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VOICEPIPE

Issue 88 September 2021

The Newsletter of the BIO-Oceans Association

Fig. 1 - Sunset on the Bay of Fundy from the mouth of Advocate Harbour. Photo Michael Murphy

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Celebrating Two Bay of Fundy Anniversaries - BoFEP & Gulfwatch (Peter Wells)

Over many years at BIO, the remarkable, world-renowned, macrotidal, and highly productive Bay of Fundy has often been a focus of research, monitoring, environmental assessment, and coastal management. Two programs connected closely to BIO that are celebrating anniversaries this year and next are the Gulf of Maine Council on the Marine Environment's (GOMC) Gulfwatch chemical contaminants monitoring program (1991-2021, 30 years) and the Bay of Fundy Ecosystem Partnership or BoFEP (1997-2022, 25 years).

Gulfwatch was initiated as an inter-departmental, inter-governmental monitoring program, utilizing the blue mussel, *Mytilus edulis*, as an indicator of the presence and trends (spatial and temporal) of toxic chemical contamination. Starting in 1991 with funding through the GOMC, a number of sites in the Bay were identified as suitable for annual sampling of mussels and some experimental bagged mussel tests were conducted to hone the techniques of seasonal collection and sample preparation. The program then ran from 1993-

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2012 with annual sampling, and has continued since with periodic archival sampling (Fig. 2), joint studies with US agencies, and the preparation of papers for publication. Trace persistent organic and inorganic chemicals are pervasive in mussel tissue throughout the Bay, at very low concentrations. Some are chemicals long banned, such as DDT and PCBs. As well, it is important to have knowledge of background levels of PAHs in case there is another oil spill, similar to the *Arrow* in 1970. One of the groups' papers, Chase *et al*. published in 2001 in the Marine Pollution Bulletin (MPB), is a citation classic (cited 188 times to date).

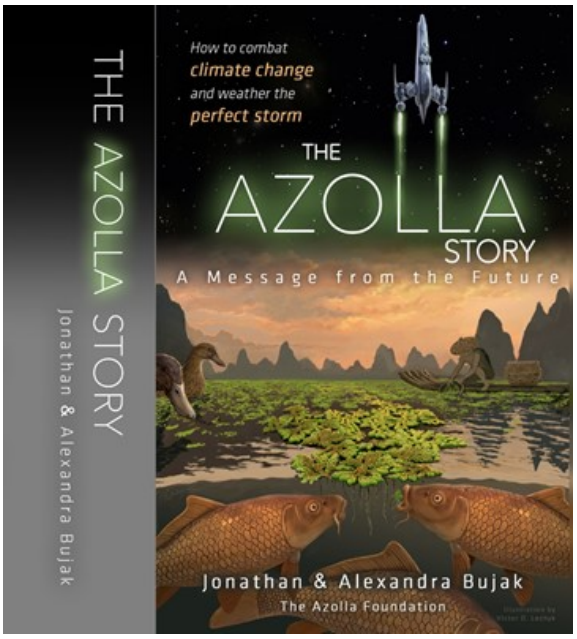
Fig. 2 - Peter Hennigar, long-time Gulfwatch member from Environment Canada, collecting mussels in the intertidal zone at Digby, NS. Photo - Peter Wells

More recently, the Gulfwatch members joined with US scientists at EPA and USGS to compare contaminants present in both mussel tissues and sediments in the Bay; a paper was recently published in the MPB. As well, US members have looked at chemicals of emerging concern, with funding from NOAA. The program continues in its 30th year with fewer members, no long-term funding, and its tissue archives now housed at the Huntsman Marine Science Centre, St. Andrews, NB, reflecting the Canadian federal government's apparent disinterest in marine pollution impacts and the marine environmental quality of coastal waters. However, there is a determination to keep collaborating through shared papers and the hopes for future re-funding. Its many papers and data reports are available at www.gulfofmaine.org .

BoFEP emerged in the mid-1990s from an initiative of a small team of people, led by Environment Canada and Acadia University, to identify current environmental issues in the Bay of Fundy. BIO's interest had waned after a number of years of research focused on the upper bay and the potential impacts of tidal power development in Cumberland Basin. There were, however, other concerns such as the causes behind the decline in numbers of migrating shorebirds and the quality of the mudflats upon which they depend for food during migration. A multi-partner workshop in early 1996 led to a jointly written and widely distributed synthesis report, identifying at least 35 current issues of interest in the whole bay. BoFEP was established formally in late 1997 and has since run twelve more biennial science workshops on the Bay (Fig. 3), bringing researchers, academics, students and managers together.

