

CONDENSED AUTOBIOGRAPHY

NAME: Samuel N. Luoma

REGION: WR

PROJECT SHORT TITLE: Bioavailability of sediment-bound trace metals
4387-12500

PROJECT CHIEF: Same

GRADE AND DATE OF LAST PROMOTION: June, 1983; GS-15

DATE & LOCATION OF ENTRANCE WITH WRD: August 1974; Menlo Park, CA

EDUCATION: 1964-1968 Bachelor of Science in Zoology, Montana State University,
Bozeman, Montana.

1968-1970 Master of Science in Zoology, Montana State University,
Bozeman, Montana. Emphasis physiology/ecology. (Thesis:
Hibernation in the Western Jumping Mouse, Zapus
princeps.)

1972-1974 PhD Marine Biology, Department of Zoology, University of
Hawaii, Honolulu, Hawaii. (Dissertation: Mercury Cycling
in a Small Hawaiian Estuary.)

LANGUAGES: German—Reading

PROFESSIONAL SOCIETIES: American Association Limnology and Oceanography;
American Association for the Advancement of Science;
Sigma Xi; The Society for Environmental Geochemistry and
Health; Society of Environmental Toxicology and
Chemistry; American Geophysical Union.

AWARDS AND HONORS: 1969 NSF pre-doctoral research traineeship. Dept. Zoology,
Montana State University, Bozeman, Montana.

1972 NSF pre-doctoral fellowship. University of
Washington, Friday Harbor Oceanographic Laboratories.

1974 Sigma Xi

1977 NSF - NATO postdoctoral fellowship. The Laboratory of
the Marine Biological Association, Plymouth, United
Kingdom.

PROFESSIONAL EXPERIENCE

- Aug. 1974 - National Academy of Sciences Postdoctoral Research
Aug. 1976 Associate, U. S. Geological Survey, Water Resources Division,
345 Middlefield Rd., Menlo Park, CA 94025
- Feb. - Nov. 1977 NSF-NATO Research Fellow. The Laboratory of the Marine
Biological Association, Citadel Hill, Plymouth, United
Kingdom.
- Aug. 1976 - Project Chief. Water Resources Division, U. S. Geological
present Survey, Menlo Park, CA.
- WRD Management Positions (held while Project Chief)
- Mar. 1981 - Asst. Research Advisor for Ecology, Water Resources
Dec. 1985 Division, U. S. G. S., Menlo Park, CA.
- Jan. 1985 - Research Advisor for Ecology, Water Resources Division,
Jun. 1985 U.S.G.S., Menlo Park, CA.
- Jul. 1985 - Chief, Branch of Western Region Research, Water Resources
present Division, USGS, Menlo Park, CA.

MISCELLANEOUS

Reviews For:

Journals and numerous symposia (about 10 per year). Journals include
Science; Proceedings of National Academy of Sciences; Marine Biology; Marine
Ecology Progress Series; Estuarine Coastal and Shelf Science; Canadian-
Journal Fisheries and Aquatic Sciences; Geochimica Cosmochimica ACTA; Marine
Environmental Research; Environmental Pollution; Journal Marine Biological
Assoc. U.K; Marine Pollution Bulletin.

Grant Proposals: NOAA: Sea Grant and Office of Marine Pollution
Assessment. National Science Foundation: Ocean Biology, Oceanography,
MONTS Program for State of Montana. DOE: Physiological Ecology Program. WRD
External Grants. Hudson River Foundation.

Tenure Review: University of Maryland; Savannah River Ecology
Laboratory.

Invited Book Reviews:

"Affected Ecosystems: Review of Effects of Pollutants at the Ecosystem
Level". Bioscience: v. 35: p. 657-658 (1985).

"Review of ECOTOXICOLOGY: Special Issue of Ecological Bulletins". Earth
Science Reviews (in press).

Section Editor: Symposium on Trace Metal Bioavailability, Aquatic Section.
Hanford Life Sciences Symposium, Oct. 1981, Richland, WA. Science of the
Total Environment: v. 28: p. 1-141 (1983).

Miscellaneous WRD Assignments:

- 1983 Wrote benthic sediment contamination section in National Water Summary
1986 Wrote section for USGS Yearbook.

