

## Charles B. Miller – A Selective Biography

by Harold P. Batchelder and William T. Peterson

Professor Charles (Charlie) B. Miller has been described by his oceanographic colleagues at various times as smart, thoughtful and insightful, by his friends as concerned for the good of mankind, by his students as a terrific and demanding mentor, by some as curmudgeonly and by some as intimidating, but by all as Charlie. Charlie grew up far from the ocean in Minnesota, raised by a grammar-correcting English teacher and a physician to whom “thinking scientifically” was a religious tenet. A high point of his life was being drum major of his high school band. He attended Carleton College in Northfield, Minnesota, graduating in 1963 with an academic record including, among other low points, a D in German. But, he was very good at Graduate Record Examination tests, which got him into graduate school. Charlie’s interest in marine biology and biological oceanography was stimulated by a summer course at the University of the Pacific’s marine station at Tomales Bay, taught by Joel Hedgpeth and Jefferson Gonor. Diverted from medical school by this experience, he enrolled in a Ph.D. program at the Scripps Institution of Oceanography. Scripps in the 1960s was the pre-eminent place in the U.S. for graduate work in Oceanography. Charlie studied with John McGowan, who taught his bevy of grad students that to learn about the ocean, one must go to sea, go frequently and go over sustained periods. Other particularly influential mentors while Charlie was at Scripps were William Fager, Abraham Fleminger and Edward Brinton.

After receiving his Ph.D. in 1969, Charlie spent a year in New Zealand as a National Science Foundation fellow, working with Prof. R. Morrison Cassie. In 1970, Charlie started work as an Assistant Professor at Oregon State University (OSU), landing in an office that he continues to occupy daily as an emeritus professor of Oceanography. While Charlie has enjoyed work as a visitor at several institutions (Woods Hole Oceanographic Institution, Scripps, Station Zoologique in Villefranche-sur-Mer, the Ocean Research Institute in Tokyo and University of Maine), he has maintained his interests in the zooplankton ecology and processes in Oregon’s coastal ocean and the oceanic subarctic Pacific.

Charlie’s early career at OSU was marked by research on the composition of mesozooplankton in the Oregon coastal upwelling region, in collaboration with OSU faculty members, Bill Percy and Jeff Gonor. It provided research opportunities and training for post-docs and technicians like Sally Richardson and Bill Peterson, and for several students (such as Peter Rothlisberg and Gregory Lough). Key papers from the early Oregon work included recognition of the strong seasonality in zooplankton species composition caused by the reversals of alongshore currents between north and south, descriptions of zooplankton

community composition variation in space and time, and some suggestions of mechanisms by which zooplankton species maintain populations in upwelling zones in the face of offshore transport (Peterson and Miller, 1976; Peterson *et al.*, 1979).

To understand the ecology of marine zooplankton, Charlie believes there is no substitute for knowing your organism, which means observing the morphology, behavior and ecology of species. Charlie’s observations of zooplankton led to (1) detailed discoveries about how siliceous copepod teeth are formed and the use of tooth-development staging to determine the phase of copepodites within their molt cycle, as well as results from more traditional incubation-based methods to quantify development rates (Miller *et al.* 1980; Miller *et al.* 1984; Miller *et al.*, 1990; Miller and Tande, 1993; Aksnes *et al.* 1997; Crain and Miller, 2001); (2) description of growth rules for copepods (work done with his Ph.D. student Ken Johnson; Miller *et al.*, 1977), (3) detailed studies of the phenology and life history of several dominant subarctic oceanic copepods and chaetognaths (done with many colleagues, but most notably Bruce Frost, Hal Batchelder, Martha Clemons, Richard Conway and Makoto Terazaki) and (4) copepod sex determination and mating behavior (Tsuda and Miller, 1998; Crain and Miller, 2000; Miller *et al.*, 2005).

In the late 1970s, Charlie and Bruce Frost of the University of Washington realized that the Canadian Ocean Weather-ship program that had been ongoing at Station PAPA in the eastern subarctic Pacific was nearing an end, as the primary function of ships collecting weather data were being replaced by satellite observations. Since 1956, vertical plankton hauls had been conducted from the ships one to several times per week. They realized that the weatherships provided a platform for frequent depth-stratified sampling of plankton both day and night, and that it would take a year of very deep sampling to get adequate data to describe the life histories of the large, ontogenetically migrating copepods of the region. With funding from the National Science Foundation (NSF) and the cooperation of the Canadian Coast Guard and Institute of Ocean Sciences, Charlie initiated weekly sampling of plankton communities at Station PAPA in early 1980. The plankton sampling was done by three technical workers: Richard Conway, Martha Clemons and Hal Batchelder. Sampling continued until the final weathership cruise in June 1981, providing a 1.5-year time series with *ca.* weekly sampling of the water column from the surface to 2000 meters. At the time, and perhaps to this day, this sample set was the best long-term, vertically resolved time series of zooplankton from a deep ocean site. Several significant papers (Miller and Clemons, 1984; Miller *et al.* 1984; Terazaki and Miller, 1986) resulted directly from these collections. Three other

