



**The Haida Salmon Restoration Project: The Story So Far**  
September 2012

The Haida (*Hi Da*) Salmon Restoration project is nearing completion of its ship borne work and the team of sailors, scientists, and fishers are now heading to the Haida Village of Old Massett and home. This summer the crew has been aboard ship engaging in what is surely the most substantial ocean restoration project in history. In a large ocean eddy west of Haida Gwaii the project has replenished vital ocean mineral micronutrients, with the expectation and hope it would restore ten thousand square kilometers of ocean pasture to health. Indeed this has occurred and the waters of the Haida eddy have turned from clear blue and sparse of life into a verdant emerald sea lush with the growth of a hundred million tonnes of plankton and the entire food chain it supports. The growth of those tonnes of plankton derives from vast amounts of CO<sub>2</sub> now diverted from becoming deadly ocean acid and instead made that same CO<sub>2</sub> become ocean life itself.

For weeks the men and women, on this village team toiled in stormy overcast weather and fog without a hint of blue sky. In mid-August the skies cleared and revealed the wonder of the mission on which they have laboured. Satellites focused on ocean health that monitor and measure plankton blooms sent back stunning images. Far offshore in these Haida salmon pastures a vast plankton bloom is revealed matching the health and vibrancy of blooms seen in rich coastal waters. The return of such blooms is “the stuff dreams are made of” for all ocean life.

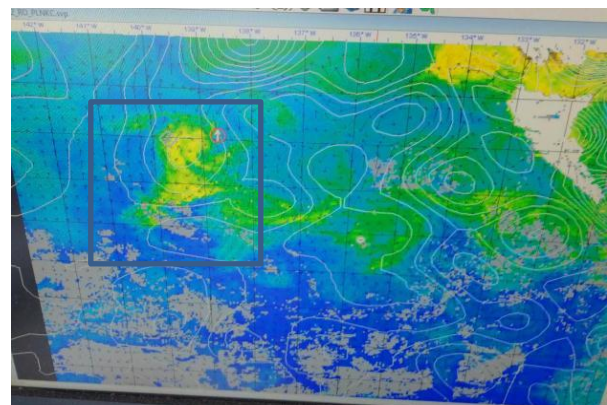
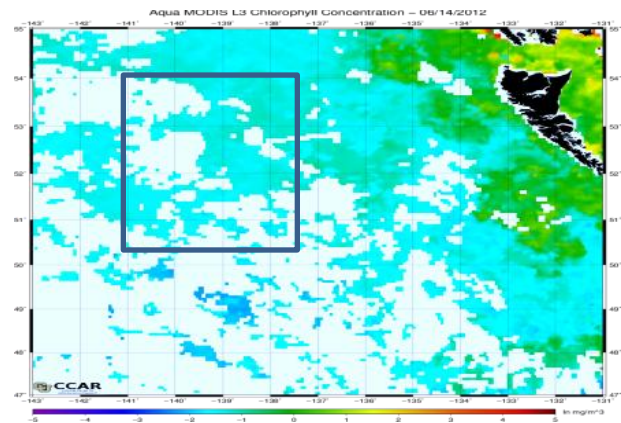
In addition to the focused study the accomplished mission of the project also included detailed oceanographic studies of the near-by Bowie Seamount Marine Protected area, the near shore and famous Haida Eddy, and the coastal ocean from Vancouver north to the study region.

**The greatest migration on Earth.**

Each day and night the sonars and other instruments reveal a rapid change in the bloom. As the phytoplankton bloom grows tiny zooplankton that graze upon those ocean plants respond both in number and behaviour.

During daylight hours the zooplankton are 300 meters down resting on the “deep thermocline” layer. As daylight wanes each evening their nightly migration to the surface pastures begins. There they engorge themselves with the blooms “fresh greens.” By morning light they swim back to the dark depths and safety where like bucolic cows they rest and digest.

**Before and after ocean restoration plankton bloom**  
**200+ miles west of Haida Gwaii.**



**Yellow is high levels of phytoplankton blue is the least.**

The team is here to watch, measure, and captures samples of this ‘greatest migration’ on Earth. Russ George the chief scientist describes the spectacle, “It is as if we are perched in a tree on the great plains of Africa privileged to witness the great herds of beasts as they run past. Here there are animals of every size and shape albeit in mostly miniature planktonic forms. We see the salps, jellies, copepods, amphipods, krill, and more.” Mysteriously rare and missing are the pteropods but that’s another story.

