MANUEL A. MARTINEZ (SBN 115075)
NEYSA A. FLIGOR (SBN 215876)
STEIN & LUBIN LLP
600 Montgomery Street, 14th Floor
San Francisco, CA 94111
Telephone: (415) 981-0550
Facsimile: (415) 981-4343

Attorneys for Proposed Intervenors
THE NEW 49'ERS, INC., a California corporation, and
RAYMOND W. KOONS, an individual

SUPERIOR COURT OF CALIFORNIA

COUNTY OF ALAMEDA

UNLIMITED CIVIL JURISDICTION

KARUK TRIBE OF CALIFORNIA and LEAF HILLMAN, Plaintiffs, v. CALIFORNIA DEPARTMENT OF FISH AND GAME and RYAN BRODDRICK, Director, California Department of Fish and Game, Defendants.	Case No. RG05 211597 **THIRD DECLARATION OF JOSEPH C. GREENE IN SUPPORT OF THE REPLY MEMORANDUM IN OPPOSITION TO PROPOSED STIPULATED JUDGMENT OF THE NEW 49'ERS AND RAYMOND W. KOONS** Res. No.: 556514 Date: January 26, 2006 Time: 9:00 a.m. Judge: Honorable Bonnie Sabraw Place: Department 512 Filing Date: May 6, 2005 Trial Date: None Set

Joseph C. Greene, being duly sworn, deposes and says:

1. I make this third declaration in further support of the opposition of The New 49'ers and Raymond W. Koons to the Proposed Stipulated Judgment in this action, and most specifically in response to certain declarations filed by the above-captioned parties in support of that Proposed Stipulated Judgment. Because I am informed that the hearing on this matter is scheduled for January 26, 2006, I have not had sufficient time to prepare a full response, and have not attempted

to offer a response to all of the materials presented in such declarations; my failure to respond should not be taken as agreement with the opinions of those declarations.

2. In its papers, the Karuk Tribe complains that I "identified [myself] as a 'research biologist' . . . but offers no credentials whatsoever as an expert on fisheries, the rivers in question or suction dredging . . . His declaration offers no opinions of his own, but consist entirely of selective quotes and paraphrases of reports by others."

3. I have added my resumé to this declaration as Exhibit 1. As it demonstrated, my association with problems of mining and surface water contamination began as early as 1974 in the Coeur d' Alene mining district relative to the Kellog, ID mine and smelter.

4. I am very familiar with suction dredge mining and other forms of gold mining. I have, over the past 15 years or more, observed and participated in suction dredge mining operations. My exposure to mining techniques have occurred on the Umpqua River, Calapooia River, Quartzville Creek, Stratton Creek and Carberry Creeks in Oregon, the Klamath River and Stanislaus Rivers in California, and Humbug Creek, San Domingo Wash, Rye and others in Arizona.

5. Some 25 of my 30 years of government service have related to biological research. A lifetime of biological testing on toxicity and nutrient pollution in the aquatic environment provides a sound basis for appreciating the magnitude of impacts associated with the asserted environmental contaminants, and gives a quantitative perspective generally lacking in general biologists, which leaves them less able to ascertain which environmental effects are significant and which aren't.

6. With respect to the claim that my declarations offered no opinions of my own, but merely quoted or paraphrased reports of others, I must disagree. The reason I included extensive quotations was to provide support for the opinions presented, which are my own opinions based upon my review of the literature, professional experience, experience with suction dredge mining, and, particularly in the case of water temperature, actual scientific data. While the refusal of the Karuk Tribe and the Department to make its data available limits my ability to respond to the claims made, I believe that I have been able to demonstrate with the data and scientific

information available that many of the claims are not substantiated and contradicted by what data and literature is available.

7. In his declaration, Dr. Moyle states, "I agree with the thrust of Harvey and Lisle (1998), that it should be assumed that dredging is harming declining species unless it can be proven otherwise". I believe the weight of the available scientific literature establishes that this is the case. In particular, in April 2003 Dr. Peter B. Bayley, of the Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR published a final report titled "Response of fish to cumulative effects of suction dredge and hydraulic mining in the Illinois subbasin, Siskiyou National Forest, Oregon". Dr. Bayley stated that, "Harvey and Lisle (1998) opine that "effects of dredging commonly appear to be minor and local", but stress that cumulative effects of several operations at larger scales have not been investigated. This is one reason this study has been undertaken. Because most suction dredge mining activity in the Rogue basin and the Siskiyou National Forest was concentrated in the Illinois River drainage, the study described here was limited to the drainage of that subbasin." Dr. Bayley concluded, "Localized, short-term effects of suction dredge mining have been documented in a qualitative sense. However, on the scales occupied by fish populations such local disturbances would need a strong cumulative intensity of many operations to have a measurable effect. Local information reveals that most suction dredge miners more or less adhere to guidelines that have recently been formalized by the Forest Service and generally in the Oregon." Dr. Bayley's study and other works confirm that even when analyzed from a cumulative effects perspective, there is no reason to believe that suction dredge mining is deleterious to fish.

8. Dr. Moyle goes on to state, "It should be assumed there is harm, unless it can be proven otherwise. One reason for taking this conservative position is that we simply do not know the effect of dredging on many species." He went on to further state that, "Even for salmonids, information on the effects of dredging, with the exception of a few studies such as Harvey (1989), is largely anecdotal or in non-peer reviewed reports". Dr. Moyle continues with the statement, "In particular, coho salmon, spring-run Chinook salmon, and summer steelhead are particularly

vulnerable to the immediate effects of dredging and have been reduced to low numbers in the Klamath Basin so need special protection".

9. This is mere opinion without scientific supporting data, for as previously described, Dr. Moyle has in substance acknowledged that he does not have any documentation to support these assertions. As far as I can tell, the perception of Dr. Moyle and others of the condition of salmonid stocks is rooted in misconceptions concerning the relative importance of fresh water habitat as compared with ocean conditions and harvest which are of much greater importance in the population dynamics of these fish.

