



## Editorial

## More jellyfish everybody?



*Jellyfish stew,  
I'm loony for you,  
I dearly adore you,  
Oh, truly I do...*

[Iraira Cedillo, March 2014]

On the 26 October 2014, *The Sunday Times* reported that scientists had warned that because blooms of jellyfish are becoming increasingly common around the coasts of Great Britain, they are threatening to clog (the jellyfish, not the scientists) the intakes of the cooling water systems of coastally located nuclear power stations. Apparently, three years ago a massive swarm clogged the intakes of the Torness Power Station in East Lothian, Scotland, forcing both reactors to be shut down. Further, jellyfish swarms have become a global phenomenon forcing the shutdown also of Sweden's Oskarshamn nuclear station in September 2013. In this case, the offending scyphozoan was the moon jellyfish *Aurelia aurita* and, in the Baltic, power station closures are a recurring problem, the previous one in 2005 also at Oskarshamn being caused by the same species. Actually, *A. aurita* is common in the Baltic Sea and two autumns ago, in 2012, I witnessed a vast bloom exiting the Kattegat from the Baltic into the North Sea via the Skagerrak. At that time, I was more interested in drawing the little red amphipod *Hyperia galba* that lives in its host's gonads, eating them, but it was an amazing sight with untold thousands and thousands of them stranding in Albæk Bay on their voyage.

Actually, my first up-close encounter with a jellyfish was in Hong Kong waters in the early 1980s where, every summer, as the south-easterly monsoon drives hot South China Sea water towards the coast of southern China, it brings with it, not *Aurelia*-scale swarms, but large numbers of the lion's mane jellyfish *Cyanea nozakii*. Again, I was more interested in this species' associates, which includes the barnacle *Alepas pacifica* and juvenile carangid fishes. At the time, I did not know the species' name and so sent a specimen to the eminent marine biologist Freddie (Sir Frederick) Russell FRS at Plymouth – a world authority. I packed up a preserved individual with the dimensions of a big, tentacled, dustbin lid and posted it off. A month or so later, a reply from Freddie provided the identification. This species, like *A. aurita*, doesn't have much of a sting but in Hong Kong waters it and the more toxic *Stomolophus meleagris* are eaten by the pomfret, or melon seed, *Psenopsis anomala* (Pisces). On one of the rare occasions I was allowed onto the Hong Kong Government's research vessel, *Cape St. Mary*, we caught some pomfret and after their data were recorded I was allowed to take a couple home for supper. That evening, my first wife (as Clement Freud always introduced

his) cleaned the fish and came out in a terrible rash and swellings to her hands and face where she had been stung by the latent nematocysts in the fish's guts. A few day's rest and anti-histamine pills slowly resolved the puffy eyes and hands problem but for a marine biologist it was a fascinating insight into a predator–prey relationship and the effects of nematocyst discharges on a human being.

A just as interesting feature of the summer invasion of Hong Kong's waters by jellyfish was their impact on local power stations – they too blocking the cooling seawater intakes. The most serious problem was at China Light & Power's Castle Peak Station at Tap Shek Kok and which is the largest coal fired power station in Hong Kong. In the 1980s, this station too had a jellyfish problem and the company was persuaded to fund a Ph.D. studentship to look into the matter. The student, Vivian Lam, showed that, as predicted, the jellyfish problem was a seasonal one but an analysis of all the species caught by the intake filters for the cooling waters revealed something else. A side result of the study was that, in addition to the impact of ingested animals (and detached algae) upon the efficiency of the intake screens, the sheer volume of cooling water taken in was so great that it was culling mainly fishes to the extent, Vivian calculated, the station's own impact was equivalent to that of a local hang trawler (fishing the from the sea surface to the sea bed) operating for 24 h each and every day of the year.

This journal (Dong et al., 2010) published a paper which showed that three species of jellyfish, *A. aurita*, *C. nozakii* and *Nemopilema nomurai* form large blooms in Chinese waters, including the East China Sea, Yellow Sea and Bohai Sea as a collective result of eutrophication, habitat modification for aquaculture, over-fishing and, possibly, climate change. Such is the extent of the problem that the blooms are altering trophic systems in inshore waters, increasingly it is believed virtually world wide, but also themselves adversely affecting fisheries, stinging recreational bathers, blocking all kinds of seawater intakes and, generally, causing mayhem. As a consequence, *The Sunday Times* article mentioned at the beginning of this editorial, also reported that the British Government's business secretary, Vince Cable MP, is going to fund a “jellymonitor” early warning system where sea-based detectors will spot blooms and alert power stations. In these straightened times, therefore, the problem must be a real one.

