

Sandra Shumway ('74):

Solid Science and Seafood Sanity

By Wallace Kaufman ('61)

“We believe that science, the cornerstone of modern human civilization, now faces an existential threat.” Sandra Shumway, Peter G. Beninger, and Jeffrey Beall.

Dr. Sandra Shumway is a research professor at the University of Connecticut with more than 44 years of analyzing marine toxins and invertebrate physiology. She has edited scientific journals and published hundreds of peer reviewed articles. Co-author Peter G. Beninger is an accomplished senior scientist in France with significant honors, while Jeffrey Beall is a professional librarian. Their conclusion appears in a scholarly and heavily documented article about the growing and corrupting influence of over 7,000 pay-for-publication and open access journals offering over 400,000 articles. An airing of the now bitter and litigious controversy over such journals is beyond our scope here, but threat to public confidence in science and the reaction to the article are important.

The reaction? Loud protests from open access and pay-for-publication journal owners, threats of litigation, pressure from the University of Colorado on Beall to close a blog on science journals, mild debate among a few scientists, and outside the scientific community—silence.

Overlapping this research quality problem are the alarmist and emotional scientists who also sway the public by appearing in a respected forum like Ted Talks or *Scientific American*. The contents of both are consumed by credulous non-scientific Americans.

In Shumway's sphere Ted Talks and *Scientific American* have made micro-plastics a cause celebre with presentations

from scientists and activists showing dead birds with open guts filled with plastic bottle caps and other plastic debris. (Microplastics are plastic bits smaller than 5mm that come from many sources—synthetic fibers, the tiny plastic beads added to personal care products and detergents, and from the breakdown of larger plastics of all sorts.)



Emotional alarms? Consider, for instance, a talk by a young fisheries biologist, Sarah Dudas, some 15 minutes of startling claims about the dangers of microplastics that show up in shellfish and even in our table salt. Her claims have been featured on National Public Radio and numerous web sites. Another Ted Talk by the young and attractive Dr. Sherri “Sam” Mason of SUNY-Fredonia is called “Beads of Destruction” and begins, “I couldn't sleep.” The presenters (often non-scientists and curiously mostly attractive young women) seldom if ever talk about how much precision and careful lab work is required to identify microplastics and their origins (some can come from the laboratory itself).

About one of the scientists presenting, Shumway says, “Just regurgitating a lot of factoids. It's a decent summary of the problem and environmental issues and telling Joe Q. Public to stop using so much plastic. No agita, no science either.”

Scientific American ran a three-part series by science writer Andrea Thompson on microplastics in the environment, in our food, and in our bodies. Like most science writers (yours truly being one of them), Thompson goes to the experts, but she almost exclusively goes to the experts who confirm her crisis perspective. (Psychologists call this “confirmation bias.”) The articles have provocative titles like “From Fish to Humans, A Microplastic Invasion May Be Taking a Toll,” and “Microplastics Have Been Found in People's Poop—What Does It Mean?”



Left: ‘Look what I found’ – Sandy ~ 3 years old and already investigating the local fauna at the Hummocks. Right: Sandy with her dad's striper catch.

Yes, what does it mean? Read the many articles on microplastics, and the phrases “may be” and “possibly” and other qualifiers that readers gloss over whisper from behind the curtain of fear, “We don’t know.” Shumway has an even deeper concern—many of these scientist-alarmists not only don’t know, they don’t follow correct scientific methods for finding and categorizing and analyzing the microplastics. Some may be finding the microplastics contributed by their own laboratory environments, their own clothes.

About two of the Ted Talks in which a young scientist and an anti-plastics activist scare the audience by noting how we sprinkle our foods with sea salt containing microplastics, Shumway says, “The amount they are reporting in these salt shakers is miniscule, and you get as much from the clothing you are wearing and everyday exposures.”

Shumway became so concerned about the way passion for a cause is replacing scientific rigor that she and two colleagues wrote an editorial warning about the problem: “The Microplastics and Shellish Media Frenzy: Stop The Train, We Want To Get Off!”

Yes, begins the article, “It has been well documented that plastics are pervasive, persistent, and perpetual components of the marine environment.” “Well-documented” means quantity, many years of publicity, and “the ubiquitous plastic bags smothering coral reefs and choking sea turtles, the bottle caps and detritus causing sea birds to starve.”