10. I have prepared 2 charts using data found on the Kris Klamath Resource Information System (KRIS) http://www.krisweb.com/ on the Internet, which is referenced in Mr. Soto's Declaration. The captions from the data used for Exhibit 2 and 3 stated,

> **Caption for Exhibit 2:** "The U.S. Forest Service has conducted annual spring Chinook and summer steelhead dive counts since 1990. Grilse are also known as jack salmon and are generally precocious males that have spent only one year in the ocean. Grilse counts were separated from adult counts starting in 1995. The Salmon River is very clear so direct dive observation counts can be very accurate during periods of low flow. The spring Chinook population dropped to very low levels, with as few as 170 adults returning in 1990, but the population rebounded strongly starting in 1993. The increase in the population may be in response to improved ocean conditions and decreased harvest. Data are provided by the Klamath National Forest, Salmon River Ranger District. Values for spring Chinook before 1990 come from West (1991)." I noted that even here it is recognized that ocean conditions play an important part in the population dynamics of salmon returns.

> **Caption for Exhibit 3:** "The Chart is derived from data provided by the Klamath National Forest, Salmon River Ranger District. Summer steelhead counts before 1990 come from Eric Gerstung (CDFG)."

The data illustrated in Exhibits 2 and 3 show a pattern of fish counts over a 24-year period. Throughout this there were small-scale suction dredges operating in the Klamath River Basin, the Salmon River and other confluent streams to the Klamath River. During this period there were cycles where large or small returns in fish number occurred. I believe it unlikely that small-scale gold suction dredges caused the great fall-off of fish counts in low years. Furthermore, I believe it is unlikely that the large peaks in salmon counts can be attributed to the operation of small-scale suction dredges.

11. The dredging activities of small-scale suction dredging operations are not impacting the growth, survival, or returns of salmonids in the Klamath River Basin to any significant degree, and there is no scientific evidence to the contrary. In fact, there is some evidence that suction dredge mining may be associated with higher fish populations, particularly in areas where spawning gravels that have become impacted and suction dredge mining improves spawning habitat.

12. Mr. Soto claims to have extensive data supporting the restrictions in the Proposed Stipulated Judgment, none of which he has disclosed. In particular, he states a conclusion for Tom Martin Creek but, he does not disclose any factual data. Neither I nor the Court can evaluate the strength of the data to support his conclusions, and one would ordinarily expect that strong supporting data would be disclosed.

13. Although our investigation of water temperatures in the Klamath River was preliminary, all of the data were presented to the court to support our position. Mr. Soto's attack on our test plan is misplaced, for there was no plan, inasmuch as the work was preliminary. As a professional Mr. Soto should have understood the nature of the work.

14. I stated in my declaration "...All of the measurements taken in the mainstream Klamath River during this survey exceeded the 20°C upper incipient lethal temperature for salmonids. ...The confluent streams to the Klamath River, listed in Table 2, ranged in temperature from 15.34°C in Mill Creek to 22.57°C in Elk Creek (measured Aug. 9, 2005). Obviously, tributaries above 20°C cannot serve as thermal refugia for salmonids." Soto states, "His conclusion is that the temperature readings at the confluence of tributaries with the mainstem of the river were higher that the level (he says 20 degrees Centigrade) that could accommodate salmonids on the days of his measurements that month. This conclusion is not supported by any fisheries research of which I am aware."

15. In fact, the supporting research is voluminous. In particular,

- The *optimal pre-spawning broodstock survival, maturation and spawning temperature range for salmonids* is 6.1°C – 17.8°C (50°F – 64°F) (Coutant, 1977; Piper et al. 1982, Raleigh et al. 1986).

- For *chronic exposure, inferred range of incipient sublethal elevated water temperature for broodstock, increased infertility, and embryonic development abnormalities* is in the range of 15°C – 17.2°C (59°F – 63°F) (Marine, 1992).

- I referred, conservatively, to the *chronic exposure, incipient range of upper lethal water temperatures for pre-spawning adult Chinook salmon* which was primarily derived from observations of captive broodstock. That range is 17.2°C – 20.0°C (63°F – 68°F) (Berman, 1990; Bouck et al., 1977; Hinze et al., 1956; Rice, 1960).

- The *temperature ranges for increased pathogenicity of many of the important salmonid disease organisms with potential for impairing reproduction in Chinook salmon.* The temperature range defined for these effects are 13.3°C – 27.2°C (56°F – 81°F) (Becker and Fujihara, 1978; Fryer and Pilcher, 1974; Post, 1987).

- Lastly research has defined *the range of highest elevated temperatures observed to be transiently passed through during migrations or tolerated for short-term by adult Chinook salmon* are 25°C to 27°C (77°F – 81°F).

16. The point of my testimony was that although the salmonids may survive for a time in waters with temperatures greater than 20°C, they are in harms way because sublethal reproductive effects may be occurring at water temperatures as low as 17°C. I did not intend, at any time, to suggest that salmonids would not prefer such waters if they were cooler than surrounding areas and they had no better choices. Nor did I intend to suggest that salmonids would not survive at all at these temperatures. I never stated, as Mr. Soto implies (page 8, lines 23-24) that 20°C was a lethal temperature to the resident fish.

17. Mr. Soto lists a large number of data sources in paragraph 8 of his Declaration. He states, "All of the above studies were made available to and reviewed by the parties conducting the settlement negotiations in this case. In many cases (*i.e.*, other than the www.krisweb.com materials), they have not been made available to the public and the scientific community, and I am informed that the attorney representing the California Department of Fish and Game has refused to make them available to The New 49'ers and Mr. Koons.

18. With regard to Dr. Duffy, he states, "The entrainment of fish eggs and yolk sac fry by suction dredging is another serious impact. Dredging on fish eggs and yolk sac fry can cause up to 100 percent mortality if sucked through a dredge of any size of covered with sediment

produced by suction dredge mining equipment." This argument is used over and over by anti-dredging forces and has no substance in fact. Fishery biologists should all know that the California Department of Fish and Game protects the fish by establishing dredging seasons that are outside to the period of fish spawning and egg hatching.

19. Dr. Duffy also states, regarding ocean temperature cycles, "If these changes in ocean productivity were the sole determinant of salmon population abundance one would expect to see periodic increases in salmon population abundance, but salmon abundance has only declined." I suggest a look at Exhibits 2 and 3. Each of these charts covers a 24-year history for fish counts in the Salmon River and the Klamath River Basin. It is pretty clear that fish counts in 1978 for the Klamath River Basin, the first data presented, were coming off of a higher fish population. The populations bottomed in 1981 and began their population growth phase up through 1987. There was a small reduction in fish counts in 1988 and 1989 followed by the population topping out in 1990. In 1991 and 1992 there was a reduction in fish counts again. But that was followed by a 5-year spike in fish counts. A pattern of peaks and valleys is also observed in Exhibit 3, Fish Counts in the Salmon River. The data does in fact meet Dr. Duffy's expectations of seeing a "periodic increases in salmon population abundance". It is unclear how he can credibly opine that "salmon abundance has only declined".