significant events are associated with this sampling at Station PAPA. First, it sowed the seeds for future big-program interdisciplinary ocean research to understand the spring–summertime dynamics of the planktonic ecosystem in the subarctic oceanic Pacific (SUBarctic Pacific Ecosystem Research, a.k.a. SUPER). Second, the project entrained a recent M.Sc. graduate student (Hal Batchelder) into the world of zooplankton ecology. Ultimately, Batchelder would complete a Ph.D., with Charlie as his advisor, that focused on the population dynamics and ecology of the subarctic Pacific copepod, *Metridia pacifica*. Finally, Martha Clemons, cribbage champion of weathership tournaments, later became Charlie’s wife.

Professor Miller’s leadership role in collaborative research to understand ecosystem ecological processes regulating plankton abundance and production in the open subarctic Pacific was critical to the success of project SUPER. Charlie was the organizing force, and the glue, that held together the pieces of the SUPER projects of the mid-1980s. SUPER was a large, multidisciplinary group of scientists that had a common goal: to understand the spring–summertime dynamics of the planktonic ecosystem of the eastern subarctic Pacific. In more recent terminology, the eastern subarctic is a High Nitrate, Low Chlorophyll (HNLC) region, and multiple hypotheses, including iron limitation, microzooplankton grazing capacity, and early-season macrograzing capacity provided by the unique life cycles of *Neocalanus*, were advanced to explain the lack of a spring phytoplankton bloom in this environment that experienced strong seasonal physical forcing. The SUPER team (including Hal Batchelder, Suzanne Strom, Thomas Powell, Nick Welshmeyer, Beatrice Booth, Pat Wheeler, Mike Dagg, Mike Landry, Dian Gifford and many others) went to sea for month-long cruises in spring and summer of 1984, 1986 and 1987 to examine these hypotheses. For some of these efforts, SUPER collaborated with Canadian investigators (Dave Mackas, Ken Denman and others) for multi-national, multi-vessel investigations of the eastern subarctic Pacific. A unique aspect of the SUPER research was the focus on examining the system in its entirety—from ocean hydrodynamics and turbulence to nutrient–phytoplankton interactions to phytoplankton–microzooplankton–macrozooplankton interactions. The research resulted in the SUPER synthesis (Miller *et al.*, 1991), successfully modelled by Bruce Frost (1993), which was later called the “ecumenical iron hypothesis” by John Cullen (Cullen, 1995). That synthesis, which attributes the lack of bloom to both grazers and iron limitation, remains the right way to see the functioning of iron-limited HNLC systems. As part of the SUPER effort, Charlie discovered (it was probably recognized earlier by other investigators, but never documented) and described *Neocalanus flemingeri*, and wrote all of the early papers about the unusual life history of this important North Pacific copepod (Miller, 1988; Miller and Clemons, 1988; Miller and Nielsen, 1988; Miller and Terazaki, 1989).



Charlie (age 2) with his schoolteacher mother.



Charlie (age 10) riding "Smokey" during a stay in the Rocky Mountains.



Charlie speaking with Dr. Patricia Kremer at the SUPER planning workshop (1982), where the SUPER team was put together and which resulted in the funding of the first round of SUPER. Behind Pat, with back to camera, is 2007 Wooster Award winner, Dr. Kenneth Denman.





Charlie at sea (clockwise from top left): sampling with a Van Dorn Bottle in a more laissez-faire era—no hard hat, no PFD vest (1960); an equipment test cruise prior to the first SUPER cruise (1984); a cruise in Puget Sound, WA (2002); and a cruise to Dabob Bay, WA (2004).

Charlie's research on zooplankton and pelagic ecology in the oceanic subarctic Pacific spans more than 40 years—beginning with cruises while a graduate student at Scripps in the summer of 1964, his sampling at Station PAPA in the early 1970s, the time series sampling he initiated from the Canadian weatherships during their last year of Station PAPA operations, the large interdisciplinary research conducted as part of the SUPER programs of the 1980s, and continuing with his involvement in the PICES' OECOS planning and workshops.