**Sea life from near and far are drawn to an ocean oasis.**

That this wondrous plankton growth is beneficial is perfectly clear as is seen in the immediate shift from scarcity to abundance in sea life of all kinds. Spouting plumes of misty breath from the great whales, Fins, Seis, Sperms, and Orcas reveal the most obvious herds attracted to and now thriving on this renewed pasture. Two months ago, before the bloom, whale sightings were so few that not more than five or six were seen during weeks at sea. Now every day shows at least that many, some days whales are counted by the score.

Surely only a tiny fraction of the whales that are here are being seen from the ship. Frequently the whales swim to within a few meters of the ship as if they wonder who is so noisily engaged on their ocean pasture. As the ship returned to shore it found great whales again in similar numbers in a natural plankton bloom in the shallow near shore waters of Queen Charlotte Sound.



*Ocean Pearl at anchor on the west coast of Haida Gwaii*

Seabirds, previously rarely seen outside of or before the bloom are now in abundance, they are followed by the research ship where their presence coincides with calls of “fish on” by the team’s research fishers. In the early morning before dawn sometimes the sea birds, mostly Storm Petrels, Sooty Shearwaters and Albatross, circle the ship by the hundreds, even thousands, bringing the sound of morning bird life to the ship as if it were in a forest. More remarkable flocks of Brant geese, common to coastal waters, are seen settling on the now green waters hundreds of miles from land.

Tuna have arrived at the bloom and prowl the edge, first to arrive are the “scouts” in small packs then later the “schoolies” arrive in large schools. They make feeding forays in the bloom; filling their stomachs full of plankton and tiny fish.



*Albacore tuna arrived at the bloom.*

Observations of jumping fish and quick action by the fishing team have led to capture of young salmon in the bloom; surely many of these salmon were spawned in the

rivers and streams of Haida Gwaii. In the dark of night when the ship is not underway the crew often watch as legions of squid arrive attracted to its deck lights.

### **Science and Hope**

The work routine on this fully equipped research ship begins before dawn each day as the science and ship ops teams prepare for deployment of a plethora of ocean instruments. The work typically carries on until well past midnight so that both day and night sea life is studied.

The “down-to-earth” science here bears the characteristics of the world’s greatest ocean institutes’ performed on ships many times the size. In January the project began, using ships of opportunity, to collect water samples in the area in preparation for this summer project which has chartered a large commercial fishing vessel and transformed it from a ship of ocean death into one of ocean hope.

The multidisciplinary science team is made up of scientists from several countries and includes a number of Haida people who are receiving shipboard training in practical applied ocean pasture management. Our Haida shipmates are also there to teach the rest of the crew some of what it means to be Haida. They brought indisputable magic. One of the Haida, a natural leader, signed on as our white haired ships cook and storyteller. He nourished both body and soul. On one of his first days aboard he reported that his Uncle Fred always visited him at sea. Uncle Fred had died some many years ago while trying to save his young son from drowning. Both Fred and little Fred’s spirits became Orca whales and sure enough as we replenished and restored the ocean and our plankton bloom was flourishing an adult male Orca and a younger male Orca swam next to the ship from time to time. “See there’s Uncle Fred and Little Fred Gene proclaimed.”

Our captain, engineer, and deck hand are fishermen whose lives have been spent hunting and harvesting fish. This year they have joined the village team to become ocean pasture stewards lending their wisdom and strong arms to restore that ocean.

One pivotal science tool, the “CTD” vertical profiling instrument array, is lowered ten times or more each day into the abyssal depths. Its state of the art instruments measure all manner of ocean physical, chemical, spectral, optical, and biological characteristics. Accompanying the “CTD” are the “Niskins”, meter-long bottles that capture discreet water samples from differing depths for highly detailed analysis in on-board and on-shore laboratories.

Next come the nets to capture and facilitate the study of everything from the tiniest microscopic phytoplankton to the larger zooplankton and micro-nekton (tiny fish). The net samples the team collects, records, and preserves will sustain work for months to come to unravel the mysteries of the life that is now flourishing in the bloom. The Queen of the nets is the MOCNESS, a seven net monster which is towed by the ship. It carries, like barnacles on its back, a fleet of ocean instruments.



***MOCNESS multiple net plankton collection device***

For the first time ever, ‘Nessy’ carries a highly sophisticated multi-frequency biomass sonar that records 3D sonar movies of the incredible scene below the waves and the plankton as they are captured in the nets. Positioned from masthead to keel are additional instruments that continuously measure ocean and atmospheric characteristics including logging the content of gases such as Oxygen and CO<sub>2</sub>.



