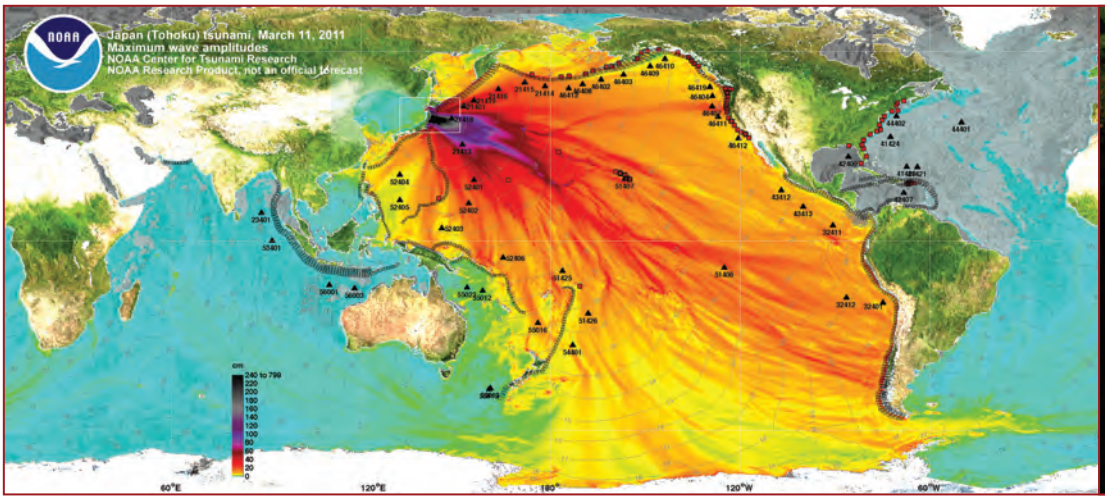
Beachcombers' Alert!™

OCTOBER - DECEMBER 2020 98 ISSUES SINCE 1996

Typhoon derelicts; Shinto shrines; Yachting hazards

Tsunami Flotsam Fingerprint



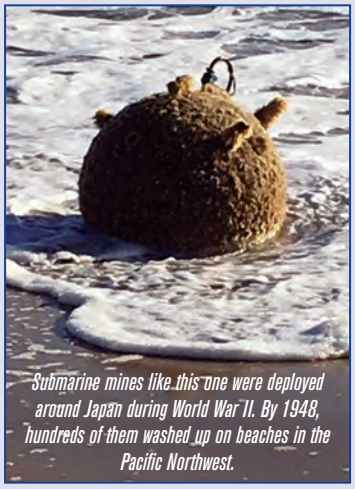
Sign from an Oregon state beach. Photo: Wikimedia Commons

For countless eons, winds have blown flotsam across the gyres. In March 2011, a magnitude-9 earthquake and ensuing tsunami struck the Tōhoku region of Japan and set off an accidental experiment sending uncounted tons of flotsam through a prism of water bodies.

The winds spin the waters of the north Pacific into a quartet of orbiting bodies: two gyres, a great garbage patch, and a "blob" that has been warmed by global atmospheric additions of carbon dioxide. Flotsam from the tsunami revealed the pattern of the quartet's currents, creating a sort of crime scene caused by shifting global climate influenced by human activities. The flotsam consists of an eclictic mix ranging in size from small (soccer balls), medium (utility poles; Shinto shrine tops), to large (sections of highway; commercial vessels). Regardless of girth, many pieces sped across the Pacific in as little as seven months (20 miles per day).

In this issue of the *Alert!*, we take a dive into how the tsunami enahnced our understanding of the ocean currents, looking at some of the debris that made its way across the globe from Tōhoku. Material from this issue will be incorporated into a forthcoming book about what we have learned from 25 years of beachcombing.

First Arrivals



Submarine mines like this one were deployed around Japan during World War II. By 1948, hundreds of them washed up on beaches in the Pacific Northwest.

Typhoons play key roles in understanding the oceanography of the Pacific Ocean. For example, to end World War II in Japan, President Truman considered several strategies: Invading the island nation with a million US soldiers; starving the Japanese into submission by deploying submarine mines to prevent the arrival of supply ships; and dropping atomic bombs. By September 1945, Allied warcraft had ringed Japan with 35,000 mines. Dropping atomic bombs obviated invasion, but by the time that happened, the mines had been laid. (It's been estimated that had the bombs not been used, within months millions of Japanese would have starved.) Before the Navy could recover the mines, however, two major typhoons freed them to drift across the Pacific. Three years after the war, three hundred mines had beached along Washington State.