For many years, it ran a number of working groups, on topics ranging from informatics to the ecology of mudflats. Its newsletter called *Fundy Tidings*, edited by one of the founding members, Dr. Jon Percy, formerly with DFO, has proved popular. The group has also sponsored a number of specific projects, such as identifying community concerns around the Minas Basin. Publications on all of these activities are on its very active website. It has a membership of over 500 people, and a steering committee representing various sectors in NS and NB. Though funding and recruitment remain a challenge, BoFEP continues with new initiatives, highlighting the Bay of Fundy's ecosystems and the need for science, monitoring, effective policies and management, and community vigilance to protect its unique habitats and biodiversity in this era of climate change. The group celebrates its 25th anniversary next year. Check it out at www.bofep.org.

Fig 3 - BoFEP's information booth at the 11th Bay of Fundy Science Workshop, Fredericton, NB, June 2016. Photo - Peter Wells



The Azolla Story: A message from the future (Jonathan and Alexandra Bujak)

Editor's note: Many of you may remember Dr. Jonathan Bujak from his time at BIO in the early 1980s. He and his daughter, Alexandra wrote this book which is currently available as an ebook (http://theazollastory.com/about-the-azolla-story/), and supplied this information on their book about the azolla plant.

This is the story of a wonder plant called azolla that can help us at this crucial moment in our human journey. Written by Dr Jonathan Bujak, a palaeontologist with more than forty years' experience in the Arctic and his environmental scientist daughter, Alexandra, *The Azolla Story* takes the reader on an amazing journey through time and space, ending with a message written a hundred years from now in a world of incredible opportunities.

It begins with the 2004 Arctic Coring Expedition (ACEX) that discovered the Arctic Azolla Event (link: http://theazollafoundation.org/azolla/the-arctic-azolla-event-2/) featured in National Geographic (May 2005), Nature (1 June 2006) and the New York Times (November 2004). Forty-nine million years ago azolla repeatedly covered large areas of the Arctic Ocean and drew down enormous quantities of the greenhouse gas carbon dioxide (CO_2), ending the world's greenhouse climate and moving it towards today's icehouse with its succession of ice ages.

Combining the latest data on biology and genetics with geology and paleontology, *The Azolla Story* describes the timing and location of a Whole Genome Duplication event that led to the third major evolutionary jump since life began on our planet. The result was azolla – the only plant with a co-evolving nitrogen-fixing cyanobacterial symbiont that draws down the nitrogen needed for the plant's growth directly from the atmosphere**.** As a result, azolla is one of the fastest growing plants on the planet – doubling its biomass in less than two days free-floating on freshwater, purifying the water and converting the CO_2 that it sequesters into a variety of products that we urgently need.

Azolla was formally designated as a Superorganism by University of Lisbon's Francisco Carrapiço in 2010 – a unique plant that can help us overcome the multiple threats of the Perfect Storm we face today: shortages of land, fresh water, food and energy, plus man-made climate change as our population grows by more than a million every three days.

The Azolla Story also takes the reader on a voyage along Nova Scotia's coast as two BIO scientists sail from Cape Breton to Halifax: Felix Gradstein, now Professor Emeritus at the University of Oslo, and the book's co-author Jonathan Bujak who describes BIO as it was forty years ago:

'It was in the early-eighties and we were all young research scientists working at the Geological Survey of Canada. The GSC was located at the Bedford Institute of Oceanography on the eastern shore of Nova Scotia's Bedford Basin, a deep body of water connected to the Atlantic Ocean by "the Narrows" that separate the towns of Halifax and Dartmouth. Some of the geologists and oceanographers lived in the village of Bedford on the inland side of the basin – old wooden houses set in birch, spruce and pine woods with dirt lanes connecting them. That small community of scientists living in Bedford were all friends with young families who shared their children's birthdays and their dreams. We sailed together on the basin in the summer evenings and canoed down the lakes and rivers on weekends, following the old Mi'kmaq Indian routes, or cross-country skied along their trails in the winter. And we worked together to unravel the geology and oceanography of the Atlantic and the world's other oceans.'

'It was a wonderful time and an interesting mix of characters with expertise on the processes and inhabitants of today's oceans, so the geologists could talk with biologists and oceanographers to compare what they saw in the geological record with processes that are occurring today. We were all young and enthusiastic, filled with energy and, even better, very little was known about the geological history of the Atlantic Ocean at that time. It was all waiting to be discovered.'

'Five of us shared a car to drive from Bedford to the Institute – a carpool sparked by the 1979 oil crisis:

Bosko Loncarevic who was the Institute's Director, Willem Van der Linden and Felix Gradstein from the Netherlands, and Brian Nichols and me from the UK. Felix and I became friends because we were both palaeontologists and we loved sailing. Felix had a traditional Nova Scotian wooden sailboat – a Herreshoff H-28 ketch called the Lone Duck – and one day he asked if I would help him sail it back to Halifax and Bedford from Cape Breton where he had cruised that summer . . . '

'You have sailed hard all day from Cape Breton, beating against a strong Atlantic wind that burns your face despite the cold, tasting the clean air and the salt on your lips. Tired but exhilarated you weigh anchor in a sheltered bay, sharing a simple meal as the sun goes down behind a hill to the southwest, two horses silhouetted against the sky. It is so peaceful now, with no sound except for waves lapping against the boat, rocking it gently as you talk about the day's sailing and tomorrow's weather, the wind veering around to the northeast, a good run straight down to Halifax and home.

