THE JOURNEY OF A CONCRETE SHIP: FROM BREAKWATERS TO REEFS

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Photos by ARSBC and John Campbell

Sometime not so long ago the ocean carried a fleet of ships built mostly of concrete. Wood was the preferred medium for ship building for centuries until the late 19th century when ship manufacturing converted to the use of sheet steel. While sheet steel was the go to material for many years it became scarce during the first World War. This is when ship builders turned to using steel reinforced concrete, which uses less refined and easier to obtain steel reinforcing bar.

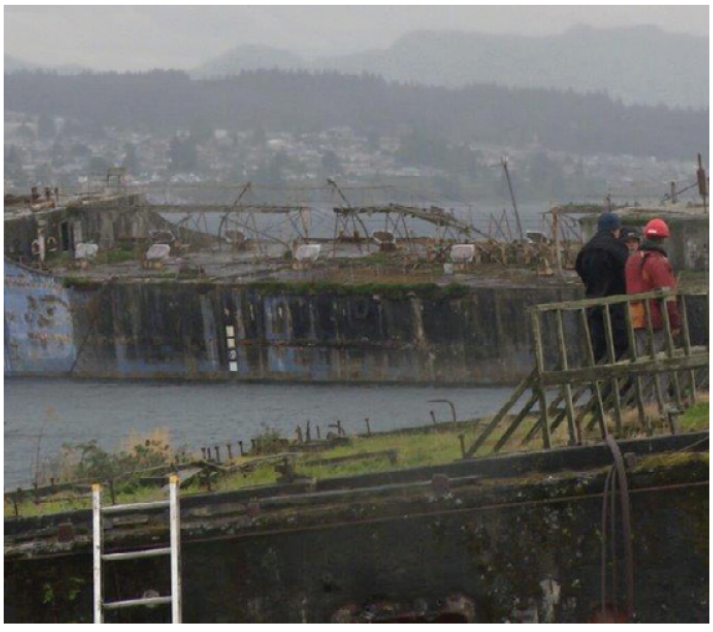
While it may seem strange, concrete ships do float when built correctly – it is all about density.

It already seemed ambitious for the British ship builders to build concrete barges, tugs, and fishing boats in 1917 and 1918; however, the Americans had bigger dreams. They commissioned a fleet of 12 ocean-going concrete freighters to the tune of 50 million dollars. The concrete ship designs were based on traditional shipbuilding techniques but were considerably more complex and difficult to build. Some of the best American civil engineers were commissioned to help in building the vessels, developing many of the practices and procedures still in use today in concrete construction. The Polias was the first ship in the WWI Emergency Fleet to be constructed although the Atlantus was launched one month earlier. She was constructed by the Fougner Shipbuilding Company, NY in 1918. She was 250 feet long with a draft of 22 feet and a beam of 45 feet. The walls of the hull were six inches thick. Many of the men who served on these concrete ships referred to them as "floating tombstones".

Soon after WWI ended steel became abundant and concrete ships quickly were replaced with less expensive steel ships. Many of these floating tombstones were sold, one turned into a casino and another a restaurant. When the second World War began, once again sheet steel became a scarcity and in 1942, the United States Maritime Commission contracted McCloskey and Company of Philadelphia, Pennsylvania to build a new fleet of 24 concrete ships. Other companies built many large oceangoing barges. Three decades of improvements in concrete technology made this new fleet lighter and stronger than its WWI predecessors.

Once again, after the war ended, the ships became marked as surplus and were sold to a variety of different businesses including the Powell River Company pulp and paper mill, now owned by Catalyst Paper, who operate three mills in British Columbia as well as two mills in the United States. Of all the concrete ships built during World War I and II, it is believed there are only ten still afloat, all of which are found on Malaspina Strait in Powell River, British Columbia, Canada. The company bought them to create a breakwater to protect the log pond. All ships but one, the S.S. Peralta, were constructed during WWII. The S.S. Peralta is the last known survivor of WWI.