20. Dr. Duffy also takes exception to my testimony that there are ocean cycles of importance to the population dynamics of salmon. This is a widely-recognized phenomenon that cannot seriously be disputed by fisheries biologists. I am including as Exhibit 4 hereto a report downloaded from the Internet titled "Hot topics, Where Are The Salmon?: What scientists at the University of Alaska Fairbanks say about salmon declines in Alaska. The attachment contains interviews with:

- Dr. Ted Cooney, Professor of Fisheries Oceanography
- Dr. Milo Adkison, Professor of Fisheries
- Dr. Tom Weingartner, Assistant Professor of Oceanography, and
- Dr. Donald Schell, Director, Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks.

I have highlighted pertinent portions of these materials.

21. In light of the predominant effects of ocean cycles and factors more directly affecting fish survival, particular harvest, changes in the relevant fish runs cannot be presumptively associated with human use of fresh water habitat, particularly at the insignificant levels reflected by suction dredge mining.

I certify under penalty of perjury under the laws of California that the foregoing is true and correct.

Executed on January 24, 2006

Joseph C. Greene

Joseph C. Greene

JOSEPH C. GREENE

Research Biologist

Greene Environmental Services

33180 Dorset Lane
Philomath, OR, USA
97370-9555

<u>Summary of Experience</u>

Over 30 years of national and international professional experience including consulting, research, and teaching for industry and government regulatory agencies. Activities included project management, contract administration, experimental design, preparation of research reports and technical documents, laboratory supervision, statistical analysis of data, computer simulation, development and application of biological methods, and performance of algal growth potential and aquatic and terrestrial toxicity tests.

Consulting experience included assessment of nutrient pollution in freshwater canals and rivers, assessment of heavy metals toxicity from mining activities and paint stripping, investigation of toxicity and bioaccumulation in soils at a military facility, evaluation of water soluble toxicants at Superfund sites, and assessment of algal toxicity from textile dyes.

Research activities included establishment of an ecotoxicology laboratory, development of a biological-chemical-physical protocol for measuring potential toxicity of construction materials, development of internationally standardized test methods (aquatic algae, aquatic macroinvertebrate, terrestrial plant and terrestrial invertebrate), chairman of testing committees for ASTM and Standard Methods, platform chairman of several international symposiums, workshops, and congresses, and invited speaker to numerous national and international professional scientific meetings.

Teaching experience included a number of short courses and workshops on performance of algal growth potential and interpretation of results across the nation, a workshop on environmental analysis techniques in Europe, a workshop on complex problems with point and non-point sources of water contamination for the US Department of the Interior, and an environmental engineering graduate seminar on toxicity testing for environmental engineering applications.

Government agencies experience included project management, experimental design, hands-on research, data analysis, and report writing.

EXHIBIT 1

Employment History

US Environmental Protection Agency (EPA), Terrestrial Processes & Effects	10/1994 - 06/2002
Oregon State University, Corvallis, OR (OSU)	10/1990 - 02/1997
US Environmental Protection Agency (EPA), Ecotoxicology Branch	10/1988 - 09/1990
US Environmental Protection Agency (EPA), Terrestrial Toxicology	10/1987 - 09/1988
US Environmental Protection Agency (EPA), Hazardous Waste & Water	10/1985 - 09/1987
US Environmental Protection Agency (EPA), Hazardous Material Team	10/1981 - 09/1985
US Environmental Protection Agency (EPA), Freshwater Toxicology	3/1979 - 10/1981
US Environmental Protection Agency (EPA), Special Studies	8/1976 - 03/1979
US Department of the Interior, National Eutrophication Research	6/1969 - 07/1976

US EPA, Terrestrial Processes & Effects Team- Research Biologist (Retired June 2002). Responsibilities include development of weather data sets for sites throughout the Western United States for simulating the effects of changes in CO_2 and ozone concentrations on global climate changes. Activities include performing data parameterization, sensitivity analysis, field studies, and computer simulations using the TREGRO model for ponderosa pine and Douglas fir.

Oregon State University, Dept of Civil Engineering- Adjunct Professor / Research Biologist (6 years). Developed an ecotoxicology research program to evaluate environmental contamination, nutrient pollution in surface waters, and standardized testing methodologies. This effort included the establishment of two modern ecotoxicology laboratories encompassing three temperature controlled environmental chambers, electronic particle counters, fluorometers, microscopes, a high-speed refrigerated ultracentrifuge, and high capacity commercial refrigerated storage. The facilities are used for the performance of aquatic and terrestrial toxicity tests such as: terrestrial acute toxicity tests and bioaccumulation in earthworms cultured in site soils; 48-static acute freshwater macroinvertebrate toxicity tests; 96-hour static chronic freshwater algal toxicity tests. 48-hour in-situ, acute marine mysid toxicity tests, Microtox toxicity tests; and SOS Chromotests. Research projects included ecotoxicology investigations involving the Burnt Fly Bog Superfund Site, Marlboro, NJ; Cannelton Superfund Site, Saulte Ste. Marie, MI; Camp Pendleton Marine Base, San Diego County, CA; Black Point Canals, Dade County, FL; Lower Granite Reservoir, Snake River, WA; and, near Kelly Boatworks, Coos Bay, OR. Project proponents included The US EPA, US Army Corps of Engineers, National Academy of Sciences (TRB), CH_2M-Hill, Jacobs Engineering Group, Ciba-Geigy Corporation, Metropolitan Dade County Florida, Oregon Department of Environmental Quality, and the City of Corvallis, OR.

Research activities have resulted in numerous publications, peer reviewed journals, book chapters, conference proceedings, manuals, research reports, and consultation to the Canadian Association of Petroleum Producers and Environment Canada. The published research has been recognized and has resulted in national and international invitations to profession conferences and workshops.

US EPA, Ecotoxicology Branch- Research Biologist (2 years)
Responsibilities included project management for investigations of Superfund sites including: Drake Chemical, Loch Haven, PA; California Gulch, Leadville, CO. Activities included test design, statistical data analysis, and report writing.

