SPERA Newsletter December 2019

Jeffree Conservation and Research (Ross Jeffree; Ross.Jeffree@hotmail.co.uk)

Sydney Estuary studies

Scott Markich is leading a series of field and radio-tracer experimental studies on metal contaminants in the Sydney Estuary and the capacity of the euryhaline pygmy mussel, *Xenostrobus securis*, to operate as a useful biomonitor of key metals contamination in sediment and the water column. The study has now provided a quality-assured benchmark of key metal contamination in the Sydney Estuary, and an appropriate methodology that may be used in the future to discern any changes in metal contaminant status using *X. securis*. The data from a series of radiotracer experiments on metal biokinetics in the pygmy mussel are currently being assessed to better predict how it will respond to any changes in the metal contaminant levels in Sydney Estuary.

S.J. Markich, R.A. Jeffree (2019). The euryhaline pygmy mussel, *Xenostrobus securis*, is a useful biomonitor of key metal contamination in the highly urbanised Sydney Estuary, Australia. Environmental Pollution 252, 813-824.

S.J. Markich, R.A. Jeffree (2019). Physico-chemical and key metal data for surface waters and sediments of the Sydney Harbour and Hawkesbury estuaries, Australia. Data in brief 25, 104255.

Shark maternal transfer experimental studies

This study is investigating the rates of transfer of radio-elements ^{54}Mn, ^{75}Se, ^{110m}Ag, ^{109}Cd to the progeny of a small shark, in order to i) compare with those previously determined for the radionuclides ^{134}Cs, ^{65}Zn, ^{60}Co and ^{241}Am, ii) determine if their maternal transfer rates to progeny are positively related to their maternal assimilation rates (AEs) from radio-labelled food, and iii) assess the susceptibility of the egg compared to the free-swimming juvenile in the bioaccumulation of these radio-elements via their life-stage specific transfer pathways.

Internal distributions of multi-nuclides accumulated in cartilaginous and bony marine fishes

This study investigates the distributions of nine radionuclides (^{54}Mn, ^{60}Co, ^{65}Zn, ^{134}Cs, ^{241}Am, ^{109}Cd, ^{110m}Ag, ^{75}Se and ^{51}Cr) among six body components of six species which are representative of a range of families of teleost and chondrichthyan fishes. The specific objectives of the study are to determine; i) the degree of heterogeneity in the distributions of these multiple radionuclides, and ii) the nature of any differences between bony and cartilaginous fishes in their internal distributions of these radionuclides. The results will be relevant to further assessment of the adequacy of the simplifying assumption of homogeneous internal distributions of radionuclides for radiological dose assessment.

Science and Technology Australia (STA) – how it benefits SPERA and its members (Sue Barrell, STA Former Vice President)

Science & Technology Australia (STA) is Australia's peak body in science and technology, representing more than 75,000 Australian scientists and technologists, belonging to more than 80 member associations (including SPERA) and working across all scientific disciplines. STA's mission is to bring together scientists, governments, industry and the broader community to advance the role, reputation and impact of science and technology in Australia.

As well as providing a unified and respected voice for the STEM sector as a whole on issues of national importance, STA offers a range of resources and other benefits to its members to enhance their capability, efficiency and connections. A detailed description of STA and what it provides to its members can be found on the STA website (www.scienceandtechnologyaustralia.org.au), but in summary, STA:

