

Many will remember the summer of 2021 for our cautious overtures towards normalcy after many months of turmoil from the Covid-19 pandemic. It will be hard to think of life being normal, however, for friends and colleagues of David Rosenberg. Dave passed away on 25 June. He is survived by his wife Trudy, brother Nathan, kids Tina (and Scott), Lee (and Sara), and grandchildren Aaron, Rayne and Zoey. Dave was known for his honesty and integrity, his quick wit and sense of humour, his “salty” language, and his commitment to his family and his career.

Dave was an internationally known aquatic entomologist. He was a generous supervisor and mentor, and was recognized throughout his career with many awards, including The Gold Medal of the Entomological Society of Canada (1998), the North American Benthological Society (“NABS”, now Society for Freshwater Science) Distinguished Service Award (2000), The K.H. Doan Publication Award for the Most Significant Publication of the Freshwater Institute (1984, 1998, 1999) and The Canadian Department of Fisheries and Oceans Prix d’Excellence (2000). He presented many prestigious plenary and invited lectures and was involved in many national and international collaborations. He served as the President of NABS in 1986 and was active in the Entomological Societies of Manitoba and Canada. He played an important role in the establishment and ongoing projects of the Biological Survey of Canada (Terrestrial Arthropods). His professional legacy can be seen in his nearly 150 publications (the full list will appear in an upcoming issue of the Proceedings of the Entomological Society of Manitoba), and in the remembrances of his friends and colleagues.

Dave grew up in Edmonton, where his parents owned a home-made ice cream parlour. He worked part-time in the store, as well as for various relatives with businesses in Edmonton before attending the University of Alberta. He received his Bachelor’s (1965) and PhD (1973) degrees from U of A. In his 2017 memoir (Rosenberg 2017), he described himself as a “failed veterinarian”, as he had initially planned to attend Vet College. Instead, he entered the Department of Entomology, and embarked on a decades-long career that would see him work on some of the most important environmental issues of our time, from pesticides (his PhD work) to pipelines, impoundments, acidification, and river health. His career was characterized by participation in large projects, and it is worth spending some time exploring these, as well as the connections that arose from them.

In 1971, before he even finished his PhD, he was recruited to work on the Mackenzie Valley Pipeline Study, based out of the Freshwater Institute of the Department of Fisheries and Oceans (DFO) in Winnipeg. Dave and Trudy, his life partner of more than 55 years, packed up everything and moved to Winnipeg, in preparation for heading north in the spring. This was to be a large study evaluating potential impacts of a proposed oil pipeline along the Mackenzie River from the Beaufort Sea to markets in the south and Dave’s focus would be the benthic invertebrates in tributaries along the Mackenzie mainstem (from Great Slave Lake to the Delta; ~1738km!). He was tasked with identifying the main environmental problems associated with construction and operation of a pipeline (e.g., increased sedimentation and oil spills), and with cataloguing the species of freshwater plants and invertebrates in the area. Either one of these goals would be daunting to most people, much less both, and he carried them out while also finishing his dissertation work! Details of the study and the taxa list can be seen in Brunskill et al. 1975 and Wiens et al. 1975.

The Mackenzie River Pipeline Project introduced Dave to his long-time side-kick Allen Wiens, and set up a partnership that lasted more than 25 years. Al and Dave met at the Fisheries camp in Yellowknife, where Al was scouting locations for the benthic invertebrate studies, and Dave



C. Resh

**David M. Rosenberg
(1943 – 2021)**

persuaded him to choose the Fort Simpson area as a study base, giving access to several Mackenzie River tributaries near there. This year on 23 March, Dave and Al marked 50 years from the time that Al first began working as his Biologist. Trudy (a teacher) was able to join Dave in Fort Simpson each summer once the school term ended, and then returned with Dave to Winnipeg at the end of each summer.

In his 2017 memoir, Dave commented that his career-long partnership with Al stemmed from how well they complemented each other: Al's outdoor skills and ability to fix nearly anything made him a perfect companion to the more academically oriented Dave. In contrast, Al describes Dave as a "consummate camper" who had his priorities right on their trips to the field. Al remembers winter camping (on the ice in a double-walled tent) near Fort Simpson during one winter sampling trip. They took turns running and emptying the 24-hour drift nets set under the ice of the Martin River, but Dave took charge of the cooking. He arrived on site with pre-marinated T-bone steaks to cook on the Coleman stove. After digging out a large snowdrift to provide shelter for the stove, Dave cooked Al's steak first (it was delicious!) then set in on his own, which he liked very rare. It was almost done when one of the icicles attached to his moustache melted off and fell into the frying pan with a "pssss" sound. When he sliced into the steak he said, "Damn it all, the steam over-cooked my steak!" [though it should be noted that his language may have been a bit saltier than reported here].