US EPA, Terrestrial Toxicology- Biologist (1 year)
Responsibilities included project management for an investigation of toxicity at the United Chrome, Superfund Site, Corvallis, OR and a surface water pollution investigation of the Red River of the North for the International Red River Pollution Board. Activities included test design statistical data analysis, and report writing.

US EPA, Hazardous Waste & Water Branch- Biologist (2 years)
Responsibilities included project management for an investigation of toxicity at the largest Superfund Site in the US, Clark Fork River and Silver Bow Creek, MT, the Cabot/Carbon Superfund Site, Gainesville, FL, and Sapp Battery Superfund Site, FL. Activities included test design, statistical data analysis, and report writing.

US EPA, Hazardous Materials Team- Biologist (4 years)
Responsibilities included project management for an investigation of toxicity at the Rocky Mountain Arsenal Superfund Site, Denver, CO; Aberdeen Arsenal, MD; Sunflower Arsenal, KS; H&L Landfill, IL; and United Chrome Superfund Site, OR. Activities included test design, statistical data analysis, and report writing.

US EPA, Freshwater Toxicology- Biologist (2 years)
Responsibilities included project management for an investigation of surface water quality (toxicity and nutrient pollution) in: Lake Mead, NV; Zumbro Lake, MN; and Lake Pend Oreille, ID. Special research projects included investigations of the toxicity of Dimilin and Dimethyl Foramide to algae. Activities included test design, statistical data analysis, and report writing.

US EPA, Special Studies Branch- Biologist (3 years)
Responsibilities included an investigation of nutrient pollution (Eutrophication) in Shagawa Lake, MN; the Snake and Columbia River systems of ID, WA, and OR. A laboratory investigation was performed to determine the sensitivity of the green algae *Selenastum capricornitum* to zinc in the presence of EDTA and phosphorus. Activities included test design, statistical data analysis, and report writing.

US EPA, National Eutrophication Research Program- Biologist (7 years)
Responsibilities included an investigation of nutrient pollution (Eutrophication) in: the South Fork Coeur d'Alene River, ID; Lake Coeur d'Alene, ID, the Spokane River, ID; Long Lake, WA; and 49 lakes throughout the United States. The objective of these studies was to test surface water samples and validate the results obtained from the performance of the Algal Growth Potential (AGP) laboratory assay. Investigations included: comparison of the indigenous algal biomass to that grown in the AGP laboratory tests; AGP yields in surface waters containing toxic concentrations of zinc; development of coefficients for the prediction of algal yields based upon

chemical analysis of the growth limiting nutrient (nitrogen or phosphorus). These studies formed the basis of the U.S. EPA standard method for biologically measuring algal growth potential (nutrient pollution) in surface waters.

Professional Societies

- Society of Environmental Toxicology and Chemistry (Charter member), 1980-1997
- American Society for Testing and Materials, 1978-1997
- Pacific NW Society of Environmental Toxicology and Chemistry (Charter Member), 1990-1997.
- Hazardous Materials Control Resources Institute, 1992-1995.
- Water Environment Federation, 1992-1995

Professional Recognition

- Sigma Xi, the Scientific Research Society;
- Intergovernmental Personnel Act (IPA) exchange with Oregon State University, Department of Civil Engineering, Western Regional Hazardous Substance Research Center, 1990-1994;
- Courtesy Faculty Appointment, Adjunct Professor, Oregon State University, Department of Civil Engineering, 1990-1997.

Committees, Commissions and Boards

- Joint Task Group Chairman, American Public Health Association, Standard Methods for the Examination of Water and Wastewater, Committee on Part 8111, Biostimulation (Algal Productivity) 1995-1997;
- Scientific Advisory Group Member, Canadian Association of Petroleum Producers, Testing of Toxicity Based Methods to Develop Site-Specific Cleanup Objectives, 1993-1994;
- Member, Middle Snake River (Idaho) Nutrient Management Technical Advisory Committee, 1992- 1994;
- Chairman, American Society for Testing and Materials, Task Group for a Proposed Standard Guide for Conducting Static Chronic 96-h Toxicity tests on Hazardous Chemical Wastes Using the Freshwater Alga *Selenastrum capricornutum*, 1990-1991;
- Co-Chairman, American Society for Testing and Materials, Task Group for a Proposed Standard Guide for Conducting Seed Germination and Root Elongation Soil Elutriate Chronic Toxicity Bioassays, 1990-1993;
- Co-Chairman, American Society for Testing and Materials, Task Group for a Proposed Standard Guide for Conducting Seedling Emergence Toxicity Tests in Soils or Sediments from Hazardous Waste Sites, 1990-1993;
- Member, Organization for International Standards (ISO), Technical Advisory Group for the United States, International Standards Committee, Technical Committee 147 for

Water Quality, Subcommittee 5 for Aquatic Toxicology, 1988-1993;

- Chairman, American Society for Testing and Materials, Task Group for A Standard Guide for Conducting Static 96-H Toxicity Tests with Micro algae, 1987-1990;
- Reviewer, Journal of the Society of Environmental Toxicology and Chemistry (SETAC), 1987-1990;
- Reviewer, Acute Lethality Test Method Documents, Environment Canada, Conservation and Protection, Ottawa, Ontario, Canada, 1989;
- Reviewer, Archives of Environmental Contamination and Toxicology, 1985-1990.
- Reviewer, Journal of Water, Air and Soil Pollution, 1974-1985;
- Chairman, American Society for Testing and Materials, Committee on A Standard Practice for Algae Growth Potential Testing *with Selenastrum capricornutum*, 1977-1981;
- Chairman, American Public Health Association, Standards for the Examination of Water and Waste Water, Task Committee on Part 802, Biostimulation (Algal Productivity), 1977-1981;
- Chairman, American Public Health Association, Standards for the Examination of Water and Waste Water, Task Committee on Part 803, Toxicity Testing with Phytoplankton, 1977-1981.

