abstract

All of the research and development objectives of this project will have been completed or deemed unnecessary by FY2000. In 1995, the Columbia River Research Laboratory (CRRL) developed and implemented protocols for monitoring juvenile salmonids for signs of GBD. Monitoring is now part of the Smolt Monitoring Program; however, CRRL still maintains the microscopes and other equipment used for monitoring. We also train those doing the monitoring and provide QA/QC of the program during the year. These activities will be necessary as long as the GBD monitoring program continues.

### Section 8. Project description

**a. Technical and/or scientific background**

Members of the Smolt Monitoring Program (SMP) will examine emigrating juvenile salmonids for external signs of gas bubble disease (GBD). The examination will involve examining fins, eyes, and lateral line for the presence of bubbles. Monitoring will be conducted at Bonneville, John Day, McNary, Rock Island, Lower Monumental, Little Goose, and Lower Granite dams. The goal of the examinations is to determine the relative extent to which the migrating juvenile salmonids passing the dam or sampling location have been exposed to harmful levels of total dissolved gases based upon the presence and severity of GBD induced bubbles on the fish. The data will be reported to the management entities, the state water quality agencies as well as other interested parties on a daily basis during the spill season. An eight page document (*Monitoring Protocol for Signs of GBT in Juvenile Salmon* March 11, 1996) is available.

**b. Rationale and significance to Regional Programs**

Monitoring migrating salmon for signs of GBD is required of the state water quality agencies as part of their waiver of the 110% TDG standard during voluntary spill. Voluntary spill was part of the 1995 NMFS Biological Opinion in order to reach 80% fish guidance efficiency at Snake and lower Columbia river dams.

**c. Relationships to other projects**

As indicated, this project will continue each year that monitoring for signs of GBD is conducted . If monitoring is terminated, the project will end.

**d. Project history** (for ongoing projects)

As indicated, this project originally had four objectives and 14 tasks. All of these tasks will have been completed or deemed unnecessary by FY2000, except for Objective 1, Task c. This project has developed a GBD monitoring protocol now used by the SMP, and charted the progression of GBD in chinook salmon and steelhead. By the end of FY1999, we will have finished research detailing the vertical migratory behavior of spring chinook and steelhead in relation to TDGS.

Annual reports:

Maule, A.G., J. Beeman, K.M. Hans, M.G. Mesa, P. Haner, and J.J. Warren. 1997. Gas Bubble Disease Research and Monitoring. 1996 Annual Report.

Mesa, M.G., J. Beeman, K.M. Hans, P. Haner, L. Weiland, T.C. Robinson, and A.G. Maule. in review. Gas Bubble Disease Research and Monitoring. 1997 Annual Report.

Beeman, J., T. C., Robinson, P. Haner, S. VanderKooi, and A.G. Maule. in preparation. Gas Bubble Disease Research and Monitoring. 1998 Annual Report.

**e. Proposal objectives**

Objective 1. Determine significance of GBD in juvenile salmonids migrating in the Snake and Columbia rivers.

Task c. Provide support for monitoring for GBD, including care and maintenance of equipment, training, and QA/QC.

Because federal and state regulatory agencies have granted waivers of legally established water quality standards, it is necessary to insure that the quality of the data collected as a condition of those waivers be legal defensible. Our training and QA/QC will provide the needed level of assurance.

**f. Methods**

Objective 1, Task c will involve training investigators for the Biological Monitoring Program and checking their work during the migration season. At least two training sessions will be conducted at the Columbia River Research Laboratory. Training includes classroom instruction about the basic causes and physiological effects of GBD, how to evaluate the severity of GBD signs, and recording data. The training includes laboratory work examining fish with GBD. The biologists are taught standardized methods to count bubbles in the lateral line, to recognize fin bubbles, and to rank the severity of bubbles in the fins. A standardized system of non-lethal fish anesthesia and sampling is also demonstrated.

The in-season QA/QC will be performed by a trained examiner through visits to each monitoring site. The examiner will observe the technique of the on-site biologist. They also examine fish after the on-site biologist and compare results. The examiner visits each monitoring site several times during the migration season. The complete QA/QC protocol is described in a nine page document, plus appendices (*Quality Assurance Plan for the Biological Monitoring of Gas Bubble Trauma in Juvenile Salmon, March 1996*). At the end of the season we will collect all of the equipment, which is primarily composed of high-quality dissecting microscopes. All of the equipment will be examined to insure there is no obvious damage and stored. Prior to the next field season, the microscopes will be professionally cleaned and adjusted.

**g. Facilities and equipment**

The facilities at the Columbia River Research Laboratory are more than adequate for this project. We have been functioning in this capacity since 1995.

**h. Budget**

The budget for this project is composed primarily of salary and benefits costs for the person conducting the training and providing QA/QC. Karen Hans will have filled this position for the three years (1997-1999). Additional costs include supplies for care and cleaning of the microscopes and travel while performing QA/QC.

## **Section 9. Key personnel**

Key personnel in this project include Dr. Alec Maule, PI (Research Physiologist, 160 hrs) and Karen Hans, Biological Science Technician, 0.5 FTE). Brief resumes are attached.