Felix tells you about his views of Deep Time and the need to determine the age of rocks as precisely as possible, a conviction that will result in him becoming Chairman of the International Commission on Stratigraphy. More than 2000 geologists from all over the world work with the ICS to continuously update the Geological Time Scale as new information becomes available about the ages of geological periods like the Jurassic.

As Felix shares his ideas about Deep Time, the sky slowly darkens until it is filled with a mass of stars, so many that parts of the sky are almost white where a band stretches across the sky. You look up in awe as you realize that it is your own galaxy, the Milky Way, just one of the billions of galaxies in a universe that came into being almost fourteen billion years ago.

At last, exhausted after the long, hard day's sailing you fall asleep trying to comprehend the astronomical number of stars and the vast distances separating them. As your eyes slowly close, lying on that gently rocking deck, the water lulling you to sleep, your mind opens to what you have seen and heard. For a moment you glimpse the tiniest perception of Deep Time that made it possible for life to evolve on our world since its formation four and a half billion years ago, following the birth of our universe nine and a half billion years earlier. Space and time so enormous that they are impossible to grasp as you drift off to sleep.'

The story then transports us from Deep Time to Our Time as we see how azolla was first cultivated in rice paddies 6900 years ago in China, doubling rice productivity without the need for chemical fertilizers and pesticides. We see how Buddhist monks spread the knowledge of azolla's use as a biofertilizer and livestock feed in India and the Far East, and how it was brought back to France at the end of the eighteenth century by a naturalist and his remarkable assistant. Jeanne Baret disguised herself as a man so that she could go on Louis-Antoine de Bougainville's circumnavigation of the globe – the first woman to travel around the world. The plants brought back to France would be formally named 'azolla' by the French naturalist Jean-Baptiste Lamarck in 1783.

The stage was now set for the next part of our journey as we move from the Past into the Present. The Present shows us the many ways in which azolla can help us weather today's Perfect Storm. The story takes us to different parts of the world, including India where azolla is revered as a wonder plant, transforming the lives of smallholder farmers for less than one US dollar (80 rupees) a year, and then to Ecuador where it can save the country more than a billion dollars a year and protect the country's precious ecosystems.

Thanks to the Azolla Foundation (http://theazollafoundation.org/) set up by the Bujaks, thousands of smallholder farmers around the world have been shown how to sustainably farm with azolla. In Sierra Leone, azolla's use as a biofertilizer in rice paddies provides the country's Ebola Orphans with food and money to build their schools, while also preventing deforestation of the region.

Dr. Jonathan Bujak doing geological fieldwork in the Canadian Rockies and his daughter, Alexandra, doing environmental work with Manchester University in Tenerife.

The Azolla Story then takes us into space to see how azolla can be used in closed-loop life support systems (CLLS), providing food, recycled oxygen and puri-

fied water that are essential in space travel and on other worlds. Back on Earth, the Azolla Biosystem, which is described in the book, grows azolla anywhere on our own world. The highly flexible, modular biosystem sequesters CO_2 for Carbon Capture and Storage (CCS) or converts the greenhouse gas into a local source of renewable food, livestock feed, biofertilizer, biofuel and high-value pharmaceuticals. But azolla can do more. Azolla Hubs that house the Biosystem increase urban agriculture in the world's growing megacities, connecting their inhabitants with nature through living, green arteries – a connection that is essential for our health as individuals and societies.

The last part of the book transports us to the shore of the Arctic Ocean a hundred years from now. As we stand there remembering the events of the past century, we record our message and view a world that is bright with optimism. It is a future that we can all have with azolla's help – a unique plant, a Superorganism and an ally on our remarkable human journey.

The Azolla Story illustrates the relevance of geology to today's world. It shows us how we can use our knowledge of the past to solve the multiple problems that we now face and how we can turn a problem into a solution. To quote from the book:

'It shows us the value of working with nature and its roots that go far back into the mists of Deep Time – time that is measured in billions of years – an unfathomable chasm compared to our own brief time as humans.

We really are the new kids on the block, but we are also beginning an incredible journey of exploration and discovery, providing we survive the next few years and weather a Perfect Storm that threatens us all. We can do that with azolla's help – a friend and ally at this crucial time in our human journey.

All we have to do is say yes, let's do it together.'

Azolla: superorganism and ally as we face a Perfect Storm. Photograph from Ecolink courtesy of Bob Winters.

AGC History (Patrick Potter)

Did you or do you work at AGC or GSC-Atlantic? Would you like to contribute to a history of AGC/GSC-Atlantic? We're looking for anecdotes, photos and different perspectives that will help to tell the story of AGC. Format will depend on the people involved and the interest they bring. If you are interested, please email Patrick Potter at potter@eastlnk.ca.

