THRIVING ECONOMIES, HEALTHY OCEANS

::photo:: Neptune Industries, Florida, USA

Global Assessment of Closed System Aquaculture

People throughout the world love to eat seafood. And no wonder. Fish and other seafood are tasty and nutritious. They are a healthy source of protein, vitamins, and essential omega-3 fatty acids. As the global demand for seafood increases and ecological constraints put limits on wild fish supplies, aquaculture is becoming an important means of satisfying that demand.

Over the past three decades, aquaculture worldwide has grown by about 11 per cent a year, and now provides about one third (40 million megatons) of global fisheries production.

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But not all aquaculture is equally beneficial. In particular, open net-cage farms producing fish such as salmon have serious negative impacts. At their worst, they cause devastating damage to the marine environment, threatening wild salmon runs, shellfish beds, marine mammals, and many other species living in the area. Even so, salmon farming has become an important part of many coastal economies. Our goal is to achieve both financially viable aquaculture and healthy local ecosystems.

Closed system aquaculture (CSA) is already providing better ways to farm fish. This involves barrier technologies that ensure no contact between wild and farmed fish, thus eliminating the most negative impacts of fish farming and significantly reducing others. Around the world, CSA is producing fish and profits without degrading the rich abundance of oceans, lakes, and streams.

An examination of existing CSA reveals a large and complex range of technologies with varying methods of treatment for both incoming and effluent waters. All involve a physical barrier between the fish and the natural environment. These range from pond and ditch systems, which are the earliest form of closed system aquaculture, to impermeable barrier systems, such as raceways and tanks. CSA systems include those using a one-time flow-through of water with varying degrees of input and output water-treatment methods and fully recirculating systems where water is largely reused.

Geographically, CSA is found everywhere from land-locked urban centres to sea-based tanks. Systems may depend on municipal water, groundwater, lakes, rivers, or the ocean. This range and diversity of existing and emerging technologies is a promising sign that closed systems can be successfully adapted to meet specific geographic conditions and respond to social conditions such as consumer demand, policy, and legislation.

Closed system aquaculture is already providing better ways to farm fish

In the Netherlands, for example, environmental and social concerns have led to policy and legislation requiring 100 per cent of aquaculture to be CSA, using recirculated water. Some governments, such as those in the European Union, have implemented subsidies and tax reforms to encourage development and adoption of these new technologies.

Closed system aquaculture comes in many configurations. See below for examples of the most typical forms.

Recirculating tanks

Recirculating tanks are often located where land and water is limited. When a system reuses 60 to 70 per cent of treated effluent water, it is considered to be a recirculating aquaculture system (RAS). Some systems recirculate more than 95 per cent of their water.