WORKSHOPS AND COMMITTEE ASSIGNMENTS

International:

- 1984 Dahlem Konferenzen on "Importance of Chemical Speciation in Environmental Processes". Interdisciplinary, international group of invited participants consider the state of the science in a particular field. Published volume: The Importance of Chemical Speciation in Environmental Processes, Bernhard, M, Brinckman, F. E., and Sadler, P. J. (eds.), Springer Verlag, London (1986). 762 pp.
- 1985 Workshop on Pathways, Cycling and Transformation of Lead in the Environment, convened by the Commission of the Royal Society of Canada on Lead in the Environment. Technical papers assembled by the Commission to aid their recommendations on regulating discharges of lead in Canada. Published volume "Pathways, Cycling and Transformation of Lead in the Environment" P. M. Stokes (ed.), Internal publication of the Commission (1986) 426pp.
- 1985 to present:
National Research Council of Canada committee on Biological Availability of Metals in Sediments. This six person Ad Hoc panel has worked for two years preparing an exhaustive review on processes, relevant to the above, that affect metals in sediments. The document is to help provide technical background from which the Canadians would like to design pollution regulations for metals in sediments.

Interagency/National:

- 1982 DOE workshop on "Physiological Effects of Pollutants in Aquatic Environments". Section Leader.
- 1982 NOAA workshop on "Pollutant Transport on Particles", Norfolk, VA. Wrote one of four "lead" papers.
- 1983 EPA workshop on "Research Needs to Improve Assessment of Marine Sewage Discharge Impact", Newport, OR. Presented invited talk.
- 1984 NOAA workshop on Nationwide Monitoring of Coastal/Estuarine Water Quality, Oakland, CA.
- 1984 to present:
U. S. National Committees, International Association of Hydrologic Sciences and International Union of Geodesy and Geophysics. Voting member.

Local:

- 1979 to present:
Technical advisory committee for Regional Water Quality Control Board. Helped design Local Effects Monitoring Program for San Francisco Bay (1982).
- 1986 to present:
Technical Advisory Committee for EPA's Estuaries Program in San Francisco Bay.

WRD

- 1981 - present: National Research Committee.
- 1982 -1985: Sediment Chemistry Task Group. Did "lead" paper for 1982 workshop that initiated task group.
- 1982 -1983: Biology Task Group
- 1983 - present: National Water Quality Assessment (NAWQA) involvement - Four person Ad Hoc committee ("Rubin Committee") that provided philosophy and general design for NAWQA.
Technical Advisory Group

Seven-person WRD Advisory Committee for NAWQA
Committee on Biology in NAWQA
Assembled proposal and presented to NAS Water Science and Technology
Board: Role of National Research Program in NAWQA.
Liason between NRP and district team for Illinois River Basin NAWQA
pilot study.

- 1984 - present: Advisory Committee for Surface Water Hazardous Waste Thrust
1984 -1985 Advisory Committee for USGS/USBR study of trace element
problems associated with Irrigation Drainage Program.
(Received letter of appreciation from Asst. Sec. Interior for
work with USBR in the early phases of this study).
1987 - present: WRD Science Advisory Committee. Two year appt. to committee
of senior scientists that advise Chief Hydrologist on major
technical issues.

CONSULTING

- 1978 Consult and conduct trace metal analyses for Wyoming District on study
of trace metal concentrations in trout.
1980 Consult and conduct trace metal analyses for Nevada District study of
trout hatching success in Truckee River.
1982 - 1985: Consult, train chemist, provide lab space, assist in data
interpetation, and help write report with CA district in contracted
study with USBR on trace elements in the area of the proposed San Luis
Drain discharge in Suisun Bay.
1982 Consult with Oregon District (review proposals and reports) concerning
trace contaminant studies on Columbia River.
1981 - present: Numerous short discussions with district personnel
concerning biological studies.
1981 - present: Consultations with local agencies, local environmental
groups, and numerous interviews with media concerning environmental
issues in San Francisco Bay.
1985 - 1987 Presentations to Western Region District chiefs concerning
District-NRP relations.

STUDENT AND FACULTY INTERACTIONS

- Frequently have MPES students.
- Students from Cal. State, Stanford, and U. C. Davis have done MSc work on
project.
- Postdoctoral studies: Ron Harvey from Stanford U.; Carolyn Johns from the
University of Montana.
- Y. B. Ho, University of Hong Kong faculty spent four months on sabbatical
with project.