Ten concrete ships make up the Powell River breakwater: USS YOGN 82, SS Henri Le Chatelier, USS Quartz, USAT P. M. Anderson, S.S. Peralta, S.S. Emile N. Vidal, USAT John Smeaton, S.S. Thaddeus Merriman, S.S. L. J. Vicat, and the USAT Armand Considere. These ships are quite old, between 65 and 87 years old. Some of these relics of the past have been part of the Powell River's seascape for



almost 70 years.

Powell River, located in the northern Sunshine Coast, between Vancouver Island and British Columbia's mainland, is a pocket of western Canada beloved for its natural adventure and charming, rustic culture. Visitors who experience Powell River soon recognize the natural beauty this small, yet exciting locale has to offer. Nature has played a predominant role in the small city's development since the beginning. Powell River started as a company town with the construction of the pulp and paper mill in 1910. Shortly after successfully producing its first roll of paper in 1912, the area became popular for its booming lumber trade. During its prime the Powell River Mill was the largest pulp and newspaper producer in the world. Due to price competition and falling demand, the mill now produces more profitable paper products such as glossy paper for magazines, food grade paper, and other general use paper products. Still, visitors can check out the mill and see how nature's bounty helped shape Powell River and the entire province.

While the ships have served successfully as a breakwater for Catalyst Paper, several have begun to deteriorate due to the age of the concrete. This slow deterioration, also known as spalling of the ship's concrete matrix, is due to many factors including the relentless action of the sea over the decades, more intense storms, and higher stressors acting on the aging ships. Unfortunately, while the paper mill has judiciously maintained these aging vessels, four have been identified as well past their lifespan and subject for retirement. More recently, in collaboration with Catalyst Paper's Powell River Division, the Artificial Reef Society of British Columbia (ARSBC) announced plans to prepare, sink, and install these four vessels within Powell River, thus adding to the organization's robust series of artificial reefs within British Columbia waters and re-purposing these historically significant ships into functional artificial reefs.

The ARSBC has sunk more ships and aircraft than any other non-profit group in the world to create marine habitat. They successfully completed their eighth major project on April 4, 2015 after the successful sinking of the former HMCS Annapolis in Halkett Bay, Gambier Island.

Reef Society President Howie Robins believes this exciting new project will build on the organization's successful record of accomplishment of converting ships into productive reef habitat.

"The vintage of the vessels does not render them safe enough to be placed in any appreciable distance," Robins says. " The idea of reefing them is the preferred option. They're very fragile and require a lot of maintenance to stay afloat."

"This will be the most unique and creative marine habitat project ever undertaken by our Society and we are delighted to work with Catalyst throughout this process," says Robins. "Divers of all skill levels seek novelty and this will be a dive back into maritime history for adventure divers worldwide".

The plan is to gradually sink the four vessels over a period of time, beginning with YOGN 82, then link them together, thus creating a multi-faceted dive site, which will be easily accessible, recognizable, and iconic. Robins estimates the entire structure will be 1,400 feet in length with a distance of 70 to 80 feet between each site.

"The concept of these vessels is that would be put in a close configuration from one another in shallow recreational waters – ranging from 80 to 110 feet in depth. We would cluster them within 50 to 60 feet from each other to allow recreational divers to explore them and swim from one to another. Although it would take more than one dive to inspect each ship and in their intricacies. That's the attraction behind putting these historic ships in a cluster close to where the mill is now - approximately 400 meters from the mill itself."

The four ships planned for reefing are currently part of the mill's 10-vessel breakwater infrastructure. Individual pieces of the planned artificial reef include the YOGN-82, the Emile N. Vidal, the Quartz, and the S.S. Peralta. All four vessels were American vessels, sold as surplus: the former three after World War II; the Peralta after World War I. The reefing program will be a multi-phase initiative with YOGN-82 to be the first vessel prepared and sunk. She is an unpowered B7 A2 gasoline barge constructed in 1944

by Concrete Ship Builders of National City, California. The ship roughly measures 367 feet and weighs in at nearly 5,000 tons. The YO stands for "Yard Oiler" while the G stands for "Gasoline" and the N signifies her lack of engines.