Technical Advisor to Environment Canada

- Member Environment Canada's External Advisory Committee on Development of Guidance Document for Environmental Toxicological Data Interpretation and Application, 1993-1994;
- External reviewer for the "Toxicity Data Interpretation and Application Guidance Manual in support of the Environment Canada Steering Committee, 1993-1994
- Provide an International Review of toxicity bioassay protocols for use in the assessment of contaminated sites under the Canadian Governments National Contaminated Sites Assessment Program, 1991-1993;
- Member, Canadian Intergovernmental Aquatic Toxicity Group Subcommittee, Microplate Growth Inhibition test Using *Selenastrum capricornutum*, Environment Canada 1990-1992;
- Waste Management Division, Ottawa, Ontario. Participation led to an agreement to include a waste extraction procedure for hazardous wastes with a biological testing component included, 1986-1993;
- Oil, Gas and Energy Division, Ottawa, Ontario, Technical advisor to Environment Canada and the Canadian Petroleum Association, Participation led to a procedure for determining the character and environmental hazard of natural gas processing industrial waste sludge which includes a biological testing component, 1986-1992;

Awards

- Technical Contribution Award, U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis OR., 1988;
- Nomination for the Scientific and Technological Achievement Award for the research publication "Comparative Toxicology of Laboratory Organisms for Assessing Hazardous Waste Sites," U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC, 1987;
- Nominated for The Gold Medal for Scientific Achievement, U.S. Environmental Protection Agency, Office of the Administrator, Washington. D.C., 1979;
- Special Achievement Award for Noteworthy Contribution in the Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR., 1979;
- Special Service Award for Special achievement in the Environmental Protection Agency, Environmental Research laboratory, Corvallis, OR, 1977;
- Special Achievement Award, U.S Environmental Protection Agency, Environmental Protection Agency, Corvallis, OR, 1974.

PUBLICATIONS

Books and Book Chapters

Application of Recommended Whole Organism Bioassays in the Assessment of Contaminated Sites in Canada. (with C. Keddy and M. A. Bonnell), Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada. 1996.

Evaluation of Hazard Potential of Chemicals and Chemical Wastes Through the Use of Toxicity Bioassays, In: **Pollution and Biomonitoring**, ed. Dr. B.C. Rana, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, India, ISBN 0-07-462351-6. 1995. pp. 101-116.

A Review of Whole Organism Bioassays for Assessing the Quality of Soil, Freshwater Sediment and Fresh Water in Canada, (with C. Keddy and M. A. Bonnell), Scientific Series No. 198, Ecosystem Conservation Directorate, Evaluation and Interpretation Branch, Environment Canada, Ottawa, Ontario, Canada. (ISBN 0-662-22155-9), March 1994, 185 pages.

Biological and Chemical Evaluation of Remediation Performed on Metal Bearing Soils, (with J.J. Barich, III), In: **Tailings and Mine Waste '94**, ed. A.A. Balkema, A.A. Balkema Publishers, Brookfield, VT, ISBN 90 5410 3647,1994, pp. 157-166.

The Toxicological Assessment of Remedial and Restoration Techniques, (with J.J. Barich and S.A. Peterson), In: **International Seminar on Nuclear War and Planetary Emergencies, 14th Session: Innovative Technologies For Cleaning The Environment: Air, Water and Soil.** ed. A. Zichichi, 1993, pp. 221-233.

Biological Assessment of Toxicity Differences in Survival for Four Organisms Cultured in Sodium Acetate Leaching Media and Elutriates of Municipal or Industrial Waste Leached with De-ionized Water or Sodium Acetate Leaching Media, (with S.A. Peterson and W.E. Miller), In: **Symposium on Waste Testing and Quality Assurance**: ASTM STP 1062 (D. Friedman ed.). American Society for Testing and Materials, Philadelphia, 1990 [INVITED].

Protocols for Short Term Toxicity Screening of Hazardous Waste Sites, (with C. L. Bartels, W.J. Warren-Hicks, B.R. Parkhurst G.L. Linder, S.A. Peterson, and W.E. Miller), U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR., EPA/600/3-88/029, 1988.

Early Plant Development and Plant Toxicity Assessments: Seed Germination and Root Elongation Tests, (with G. Linder, C. Bartels, S. Nwosu, S. Smith, D. Wilborn and H. Ratsch), **1st Symposium on the Use of Plants for Toxicity Assessment**, American Society for Testing and Materials, Atlanta, GA., 1989.

Limnological Studies of Zumbro Lake and the Application of Quantitative Techniques to Control the Sources of Cultural Eutrophication, (with J.G. Schilling and C.N. Affeldt), In: **Surface Water Impoundments**, (H.G. Stephen, ed.) American Society of Civil Engineering, New York, 1982.

Bibliography of the Literature Pertaining to the Genus Selenastrum, (with A.A. Leishman and W.E. Miller) US Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR. EPA 600/9-79-021. 1979.

The Selenastrum capricornutum Printz Algal Assay Bottle Test: Experimental Design, Application, and Data Interpretation Protocol, (with W.E. Miller and T. Shiroyama), U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR. EPA 600/9-78-018. 1978.

"The Relationship of Laboratory Algal Assays to Measurements of Indigenous Phytoplankton in Long Lake, WA," (with R.A. Soltero, WE. Miller, A.F. Gasperino, and T. Shiroyama) In: **Biostimulation and Nutrient Assessment**, (E.J. Middlebrooks, D.H. Falkenborg and T.E. Maloney, eds.) Ann Arbor Science, 1976.

Application of Algal Assays to Define the Effect of Waste Water Effluents Upon Algal Growth in Multiple Use River Systems, (with W.E. Miller and T. Shiroyama) In: Biostimulation and Nutrient Assessment, (E.J. Middlebrooks, D.H. Falkenborg and T.E. Maloney, eds.) Ann Arbor Science, 1976.

The Algal Growth Responses of Selenastrum capricornutum Prinz and Anabaena flos-aquae (Lyngb.) De Brebisson in Waters Collected from Shagawa Lake, Minnesota, (with W.E. Miller and T. Shiroyama) In: Biostimulation and Nutrient Assessment, (E.J. Middlebrooks, D.H. Falkenborg and T.E. Maloney, eds.) Ann Arbor Science. 1976.

Technical Journals

Elevated CO_2 and Temperature Alter the Response of Pinus Ponderosa to Ozone: A Simulation Analysis, (with D.T. Tingey, J.A. Laurence, J.A. Weber, W.E. Hoggsett, S. Brown, and E.H. Lee), Ecological Applications, 11(5) 2001, pp1412-1424.