Fig. 1 - From the archives. Who can name these folks?

I Remember Alex Trebek (Ron Mcnab)

Alex Trebek and I grew up in Sudbury where we attended separate schools together, that is to say we were educated in parallel at two of the city's Francophone separate schools: Alex at *l'école Saint Louis de Gonzague*, myself at *l'école Saint Albert*. In 1953 when we were both in grade eight, we met as competitors in the annual c*oncours de français*, which tested the oral and written skills of students at that level who were drawn from the city's Francophone separate schools. We both placed well in that competition, which may have caused some consternation among the organizers because neither of us had a French-sounding surname (remember this was an era that preceded official bilingualism as a national policy). However we were born of Francophone mothers, so French was literally our mother tongue.

Our paths diverged in subsequent years, but with frequent reminders of Alex's varied roles at the CBC, followed by a thirty-year run as host of the popular quiz show *Jeopardy!* it was not difficult to keep track of his achievements. It does not surprise me to

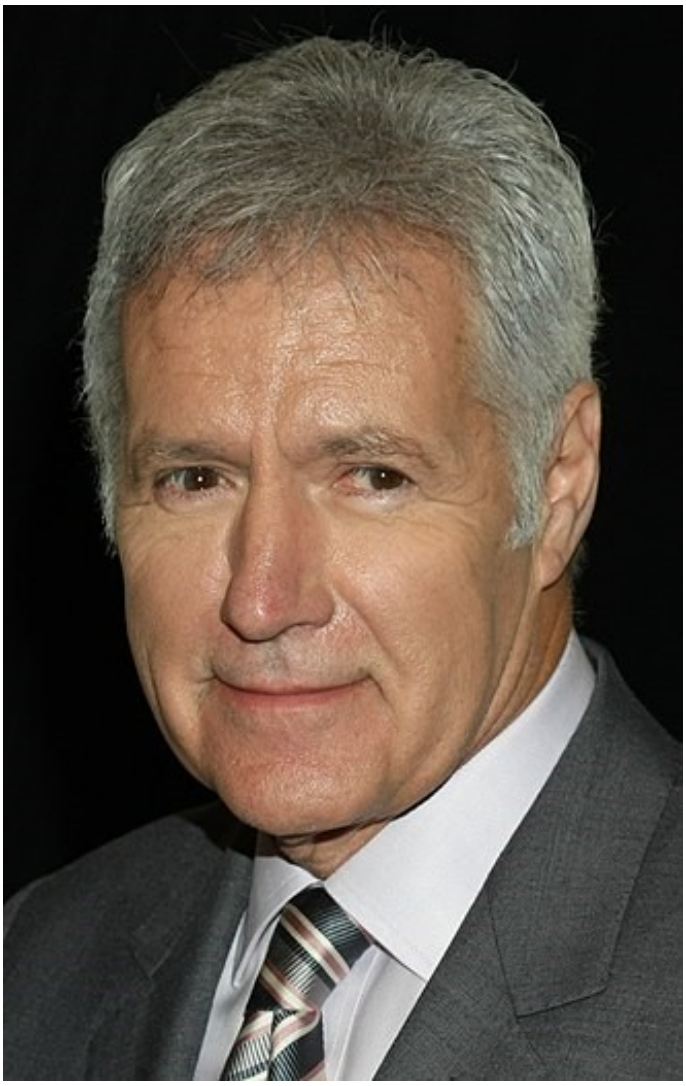


Fig 1 - From Wikipedia, Anders Krusberg from the Peabody Awards, May 21, 2012.

read descriptions of Alex's fluency in French and of his ability to switch seamlessly between French and English. It was a skill he would have practiced many times on a daily basis while growing up, and which he obviously retained throughout his career. Surely this accomplishment has to be an inspiration to French immersion students across the land.

Even as a young student, Alex always presented as an urbane individual, courteous and well-spoken. With qualities like that, he was clearly predestined to play significant roles that demanded polished presentations and a calm demeanour. He was a credit to his hometown and his country, and he will surely live on in the memories of the many whose lives he touched.

I have no doubt that Canadians in all walks of life were chagrined to learn that Alex had to confront, and eventually succumb to, a significant health challenge – but there can be no doubt that he rose to that challenge with all his customary *sang-froid*.

Memorial - Robert Kirkman Mohn (Bob O'Boyle)

On 13th June, we lost our colleague, Bob Mohn, to cancer. Bob was born on 2nd November 1944 in the USA. He did not receive his academic training in the field that he ultimately pursued. Bob was a physicist, by training and temperment – he loved to get to the root of a problem, no matter what it was. Bob received his undergraduate degree in Science (Physics) at the Rensselaer Polytechnic Institute after which he emigrated to Nova Scotia to complete his Master's degree in Physics and Computer Science, being the first graduate of Dalhousie's nascent computer science program. He pursued his PhD (1974) in the Department of Physiology and Biophysics, investigating the autonomic control of human heart rate. A series of papers on the decoding of information from cardiac pacemakers followed which highlight a major theme in his research – the analysis of signal, bias and error in noisy data.