PAPERS GIVEN AT SCIENTIFIC MEETINGS

Plenary Lectures/Invited Overview Lectures

- 1981 Physicochemical partitioning of trace metals in oxidized estuarine sediments: Requirements for a model. Marine Chemistry Symposium, Canada Society of Chemists, Halifax, Nova Scotia.
- 1981 Bioavailability of trace metals to aquatic organisms. Trace Metal Bioavailability Symposium, Hanford Life Sciences Symposium, Richland, WA.
- 1982 Summary and Conclusions. Mississippi River Research Consortium Symposium on Contaminants in the Upper Mississippi River. (Invited to summarize symposium and provide concluding remarks.)
- 1985 Transfer of trace metals from sediments to organisms: The importance of interdisciplinary research. Colloquium on Human Impacts on the Seine. Cherbourg, France.
- 1987 Predicting the bioavailability of trace metals in sediments. Fourth International Symposium on Interactions Between Sediments and Water, Melbourne, Australia.

Invited Talks

- 1980 Impacts of wastewater discharge on the biological community of San Francisco Bay. AAAS Pacific Division, Symposium on San Francisco Bay: Use and Protection, Davis, California.
- 1982 Temporal changes in the chemistry of surface sediments in San Francisco Bay. Am. Geophysical Union, San Francisco, CA.
- 1983 Defining the biological significance of adsorbed metals. AAAS symposium on Metals in Estuaries, Detroit, MI
- 1983 The effect of particle chemistry on trace metal-particle associations in estuaries. Estuarine Research Federation special symposium on The Estuary as a Filter, Virginia Beach, VA
- 1984 Significance of metal tolerance in invertebrates. Am. Assoc. Advancement of Science, symposium Adaptations to Trace Metal Stress in Aquatic Environments, New York, NY.
- 1985 An evaluation of methods for assessing the partitioning of trace metals in natural oxidized sediments. Am. Chemical Society, Miami, FL
- 1985 Aquatic biologic monitoring of lead and cycling in freshwater and marine systems. Royal Society of Canada Workshop on Lead in the Environment, Edmonton, Alberta, Canada.
- 1986 Processes affecting trace element concentrations in the sediments and biota of estuaries. Gordon Research Conference on "Estuaries", Plymouth, New Hampshire.
- 1986 Distribution of Selenium and Arsenic in benthic bivalves from San Francisco Bay and the San Joaquin Delta, Am. Geophysical Union symposium on Water Quality Issues Associated with Agricultural Drainage in Semiarid Regions, San Francisco, CA
- 1987 Processes affecting Silver availability to a deposit feeding bivalve. 70th Canadian Chemical Conference symposium on Trace Element Speciation. Sainte-Foy, Quebec, Canada.
- 1987 Detecting trace metal enrichment in aquatic sediments. XIX General Assembly of Intl. Union Geodesy and Geophysics, symposium on Estimation of Natural Baseline Conditions as a Basis for Detecting Changes in Water Quality, Vancouver, British Columbia, Canada.

Contributed papers: See Abstracts

ADDITIONAL SCIENTIFIC CONTRIBUTIONS.

1. INVITED LECTURES GIVEN AT UNIVERSITIES:

- 1976 Stanford University. Availability of Ag, Cd, Co and Zn to bivalves.
- 1978 Stanford University. Physiochemical form of metals in sediments and affect on availability to bivalves in 17 English estuaries.
- 1979 WC³ (Consortium of several West Coast University departments interested in chemistry of water quality) Assessing the form of metals in oxidized sediments.
- 1980 Stanford University. Temporal variability in metal concentrations of animals and chemistry of sediments in San Francisco Bay.
- 1982 University of California, Lawrence Livermore Labs. Problems with the paradigms for assessing the availability of metals to aquatic biota.
- 1984 University of California, Berkeley. Defining the biological impacts of heavy metals in nature.
- 1984 International Atomic Energy Agency Laboratory of Marine Radioactivity, Monaco. Processes affecting trace element bioavailability from sediments.
- 1985 California State University, Hayward. Trace element availability from sediments to benthic invertebrates.
- 1985 Diablo Valley College. Impacts of waste discharges to San Francisco Bay.
- 1985 University of California at Davis. Effects of Trace Metals upon Aquatic Organisms in San Francisco Bay.