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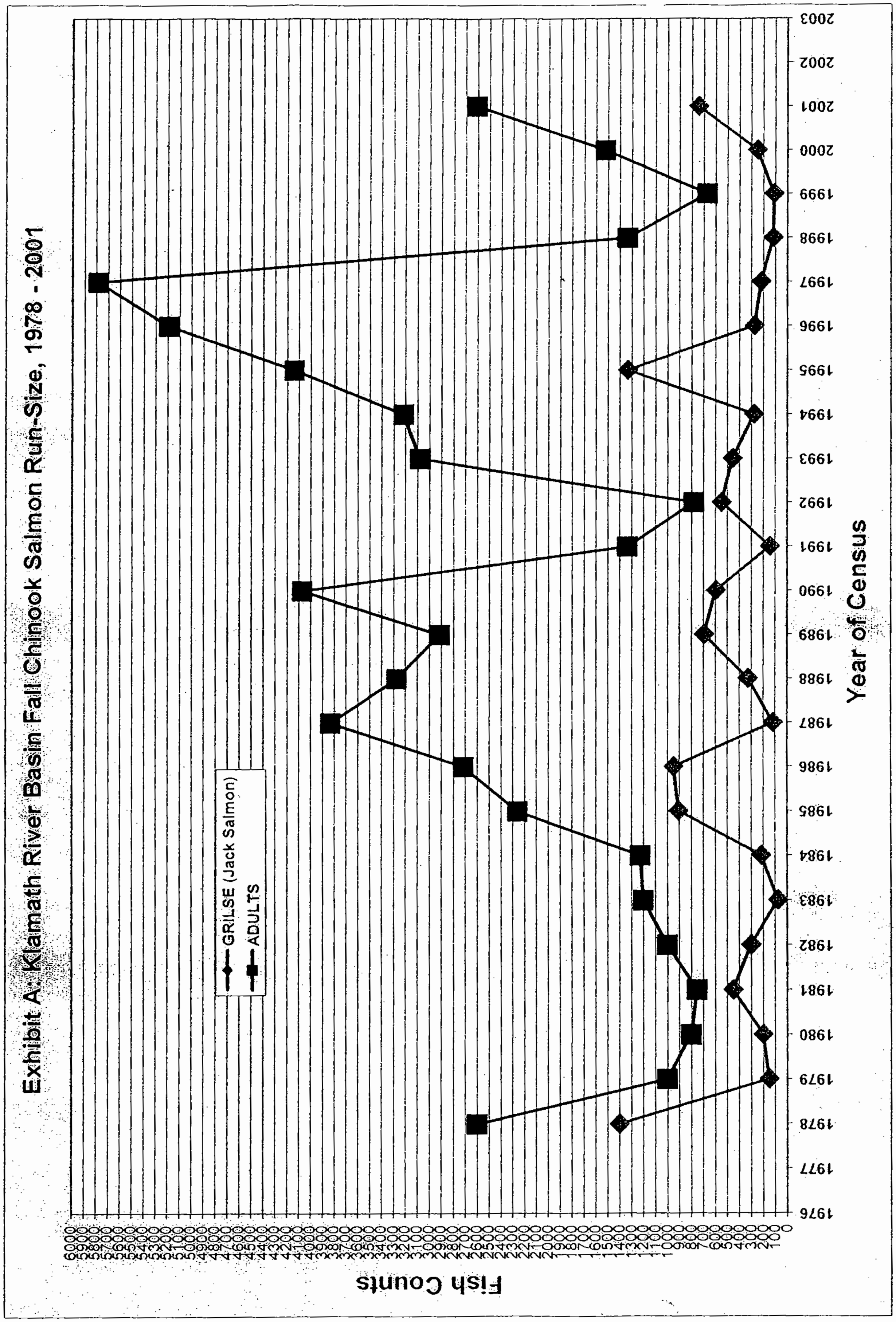
Exhibit A: Klamath River Basin Fall Chinook Salmon Run-Size, 1978 - 2001
GRILSE (Jack Salmon)
ADULTS
Fish Counts
Year of Census
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

EXHIBIT 2

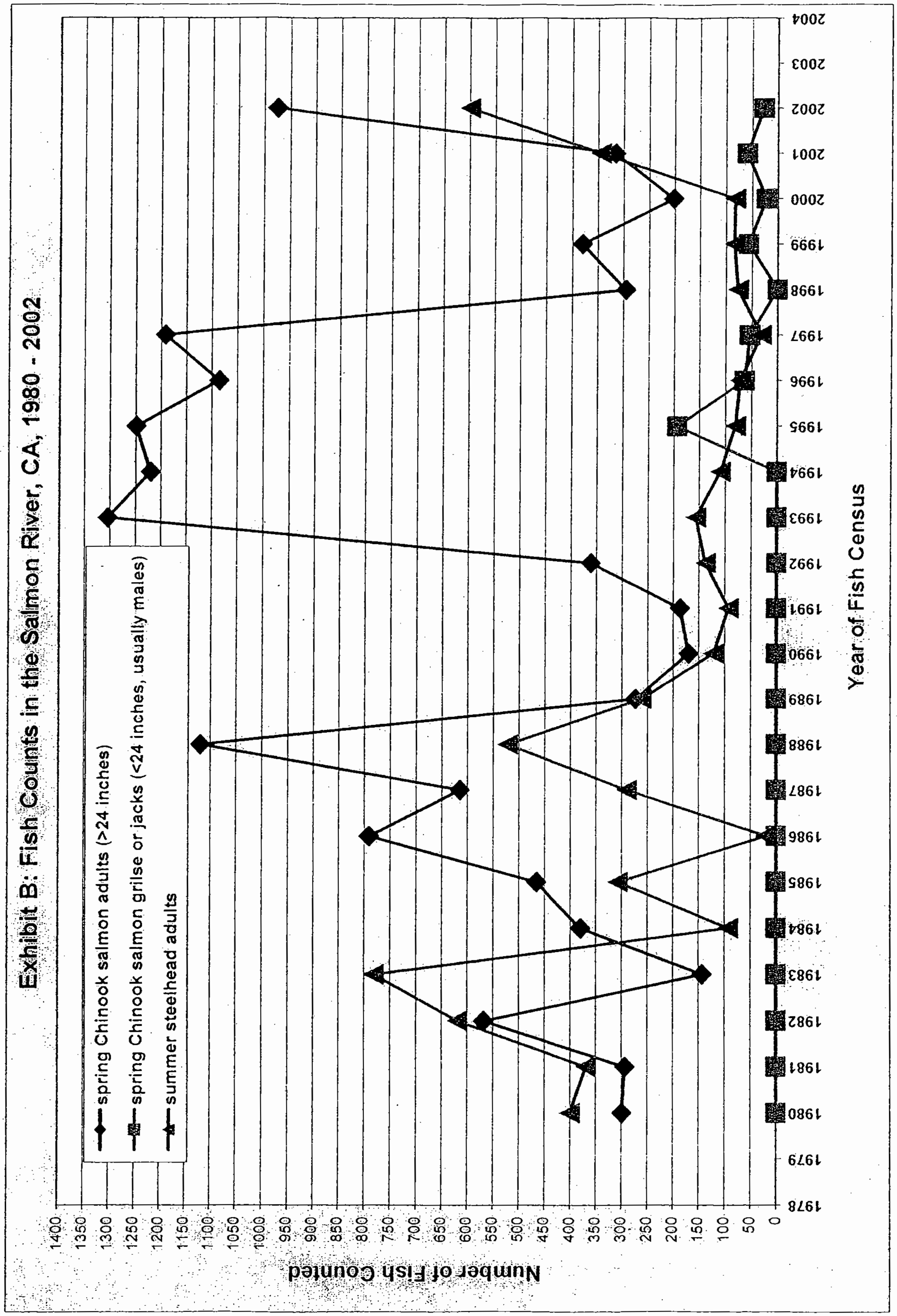
Exhibit B: Fish Counts in the Salmon River, CA, 1980 - 2002
spring Chinook salmon adults (>24 inches)
spring Chinook salmon grilse or jacks (<24 inches, usually males)
summer steelhead adults
Number of Fish Counted
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
1250
1300
1350
1400
Year of Fish Census
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004