Charlie has not restricted his research interests solely to North Pacific zooplankton. He has had a long-standing interest in understanding the phenology and population dynamics of *Calanus finmarchicus*, the dominant large copepod of most North Atlantic systems, work that he initiated with Helen Grigg in the UK during the late 1980s (Miller and Grigg, 1991; Miller *et al.*, 1991). This interest in *C. finmarchicus* continued in the U.S. GLOBEC Northwest Atlantic/Georges Bank system program in the 1990s, a large-group collaboration enabled by his long-time friend and colleague, Peter Wiebe of Woods Hole. This

connection allowed Charlie to lead, with Kurt Tande of Norway, the Trans-Atlantic Studies of *C. finmarchicus* (TASC) program of ICES. This was a multinational effort, involving scientists from the United States, Canada, and many countries of the European Union, to complete an intensive, cross-regional comparison of a single species from many sites in the North Atlantic—all in one year—The year of *Calanus* in 1997. Of course, that turned out to be a realization of “Miller's Law”: (in brief) *Big programs always operate in ecologically unusual years*. Several post-study workshops were held, co-chaired by Charlie, Roger Harris (UK) and Kurt Tande, and resulted in a TASC publication “Population Dynamics of *Calanus* in the North Atlantic” in the *ICES Journal of Marine Science*.

Charlie has provided extensive service at both national and international levels. Within the U.S., he has served on NSF review panels and on the Exxon Valdez Oil Spill Scientific and Technical Advisory Committee (2003–2005). In the 1980s, Charlie spent 6 years (2 years as Chairman) on the UNOLS (University–National Oceanographic Laboratory System) Advisory Council in the U.S. UNOLS is the

organization that provides both short- and long-term planning for the U.S. oceanographic research fleet. Internationally, Charlie has contributed to the ICES Working Group on *Zooplankton Ecology*, to the ICES TASC effort (described above) and to several PICES activities. In the initial PICES years, he served on the MONITOR Task Team. In 2000, Warren Wooster and Mike Mullin asked him to chair the PICES Advisory Panel on *Continuous Plankton Recorder (CPR) Survey in the North Pacific*. In that role (continued until 2008), he served as an outside reviewer and supporter of the CPR work between Alaska and the U.S. West Coast, with the actual work sustained entirely by the program PIs, Sonia Batten of SAHFOS in the UK and David Welch of DFO, Canada. The PICES CPR program was eventually expanded to include up to three runs each year from Vancouver to Yokohama, passing through the western Bering Sea on a great circle track. A bird and mammal observer was placed on that run as well. Charlie, with Tom Ikeda (Japan), organized and continues to co-chair the PICES project titled Ocean Ecodynamics Comparison in the Subarctic Pacific (OECOS). The goal of this multinational (Japan, Canada and U.S.A.) project is a detailed and parallel comparison of plankton processes and dynamics of the western and eastern subarctic gyres during spring. The Japanese component was funded and conducted their investigations during spring 2007. Charlie co-convended (with Atsushi Yamaguchi) a workshop on OECOS-West results at the 2008 PICES Annual Meeting (see article in this issue of PICES Press).



Organizers of the PICES' OECOS project, Tom Ikeda and Charlie Miller, posing with a rooster-hat death mask.

Charlie's editorial contributions included several years of service on editorial boards of major journals: *Limnology and Oceanography* in the 1980s, *Plankton Biology and Ecology* of the Plankton Society of Japan (1996–2001), and *Progress in Oceanography* from 1983–2003. He served as Co-Editor-in-Chief of *Progress in Oceanography* from 2003–2006. Beyond these formal editorial roles, Charlie often reads, and rewrites into more standard English, manuscripts on marine plankton sent to him by authors (whose native language is not English) prior to submission of the paper to a journal for publication. This valuable service is rarely recognized in the ocean sciences community.

Charlie Miller advised (as major professor) 10 master and 12 Ph.D. students (including both co-authors of this biography).

Charlie has served on the committees of other oceanography students, and has influenced most oceanography students passing through OSU in the past thirty-plus years.

Awards and honors bestowed upon Charlie include being a fellow of the American Association for the Advancement of Science, receiving the best presentation award at the 1997 ICES Annual Science Conference, and being the recipient of the Excellence in Mentoring (2001) and Excellence in Teaching awards (2003) from the College of Oceanic and Atmospheric Sciences at OSU. At the Third International Zooplankton Production Symposium in Gijon, Spain (May 2003), Charlie was invited by the symposium conveners to summarize the sense of the meeting—the progress in the field of zooplankton ecology.