In 1977, Canada established its 200-mile limit and set up the Marine Fish Division at BIO to undertake stock assessment and research within its new economic zone. Fisheries data are notoriously difficult to analyse and represented a scientific bonanza to Bob. MFD worked on a wide array of projects, pursuing problems not only in the Maritimes but throughout Atlantic Canada. For instance, Bob's first foray into marine mammal research was a comparison of models of the dynamics of Newfoundland harp seal populations.

He pursued a short career in the private sector in the late 1970s, while continuing his study of fisheries models, publishing (1980) an analysis of bias and error in fisheries production models.

In 1981, Bob joined the Invertebrate Fisheries Division, undertaking assessments of shellfish (shrimp, scallop, etc) stocks until 1990. He used the practical need of assessment as an opportunity to explore analytical approaches, investigating 'cohort-slicing' of length compositional data, Leslie and yield-per-recruit model behaviour and Cohort Analysis optimization. Anticipating Management Strategy Evaluation, Bob and colleagues examined the optimal harvest strategy of scallop stocks.

Bob rejoined MFD in 1990 where he was one of its preeminent modellers, undertaking assessments of groundfish (cod, haddock, etc) stocks. Furthering his research on bias and error in fisheries models, Bob was one of the first to characterize modelling error and undertake risk analysis in support of decision-making. He wrote an exhaustive chapter in the 2009 book "The Future of Fisheries Science in North America" outlining the state of model uncertainty in fisheries science.

In September 1993, the Scotian Shelf groundfish fishery was closed due to overfishing. In the 1980s, there had been growing evidence that stock assessments were systematically underestimating fishing mortality in what came to be known as retrospective error, the cause being some undetermined process that was 'removing' fish from the data. Bob undertook a study of retrospective error in the Scotian Shelf cod assessment to better determine what these processes might be. In what later became one of his signature accomplishments, he defined a metric of retrospective error, ρ, now referred to as Mohn's rho. One of the possible causative processes was natural mortality due to fish consumption by grey seals. The seal herds off Nova Scotia had been growing exponentially and many, particularly in the fishing industry, blamed seals for the fishery's collapse. Bob worked with colleagues to model the interaction between the Scotian Shelf cod and grey seal herds, showing that grey seals were not responsible for the decline of the stocks. Further work suggested that grey seals were not inhibiting fish stock recovery although this has been a topic of debate. Although a modeler, Bob also realised the merits of exploring index-based ways (Traffic Light Approach) to determine stock status in data-poor situations. More recently (2015), Bob was involved in an investigation of the dynamics of the Scotian Shelf ecosystem, a topic which he was well able to tackle based on his earlier work.

Bob was heavily engaged in the peer review process, attending and chairing many meetings in Canada (CSAS, NAFO), the USA (Center of Independent Experts) and Europe (ICES, ICCAT). His expertise was well recognized and sought after. He published over 100 papers, technical reports and research documents. Bob was eclectic in his analytical explorations and saw merit (and fun) in pursuing problems from different angles. He stands as a role model for how scientific exploration should be done. He will be missed.

For Bob's life outside science, see his obituary at https://www.dartmouthfuneralhome.ca/obituary/robert-mohn.

Mystery Solved (Don Gordon)

Our first jobs after finishing our graduate degrees and getting married were with the Department of Oceanography at the University of Hawaii in Honolulu on the island of Oahu. While there we took full advantage of the opportunity to explore the other nearby Hawaiian islands. One of our favourites was Maui where Haleakala National Park is located. Managed by the National Park Service, this unique extinct volcanic crater, at an elevation of 2000-2500 m, contains an extensive network of hiking trails and a series of cabins for overnight accommodation.

In the spring of 1970, I accepted a position in the new Environmental Quality Division being created in the Marine Ecology Laboratory at BIO. We were thrilled to be able to return home to Nova Scotia after our special two-year honeymoon in tropical paradise. However, before we left, we wanted to visit our favour-

ite places one more time. This included Maui and so we organized a four-day hike through Haleakala with other friends.

Fig. 1 - Don and Jo Gordon in Maui, 1970. Photo courtesy of the author.

We flew over a few days early to see other sights on the island before the others arrived. We spent the first night camping at Hosmer Grove, a state park part way up the road to the summit of Haleakala. After cooking our supper, we sat around the fire enjoying the evening sky. Suddenly, we saw a burst of pink and blue overhead that rapidly expanded to cover a large area of the sky. We had never seen anything like it before and were both puzzled and concerned. It was not an aurora and seemed to be of human origin. The only other couple in the campground was watching it as well and together we drove up the road to the National Park Office to inquire what it might be but no one was there. After about an hour it began to dissipate and was gone by the time we went to bed.