2. TRAINING GIVEN AT USGS NATIONAL TRAINING CENTER:

- 1976--Toxic effects of metals upon aquatic biota; 1 hour.
- 1980--Metal availability from sediments; 1 hour.
- 1985--Aquatic Biology: Interpretation and Application of data; 5 hours.
- 1987- Trace metals in organisms for OJT training course in organic chemistry; 4 hrs.

3. INFORMAL SEMINARS:

- 1976 Availability of Ag, Cd, Co and Cu to bivalves from well-defined sediments, WRD, Menlo Park.
- 1977 Fluctuations of Cu and Ag in M. balthica from San Francisco Bay, WRD, Menlo Park.
- 1977* Same as above, Bay and Estuarine Society, San Francisco, Ca.
- 1977* Predicting the biological availability of sediment-bound trace metals. CNEXO (French agency for ocean research), Brest, France.

- 1977* The form and biological availability of trace metals in the sediments of estuaries in southwest England. Institute for Marine Environmental Research, Plymouth, United Kingdom.
- 1978* Bioavailability of sediment-bound metals. Southern California Coastal Water Research Project, El Segundo, Ca.
- 1978* Statistical assessments of the bioavailability of sediment-bound metals. Environmental Research Laboratory, Environmental Protection Agency, Narragansett, R.I.
- 1980 Availability of metals to benthic organisms. WRD, USGS, Menlo Park.
- 1980 Impact of wastewater discharge on San Francisco Bay, USGS, Marine Geology, Palo Alto.
- 1982* The future of San Francisco Bay, Bay Interpreters Society (Park Rangers, etc.), Sausalito, CA.
- 1982 Trace metal bioavailability. WRD Water Chemistry--Geochemistry Workshop.
- 1983 Temporal variability in characteristics of oxidized sediments. WRD, USGS, Menlo Park.
- 1983 Effects of geochemical forms on the transport of trace elements. WRD Workshop on Solute Transport in Estuaries and Streams.
- 1984 Fate of dissolved constituents from hot spring waters in Yellowstone National Park, With Mike Thompson. Geothermal Program Seminar, USGS, Menlo Park.
- 1986 *California Environmental Health Association. Toxic Chemicals in San Francisco Bay.
- 1986 *California Regional Water Quality Control Board. USGS Research in San Francisco Bay.
- 1986 Detecting trace metal enrichment in estuarine sediments. WRD seminar

*Invited talk

BIBLIOGRAPHY

- Luoma, S. N., 1976. Uptake and interorgan distribution of mercury in a carnivorous crab: Bull. Environm. Contam. Toxicol. 16, 719-723.
- Luoma, S. N., 1977. Dynamics of biologically available mercury in a small estuary: Estuar. Coast. Mar. Sci. 5, 643-652.
- Luoma, S. N., 1977. Physiological characteristics of mercury uptake by two estuarine species: Mar. Biol. 41, 269-273.
- Luoma, S. N., and Jenne, E. A., 1977. Factors affecting availability of sediment-bound Cd to an estuarine deposit-feeding clam, in Cushing, E., Radioecology & Energy Resources: Proc. of Fourth National Symposium on Radioecology: Dowden, Hutchinson & Ross, Stroudsburg, PA, p. 283-291.
- Luoma, S. N., Jenne, E. A., 1977. Availability of sediment-bound cobalt, silver, and zinc to a deposit-feeding clam, in Wildung, R. E., and Drucker, H., Biological Implications of Metals in the Environment: ERDA Symposium Available from NTIS as CONF-750929, p. 213-231.
- Jenne, E. A., and Luoma, S. N., 1977. Forms of trace elements in soils, sediments and associated waters, in Wildung, R. E. and Drucker, H., Biological Implications of Metals in the Environment: ERDA Symposium Available from NTIS as CONF-750929, p. 110-144. I wrote one-half of this review.
- Luoma, S. N., and Jenne, E. A., 1977. Estimating bioavailability of sediment-bound trace metals with chemical extractants, in Hemphill, D. D., Trace Substances in Environmental Health: University Missouri Press, Columbia, p. 343-353.
- Leland, H. V., Luoma, S. N., and Wilkes, D. J., 1977. Heavy metals--Annual literature review: J. Water Pollut. Contr. Fed. 49, 1340-1369. Wrote one-half of this review.
- Luoma, S. N., 1977. Detection of trace contaminant effects in aquatic ecosystems: J. Fish. Res. Bd. Can. 34, 436-439.
- Luoma, S. N., and Cain, D. J., 1978. Fluctuations of copper, zinc and silver in tellenid clams as related to freshwater discharge in South San Francisco Bay, in Conomos, T. J., San Francisco Bay: The Urbanized Estuary: AAAS-Pac. Div., San Francisco, p. 231-247.
- Luoma, S. N., and Bryan, G. W., 1978. Factors controlling availability of sediment-bound lead to estuarine bivalve Scrobicularia plana: J. Mar. Biol. Ass. U.K., 58, 793-802.
- Leland, H. V., Luoma, S. N., Elder, J., and Wilkes, D. J., 1978. Heavy metals--Annual literature review: J. Water Pollut. Contr. Fed. 50, 1469-1514. Wrote sections on bioaccumulation and on sediment - one third of paper.