The S.S. Emile N. Vidal was the last concrete ship built by McCloskey and Company in Tampa, Florida and launched on September 24, 1944. She was used as a transport and store ship in the South Pacific and towed back to the United State after losing her propeller. She was used as a salt storage hull in Oregon for many years before being bought by MacMillan Bloedel, the successor of the Powell River Company, around 1965.

The Quartz was built by Barret and Hilp Company at Belair Shipyard in San Francisco, California and launched on December 4, 1943. She was commissioned by the US Navy in 1944 and used as a storage barge, a floating warehouse used at forward bases in the Pacific Islands. In July 1946, the Quartz participated in the atomic bomb tests at Bikini Atoll.

The S.S. Peralta was an oil tanker built by the San Francisco Shipbuilding Company and launched in October of 1920. In 1924, she was purchased and converted into a sardine cannery in Alaska, then was bought by MacMillan Bloedel in 1961 and has served in her role as part of the breakwater for almost 60 years.

"These wartime relics are already floating artificial reefs based on the generations of biodiversity on their hulls," Robins states. "When fully submerged, these ships will form a pinnacle oasis for marine flora and fauna settlement with scale and habitat complexity."

Robins elaborates, "Due to the size of the ships, their iconic history, and the fact they can be sunk so close together, it provides a novelty that's very different from anything we've done before. It is truly unique. The artificial reef cluster will recognize this historic significance through visual aids, which will help direct divers to different ships, instilling them with an understanding of what exactly they are exploring. We are exploring ways of connecting the ships with lines and signs."

This project will extend the region's wreck offerings from Vancouver to north Powell River, offering a larger loop of wreck sites for divers and historians to enjoy.

Artificial reefs are a mainstay in scuba diving: they provide habitat for native critters, thus electrifying the underwater ecosystem; they offer unique, often untold glimpses into history; and they provide exciting new playgrounds for divers to hone their skills, capture vivid imagery, and just have a good time diving.

Why Artificial Reefs?

Artificial reefs are man-made habitats built from a variety of materials intended to create new marine life communities in areas of generally featureless or barren bottom. Important to note barren ocean floors are not biologically dead zones, they are biologically "depressed" because there are no significant substructures from which other varieties of marine life can thrive. These reefs may serve a variety of purposes besides promoting marine life; they may serve to improve hydrodynamics for surfing, control beach erosion, and also serve to divert divers and snorkelers away from fragile coral structures. Research has suggested these artificial reefs allow visitors to enjoy the marine life without damaging natural reef structures while also creating a positive impact on local economies. In such cases it would create a win-win scenario for both the community and the environment.

Planning for an artificial reef takes extensive research and development; however, and meticulous care to study the overall impact is necessary. Construction and development of an artificial reef must not impact already existing natural habitats and instead should be carefully considered before implementation. While it is possible to increase a habitat for spawning invasive species, in most

cases, the resident marine life is attracted to the reef and find homes and safe breeding grounds such as in the case of the Canadian Navy destroyer, the HMCS Annapolis sank April 4, 2015 off Gambier Island, northwest of Vancouver British Columbia. The ARSBC dedicated the sinking of the HMCS Annapolis to the restoration of the lingcod and rockfish species, which were in rapid decline in the area. Studies, since the sinking, through a biodiversity survey conducted by the ABIS Project, has confirmed the sighting of juvenile rockfish.