- Connects with Policy
    - STA connects scientists and technologists directly with Parliamentarians through initiatives like **Science meets Parliament** (which SPERA is sending a delegate to the 2019 event) and the **STEM Ambassadors Program**, and to Departmental decision-makers through strategic initiatives and networking events;
    - STA also makes regular submissions to government, publishes statements on policy decisions, and contributes to national discussions around the future of Australian science and technology through Parliamentary Forums.
- Connects with Business
    - Through industry collaboration events, STA facilitates dialogue between STEM professionals and industry leaders, and addresses the obstacles scientists and technologists are faced with when moving into the commercial sphere.
- Fosters Collaboration
    - STA forms partnerships and alliances to promote and enhance the role of science and technology in Australia and facilitates introductions for its members to sector influencers.
    - Through initiatives like the **National Research and Innovation Alliance**, STA brings representative bodies together to collaborate on issues facing research and development in Australia.
- Empowers STEM Professionals
    - STA offers a range of workshops, programs, and events which empower the members and staff of our member organisations, including **Superstars of STEM**, designed to propel Australian women of STEM into the spotlight, and **Super STEM Communicator Workshops**.
- Supports the growth and success of members
    - Tailored advice, tools, how-to guides, templates etc assist members in crafting advocacy and communication strategies, attracting new members, enhancing back-end administration.
    - Promotes equity, diversity and inclusion (EDI) through active advocacy across the STEM sector, industry and government and through direct assistance to members in developing their own EDI policies and practices.
    - Provide members (and their members, in turn) with access to a range of benefits designed to help science and technology associations, societies and other organisations to work smarter while saving time, money and resources, such as discounts, training, quality professional advice and exclusive offers from a range of service partners offering accounting & auditing, corporate governance and insurance, among other services.

As a respected and influential contributor to debate on public policy since 1985, STA provides a strong voice for the science, technology, engineering and mathematics sector. A thriving and diverse STEM sector is critical to Australia's future, with value extending beyond economics and innovation potential, to our wellbeing, prosperity, happiness and the environment. As an example of STA's advocacy, STA's 'Solve it with Science' campaign brought

the collective voices of thousands of STEM professionals to speak on behalf of the STEM sector leading up to the 2019 Federal Election, seeking a focus on a whole-of-government plan for science and technology; a strategy to equip the future Australian workforce with STEM skills; strong investment in both fundamental and applied research; and a commitment to creating policy across all portfolios that is informed by the best available evidence.

STA is working to ensure the diversity of the STEM sector is reflected in its representation, as a diverse and inclusive sector will achieve better outcomes and more meaningful, lasting success. Building on its achievements through programs such as the Superstars of STEM, STA has become an inaugural champion of the AAS-ATSE Women in Science Decadal Plan https://scienceandtechnologyaustralia.org.au/wp-content/uploads/2019/08/WIS-DecadalPlanSTAResponse-compressed.pdf

Article written by Sue Barrell, Former Vice President, STA (and proud AMOS member)

Delegate Report from Science meets Parliament 2019 (Maddy Hoffman; m.hoffman@ecu.edu.au)

On the 26th and 27th of November, I was sponsored by SPERA to attend Science meets Parliament 2019, at Parliament House in Canberra. Science meets Parliament is an annual event where members of the scientific community meet with members of the Australian Federal Government. There were also numerous workshops designed to help us hone our communication skills, particularly so we can inform people outside the scientific community what we do and why it's important. On the second day, I met with Mr. Josh Wilson MP for Fremantle, Shadow Assistant Minister for the Environment and Deputy Chair of the recently completed *Inquiry into the prerequisites for nuclear energy in Australia*. I was able to sit and have a discussion with Mr. Wilson about my proposed research into the radiological legacy remaining in the Montebello Islands, Western Australia, but was also the first step to developing and fostering a great working relationship with Mr. Wilson and other politicians at the federal level. I was able to talk about the work of SPERA, and the need for support and understanding environmental radioactivity in our corner of the globe. I networked relentlessly for 48 hours, building bridges between academic and industry bodies and swapping business cards with fellow scientists who suggested a new technique, offered a different perspective or said they knew someone I could contact to push my project further. I was inspired by people with experience ranging from decades to months, but who all shared the same belief that they could help increase our understanding of the world around us.



From left to right: Developing the perfect pitch with other delegates on Day 1 of Science meets Parliament. A small prop I made and took to better explain why and how we investigate radioactivity in a coastal environment such as the Montebello Islands. A quick photo after a positive meeting with Mr Josh Wilson MP in his office in Parliament House on Day 2 of Science meets Parliament.

I highly recommend Science meets Parliament to any member of SPERA, or any member of the scientific community, who has the desire to get their work out in the public sphere. It was an experience that was mentally and physically challenging but with immense benefits personally and professionally. I think that the need for scientists to actively pursue communication of their work to the wider community is summed up perfectly by one

of the 2019 keynote speakers Professor Fiona Wood, 'You can be the best violinist in the world but if you're in a soundproof room it's a waste'.