Shumway is not Dr. Pollyanna Pangloss, but well-seasoned with prudent perspective. “While microplastics have plagued the marine environment for decades, recent publicity and campaign efforts have brought the blight to the forefront. Microplastics pollution is now the latest scientific bandwagon — driven unfortunately by some scientists’ desire to establish their territory in the quest for research funding and fame.”

The publicity not only ignores how long these plastics have been part of our lives, but it ignores findings that do not support grant getting for scientists and fund raising for organizations. Shumway writes in her editorial, “What is in question is the extent of the impacts (if any) on marine animals. Identifying detrimental impacts quickly garners the attention of both funding agencies and the public. Just as important are findings that demonstrate no impacts, but these results rarely make the news.” She notes that actual accumulation of microplastics or any particles is very different from uptake. “In most animals the microplastics are excreted very quickly, and they have not been demonstrated to be toxic.”

How does she know? For over thirty years she has been using microplastics as test particles and markers in her studies of shellfish physiology.

Shumway also cites research on what psychologists and statisticians might call “base rates.” Researchers at Scotland’s



Shumway, as Chief Marshall, bestows honorary degree to Kermit the Frog at Long Island University.

Heriot-Watt University examined the exposures to microplastics that diners get from eating mussels and from the house dust that falls during a meal. Two from mussels, 114 pieces from house dust falling on the dinner plate. Shumway concludes, “Although more data are needed to confirm ‘potential’ impacts, the current media hype and scare tactics with regard to “potential” impacts is irresponsible, unwarranted, and dangerous.”

While some scientists speak confidently about the swarm of microplastics in seafood, Shumway says, “One (or even five or 10) microparticles cannot be extracted reliably from an entire mussel or oyster with any degree of confidence. And even if it could be, is that really of any consequence for the shellfish or, as some have suggested, human health? The answer is most likely No on both points, but experiments are currently underway in our laboratory to address this question.”

Science writers who act as intermediaries between researchers and the public have little patience for or interest in “experiments currently underway” unless researchers leak exciting details. Journalists in their own sphere, like the proliferation of pay-for-publication and non-peer reviewed journals, contribute to corrupting the public understanding of and confidence in science. They are employed by organizations and publications that want profitable headlines or increased contributions to a cause (not unlike corporations who concentrate on emphasizing their success in quarterly reports rather than long term profits and viability).

An irony of time is that Sandra Shumway was about to graduate second in her Taunton, MA high school class and enter the now extinct Southampton College of Long Island University as a marine biology major in 1970, the year of the first Earth Day. A shining star of the events was Dr. Paul



Sandy hard at work last summer on Bainbridge Island, Washington, at the Kenneth K. Chew Center for Shellfish Research and Restoration.

Ehrlich, a butterfly entomologist re-inventing himself as a futurist. His first claim on public attention was his 1968 bestseller, *The Population Bomb*. Its first sentence was, “The battle to feed all of humanity is over.” That catapulted him to the top rank of environmental prophets. On Earth Day he declared, “In ten years all important animal life in the sea will be extinct. Large areas of coastline will have to be evacuated because of the stench of dead fish.”

Shumway would go on to publish her first research paper as a senior and graduate *summa cum laude*. Ehrlich, despite decades of famously failed prophecy of doom, has gone on warning of an environmental apocalypse, part of an ever more publicized chorus. This year he declared, “We’re continuously harvesting the low-hanging fruit, for example by driving fisheries stocks to extinction.”

While the chorus of doom grew ever louder, Shumway continued to develop her expertise as a comparative physiologist and, more importantly, to apply it to increasing the world’s food supply. In the popular media, work like hers is largely unsung.

Where Shumway’s achievements are sung is among the people who produce seafood, both fishermen and the aquaculture entrepreneurs—the people who actually produce more and more seafood. Perhaps her most solid honor is the long list of organizations that have backed their confidence with their money. The National Oceanographic and Atmospheric Administration has funded several projects that range from analyzing marine toxins—e.g. domoic acid that renders crab and molluscs toxic—to the use of scallops in aquaculture as a means of utilizing nutrients that escape from fish farms higher in the water column.