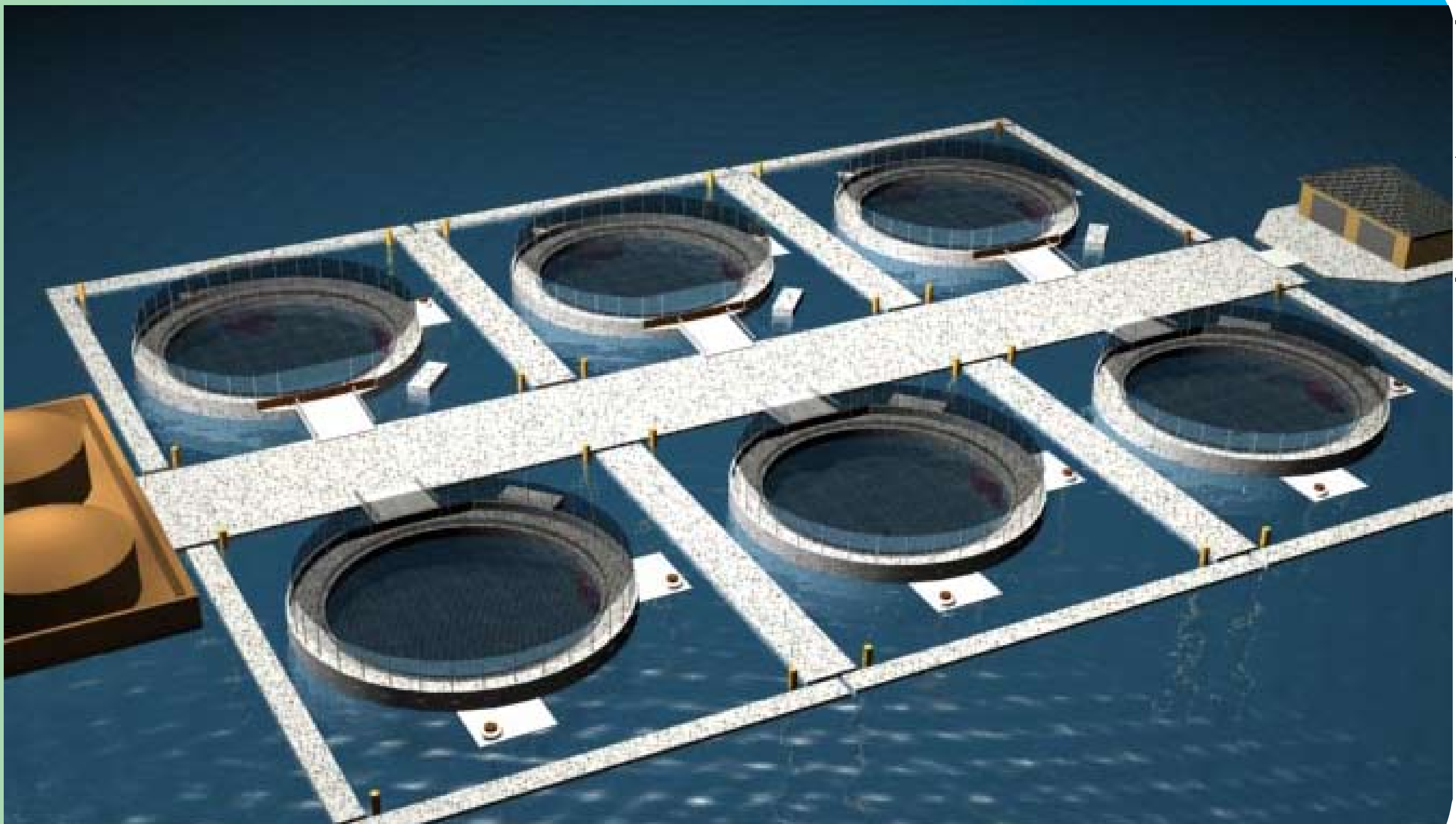
Tanks come in a variety of forms. Circular tanks are often used because of their self-cleaning properties. Polygon shapes, however, are more space efficient. These systems are often modular and scalable, which allows producers to add greater capacity at their own pace without having to interrupt operations.

::photo:: Cell Aquaculture Systems Europe, Netherlands

Flow-through systems

Flow-through systems allow water to enter and exit through the tanks or holding areas. Incoming water is almost always treated for bacteria, parasites, and disease, and outgoing water is treated to varying extents. Solid wastes are frequently collected and treated, possibly composted. Flow-through tanks are similar to recirculating tanks. These, however, are more commonly found where reliable water sources are available. They are made from a range of materials, in circular as well as square shapes. Hard-walled systems are generally made from reinforced plastic, fibreglass, concrete, or aluminium, and can be land-based or float in lakes or the ocean. Soft-walled are made from plastic.

::photo:: Silfurstjarnan Ltd. Iceland



::photo:: Middle Bay Sustainable Aquaculture Institute, BC, Canada

Raceways

Raceways (recirculating or flow-through) are long structures, sometimes hundreds of metres. Water flows through them, staying in any one spot only a short time. They are characterized by a low water volume-to-container surface area. This is appropriate for certain species, such as trout, which thrive in a simulated stream flow, and flat fish, such as flounder or sole, which need large surface areas. Modern raceway systems are made from a variety of materials – concrete, plastic, or steel – and can be outdoor or indoor, partially or fully recirculating, or gravity fed by a stream. Recirculating raceways are operated as land-based systems. These can be on a single level or stacked to increase production per unit of floor area.

::photo:: Aqvaplan-Niva, Norway

Inland ponds

Inland ponds and channels are considered to be closed systems because, even though they contact the soil and ground, the fish are free from traditional predators and cannot escape to mix with wild species, and any diseases generated in the enclosures can be contained. These systems can be lined with membranes or mud, but this is generally not the case. Ponds are similar to tanks but are dug into the ground, and channels are similar to raceways but in the ground.