***Botwing multi-frequency biomass sonar being deployed separated from the MOCNESS for a transect of the bloom***

But that’s just the work on the ship. Launched from ashore and aboard, more than 20 satellite-linked autonomous ocean robots have been deployed to continuously measure and monitor ocean characteristics inside and outside the bloom. The flagships of the robot fleet are the marvelous Slocum Gliders. Every ocean science institute’s “dream machine” and two are in service on this native people’s

science mission provided by the Canadian Centre for Ocean Gliders. These ocean gliders look like bright yellow torpedoes. They carry a suite of science instruments.



***Deploying one of the two Slocum Gliders***

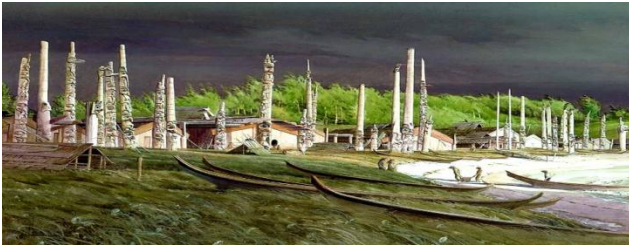
Once launched on 3-week 500-mile missions, the gliders tirelessly dive into the deep ocean abyss eight times each day. When they return to the surface from each dive they phone home via satellite and report their findings, “there’s an app for that!”

The gliders are joined by Argos Drifterbots, twenty of which have been provided to the project by NOAA, the US National Oceanic and Atmospheric Administration. The drifters carry a smaller set of science instruments and drift where currents and winds take them but similarly report daily via satellite on their findings. Both gliders and drifters will continue to send back data from the project area for months to come.

### **Sometimes it does take a village.**

Making up in spirit for what it lacks in cash this project is different in some impressive even inspirational ways. First the company was formed by the village of Old Massett on the remote islands of Haida Gwaii far out to sea off the west coast of Canada. This small village of 750 people is literally investing their future in a new future for their ocean. Deeply rooted in the traditions of the Haida people is a fundamental teaching that one must take care of the parts of the planet that give life to the people. For many years the village council has sought the means to become caring, active stewards of its ocean pastures.

Attempts to raise money from government and private investors failed so the village partners decided they would go it alone and dig deeply into their own resources and funds to try to give back to nature, to try to bring the fish back, to do something. Years of preparation starting in 2007 led to this work including an extensive community review process and a historic plebiscite.



**Village of Old Massett circa 1876**

More than a year ago (spring 2011) the largest number of voters in village history went to the polls to cast the largest super-majority vote ever to invest some \$2.5 million to create the Haida Salmon Restoration Corporation and the vital work now being performed. The dedication of the people of the village has inspired and empowered the company to put together the “world class” science it is performing. Dr. John Nightingale, head of the Vancouver Aquarium, describes the work of the project as “vital work that is gathering fundamental truths about this ocean.” The company has also recently joined as a founding member in the World Bank’s “Global Partnership for Oceans” program whose president stated its mission is to help coastal communities and small island nations become stewards of their ocean.

The “Why” this village is taking this extraordinary pioneering step was explained simply by one of the village matriarchs who put it clearly in an open village information meeting, “...she spoke of how she didn’t understand all the science talk but it sounded to her like the purpose was to try to bring the fish back ... ‘and I’m for it!’ she proclaimed.”

### **Why have the fish disappeared?**

For decades the salmon and other fish in the waters of the Haida people have been disappearing. The salmon were once here in such abundance that no one ever went with a lack of fish to eat. Until 30 years ago, almost every Haida family had a fisherman in the family bringing home a paycheck, often from the decks of boats they proudly owned. Today the number of Haida fishermen has dwindled to a tiny fraction of their former numbers and very few own a boat. The village of Old Massett suffers under a dark cloud of 70% unemployment and a tragically high suicide rate. For decades the government of Canada has engaged in constant reductions of fishing allowances while simultaneously spending hundreds of millions to repair and restore salmon streams and build and operate salmon hatcheries. In spite of the success of “salmon enhancement” in sending more and more baby salmon to sea each year, fewer and fewer adult fish have returned.

As one world acclaimed salmon scientist who lends advice to the project, Dr. David Welch, put it, “In some streams so few adult fish return to spawn that they cannot even find a mate to spawn with in the restored salmon habitat.” Clearly the problem of the salmon and of other ocean fish is that the problem exists at sea.

### **The ocean in crisis, a salmon miracle - dust in the wind.**

The crisis of ocean productivity decline is well established and widely acknowledged in ocean science circles. The steady decline of ocean primary productivity, the dying of ocean pastures, measured at 1% per year is unquestionably confirmed. Organizations like the Royal Society of England projected just a few years ago that by 2050 ocean fish harvests would no longer be possible. Just what is causing this decline has been difficult to establish, at least until the miraculous sockeye salmon story of 2010.