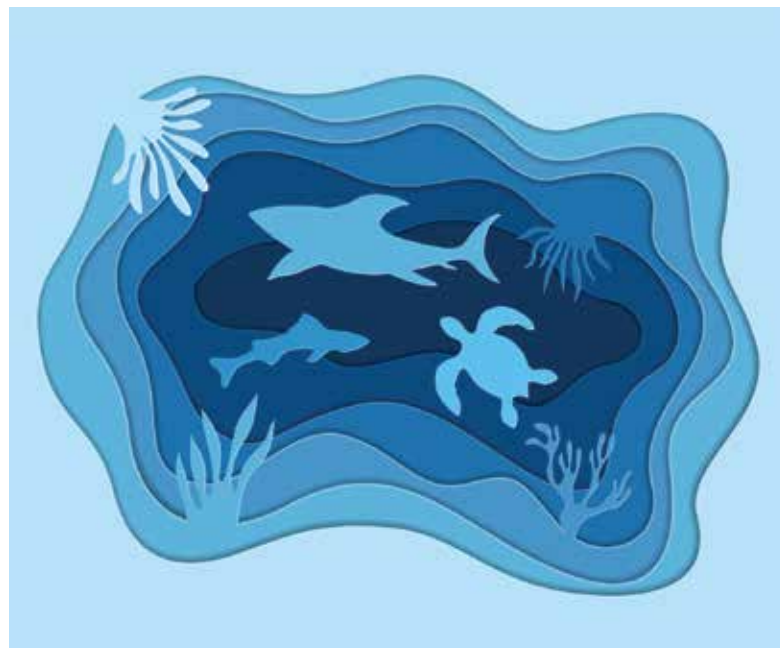
She has also undertaken work funded by NATO, ECOHAB-EPA, Sea Grant, universities in the US and abroad, the UN, the National Science Foundation, and several state agencies on both coasts.

For contributions that have led to increasing aquaculture productivity as well as protecting the natural environment, in 2001 the National Shellfisheries Association made her an Honored Life Member. When she received the Association’s David H. Wallace award, the organization noted that she had “performed physiological experiments on nearly every phyla of benthic organism and has tailored her research to benefit industry. From her early work with pandalid shrimp and sea scallops in Maine to her work with harmful algal species (HABs) and their deleterious effects on commercially important shellfish species and human health, she has had a substantial impact on global legislation and policies.”

Should such honors and recognition be surprising for a woman who dug her first mollusc (a clam) at age three? (Shumway, incidentally, insists mollusc, not mollusk, is the correct spelling. After all, these creatures are in the large invertebrate phylum Mollusca.) Research has been woven into Shumway’s life for so long she doesn’t remember when her exploration of marine organisms began.

Exploring the lives of marine animals “was just a part of me as long as I can remember. There wasn’t a day when I decided to go explore. It was just how I was.” She soon had a small boat of her own and extended her exploration beyond the supervision of parents. She tended her own lobster pots. “You couldn’t do it today because of child abuse,” she muses. A younger sister and two younger brothers “looked at me a little cross-eyed—what is she doing now?” None of them followed her into science. Her mother, a legal secretary, was not too happy to have a dissecting lab on the back porch of their summer home in Rhode Island, but Shumway is very grateful to both her mother and her father, an electrician, for the freedom they gave her to pursue her interests. “They were very supportive of all the crazy things I was doing.”

In the fifth grade she created her first science project and went on to win prizes regularly in science fairs. In her



Background image: moon sleep/bigstock.com



Shumway exploring a mudflat in France.
Photo credit: Peter Beninger

junior year in high school she took first place at the Massachusetts State Science Fair at MIT. In her senior year she earned the award of Ford Future Scientist of America and an invitation to the NASA Youth Science Congress.

She told the *New York Times* in 1974 that she applied for a Marshall Scholarship “when my adviser told me it would not hurt to waste an eight-cent stamp. I never dreamed I would get it.” She had all but forgotten the application as she pursued a research project at the Skidaway Institute on the coast of Georgia, her mind entirely engrossed in marine science. When she returned to college, a letter from the Marshall Scholarship Commission was waiting. The letter asked if she was sure she wanted to go to North Wales, where no scholar had gone for several years. She was quite certain. She was delighted that she’d be among castles and “all that archaic stuff,” but what determined her selection of universities was that University College of North Wales, Bangor, Gwynedd, had its own marine lab and ocean access. A minor regret about moving to Wales was that she would have to leave behind her pet tarantula and that her pet boa constrictor that had roamed her apartment freely would be kept in a cage by her father.

After earning her PhD and doing post-doc research at Menai Bridge, Gwynedd, she went on to New Zealand’s University of Otago for a year, then stopped in at Universidade de Sao Paulo, Sao Paulo, Brazil, as an invited researcher. That same year she was back on Long Island, where she joined the Department of Ecology and Evolution at SUNY’s

Stony Brook campus. During some thirty years of teaching and research she won high ratings from students and often took on the task of teaching or mentoring students in science writing, with special attention to students whose first language was not English.