It was during this period that Dave met Vince Resh, who became a longstanding collaborator and friend. Dave accepted an invitation to participate in a workshop on sampling benthic invertebrates at the ESC meeting in Banff (1973), to which Vince was also invited. They became fast friends, collaborating on several research projects and two major books (Resh and Rosenberg: *Ecology of Aquatic Insects*, 1984, and Rosenberg and Resh, *Freshwater biomonitoring and benthic macroinvertebrates*, 1993). Donna Giberson remembers the book collaborations as her introduction to Dave's well-known "salty language" when she was a graduate student working with him at the Freshwater Institute in the 1980s. In May 1984, Vince persuaded Dave to join him on a post-conference canoe trip following the NABS meeting in Kansas, with Dave under the impression that they would be discussing the book along the way. That didn't happen, but at least no-one got wet! They co-wrote or co-edited 30 papers, chapters, and reports over their career.

After the Mackenzie Pipeline project wound down, Dave moved his research focus to the Churchill Diversion project in northern Manitoba. This was another large project, assessing impacts of a Manitoba Hydro Megaproject impounding Southern Indian Lake (SIL) and diverting the Churchill River into the Nelson River to provide stable flows for the hydro-electric dams on the Nelson. The assessment project was a huge team effort involving researchers working on hydrology and fisheries as well as aquatic flora and invertebrates, and an important result from the study was identifying the link between mercury bioaccumulation and formation of permafrost-surrounded reservoirs (summarized in Hecky et al. 1984, Rosenberg et al. 1985). Dave and Al, along with groups of summer and grad students, made regular 13-hour treks to SIL from 1975 to 1991 to assess invertebrate responses to flooding in the lake and along the diversion route, as well as in the "dewatered" Churchill River downstream.

Donna remembers a life-lesson from her first trip collecting Ekman dredge samples from the lake with Dave and Al. These dredges, equipped with spring-loaded closable jaws, are designed to sink into the mud and snap shut when struck by a "messenger" sent down a rope to the trigger



D. Giberson

Dave and Vince caught in a bit of an eddy while canoeing past another noted benthic biologist, Tom Waters who was trying his luck with the fishing.

mechanism. Theoretically, the operator just pulls up the dredge and empties it into a net to strain out the invertebrates. In reality, the dredge was usually stuck tight in the mud, resisting all attempts to pull it up. After watching her struggle for a bit, Dave and Al told Donna to hold the rope tightly and brace herself, while they proceeded to gently rock the boat from side to side. In no time, the rocking motion of the boat broke the suction of the mud around the dredge, and it came free. Dave's lesson? "The most important thing in life, Donna, is learning just when to rock the boat".

The SIL project introduced Dave to another important collaborator and long-time friend – Bob Newbury. Bob is a hydrologist who, in addition to his work on the Churchill River Diversion study, has long been involved in river and stream restoration work. Bob remembers a camp they set up on the lake on one sampling trip. Bob's young son Peter was with him and introduced Dave to hammering up a tent frame shelter, leaving Bob to note that "his profound talents lay in other areas". Making things for Dave became a small way to repay him for his affectionate friendship. They had a lot of laughs over the last one (a set of dreidels with buy, sell, hold, lose labels) after Dave sent a copy of his investment advice book. Their lasting relationship was not in science.

As is clear from the reminiscences in this tribute, Dave's strong sense of professionalism in research did not preclude light-hearted fun as well, and most of us whose lives were touched by Dave remember many such moments. Dave himself includes many funny stories of his time working on various projects in his 2017 memoir. Bob remembers Dave demonstrating his bubble blowing ability on a trip with visiting Russian and Chinese permafrost scientists to SIL. During one of Bob's stream hydrology workshops at Wilson Creek (on the Manitoba Escarpment, near the town of McCreary), Dave noticed a Dave's Septic Service truck on the road. He quickly staged a photo with the workshop participants, quipping that it could be a possible alternative career for him.

It was probably impossible for someone to work at the Freshwater Institute in Winnipeg and not also be drawn into work at the Experimental Lakes Area (ELA), a research facility east of Winnipeg near the border with Ontario (Hecky et al. 1994). Dave worked on two projects at ELA from 1991 to 1997: a peatland acidification project and a reservoir project. The peatland acidification project involved assessing chironomid responses to acidifying a poor fen, and was part of the larger group of studies on ecological effects of acidification. The Experimental Lakes Reservoir Project looked at the evolution of greenhouse gases and mercury release from flooded peatlands. Dave's role in this study was assessing responses of benthic invertebrates to the flooding, and the role of benthic invertebrates in the uptake and concentration of methyl mercury.

