

New fish farm designs mimic nature

Noreen Parks

Industrial-scale fish farming has earned strong criticism over the past three decades, because of various environmental and health concerns. However, ongoing research suggests that rearing multiple species in concert provides considerable biomitigation, while potentially boosting aquaculture's bottom line.

A chief complaint about aquaculture is its production of excess feed and copious fish wastes, which degrades the coastal environment. Realizing the potential for recycling this output into food for other organisms, marine biologist Thierry Chopin, of the University of New Brunswick (Saint John, Canada), and colleagues have pioneered the development of integrated multitrophic aquaculture (IMTA).

Inspired by ancient Asian practices, IMTA aims to create balanced systems



IMTA site in the Bay of Fundy, New Brunswick: salmon (left), mussels (right foreground), and seaweeds (right background) are cultivated in proximity.

by combining varieties of finfish (or shrimp) with organisms that absorb inorganic nutrients (think seaweeds) and organisms such as shellfish, which dine on organic matter. "The concept is feasible on land as well as offshore, for both marine and freshwater systems. What's critical is selecting the appropriate organisms, based on their ecosystem functions", Chopin explains. His extensive collaborative research has shown that kelp and mussels absorb fish-generated waste when grown near salmon pens, resulting in a

50% increase in kelp and mussel growth rate. Mussels are also capable of inactivating the virus that causes infectious salmon anemia. A new project will investigate whether shellfish can remedy another aquaculture-related plague: sea lice. Other researchers are working on integrating sea cucumbers and urchins to increase waste uptake.

Meanwhile, the concept has been adopted by the business world; IMTA systems are successfully operating in Canadian waters, at five commercial sites in the Bay of Fundy and one off Vancouver Island. China, Chile, Israel, and South Africa also have operations at or near commercial scale, and IMTA is firmly on the radar screen of the UN Food and Agriculture Organization.

While some aquaculture critics propose moving all fish farms to land-based sites, Chopin points out that this would require pumping and aerating seawater (which has its own footprint) and effluents would still have to be treated. "IMTA is no silver bullet, but using the services of different species to balance the system is one promising strategy toward sustainable aquaculture", he concludes. ■

BPA causes environmental concerns

Johanna Polsenberg

In late March 2010, the US Environmental Protection Agency (EPA) announced immediate actions to address the potential effects of bisphenol A (BPA) in the environment, especially with regard to its impact on aquatic species. BPA – a reproductive, developmental, and systemic toxin, as well as a possible endocrine disrupter in animals – is often used to harden polycarbonate plastics, such as some baby bottles, reusable water bottles, and food-can linings.

While humans are primarily exposed to BPA via contamination from food and drink containers, less than 5% of the BPA produced in the US is used in food applications. The EPA estimates that environmental releases of BPA exceed 450 000 kg per year, and the

two areas with the most potential for direct environmental releases and exposure are manufacturing and processing. Mary Dominiak (EPA, Washington, DC), project manager on the BPA Action Plan, says "[The] EPA is proposing to add BPA to their Concern List as a substance that may present an unreasonable risk of injury to the environment, marking the first time EPA is using this authority under the Toxic Substances Control Act of 1976". The EPA will also initiate further regulatory actions, including an investigation of thermal and carbonless paper coatings.

Thermal paper, used to print receipts, airline, and event tickets, contains free BPA. When handled, this easily transfers to skin, and residues on the hand may then be ingested. Use of BPA in paper may also be a major vector for BPA presence in landfills. There are adequate

alternatives, so eliminating its use in paper could reduce both human exposure and environmental releases.

Another possible route of environmental BPA contamination, reported in late March by Katsuhiko Saido (Nihon University, Tokyo, Japan) at an American Chemical Society meeting, is by leaching into the marine environment – from the breakdown of hard plastic debris and epoxy resins used on the hulls of ships. Saido and his team analyzed sand and seawater from more than 200 sites in 20 countries and found BPA in every sample. "We were quite surprised to find that polycarbonate plastic biodegrades", admits Saido. He calls it, "a finding that challenges the belief that hard plastics remain unchanged in the environment. Recent studies have shown that mollusks, crustaceans, and amphibians could be affected by BPA, even in low concentrations". ■