- Luoma, S. N., and Bryan, G. W., 1979. Trace metal bioavailability: modeling chemical and biological interactions of sediment-bound zinc, in Jenne, E. A., ACS Symposium Series 93: Amer. Chem. Soc., Washington, D.C., p. 577-611.
- Leland, H. V., Luoma, S. N., and Fielden, J. M., 1979. Heavy metals: Bioaccumulation and toxicity--Annual literature review: J. Water Pollut. Contr. Fed. 51, 1592-1616. Wrote half of paper--sections on bioaccumulation.
- Bradford, W. L., and Luoma, S. N., 1980. Some perspectives on heavy metal concentrations in shellfish and sediment in San Francisco Bay, in Baker, R. T., Contaminants and Sediments: Ann Arbor Sci. Publ., Inc., p. 501-532. Wrote half of paper.
- Thomson, E. A., Luoma, S. N., Cain, D. J., Johansson, C. E., 1980. Effect of sample storage on the extraction of Cu, Zn, Fe, Mn and organic material from oxidized estuarine sediments: Water Air Soil Pollut. 14, 215-233.*
- Luoma, S. N., Cain, D. J., Thomson, E. A., Johansson, C. E., Jenne, E. A., and Bryan, G. W., 1980. Determining availability of sediment-bound trace metals to aquatic deposit-feeding animals: US Geological Survey Open File Report - 80-341. This paper is a compendium of many of the above, done to satisfy EPA contract with WRD.
- Luoma, S. N., and Bryan, G. W., 1981. Statistical assessment of the form of trace metals in oxidized sediments employing chemical extractants: Sci. Total Envir. 17, 165-196.
- Strong, C. R., and Luoma, S. N., 1981. Variations in correlation of body size with concentrations of Cu and Ag in bivalve Macoma balthica: Can. J. Fish. Aquat. Sci. 38, 1059-1064.
- Luoma, S. N., and Cloern, J. E., 1982. Impact of waste water discharge on biological communities in San Francisco Bay, in Kockleman, Levinton and Conomos, San Francisco Bay: Use and Protection: AAAS-Pac. Div., San Francisco, p. 137-160.
- Luoma, S. N., and Bryan, G. W., 1982. Statistical study of environmental factors controlling concentrations of heavy metals in burrowing bivalve Scrobicularia plana and polychaete Nereis diversicolor: Estuar. Coast. Shelf Sci., 15, 95-108.
- Luoma, S. N., and Bryan, G. W., 1982. Scavenging of As, Cu, and Pb from particulates by seaweed: Mar. Pollut. Bull., 13, 394-396.
- Luoma, S. N., Cain, D. J., Ho, K., and Hutchinson, A., 1983. Variable tolerance to Cu in two species from San Francisco Bay: Mar. Envir. Res., 10, p. 209-222.
- Luoma, S. N., and Davis, J. A., 1983. Requirements for modeling trace metal partitioning in oxidized estuarine sediments: Mar. Chem. 12, p. 159-181.