## **Section 10. Information/technology transfer**

Information and technology transfer will take place during the training sessions described above and on a “real time” basis during the QA/QC trips to monitoring sites. The QA/QC reports will be kept on file at CRRL and will be sent to the Fish Passage Center. At the end of the monitoring season, we will file an annual report describing all activities for the year.

**Congratulations!**

# Alec G. Maule

## EDUCATION

- B.A., University of California, Riverside (Psychology) 1969
- B.S., California Polytechnic University, San Luis Obispo (Natural Res. Managmnt) 1979
- M.S., Oregon State University (Fisheries Science) 1982
- Ph.D., Oregon State University (Physiology/Fisheries) 1989

## EMPLOYMENT

- Associate Professor (Courtesy), OSU (1998-present)
- Adjunct Associate Professor of Biology, Portland State University (1992-present)
- Supervisory Physiologist (Research) USGS-BRD, Columbia R. Res. Lab, (1991-present)

## SELECTED PUBLICATIONS

Maule, A.G., D. Rondorf, J. Beeman, and P. Haner. 1996. Incidence and severity of Renibacterium salmoninarum in spring chinook salmon in the Snake and Columbia rivers. *Journal of Aquatic Animal Health* 8: 37-46. (Finalist for Best Paper in the journal for 1996).

Maule, A.G., R. M. Schrock, C. Slater, M. S. Fitzpatrick, and C. B. Schreck. 1996. Immune and endocrine responses of adult spring chinook salmon during freshwater migration and sexual maturation. *Fish and Shellfish Immunology* 6:221-233.

Beeman, J.W., P.V. Haner, and A.G. Maule. 1998. A new miniature pressure-sensitive radio transmitter. *North American Journal of Fisheries Management* 18:458-464.

Weiland, L.K., M.G. Mesa, and A.G. Maule. In press. Influence of bacterial kidney disease on susceptibility to gas bubble trauma in juvenile spring chinook salmon. *Journal of Aquatic Animal Health*.

## PROFESSIONAL ORGANIZATIONS

- International Society of Developmental and Comparative Immunologists
- American Fisheries Society
  - Fish Health Section
  - Physiology Section (Charter member)
    - Vice Pres., Pres.-elect, Pres., Past-Pres. 1993-97
  - Oregon Chapter
    - Pres.-elect/Pres./Past Pres. 1990-93
- Associate Editor for the *Journal of Aquatic Animal Health* 1997-present

## REGIONAL COMMITTEES

- Dissolved Gas Team 1995-present
- Grand Coulee Dam Dissolved Gas Team 1996-present

## Karen M. Hans

### **Present Position:** Biological Sciences Technician

U. S. Geological Survey

Northwest Biological Science Center, Columbia River Research Laboratory

Cook, Washington 98605

**Current assignment:** assist team leaders and project leader with conducting experiments, collection of biological samples in field locations, data analysis, and report writing. Conduct gas bubble trauma training sessions for Smolt Monitoring Project personnel and monitor field data collection as part of quality control/quality assurance program (QA/QC).

<b>Education:</b>	<u>Degree/Course</u>	<u>Date</u>	<u>School</u>
	B.S. (Animal Science)	1983	Oregon State University
	A. A. (Vet. Med.)	1988	Portland Community College

### **Experience:**

1993-present: Biological Science Technician, Columbia R. Res. Lab., Cook, WA

1990-1992 Experimental Biological Aid, field data collection and analysis,  
Oregon Department of Fish and Wildlife

1987-1990 Veterinary Medical Technician, Willamette Veterinary Clinic,  
Oregon State University Veterinary Teaching Hospital 1987-1988

### **Expertise:**

Gas bubble disease physiology related to progression of signs leading to mortality, and recovery.

Organize and conduct training sessions regarding recognizing the signs of gas bubble disease in juvenile salmonids, recording data, and fish handling for non-lethal sampling.

Observe field personnel collect gas bubble disease data for QA/QC.

Juvenile salmonid seaward-migration and smoltification; comparison of wild and hatchery fish

### **Publications:**

Hans, K. M., M. G. Mesa, and A. G. Maule. *in review*. Rate of disappearance of gas bubble trauma signs in juvenile salmonids. To be submitted to Journal of Aquatic Animal Health

Schrock, R. M. and 9 co-authors. 1998. Assessment of smolt condition for travel time analysis. Project review 1987-1997. Report to the Bonneville Power Administration. Contract number DE-A179-87BP35245. <http://www.bpa.gov>

Hans, K. M. and A. G. Maule. 1997. Gas bubble trauma monitoring and research of juvenile salmonids 1996. Chapter 2 *in* Gas bubble trauma monitoring and research of juvenile salmonids, Annual Report 1996. Report to the BPA, Portland, Oregon.

Maule, A. G., K. M. Hans, M. P. Swihart. 1997. Gas bubble trauma monitoring and research of juvenile salmonids. Chapter 2 *in* Gas bubble trauma monitoring and research of juvenile salmonids, Annual Report 1995. Report to the Bonneville Power Administration, Portland, Oregon.