Several days later we met our friends from Honolulu joining us on our hike. They knew nothing about the mysterious event we had observed. During our four-day hike through the crater, we asked everyone we met if they had seen this phenomenon. Only one group had. They were a bunch of hippies and they thought it was the result of being high on LSD!

At the end our hike, we left the crater by a different route and I had to hitchhike back up to the summit where we had left our rental car. It took me a while to get a ride but finally a car with two men kindly stopped to pick me up. I thought I would try one more time to solve the mystery so I asked them if they knew anything about what we had experienced. After all, nothing ventured, nothing gained. They immediately laughed and replied that they certainly did. They were two astrophysicists from the mainland who had come out to Hawaii to conduct a barium plasma injection experiment in the ionosphere. They had fired a rocket from the island of Kauai, about 350 km to the northwest, and when it exploded as planned over Maui it released a payload of barium which was highly visible. On board instrumentation recorded the electric and magnetic fields and the energy distribution of charged particles while optical emissions were photographed at the observatory at the summit of Haleakala. It turned out they were on their way up the observatory for the final debriefing on the success of the experiment.

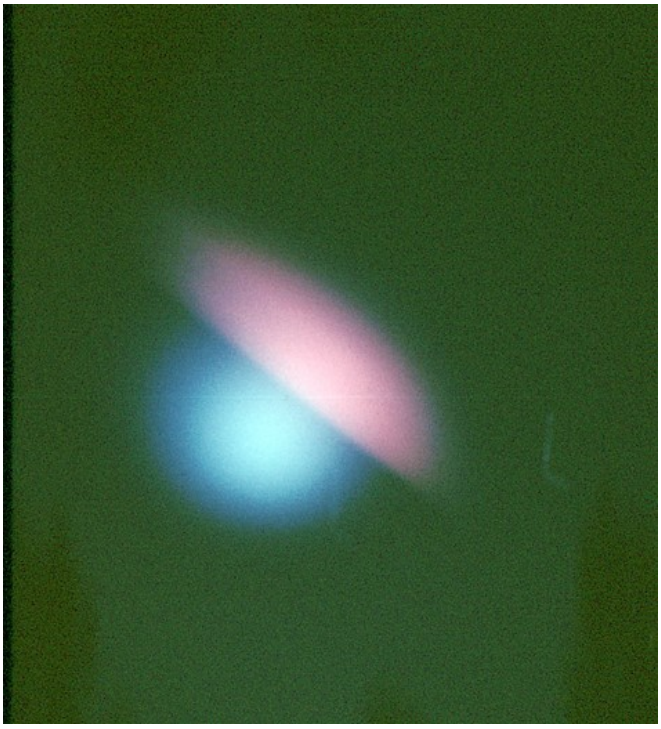


Fig. 2 - The mysterious phenomenon. Photo courtesy of the author.

So the mystery was finally solved in fine order by those who were directly involved in creating it. I had rarely hitchhiked before but was sure glad I was forced to do so this time. A year later, while scanning new journals in the BIO Library, I was most surprised and pleased to find an article, complete with photographs, describing the experiment which I read with particular interest. This was a most fitting way to conclude this unusual experience while sitting beside a campfire at night on the slope of a mountain in the mid-Pacific.

Bedford – What's in a Name? (Peter Wells)

Researching names or etymology is a fascinating pursuit, one of many during Covid! We're at the BIO, named after its location in Bedford, NS. But why Bedford? At settlement, it was named after the original Bedford in England, "an historic market town and the county town of Bedfordshire", located west of the uni-

versity town of Cambridge. The name itself "is believed to derive from the name of a Saxon chief named Beda, and a ford (or fjord) crossing the river Great Ouse" that flows through the town and led to its establishment. Hence, 'Beda's ford' became Bedford! Aren't names fun! [information in quotes - thanks to Wikipedia]

Summer Hiking in Nova Scotia – Exploring the Celtic Shores Coastal Trail (Peter Wells)

As many readers of *Voicepipe* know, beautiful and walkable coastal trails are abundant in all regions of our province, from Yarmouth County and the Annapolis Valley, to the heights of Cape Breton Island (CBI). One trail explored last summer and highly recommended, for either walking or cycling, is the Celtic Shores Coastal Trail in Inverness County, in the southwest of the island. It is the track of the old Inverness Railway and Coal Company line, officially called a provincial abandoned railway corridor. It runs from the Canso Canal through to Port Hood, Mabou and Inverness, a distance of 92 km. Being refurbished and maintained by local outdoor groups, the trail is a gem for folks wishing to explore a spectacular coastline by foot or bike, and perhaps unfortunately (excuse my bias), also by ATVs.