While Dave was still working on ELA projects, Trefor Reynoldson (then with Environment



Dave and Al on Southern Indian Lake during the 1987 Whole Lake Survey.

D. Giberson



Dave blowing bubbles at SIL.

R. Newbury



R. Newbury

A "possible alternative career" for Dave, at the Wilson Creek Stream Hydrology workshop. From left: Dave Rosenberg, Bob Newbury, John Flannagan, Dave Burton, Donna Giberson, Brian Heise, Dave Benson?, Dale Wrubleski, Dan Soluk, and Margaret Friesen.

Canada) invited him, along with Vince Resh, to participate in the Fraser River Biomonitoring Project, which became his last major project as a Canadian government researcher. Dave first met Trefor back in 1974, when Trefor was working to update the Alberta stream monitoring program; he remembers the interaction with Dave as “gracious and helpful to a couple of neophyte government biologists”. Fast forward to the 1990s, when they both participated in a workshop to develop a large reference condition study on the Great Lakes, defining biological indicators and numerical criteria using benthic invertebrates. The premise behind this approach is that a baseline or natural state can be defined through multivariate analysis of biotic and physical/chemical variables in a large number of undisturbed or “reference” sites. Other sites of interest can then be compared to the reference condition to identify disturbed sites, to determine the causes of perturbations, and suggest remediation.

The Fraser River Biomonitoring Project was part of the Fraser River Action Plan, a large Federal Government Green Plan initiative centred in British Columbia. The goal was to design and test a river monitoring project similar to the Great Lakes project that could be applied elsewhere in the country, and it ultimately resulted in the now widely applied CABIN (Canadian Aquatic Biomonitoring Network) protocol for assessing river health in Canada. Over 250 river sites were sampled annually by helicopter over a short period of time, resulting in long, tiring days for the teams. Dave was known for his work ethic and ability to spend long hours in the field or lab, but cheerfully reported in his 2017 memoir that grad student Stephanie Sylvestre (now Strachan) referred to Trefor, Vince, and Dave as the “Geriatric Team”, a possible reference to the fact that he was starting to slow down a bit.

Trefor remembers working closely with Dave between the project’s inception in 1994 to the final publication in 2001 (Reynoldson et al. 2001). Both Dave (in his memoir) and Trefor remember one day when they were scouting sites to use for their pilot study, when their guide (a technician lent to them from Environment Canada) said that he would have fired them if they had worked for him, as they kept stopping at restaurants, tourist shops, and sightseeing venues. Vince in particular was hunting for moccasins to take home to California. However, they were “re-hired” next day, after they put in a long day testing and ground-truthing their methods in their pilot stream, leaving the technician exhausted in the process.

Clearly, the story of Dave’s involvement in successive large bioassessment projects is also a story of collaborators that became firm friends with Dave and Trudy. In addition to Trefor, the large Fraser River project led to work with Richard Norris, who was involved in a similar large stream monitoring project in Australia and had helped with the planning of the Fraser River study. As a direct result of this project, Dave was invited to Australia in 1996 and to Oxford University in 1997 to present research on scientific collaboration and the Fraser River project. Trefor especially remembers the Oxford trip and the chance to show the team his home jaunts in north Wales.

Several common themes emerge from colleagues and friends when talking about Dave. Discussions were always lively and covered a variety of topics, and were endlessly entertaining (or at least, never boring!). Al Wiens notes that Dave had a very good memory and he read a lot, giving plenty of scope for discussions in the plane going to Fort Simpson (or later, on the 13-hour drives to South Indian Lake in northern Manitoba). Trefor remembers falling off rocks into the stream when processing samples as he was laughing so hard from listening to Dave’s stories.

Another common theme in reminiscences was food. Dave enjoyed cooking and was a great cook (including camp



Dave and Trefor processing samples on a tributary of the Fraser River.

A. Wiens

cooking throughout his many field trips), and many of the stories in his 2017 memoir involved food. Both Dave (in his memoir) and Trefor recalled an excellent Italian restaurant in Lillooet, British Columbia that they enjoyed for 3 nights. After complimenting the chef on the meals, the chef offered to prepare them a special meal with ingredients that would have to be ordered from Vancouver, therefore requiring a commitment prior to the meal. Dave begged off and opted for Chinese (Dave remembers being teased for not wanting to exceed his meal per diem, but Trefor thought he had just had enough Italian meals after 3 nights in a row).

