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Prof. Emma Johnston: Underwater Trailblazer

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Author: Leigh Dayton

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Emma Johnston's passion and laboratory are Sydney Harbour and the coastal waters and estuaries of Australia's 'marine estate'. The multi-award winning scientist and communicator uses her brains, collaborations and cutting edge tools to ensure vulnerable underwater worlds remain healthy for generations to come.

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Emma Johnston is on a mission, a mission to use the tools of science and communication to help protect the underwater world she has loved since she was a youngster growing up next to Melbourne's Port Phillip Bay.

"We swam and snorkelled and sailed," says Johnston of life sandwiched between two brothers. One brother went on to become a landscape architect and the other, a musician, so Johnston again stands out. She is the sibling who turned the family passions into a professional career.

At age 42, Professor Emma Johnston is a pace setting ecologist and ecotoxicologist at the University of New South Wales. There she heads the Subtidal Ecology and Ecotoxicology Research Group, training tomorrow's marine scientists and collaborating with today's experts. She is also the Inaugural Director of the multi-disciplinary, multi-institution Sydney Harbour Research Program (SHRP) at the Sydney Institute of Marine Science.

Johnston is passionate about Sydney Harbour because, despite being surrounded by almost 5 million people, it's a global hotspot for marine and estuarine diversity. "It hosts almost every type of habitat that exists in the ocean," she explains.

In November 2014, Johnston and her SHRP colleagues launched the World Harbour Project. "The new project arose out of a desire to share techniques and learnings about multiple use harbours that are heavily impacted but also highly valued, so the findings and priorities are being rolled out globally," she says proudly. There are 20 city partners, from Jakarta to San Francisco, Shanghai to Rio De Janeiro.

"We're publishable in the international scientific literature and we're policy relevant. That's the 'sweet spot' where I really like to be," says Johnston, claiming she's always been interested in "useful research".

If that weren't enough, the energetic marine scientist advises government through bodies such as the Marine Estate Expert Knowledge Panel, an independent arm of the New South Wales Marine Estate Authority. She is also the lead author of the Coast chapter of the five-yearly National State of the Environment Report, funded by the Australia Government.

Topping off this impressive list of accomplishments, Johnston is a high-profile science communicator and broadcaster, familiar to viewers worldwide as a co-presenter of the Foxtel/BBC television series Coast Australia.

"I do need eight-hours sleep," Johnston admits, shrugging off the suggestion that she is a 'short-sleeper' like

British Prime Minister Margaret Thatcher. “I can get by on seven hours for a few days but then I crash,” she laughs, before answering the phone.

“That was a call from The Discovery Channel,” explains Johnston. “They’re filming six episodes on Sydney Harbour, to air next year. I’m hoping to get some underwater research into the program, not just cruises and New Year’s Eve.”

Given her diverse but integrated projects, it may seem that Johnston followed a preordained career path, from young sailor to professional marine scientist and communicator. That’s not the case.

“I didn’t have a clue what I wanted to be,” she confesses. “Growing up we had lots of music and visits to art galleries. I was tempted to be a painter.”

The fact is, young Johnston was presented with a world of ideas and options. Her father was an applied mathematician at Melbourne’s Monash University. Her mother was a chemist, until she was forced to leave work when refused a request for part-time work after starting a family. Undaunted, she took up painting and studied Japanese.

“That was back in the 70s,” sighs Johnston who works hard to encourage girls to see a place for themselves in the STEM disciplines: science, technology, engineering and mathematics.

“Women are socially and culturally engendered to think of maths and physics as difficult, that we don’t have a natural facility with them,” says Johnston. “It’s not true. What the community believes the child believes, and it affects a child’s choices and performance,” she says, acknowledging it will take effort and a “massive cultural shift” to shake off entrenched prejudices.

Proving her point that women can handle the ‘hard’ subjects, Johnston won the first Nancy Millis Medal for Women in Science, awarded by the Australian Academy of Science on International Women’s Day, 2014. The award honours the memory of the late Professor Nancy Millis, a Melbourne University microbiologist who pioneered the field of biotechnology in Australia.

It is just one of a string of awards, including the 2012 New South Wales Science and Engineering Awards [plural] and the New South Wales government’s 2015 Eureka Award for the public communication of research.

At first glance, the Eureka Award represents a recent twist on Johnston’s linear path from sailor to scientist. In fact, it links directly back to her childhood as the daughter of a scientist who had postings in France, England and Japan, as well as Australia. With so many experiences under her belt at an early age, it’s not surprising that in her teens she had decided to be a science journalist.

“So I studied, biology, physics, chemistry and maths, and majored in the philosophy of science at the University of Melbourne,” Johnston recalls. “I was also very motivated by social and environmental issues and was the president of the student union.”

Science, journalism, public advocacy – it began to fuse when Johnston took a class in ecological research.

Johnston explains: “I was fascinated. I did an honours then PhD in the field, and got a job straight out of my PhD. That’s very unusual”.

This professional head start enabled the early career scientist to get straight into the field, in Johnston’s case the water. She has explored the tropical waters of the Great Barrier Reef and the sea beds of Antarctica, investigating the impact of human activities on marine life.

Sweeping seagrass meadows and kelp forests, rocky corals and sponge gardens, even handfuls of soft sediment from harbours and estuaries provide vital information about life underwater.

The results can be significant. For instance, by combining data collected in Sydney Harbour and many other estuaries in NSW, with laboratory assays, Johnston demonstrated a decade ago that toxic contaminants, particularly copper, facilitate the potentially disruptive invasion of alien species into coastal waterways.

“We’ve now got multiple lines of evidence, a causal mechanism and real world data through time and space,” says Johnston who regularly discusses her team’s findings with policymakers and ‘stakeholders’, among them recreational fishers, often reluctant to acknowledge the impact of their favourite hobby.

“It’s my job to put the information we gather out, explaining how it was gathered and to acknowledge and discuss it within the context of their personal experiences.”

Meanwhile, Johnston’s group is working with collaborators at the CSIRO, National University of Singapore and the Canadian Rivers Institute to build “very fun, very cutting edge” tools. The idea is to use powerful new tools of genetics and ‘big data’ to assess the biodiversity and health of marine ecosystems.

“This is the kind of information we need to understand how we can help species survive in rapidly changing circumstances which include rising sea surface temperatures,” Johnston says, noting that some of their “bio functional diagnostic tools” are this year being adopted by Australian national research programs.

“But the latest, most cutting edge tools are still in development, and our initial findings have been received with much interest at International conferences in Hong Kong and the UK at which I have been a plenary speaker this year”.

Despite such successes, there’s more to do. After pulling data together for the State of the Environment Report, Johnston became acutely aware that there is no national monitoring system for near shore coastal systems and estuaries. The result is confusion and conflict about the use of ecosystems such as the Great Barrier Reef and Sydney Harbour.

“We need to know if an ecosystem is in good shape or close to a threshold which could put it over the edge. We need tools to get information and provide feedback about how ecosystems are responding to change,” says Johnston. “We need a national monitoring system to provide confidence that monitoring is ongoing and consistent.”

We need more Emma Johnstons, Johnstons who do, talk, and train the next generation.

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