In 2010 the expert forecast for salmon was dismal. The iconic sockeye salmon of the Fraser River was predicted to be even fewer than the previous year’s historic lows. A Canadian Royal Judicial Commission, the Cohen Commission, had been convened in Vancouver with a budget of tens of millions to receive the testimony of fisheries experts. It had been charged with providing a verdict as to the root cause of why salmon restoration efforts of 40 years had failed. However, instead of the expected dismal sockeye salmon return of less than 1 million fish, upwards of 40 million sockeye swam home that year. This was not a record high in recent years but the largest salmon return in history. What could possibly have caused this unexpected abundance?

The source of the sockeye miracle is simple. In the summer of 2008 when the young sockeye swam out of the river and out to sea nothing was unusual about their number of 100 million or in the condition of the young salmon. As they swam past the north end of Vancouver Island around the 1st of July, all seemed normal but this was the last point where the salmon’s mysterious two year ocean journey is known.

Meanwhile, in early August 2008 a volcano on one of the Aleutian Islands erupted for several days during which time great clouds of volcanic ash and dust spread out over the North Pacific. Some of those dust clouds blew to the southeast toward the ocean pastures to the west of Haida Gwaii, right on the path of that year’s Fraser River baby sockeye salmon. As the satellites revealed, that volcanic dust stimulated vast blooms of plankton in the open ocean the likes of which had never been observed.

As those baby sockeye salmon swam out to sea they were treated to a feast. They flourished, grew, and grew and two years later returned home in historic abundance, equal to the largest runs in all of history.

Those 40 million salmon that swam home were in effect scientists who reported in their very bodies and numbers that something wonderful had happened on their ocean pasture. The salmon miracle of 2008-2010 was not a singular event. A look back into history shows another volcanic salmon miracle run in 1958 and another 30 years before that. Dust grows salmon!

It is well known that dust in the wind powers ocean primary productivity by delivering vital mineral micronutrients. Mineral nutrients, i.e. dirt, are common on land but are the rarest of elements in the ocean.



*Volcano miracle Fraser River Sockeye of 2010*

Productivity of the North Pacific Ocean pastures in particular are strongly tied to the dust that now blows in diminished amounts from the dry lands of Western China and Mongolia. Ocean scientists have reported North Pacific declines of up to 50% over mere decades.

Dust is and has been disappearing from the North Pacific due to the effects of modern society and high CO<sub>2</sub> in the atmosphere. Firstly, the dust is missing because of us. Just as the US Soil Conservation Service solved the problem of the “dust bowl days” of the thirties in the mid-western US, modern agriculture methods and climate change have resulted in dramatic declines of wind-blown, Aeolian, “topsoil” dust losses in Asia. The unexpected consequence of the slowing of the “dust bowl days” in China and Mongolia has been huge increases in grain production but also the collapse of ocean productivity as that now missing dust in the wind was a key source of ocean mineral micronutrients. Secondly, high CO<sub>2</sub> in the air has a beneficial effect on dry land grass pastures as high CO<sub>2</sub> promotes grass growth. More grass is increased ground cover and this ground cover has reduced the amount of dust blowing in the wind.

The solution to global ocean pasture decline, ocean mineral replenishment (OMR), is at the heart of sustainable ocean pasture management. It has been an internationally mandated research initiative for more than twenty years. In countless scientific papers, the result of hundreds of millions of dollars in public funding, the reports show unequivocally that iron, the key mineral micronutrient, when replenished and restored to levels common under Aeolian dust storms, ocean plankton blooms in restored abundance and supports a cornucopia of ocean life. (See Nature July 15 2012 - Smetacek et al)

### **Heart and Soul**

But the heart and soul of the Haida Salmon Restoration project story comes from Haida tradition. The Haida people have an ages old cultural imperative that ‘one must give back to the sea that nourishes’. The ocean science community work of twenty years and a chance volcanic salmon miracle brought home to our one tiny village that there was a way to honor and fulfill this ancient tradition and obligation.

In what is certainly the greatest “Potlatch – Giving Ceremony” in Haida history. The children, women, and men of the village have this summer paid for a great feast on behalf of all of ocean life.

In the tradition of the Potlatch the only obligation expected of the guests is that they truthfully acknowledge the gift of food by giving honest testimony to the spirit of the Potlatch. Like the 40 million salmon who returned home from the sea in 2010 ocean life today is doing the same as shown by their presence in such numbers and abundance being measured as never before by the village project. They are all here feeding and in this way they are providing the testimony that this replenishment and restoration of the Haida Ocean pasture, the Tang Gwan, is most welcome. Uncle Fred and Little Fred certainly have honored their role as guests of this Potlatch.

For more information see [www.hsrl.com](http://www.hsrl.com)

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