Fig.1 - Hillcrest Hall Inn, Port Hood. All photos - Peter Wells

I stayed at the lovely Hillcrest Hall Inn in Port Hood for several nights in early September, 2020, during a low Covid period, and walked four sections over four days. Being alone, I had to double back to the starting point and my car each day, hence putting in considerable kilometers. That was not ideal but it worked and the trail offered quite different views on each return walk. The path is, of course, flat; the surface is smoothed grit and gravel for the most part, making for comfortable walking. The many bridges are well maintained. I walked long stretches from Port Hood to Judique, and from Port Hood to Mabou, and shorter

Fig. 2 - A coastal marsh and inlet, looking out towards the Gulf of St. Lawrence.

stretches towards the canal and causeway. Every few km, there is an entry point to the trail, with kiosks, maps, and benches, always with glorious views. Informative display plaques are frequent along the trail, describing the coastal marshes behind the many barrier beaches, local wildlife, and history of the region. Naturally, the railway is emphasized as it was the life blood for many decades in the 19th and 20th centuries for this part of the Island, servicing the villages and the forestry, fishing and mining industries. The path gives good access to many beaches, small harbours, and villages along the way.

Fig.3 - The Celtic Music Interpretive Centre, Judique, located just off the trail.

On the first day, after 20 km, I had lunch at the Judique Celtic Music Interpretive Center listening to local fiddlers play their favorite pieces. The trail goes

Fig.4 - Small fishing craft, at rest in Baxter's Cove.

by a number of small working harbours, such as at Bax ter's Cove and Mabou. Wildflowers and long views are abundant. Although at times the straight parts of the trail seemed endless, the solitude was wonderful and only interrupted occasionally by a passing ATV or group of cyclists. Everyone politely slowed down while passing. I met very few walkers, except near Mabou, and no one hiking the whole length of the trail. Being September, it was still hot, humid and at times very buggy – the black flies were fierce near the marshes. A word of caution – there are no sources of drinking water on the trail and surprisingly, no washrooms! So go prepared. I carried plenty of water and fruit to stay hydrated, and followed my B and B rule – "benches and bathrooms" – to be used strategically for maximum comfort!

Happily, at the end of each day, on the Inn's high porch, I filled my diary recalling events of the day and viewed the spectacular sunsets over Port Hood harbor. Try out this trail, one of many in our beautiful ocean province. Above all, keep on exploring our amazing Nova Scotia coastline!

Fig.5 - A fishing boat returns to Port Hood harbour, under a spectacular sunset.

From the President

The OA had two meetings with Doug Wentzell, the RDG for DFO Maritimes Region, both very positive. Doug offered to allow the Executive to meet in person if we want and he will join our next in-person meeting, if he is free. In response to our questions about the annual reports, he has been considering some kind of BIO based reporting and saw value in raising the profile of BIO within the Department and the community.

We discussed the opening up of the BIO and how we could collaborate on revitalizing the community spirit at BIO, after the many months when staff and BIO OA members have not seen each other. This will be aA major agenda item on your Executive's next meeting. Contact me or any of the other Executive members if you have ideas.

The CSS *Acadia* has been towed to the shipyard in Shelburne for dry-docking. We were disappointed we didn't get notification so we could witness her departure, but I have contacted the shipyard and the Museum for permission to visit the Grand Old Lady while she is out of the water. More on this if we get permission.

Speaking of ships, it is heartening to know that the replacement for CSS/CCGS *Hudson* is underway. The venerable *Hudson* has had a sad recent history that has severely impacted ocean-going science and monitoring projects. It looks like the day is near and long overdue when federal government oceanographic vessels will no longer be considered unreliable.

I remember John Bujak. His venture with his daughter Alexandra with *Azolla* is a remarkable story. It made me think of all the children of BIO staff who had gone on to useful and accomplished careers. Needless to say I reflected that the intellectual and supportive community at BIO might have contributed to their success.

I did not know Bob Mohn but he is one more of our BIO colleagues that made remarkable scientific contributions but are no longer with us.

I will confess to an addiction. When we can, Sheila and I watch and play along with the contestants on Jeopardy. Alex Trebek was an icon on television and he is missed. Thank you to Ron for your reminiscences of your youth with Alex in Sudbury. Sheila and I often muse that if we could do a mind meld we might be competitive Jeopardy contestants.

Thank you to Peter Wells and Don Gordon who are consistent contributors to the *Voicepipe*.

It seems we are making one step forward and two steps back with our fight against the corona virus. I hope this issue of the *Voicepipe* finds you and yours well and keeping safe.

Fig.1 - Model of the new vessel under construction to replace the *CSS Hudson*. (Photo courtesy of R. King)

Construction Underway of the *CSS Hudson* Replacement - (Randy King)

Editor's note: This spring, Seaspan Shipyards of Vancouver, B.C. announced it had cut steel and started construction of the long-awaited replacement vessel for the CSS Hudson with completion expected in 2024. Randy King (CCG) has provided the following update on the project.