Over the last few decades, marine life habitat has been significantly reduced or impacted by development of human coastal living areas, accidents like oil spills, and severe storms. This has all led to the decline of the species populations. Artificial reefs, provide shelter, food, protection, and spawning areas for a variety of marine life. The reefs can be built by existing materials, sinking oil rigs, scuttling ships and barges, deploying material such as reef balls, concrete, or PVC. While many different materials can be used some are less optimal. Studies have demonstrated wood, tires, and PVC pipe have little advantage in reef making. In some instances, historic and modern shipwrecks have become unintentional artificial reefs when preserved on the sea floor. Unfortunately, wood is not a long term, stable material as it degrades over time and attracts marine life differently than its counterpart steel. It is also important to note that steel has been a very effective marine life attractant, it gives off a mild gentle electrical current more effectively than wood. Steel made of iron will also rust and that rust acts like a vitamin in the marine environment (iron oxide) which is not plentiful in the water. Often divers will find plumose anemones in areas high in iron oxide. The Catalyst Paper concrete ships in this case while made of concrete also have significant volumes of rebar interlaced within the concrete. Regardless of the construction method, the reefs become home to algae and invertebrates such as barnacles, corals, and oysters. These in turn serve as attractants for fish and other marine life.

It may appear man-made artificial reefs are something of a modern

invention; however, since the Middle Ages Japanese fishermen used incredible bamboo structures to enhance the proliferation of their fish stock. Some records date back to 1650 while other written records show reefs where commonly in use between 1789 and 1801. France began experimenting with artificial reefs in 1968. In the United States, many shipwrecks now serve as artificial reefs dating back to the late 1700s and early 1800s. Other countries including Australia and New Zealand have been sinking ships as diver and recreational sites for years. Since 1989 the Portuguese Institute of Marine Research (IPIMAR) has been developing an artificial reef systems pilot project. They are using large concrete cubes as a restocking tool to enhance their inshore fishery. Overall North America and parts of Europe use ships as artificial reefs for marine habitats and to develop their eco-adventure dive tourism, whereas other countries like Asia, Africa, and other parts of Europe do not use ships and instead use other man-made materials as attractants for fish in order to feed their populations, as seen in Japan over the years.

In real dollar terms, reefs serve as an attractant to divers and anglers as well, enabling coastal communities to stay together and thrive. Interestingly the governing regulatory bodies have placed stringent guidelines to mitigate pollution or accidental injury to marine life, and yet nature demonstrates her tenacity as demonstrated in the unintentional shipwreck reefs from WWI and WWII, these sites have become havens for marine life. Academic research has; however, clearly demonstrated a heavy and well cleaned ship will increase the biodiversity of the area. Artificial reefs provide shelter as well as a hard substrate for marine life to colonize and thrive.

The practical benefits of artificial reefs from a philosophical standpoint are not difficult to present – either you believe nature - the barren substrate of the sea floor should be left alone or you believe nature should be given a hand. Science across the world has clearly demonstrated human intervention has already left the sea, rivers, and other bodies of water unbalanced due to unregulated fishing, over fishing, and pollutants (US Navy carriers dump their waste to sea – as an example). Artificial reefs are one of the few proactive tools multiple industries can agree on from an economic stand point as well as sustainability. Washington State's neighbor to the north, British Columbia, has artificial reefs, many countries around the world have been using artificial reefs successfully for years – some decades. In the United States, states like Florida and Alabama have also successfully deployed artificial reefs with positive impact to the environment, yet the State of Washington is still debating the authenticity of the merits of deploying artificial reefs.

Please stay tuned for next month's follow up article regarding the science of artificial reefs from around the globe.

About the ARSBC

The Artificial Reef Society of British Columbia (ARSBC) is a registered non-profit society based in Vancouver, British Columbia. The Society has an experienced team of specialists who consult on the creation of long term stable marine habitats using ethical means of vessel preparation. As well as protecting environmentally and historically sensitive marine habitats, these new reefs also provide opportunities for eco-adventure scuba diving tourism. Since 1991, the Artificial Reef Society has sunk seven ships and one Boeing 737 in the waters off BC's west coast. For more information please visit

www.artificialreefsocietybc.ca

Many Thanks!

Many thanks to Author John A. Campbell who published, Hulks: The Breakwater Ships of Powell River in 2003. Most of the details regarding the ships was provided by his meticulous studies and descriptions of the ten concrete ships residing in Powell River. To purchase the book and make a contribution to the Powell River Historical Museum please visit: www.powellrivermuseum.ca/webstore/books/bookstore.html