::photo:: Agassiz Aquafarms, Manitoba, Canada

New Economic Opportunities

Despite some challenges around initial higher investments, CSA offers tremendous economic opportunity. A survey of existing and emerging technologies indicates that this sector has a vibrant research-and-development component. The increasing global demand for seafood products coupled with increasing concern over aquaculture's impact on natural ecologies (manifest as tightening regulation and consumer trends) is encouraging companies to invest in research and development of closed system technologies. Some proponents of closed containment systems maintain that the short-term capital investment required will be offset by gains associated with being able to control losses suffered in open net pen production systems due to predation, escapement, changing ocean conditions, diseases, and other challenges.

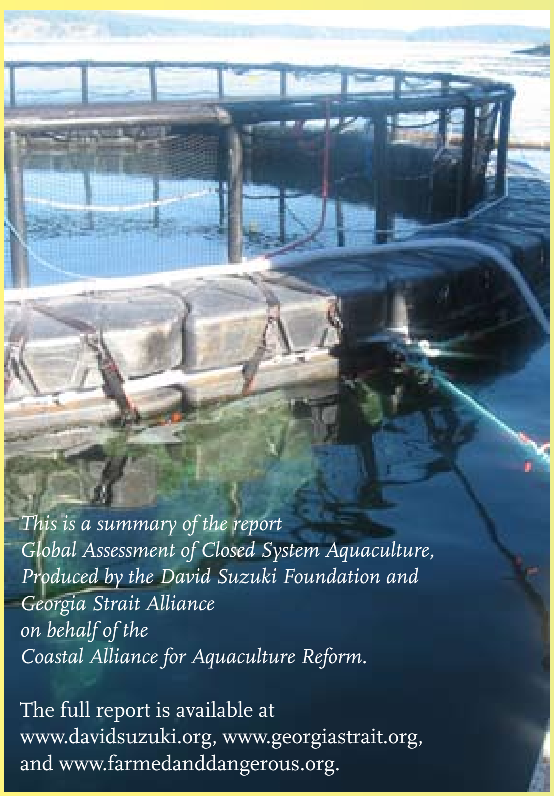
Economic Successes

Producers of fish and developers of CSA technology are creating commercial operations in countries as varied as Iceland, Morocco, the Netherlands, and China, in rural areas and in semi-urban zones, using ocean water, groundwater, and even municipal water supplies. An increasing variety and number of finfish are being raised fully to harvest size. The most common species being harvested are Nile tilapia, trout, Arctic char, Atlantic halibut, turbot, barramundi, several varieties of Australian perch, sea bream, and sea bass.

There are almost as many different systems as there are operations, each operation being tailored to specific needs. What all CSA systems share is their ability to separate the fish from the natural environment, control their inputs to reduce disease, optimize growth and minimize mortality, and control their outputs to limit external impacts on the environment.

::photo:: Mariculture Systems, Wash. USA

::photo:: Aquaculture Developments, Australia



This is a summary of the report Global Assessment of Closed System Aquaculture, Produced by the David Suzuki Foundation and Georgia Strait Alliance on behalf of the Coastal Alliance for Aquaculture Reform.

The full report is available at www.davidsuzuki.org, www.georgiastrait.org, and www.farmedanddangerous.org.

::photo:: FutureSea, BC, Canada

Environmental and health concerns are increasingly driving consumer demands as well as prompting tighter regulatory conditions for food production in general. While this has been sufficient to move the industry rapidly in Europe, additional measures may be necessary to increase the pace of CSA in North America. The Open Ocean Aquaculture Bill in the U.S. is proposing added costs for open net-pen production. In B.C., the Special Committee on Sustainable Aquaculture has called for a complete transition to closed containment aquaculture, and globally the World Bank has recommended that environmental costs be borne by the industry. Combined socio-environmental concerns, increasing efficiencies of production, and regulatory changes make CSA an increasingly interesting option for future fish production.

Beyond being a way to supply food for people around the world, aquaculture also offers many economic opportunities, particularly the development of environmentally sound technologies. CSA has the potential to offer greater economic benefits to coastal communities than open net aquaculture, and new technology development has the potential to create new jobs, particularly if the systems can be exported to other producing nations.

David Suzuki Foundation

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