As part of the National Ship Building Strategy (NSS) announced in the Federal Budget of 2007, the CCG fleet has been implementing a vessel replacement strategy. One of the vessels identified for replacement was the East Coast research work horse, the CCGS *Hudson* launched in 1963. This is a long overdue replacement of the *Hudson*, now 58 years old and the oldest research vessel in the international research fleet.

The new vessel will be a state of the art platform of similar size as the *Hudson*. Vessel particulars are:

Length Overall	87.93m
Breadth	17.6m
Design Draft	6.2m
Complement	60 persons
	(34 crew and 26 Science)

The vessel is designed similar to other research vessels operating worldwide with the work area being the aft deck and the starboard side. It will be fitted with a 20 ton A-Frame and 2 knuckle boom cranes. The main crane will allow the vessel to load up to 20 containers of scientific equipment, both lab units and storage units. The secondary crane will allow for deployment of equipment over the stern and side of the vessel.

The vessel will be fitted with a number of in-situ lab spaces. There will be a General Purpose Lab, Chemical Lab, Climate Controlled Lab, Acoustics Lab, CTD Control Lab and a Computer Lab. Total lab space on the vessel is approximately 440m². Along with the lab spaces, the vessel will also have a large Ocean Sampling Room with a CTD launch and recovery system (LARS) and one for the non-conducting Hydro Wire. For acoustic work, the vessel will be fitted with a Kongsberg EM304 multibeam on the hull. The ship will have a drop keel that will carry a secondary multibeam unit, a Kongsberg EM2040. Also on the drop keel, there will be an EK 80 system with 5 different frequencies, Knudsen 12Khz, 57Khz and a 300Khz ADCP's, 3.5kHz sub bottom profiler and 2 acoustic release transducers. The vessel will be fitted with an AML Moving Vessel Profiler (MVP) 300-3400.

In the ocean sampling room, the vessel will be able to deploy the CTD to depths of 6000m (slightly over the 6000m mark but exact depth will be determined on sea trials). Also it will be fitted with a LARS for piston coring operations. Working with the LARS is the Oceanographic Winch which is fitted to the ship on the deck below the main deck. This winch and the coring LARS will have the ability to do 30m long piston cores to a depth of 7000m.

Unlike the Hudson the vessel is designed with all the work spaces and labs on the main deck (with the exception of the Acoustics Lab, located one deck below the bridge). With this design there is no need to traverse stairs when taking samples from the deck or the OSR to the lab spaces. There are no accommodations on this deck.

Labs are fitted with large displays that can show a variety of information from the bridge navigation display, one of the 22 CCTV cameras, the CTD (or other equipment being deployed) location in the water column, etc. There will also be 2 science planning stations - one in the GP Lab and one on the bridge for the Chief Scientist to work closely with the mate on watch for planning of survey routes. In both the Chemical Lab and GP Lab there will be a full size fume hood with proper ventilation, and clean salt water supplied for flow through instrumentation. There will be dedicated sinks in each of these labs for the disposal of salt water over the side. These sinks can also be used for washing excess dirt and mud. For ease of loading mission specific winches, the main deck will have a bolt matrix of 600mm X 600mm to allow winches to be bolted in place instead of the welding that is currently required for this purpose on Hudson. Labs are also fitted with a bolt pattern on the deck (300mm X 300mm) that will allow labs to be configured in a way that suits the program.

Editor's Keyboard:

A year and a half later and we are still struggling to cope with Covid 19. It seems that we will never return to a semblance of normal. I feel lucky that I am retired and can be selective about my activities. I can only guess at the pressures facing those who need to leave their homes to go to work, to care for their children, or struggling to keep their business running in the face of the challenges from the pandemic.

My only advice is to get vaccinated and respect the orders given by the public health authorities. If you think your government is moving too fast in opening up, you can be more cautious. To those of you that have chosen not get vaccinated, I am losing patience. Your inaction is having a direct impact on many lifes - those that contract the virus, those that are trying to care for the many patients in our hospitals, and those with other illnesses that can't access treatment because the beds are taken by covid patients. While many tell me that I should respect the views of the anti-vaxxers, I am not that patient a person. We all have responsibilities as members of our community, and they are shirking theirs.

ABOUT THE BIO-OCEANS ASSOCIATION

The Bedford Institute of Oceanography Oceans Association (BIO-OA) was established in 1998 to foster the continued fellowship of its members; to help preserve, in cooperation with the Institute's managers and staff, BIO's history and spirit; and to support efforts to increase public understanding of the oceans and ocean science. Membership is open to all those who share our objectives. Most current members are present or past employees of BIO or of the federal departments of Environment, Fisheries and Oceans, and Natural Resources (or their predecessors) located in the Halifax Regional Municipality. Membership is $10 per year, $40 for five years, $70 for 10 years, or $150 for a lifetime membership.

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Membership Information

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