In 2002 she became a research professor at University of Connecticut, a position that gave her the flexibility to pursue research and the travel required of someone whose reputation brings many invitations to lecture and to consult on ways to improve seafood production.

In 2014 she completed the range of her work on shellfish that began with physiology and ecology. Having become the first woman honored life member of the National Shellfish Association, colleagues decided she ought to write a cookbook. She is the lead author-editor for *Simply Shellfish Cookbook*. Besides having over 600 recipes, as befits the product of a scientist, the introductory pages contain a table showing energy, protein, fat, carbohydrates, minerals, vitamins, and fatty acids for clams, oysters (Eastern and Pacific), and scallops. A second table lists the cholesterol found in 12 molluscs and in 8 crustaceans (crabs, lobsters, and shrimp). Buy the book, and your money will go to the Student Endowment Fund of the National Shellfisheries Association. It is also the only shellfish cookbook you will ever need.

The book is not a lark, a frill, or a fundraiser. It is the natural work for a scientist who wants her work to create the greatest benefit for the greatest number of people. Shumway sees the great potential for feeding the world in aquaculture, but while everyone is familiar with fish, she says of shellfish and crustaceans, “One of the biggest problems is people don’t know what to do with them.”

Nor is aquaculture very popular. In the popular press and environmental forums aquaculture is condemned as a



Sandy leading a touch tank experience with her sister Lorna’s special needs class.



Sandy's office holds a large library and is an entertaining collection of memorabilia, often a stop on campus tours.

polluter and producer of inferior food. Shumway says that like every industry, aquaculture “has a few bad actors,” but its benefits are far more important. It’s an industry that demonstrates what environmentalists often proclaim—that what’s good for the environment is good for the economy. “Shellfish aquaculture,” Shumway says, “is good for economy, good for ecology, and good for you.”

Farmed fish, she notes, get fed while shellfish take their food directly from the water, and in the process they improve water quality by removing particulate matter and reducing eutrophication. Their clusters provide refuge for many other animals—crabs, eels, fish, worms, and shrimp, for instance. Shellfish farming creates “whole new mini ecosystems.”



Sandy with a clam rake

Aquaculture entrepreneurs, she says, “are good stewards of the environment because they want and need good water quality.” Multitrophic aquaculture is part of that stewardship. Shumway gives as an example raising scallops with fish farms, the scallops filtering nutrients from any excess food and particulates. Responsible aquaculture moves closer and closer to using all of the natural resources and using them in the most efficient way, Shumway says. They can’t do much about natural phenomena like red tides that have been documented as early as ancient Egypt. Human pollution they try to prevent.

“A lot of info from environmental extremists is outdated,” Shumway says. “It doesn’t note that the situation has improved, and yet they get a lot of press. For example, screaming about salmon culture in Canada. If aquaculture is done well, it is not bad for the environment. Aquaculture has matured and grown a lot in the last 20 years. People are developing sophisticated models for carrying capacity used for the commercial industry. They don’t want to waste anything.”

In the US the often unfounded concerns about aquaculture have entangled startups in regulations and permitting processes. Shumway notes that Canada, Spain, and Portugal are in the vanguard of applied science. When interviewed for this article, Shumway had just returned from China where she saw “massive advances” in both marine and aquatic food farming. She says China produces more aquaculture than the rest of the world combined. Japan and the Philippines are also big producers. For the US, “The biggest problem is NIMBY (not in my back yard), and people who don’t want to see it out there.” This is where those Ted Talks and the Paul Ehrlichs of the environmental fringe take their toll.

It’s more than Shumway’s role in this science and technology that has won her not just scientific honors but strong friendships in and out of science. Just as important is her passion for using science to help others. When she first learned she could study in Wales on the Marshall Scholarship, she explained to the *New York Times* that her goal was not just “knowledge for knowledge’s sake, but research that will be worth something to other people, like mariculture or drugs from the sea.”

When the National Shellfish Association awarded her life membership, Dr. Melborne Carriker said, “It is her warm outgoing personality and genuine interest in people and readiness to extend an unselfish helping hand to those in need that have endeared her to so many of us.”

Among the kudos she’s earned, one of her most treasured was won by her prowess as a pool player, a talent she has nurtured since college. To relax after a day’s work she used to stop in a local pool hall. Friends reported that one day at a local bar a patron asked a seasoned and cynical fisherman, “Who’s the broad at the pool table?” The fisherman replied, “She’s a scientist, but she’s okay.”