EXHIBIT 3

HOT TOPICS
Where are the salmon?

What scientists at the University of Alaska Fairbanks say about salmon declines in Alaska

Ted Cooney, professor of fisheries oceanography
Institute of Marine Science
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
907-474-7407
cooney@murre.ims.uaf.edu

Do salmon runs in the North Pacific Ocean fluctuate according to cycles?

Cooney: "Scientific data on these natural cycles in salmon populations go back to the 1920s. These analyses show that for Alaska salmon stocks, there have been cycles in the past. The cycles seem to run on the order of 20 years. In some years more fish are produced and in other years fewer fish are produced. So, the recent declines aren't terribly surprising."

Have scientists expected salmon returns to decline?

Cooney: "***There was speculation in the 1980s based on research done here that salmon production might begin slipping in the late 1980s and 1990s***. That may be manifesting now in what appears to be the collapse of the red salmon fishery, since the red salmon returning this year were juveniles then."

Milo Adkison, professor of fisheries
Fisheries Division
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
907-465-6251
ffmda@uaf.edu

EXHIBIT 4

Did you expect that salmon returns would be lower this year?

Adkison: "Oh yes."

So, the declines haven't come as a surprise to you?

Adkison: "I didn't predict it would happen this year. But *the idea that it was bound to happen eventually is pretty obvious to anyone who knows much about salmon and the history of the salmon fisheries*."

Explain what you mean by the history of salmon fisheries.

Adkison: "The record of salmon returns is that they are highly variable. The salmon survival rates are highly variable. You get large year-to-year variations and you also get shifts in the productivity that run for a couple of decades or so and then shift to a different level of productivity. And *it's all connected to changes operating on similar time scales on the ocean*."

Are state biologists to blame for not predicting lower salmon returns last year and this year?

Adkison: "No. You know, my prediction was for about 38 million reds to return to Bristol Bay this year. ADF&G and the University of Washington predicted somewhat fewer fish. Based on the adult escapement, the smolt output, the returns of younger fish, and a look at some of the environmental variables used to predict, you would have predicted this would be a good year."

So what went wrong this year?

Adkison: "*The conditions out in the ocean have been really unusual the last couple of years*. It's not surprising that the models we use to make predictions fall apart when we encounter a whole new set of conditions. *Generally, warmer sea surface temperatures are better for salmon. But the temperatures these past couple of years have been much warmer than what we've seen before. We may be going past the optimum to where warmer temperatures may actually be counterproductive for salmon*.

Is that what you think is happening now, that salmon are responding to long-term ocean cycles?

Adkison: "I'm not saying that we've entered a new regime, but *the problem is that you have shifts that occur every 15 years or so. On top of that you have this huge year-to-year variation*. So it's really hard to look at a year like last year and say 'Okay, things were lousy this year and so they're going to be lousy next year.' It's very common to have things be lousy one year and good the next year. Because there's this large interannual variability, you have a hard time deciding that you're in a new regime until you've seen five years of bad returns in a row or five years of exceptional returns in a row."

Should the environmental changes seen in the North Pacific Ocean last year, such as warmer water temperatures, seabird die-offs, and scarce plankton have tipped off managers that the salmon returns would be low this year?

Adkison: "I wouldn't have thought so, but we have to take a look at that. The thinking among most fisheries biologists is that it's the youngest salmon that are the most vulnerable. So what you would have expected to see is a bad year out in the ocean and then a couple of years later a fall-off in salmon production, because the fish that had just gone to the ocean that year would be the ones most strongly affected. The adults due to come in that year could probably weather it better. *So it's puzzling that the year the ocean conditions were a bit strange, the run failed the same year and not a couple years later*."

Are you going to adjust your salmon prediction downward for next year?

Adkison: "*I'm going to tell people not to trust any particular number that they see, because we really don't have a good idea what is going on*."

There seems to be a real lack of knowledge about what happens to salmon out in the ocean. How are scientists trying to get a better understanding of the role of the ocean on salmon abundance?

Adkison: "The University of Alaska Fairbanks has been studying these questions as much as our funding permits. The Japanese are doing a lot out on the ocean looking at diets and distributions of salmon. NOAA has an ocean carrying capacity project where they're running around in the ocean too, following fish around to see what they are eating and what is available to them. I think people are trying to look at (ocean) environmental conditions. They recognize their importance, and they are doing a fair bit to figure out just what environmental conditions are important. They're doing their best to come up with a better idea of what determines this variability."

Why is this problem so difficult?

Adkison: "The thing that holds us back is that it is real expensive and difficult to get out in the ocean to see what the fish are actually doing. They go throughout the North Pacific and the Bering Sea and they are very dispersed. It's a difficult and expensive thing to study."