Charlie retired from OSU a few years ago, but he can still be found occupying his office nearly every day. In the first years of his retirement he authored a textbook, *Biological Oceanography* (2004), which is widely used in graduate “core courses” across the U.S. and elsewhere. Bruce Frost, professor emeritus at the University of Washington, referred to the book as “a masterful synthesis of biological oceanography”. At the same time, together with Hal Batchelder, Marnie Jo Zirbel and aided by Bruce Frost, Charlie completed a project estimating the mortality rates of *Calanus pacificus* eggs (before hatching) in Dabob Bay, WA. He promises us to publish the results very soon.



The 2007 Zooplankton Production Symposium in Hiroshima: Charlie with his daughter, Caroline, and wife, Martha Clemons, at the symposium dinner.

Charlie has two sons, Eric, a transportation planner, and Matthew, a magazine editor and poet, and a daughter, Carrie, a linguist, waitress and expert snow boarder. They are spread all over the U.S.: Bellevue (WA), Orlando (FL) and Steamboat Springs (CO). Charlie and Martha greatly enjoy visits near Seattle with their two grandchildren, Eric's kids. For the past five years or so, Charlie has been socially proactive within his local community in Oregon. In just the past few years he has organized community





Three generations of North Pacific zooplanktologists: on the left is Bill Peterson (Ph.D. student of Charlie Miller), on the right is Charlie Miller (Ph.D. student of John McGowan), and in the center is John McGowan. This photo is from the early 2000's on the occasion of McGowan's retirement.



Charlie and Hal Batchelder, his former Ph.D. student, at the Chairman's Reception of the 2008 PICES Annual Meeting in Dalian.

forums to inform the general public about pressing social issues—including, but not limited to, forums on health care issues, global warming and associated social changes, energy alternatives to oil, and war and peace issues. He doesn't just talk about these issues, he acts locally. He and Martha run their car on bio-diesel, and they installed both solar hot water and photovoltaic systems on the roof of their house in an effort to promote more sustainable energy use. In recent times, Charlie has volunteered at a homeless-men's shelter in Corvallis—a community attempt to keep homeless guys from hypothermia on cold, wet winter nights.

Clearly, our understanding of the functioning of the oceanic realm of the North Pacific has been advanced dramatically by Charlie Miller's ability to identify the big outstanding scientific issues (e.g., the lack of blooms in subarctic HNLC regions), to formulate plans and assemble scientific teams to investigate the issues, and to carry the research through to synthesis and publication. Just as clear has been Charlie's role in the study of the phenology and life history of key zooplankton species in several ecosystems and ocean basins.

In summary, Charlie is an oceanographer, teacher and good citizen of planet Earth. He is an active leader in the field of zooplankton ecology and has made very significant contributions to understanding the ecosystem function of several pelagic ecosystems (Oregon coastal upwelling, oceanic subarctic Pacific, Georges Bank) and the life stories of planktonic animals. He has published some 60 papers on these topics. Charlie is also generous with his time to colleagues, students and the general public. Charlie is still intellectually challenging to those around him and full of creative energy. We (and he) hope he can keep it going for years to come.

We congratulate Professor Charles Miller as the recipient of the PICES Wooster Award for 2008.

[Interested readers could access the references cited in this article on the PICES website at [http://www.pices.int/Wooster\\_Award/2008-Miller/miller\\_ref.pdf](http://www.pices.int/Wooster_Award/2008-Miller/miller_ref.pdf)]

## Latest and Upcoming PICES Publications

- *Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis* (Guest Editors: H. Batchelder and S. Kim). *Prog. Oceanogr.* 2008. Vol. 77, Nos. 2–3, pp. 83–268.
- *The northern Humboldt Current System: Ocean dynamics, ecosystem processes, and fisheries* (Guest Editors: A. Bertrand, R. Guevara-Carrasco, P. Soler, J. Csirke, F. Chavez). *Prog. Oceanogr.* 2008. Vol. 79, Nos. 2–4, pp. 95–412.
- Hollowed, A., Beamish, R., Okey, T. and Schirripa, M. (Eds.). 2008. *Forecasting Climate Impacts on Future Production of Commercially Exploited Fish and Shellfish*. PICES Sci. Rep. No. 34, 101 pp.
- Beamish, R. (Ed.). 2008. *Impacts of Climate and Climate Change on the Key Species in the Fisheries in the North Pacific*. PICES Sci. Rep. No. 35, 260 pp.
- Kashiwai, M. and Kantakov, G. (Eds.). 2009. *Proceedings of the Fourth PICES Workshop on the Okhotsk Sea and Adjacent Areas*. PICES Sci. Rep. 36.
- Jamieson, G., Livingston, P. and Zhang, C.-I. (Eds.). 2009. *Ecosystem-based management science and its application to the North Pacific* (PICES WG 19 final report), PICES Sci. Rep. No. 37.