Dave was involved with students throughout his career, thanks to his long connection as Adjunct Professor in the Department of Entomology at the University of Manitoba. His input and advice in 1978 for Terry Galloway's incipient new course in Aquatic Entomology was instrumental in solidifying its content and direction. Dave was a regular invited speaker in the course over a span of almost 35 years. He served as supervisor or committee member on several student committees and was generous with his time and advice, often delivered in the pithy language for which he was famous. He was a strong believer in getting the results and the message out and imparted that to his students, who benefitted greatly from his encouragement and support. For a graduate course he taught in 1979 on environmental impact assessments during a sabbatical year at UC Berkeley, he encouraged the students to produce a major article on the topic, with all the students in the class as co-authors (Rosenberg et al. 1981).

Dave's other professional "hat", and arguably the one that had the greatest impact on freshwater science, was as an editor and mentor to students and colleagues on scientific writing. He served as a reviewer for many journals and government technical report series, and was on the editorial boards of the *Journal of the North American Benthological Society (J-NABS, now Freshwater Science)*, *Canadian Journal of Fisheries and Aquatic Sciences*, *Freshwater Biology*, and *Journal of Aquatic Ecosystem Health*. As time went on, more people at the Freshwater Institute asked him to review the manuscripts of their work prior to sending it to a journal. Dave also offered his editorial instruction and services to any graduate student in the Department of Entomology at the University of Manitoba as they prepared their thesis and manuscripts. He viewed each submission as being the best work of a researcher who had spent considerable time and effort producing the manuscript, and therefore believed his best effort should be directed to examining the work. He edited the manuscripts for clarity, brevity, possible omissions, and alternate conclusions. His red pencil was busy, and many an author or student must have looked in dismay at the corrections and suggestions on their manuscript. But Dave was fair in his editing and was completely willing to listen to rebuttals by authors. His editing style was certainly extended to manuscripts submitted to him by Al or his students. Dave, having his name on the paper, wanted to make sure that everything was perfect, and he wore his red pencil to a nub on some of those papers. Vince noted that disagreements emerged in the many articles they wrote or edited together; generally, Dave wanted the writing to be more concise and Vince wanted to keep in what Dave disparagingly called "unnecessary flowers". Compromises resulted from a mixture of cajoling and ultimatums (and more salty language!), but always led to both being satisfied with the final product. Bob Newbury wrote a chapter on stream hydrology for the book Dave and Vince edited on ecology of aquatic insects (Resh and Rosenberg 1984), and says that Dave introduced him to the art of editing in a draft of a chapter for the now famous book. To his amusement, Bob asked him if the mysterious editing symbols were doodles, perhaps brought on by the boring hydraulics topic. Dave was especially particular about reference citations. Donna remembers going through a massive stack of papers, one by one, with Al (in the days before widespread pdf versions) for her PhD thesis and research papers, checking each title, author, issue and page numbers for every reference listed.

In 1997, Dave became Managing Editor for *J-NABS*, a position he held until 2005. He worked with NABS Business Manager Irwin Polls (another firm friend), and the two of them could always be found holding court at the *J-NABS* table at society meetings. Dave remarked in his 2017 memoir that a Managing Editor needs the "wisdom of Solomon, the patience of Job, and a willingness to do little else but work on the Journal". But David always went above and beyond for his work on the

Journal, providing detailed suggestions on how to improve the clarity of manuscripts even after they were accepted, and mentoring Associate Editors to take on leadership roles in a variety of journals.

Dave retired from DFO in 2001, though he continued to go in to the Freshwater Institute for several years as Scientist Emeritus, finishing up projects and continuing work on *J-NABS*. His NABS colleagues marked his retirement with a dinner at the NABS meeting in Keystone Colorado that brought together a diverse group of people whose lives Dave had touched over the years. After his retirement, Dave kept in touch with people through email and phone calls, through visits to Winnipeg, and through his regular winter travel to Palm Springs. He also wrote and self-published three memoirs, published in 2017, 2019, and 2020.

Sorting through our reminiscences of Dave has been a journey of sorts. Dave's mentoring, personally and scientifically, has touched us all. The Dave we remember used humour, was known for salty talk, and could blow bubbles and cook steaks on the Coleman stove on an icy river. And he also set an example to generations of freshwater scientists on integrity, science communication, and above all, just when to rock the boat.



Retirement dinner for Dave at the NABS meeting in Keystone Colorado. From left: Irwin Polls, Joseph Culp, Richard Norris, Rich Merritt, Gary Lamberti, Dave Rosenberg, Trudy Rosenberg, Jan Ciborowski, Donna Giberson, Vince Resh, Trefor Reynoldson.

Donna Giberson (Sechelt, BC), Allen Wiens (Winnipeg), Terry Galloway (Winnipeg), Vince Resh (Berkeley), Trefor Reynoldson (Canada Creek, NS), and Bob Newbury (Lake Country, BC).

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