I used to think that the Chinese (and Japanese) people had the solution to the jellyfish problem well in hand because they eat them – being unappetisingly called ‘hoi zit’ in Cantonese. The target species is *Rhopilema esculentum* and it used to be exclusively wild-caught but is, today, believe it or not, also cultured. In the early 2000s, stock enhancement was carried out on a very large

scale and for the first time in Liaodong Bay, China, where >400 million seed juveniles (umbrella diameter >10 mm) were released to re-stock over-fished inshore native *R. esculentum* numbers (Dong et al., 2008). Although the estimated recapture rate was only about 3% it was estimated that the jellyfish fishermen earned ¥159 million (~US\$25 million) over the two years the experiment lasted. Since the 1990s, this sea-ranching of jellyfish has been augmented by pond culture such that today it is an important, and expanding, coastal industry, supplying an important food resource for a population of over one billion Chinese citizens.

Actually, jellyfishes have been exploited along the coasts of China for over 2000 years but the eating of this seafood commodity has, in more recent times, spread to Japan which imports over 10,000 tonnes of jellyfish products each year valued at >US\$25 million. These jellyfishes, comprising some eight species, are mostly imported from the Philippines, Vietnam, Thailand, Malaysia, Indonesia, Singapore and Myanmar where they are caught by artisanal fishermen. The average annual catch of jellyfish between 1988 and 1999 in Southeast Asia was estimated to be about 169,000 tonnes (wet weight) and the worldwide catch ~321,000 tonnes. The comparatively recent status of the Chinese jellyfish mariculture industry was reviewed by You et al. (2007).

Although, prepared jellyfish might seem unacceptable to the Western palate, they are nevertheless edible. I used to eat them regularly in Hong Kong's restaurants when I lived there and they are typically served as a salad accessory to other dishes and in thin strips that resemble elastic bands. These are actually pretty tasteless, the flavour coming from an added sauce, but they are reportedly nutritious. They are, for example, said to be rich in protein and collagen and low in calories with only trace amounts of sugar and no fats or cholesterol. They are also said to have medicinal properties, for example, curing arthritis, hypertension, back pain, ulcers, tracheitis, asthma, burns, fatigue and, most importantly, enhancing female beauty endowing them with enormous food, pharmaceutical and, probably most importantly, cosmetic benefits.

There is only one slight problem with this. Jellyfish preparation, which, many years ago, I watched in Tsingtao (Qingdao) in Shantung Province, China, is complex and confidential to the individual factory. Essentially, however, the bell is separated from the rest of the body and stacked in appropriately sized (for the species) tubs where the tissues dehydrate and shrink when treated with recipes of soda, salt and alum in variable ratios. It is not an overtly appealing process to watch and smell. But, the end product is widely considered a nutritious delicacy.

Recently, however, Report No. 35 of the Risk Assessment Studies undertaken on Chemical Health Evaluations (Aluminium in Food) conducted in May 2009 by the Centre for Food Safety of the Food and Environmental Hygiene Department of the Government of the Hong Kong Special Administrative Region (of China), pages 1–42, identified a problem with eating jellyfish. The report showed that the aluminium content of alum-prepared jellyfish could pose a health risk. All fifteen of the commercially obtained samples of jellyfish in the ready-to-eat form contained very high levels of aluminium, ranging from 400 to 1800 mg kg<sup>-1</sup> with a mean of 1200 mg kg<sup>-1</sup>. Such high levels were believed due to the use of alum as the firming agent in processed salted jellyfish. The industrial standard for alum in jellyfish products in China is 1.2–2.2%, that is, between 12,000 and 22,000 mg kg<sup>-1</sup>, which, in turn, corresponds to between 684 and 1250 mg kg<sup>-1</sup> of aluminium. I am no toxicologist but that seems quite a lot to me and exceeds Hong Kong's food safety regulations.

Aluminium is one of the most common compounds in the earth's crust and is widely thought of as an innocent compound but is still believed to cause health problems when one is exposed to high concentrations. Lifetime uptakes of significant concentrations of aluminium can, it is thought, lead to several serious health effects, such as: severe trembling, listlessness, damage to the central nervous system and loss of memory leading to dementia, and may also be implicated in Alzheimer's disease. Hmmm! And so, with the little grey cells not so numerous as they were anyway, but accordingly more precious, on my next visit to Hong Kong this month, I think I'll give the jellyfish salad a miss. Circumspection is, I believe, a characteristic, but also a benefit, of advancing years.

## References

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