Fishery managers have come under fire for not considering the ocean's effects in their forecasts. Do you sense that fisheries managers are willing to take ecosystem influences into account in their forecasts?

Adkison: "There's an increasing verbal focus on ecosystem considerations. But where the rubber hits the road there is a growing awareness that from a practical point of view it's very difficult to take an ecosystem approach to managing fish stocks. The data requirements are beyond what is available for most fisheries."

Are there some key environmental variables that could be used to improve salmon return predictions without having to fully understand the entire ecosystem?

Adkison: "People are doing the obvious things. They look at the abundance of principal predators; they'll look at the abundance of food; they'll look at indicators of the state of the overall ecosystem such as sea surface temperatures, weather patterns, and use them as empirical predictors of salmon survival. But it's still baby steps. About as much as you can do is add one or two components and hope that they improve your predictive ability."

Tom Weingartner, assistant professor of oceanography
Institute of Marine Science
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
907-474-7993
weingart@ims.alaska.edu

Are you seeing environmental changes in the North Pacific Ocean?

Weingartner: "*It's a little hard to say what the time scales are, because there is a variety of time scales, but we have seen some rather striking changes in the last year or so. Last summer, we noticed an unusual warming that was confined to the surface layers of the Gulf of Alaska and the Bering Sea. Those temperature changes were two to three degrees above normal beginning about the middle of the summer and continuing through the fall. Beyond the fall, the temperature changes were even more dramatic. They weren't confined to just the surface but, at least in the Gulf of Alaska, they extended down at least 250 meters, or so, on the continental shelf. They were about two to three degrees above normal, and they continued through the spring. A lot of heat is required to elevate ocean temperatures by those few degrees*.

"*Through the winter we noticed that there was a decrease in the amount of cooling that usually takes place in the Gulf of Alaska. That was very dramatic. Our Canadian colleagues have noticed in the Gulf of Alaska that nutrients necessary for phytoplankton production were depleted from the surface layers of the ocean. That has not been observed before in the Gulf of Alaska. Other things that have been noticed are a change in the phytoplankton species composition in the Bering Sea*. That is usually dominated by a community called diatoms, but the last couple of summers it has been dominated by cocolithophores, a very different phytoplankton species."

As an oceanographer who has witnessed such dramatic changes in the North Pacific Ocean ecosystem, are you surprised that the salmon returns have started to ebb?

Weingartner: "*Not being an expert in salmon per se, but knowing that the ocean does illustrate environmental changes from year to year, it's not surprising that the salmon populations might change in response to those changes*."

Are the changes we see the beginnings of a regime shift or an anomaly?

Weingartner: "I don't have an answer to that question. Certainly over the last year we have been influenced by El Nino. Whether or not that is occurring in conjunction with a regime shift, I don't know. We really won't know that until we are into a regime shift for a while and are then able to identify it as such. All we can say is that there are some indications that we may be entering one."

Are there connections to be made between the changes you see in the ocean and the smaller salmon runs?

Weingartner: "It's important to note that just because we see some changes, the connection to salmon is not straightforward. In fact it is very difficult to say that the changes we observe are actually influencing salmon. Those connections have not been made. But they really need to be made to ascribe the reasons as to why salmon populations are down."

Is our understanding of the marine ecosystem a field that is still in its infancy?

Weingartner: "*Yes, very definitely so--I think in large measure because many of the mechanisms, say temperature change effects on phytoplankton and how such changes are transmitted on up the food chain, are not well understood at all. Until those connections are understood, ecosystem management of, say, a salmon population would be difficult to make*. Although I believe this is the direction we need to go, it won't occur overnight."

Donald Schell, director
Institute of Marine Science
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
907-474-7978
schell1@ims.alaska.edu

Your research has focused on understanding the Bering Sea ecosystem and the role it played in the declines of Steller sea lions, seabirds and other species. Specifically, your work seeks to understand how the sea's production of plankton, the basis of the marine food chain, has changed over time. But to understand ocean productivity, you're studying bowhead whales. Please explain.

Schell: "We've actually looked at bowhead whales to learn how ocean productivity has changed over the past 50 years. It turns out that whales are a unique window into the past. Bowhead whales over winter in the Bering Sea, where they feed on zooplankton. Zooplankton are the first consumers of phytoplankton, the small plants that are the first rung of the ocean food chain and an important indicator of productivity in the ocean. These whales consume vast amounts of zooplankton. And also because they eat the zooplankton in the fall of the year, the zooplankton have themselves consumed and stored the energy of a large percentage of the ocean's phytoplankton productivity. *This productivity can be measured by using isotope ratios in the baleen of whales*. Without getting too scientific, I measured the type of carbon in whale baleen. Since you are what you eat, the carbon in this case is from the consumption of plankton. The changes in carbon type in whale baleen reflects the abundance of plankton in any given year and can be used as an index to changes in ocean primary productivity."

And what have you discovered from looking at this record of ocean productivity?

Schell: "If you isolate the portion of the baleen that reflects plankton eaten in the Bering Sea, you can see the changes that occur over time. We've studied baleen taken from recently harvested whales and from whales harvested in the 1960s and the 1970s. And by using the animals from the 1960s we can look all the way back to 1946. From this we have developed a record of phytoplankon productivity in the Bering Sea all the way back to 1946. The story it tells is amazing because the whale baleen reflects phytoplankton productivity quite well. *The record shows that from 1946 to 1963 everything went along fairly smoothly at a relatively high rate of productivity. And then in the mid-1960s it increased and peaked at around 1965. Then ocean plankton productivity began to decline, and since the mid-1970s it has gone down and down and down. The last samples we have from 1994, 1995 and 1996 show the lowest primary productivity in the Bering Sea over this 50-year period."*

What conclusions can you draw from this finding?

Schell: "*The implication is that the Bering Sea has decreased in productivity by 35 to 40 percent since its peak in 1965 or so. Now a 40 percent decline in the carrying capacity of the ecosystem is going to have profound effects on the top consumers, and I think that is in part what we are seeing now*. Salmon are near the top of the consumer chain. Steller sea lions are at the top and they eat salmon and other fish. It implies that there is indeed a bottom-up change that is occurring, and it may have contributed to the decline of these mammals and other Bering Sea species."

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http://www.uaf.edu/seagrant/issues/salmon_gone.html