- Luoma, S. N., 1983, Bioavailability of trace metals to aquatic organisms--A review: *Sci. Total Environ.* 28, 1-22.
- Thomson, E. A., Luoma, S. N., Cain, D. J., and Johansson, C. E., 1984. Comparing sediments and organisms as indicators of biologically available trace metal input from a point source: *Wat. Res.*, 18, 755-765.*
- Luoma, S. N., 1984. Introduction to Environmental Issues. MacMillan Publishing Co., New York, 548 p.
- Harvey, R. W., and Luoma, S. N., 1984. The role of bacterial exopolymer and suspended bacteria in the nutrition of the deposit-feeding clam Macoma balthica: *J. Mar. Res.* 957-868. Harvey's work; I contributed advice and interpretations, and helped write manuscript.
- Luoma, S. N., 1984. Contaminants in the Upper Mississippi: Summary and Conclusions, in Wiener, J. G., Anderson, R. V., and McConville, D. R. (eds) *Contaminants in the Upper Mississippi River*. Butterworth Publishers, Boston. p. 345-356.
- Luoma, S. N., Casas, P. V., and Dagovitz, R. M., 1984. Trace metals in Suisun Bay, California: A preliminary report. USGS WRI 84-4170. 35 pp.
- Luoma, S. N., 1985. Transport of trace elements from particulates to biota: USGS Circular on Metals in Sediments, in press. Written for Sediment Chemistry Task Group.
- Cain, D. J. and Luoma, S. N., 1985. Copper and silver accumulation in transplanted and resident clams (Macoma balthica) in South San Francisco Bay. Marine Environ. Research v. 15: p. 115 -135.
- Harvey, R. W. and S. N. Luoma. 1985. Separation of solute and particulate vectors of heavy metal uptake in controlled suspension-feeding experiments with Macoma balthica. Hydrobiologia v. 121: p. 97-102.
- Harvey, R. W. and Luoma, S. N. 1985. Effect of adherent bacteria and bacterial extracellular polymers upon assimilation by Macoma balthica of sediment-bound Cd, Zn and Ag. Marine Ecology Progress Series v. 22: p. 281 -289.
- Thomson-Becker, E. A. and Luoma, S. N. 1985. Temporal fluctuations in grain size, organic materials and iron concentrations in intertidal surface sediment of San Francisco Bay. Hydrobiologia v. 129: p. 91-107.
- Luoma, S. N., Cain, D. J. and Johansson, C. J. 1985. Temporal fluctuations of silver, copper and zinc in the bivalve Macoma balthica at five stations in South San Francisco Bay. Hydrobiologia v. 129: p. 109-120.
- Luoma, S. N. 1985. Affected Ecosystems: Review of Effects of Pollutants at the Ecosystem Level. Bioscience v. 35: p. 657-658.

- Luoma, S. N.: 1986. Biological availability of sediment-bound trace metals. p. 347 - 363 in La Baie de Seine, Actes de Colloques No. 4, Centre National de la Recherche Scientifique, Brest, France.
- Cain, D. J. and Luoma, S. N. 1986. Effect of seasonally changing tissue weight on trace metal concentrations in the bivalve Macoma balthica in San Francisco Bay. Marine Ecology Progress Series v. 28: p. 209 - 217.
- Johansson, C. J. , Cain, D. J. and Luoma, S. N. 1986. Variability in the fractionation of Cu, Ag, and Zn among cytosolic proteins in the bivalve Macoma balthica. Marine Ecology Progress Series v. 28: p. 87 - 97.
- Nichols, F. H., Cloern, J. E., Luoma, S. N. and Peterson, D. H. 1986. The modification of an estuary. Science v. 231: 567 - 573.
- Luoma, S. N. 1986. Cycling of lead into food webs in aquatic environments. p. 185 - 203 in Stokes, P. M. (ed) Pathways, cycling and transformation of lead in the environment. Published by The Commission on Lead in the Environment, Royal Society of Canada, Ottawa, Canada.
- Luoma, S. N. 1986. A comparison of methods for determining copper partitioning in oxidized sediments. Marine Chemistry v. 20: p. 45 - 59.
- Luoma, S. N. (in press) Review of Ecotoxicology . Earth Science Reviews.
- Luoma, S. N. (in review). An evaluation of methods for determining the biological availability of sediment-bound metals.
- Luoma, S. N., Dagovitz, R., Axtmann, E. (in review). Trace metal concentrations in sediments and the bivalve Corbicula sp. from Suisun Bay and the delta of the San Joaquin River in San Francisco Bay.