Accelerator Mass Spectrometry at Australian National University (Michaela Froehlich; michaela.froehlich@anu.edu.au)

New publication on $^{240}Pu/^{239}Pu$ atom ratios across China.

The $^{240}Pu/^{239}Pu$ atom ratio has proven to be a rather effective tool to identify the origin of plutonium in the environment. We examine a dataset of $^{240}Pu/^{239}Pu$ atom ratios determined from surface and core soils at 240 sites across China. The data were compiled from 18 separate literature sources from the last 20 years. For the first time the spatial distribution (3 latitude bands and 7 natural regions) of the weighted average $^{240}Pu/^{239}Pu$ atom ratios in Chinese soils is investigated. An area to the West of Xining City, shows a weighted average Pu atom ratio of 0.167 ± 0.002, lower than that of average global fallout, which likely arises from the addition of local fallout from the Chinese nuclear weapon tests at Lop Nor between 1964 and 1980. The Yumen and Jiuquan areas of Northwest China in particular show evidence of very low ratio material from the Chinese nuclear weapon tests. Excluding the impacted area around the test site the weighted average $^{240}Pu/^{239}Pu$ ratio of 0.182 ± 0.002 suggests that global fallout is the main source of Pu in most Chinese soils.

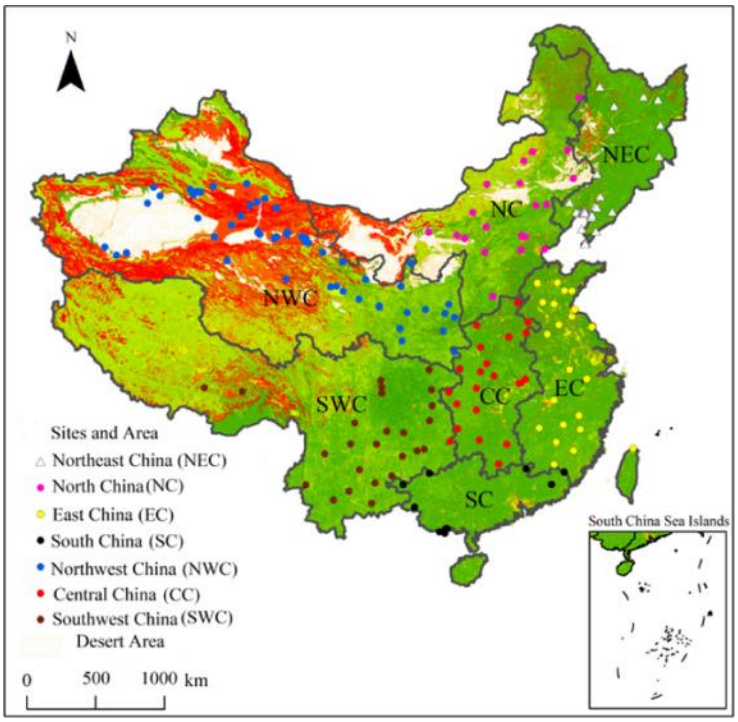

Fig. 1: Pu soil sampling sites used in the present study.

Table 1: Weighted average $^{240}Pu/^{239}Pu$ atom ratios in the different regions of China. Note that errors correspond to the larger of either the internal uncertainty or the standard deviation of the weighted average, and hence are a factor of 10–20 less than the standard deviations of the individual distributions.

Area	Abbreviation	n	Weighted Average value
East China	EC	28	0.179±0.001
Northeast China	NEC	48	0.184±0.001
North China	NC	20	0.185±0.003
Central China	CC	22	0.194±0.002
South China	SC	14	0.179±0.004
Southwest China	SWC	25	0.185±0.002
Northwest China	NWC	80	0.168±0.001
East Xining	EXN	15	0.189±0.003
West Xining	WXN	65	0.167±0.001
China (Excluding NWC)		157	0.182±0.001
China (Excluding WXN）		172	0.182±0.001
China		237	0.178±0.001

Ref: Y. Huang, S. G. Tims, M. B. Froehlich, S. Pan, L. K. Fifield, S. Pavetich, D. Koll, 2019. The $^{240}Pu/^{239}Pu$ atom ratio in Chinese soils. Sci Total Environ 678, 603–610. 10.1016/j.scitotenv.2019.04.251