That illustrates the speed at which currents can carry even the most dangerous flotsam. Just after the 2011 storm, the Navy released photos showing massive patches of tsunami debris along the Japanese coast; how the winds would ▶

sort this flotsam was something about which we could only guess.

Another typhoon provided a clue. Japanese fishermen moor buoys along their shores to attract fish. They are known as Fish Attraction Buoys (FADs). On August 9, 2006, super typhoon Saomai dislodged a FAD off Ginoza, Okinawa. In a remarkably short time (8.1 months), **Kathy Klee** beachcombed it on the other side of the Pacific, off Copalis, Washington. Jim Ingraham's ocean surface current simulator (OSCURS) indicated the FAD had floated north from Okinawa to the tsunami coast, then directly across the Pacific to Copalis Beach. Previously, Jim had simulated high-windage drifters, but they were not nearly as fast as this FAD. At 30 feet long, the cylindrical part measured 4 × 11 feet and connected to a 7-foot mast. The waterline on the red FAD indicated it sailed before the wind, explaining how it sped at a rate of 20 miles per day.

News sources projected that tsunami debris might arrive in America in two years, predictions which lulled US coastal communities to believe they had time to prepare for mass debris strandings. It became evident to me that planners did not understand how fast the winds could push flotsam. To promote understanding, in my book *Flotsametrics* I presented a windage tutorial:

The US Navy photographed tsunami debris including an overturned boat, oyster buoys, the tops of two buildings, and assorted construction materials. Beachcomber Kathy Klee discovered a FAD that the tsunami delivered to Copalis, WA. The FAD led me to expect some oyster buoys would transit equally swiftly.

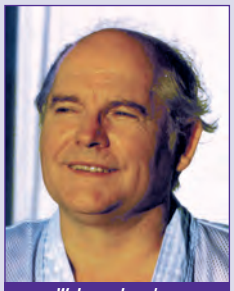
"The sea is very tidy. When onshore winds blow, you can see the invisible hand of the Floating World at work, sorting flotsam in both time and space. The wind pushes objects that rise above the water faster than those that are less exposed, and things wash up in sequences: Bic lighters one day, toothbrushes the next. Along the Washington coast, the first wash-ups to arrive are the airy purple jellyfish known as by-the-wind sailors (velella velella).

"Next come electric light bulbs, followed by the larger glass balls once used to suspend fishing nets. Riding lowest, and landing last, are the rolling-pin shaped glass floats used to net octopus at the sea bottom. Like birds of a feather, flotsam of similar wind resistance flocks together. One beachcomber, ***Vardon Tremain****, came upon three beaches near the village of Tambor on Costa Rica's Pacific coast named after the flotsam they collected: Sandal Beach, Toy Beach, and Bottle Beach. The south shore of Maui has Lumberyard Beach, a hundred-yard stretch where driftwood piles up; extraordinarily little reaches the adjacent shoreline.*

"Such inshore sorting marks the end of a process that begins thousands of miles up-current and echoes around Turtle Gyre. Pervasive though it is, it went unexamined until we tried to account for its effects with OSCURS. Jim labored to estimate how the winds affected both

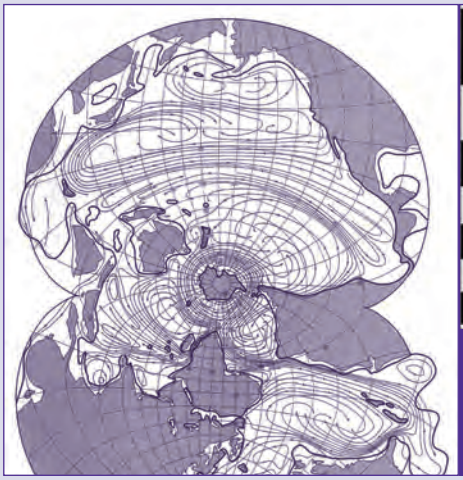
Computing Flotsam

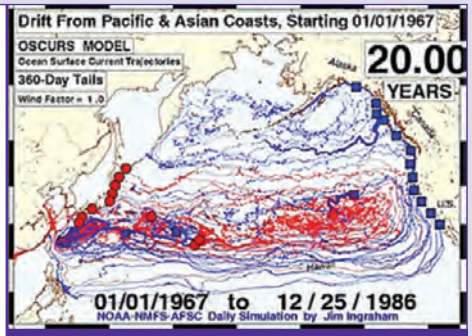
During 42 years at NOAA to examine many aspects of fisheries science, Jim Ingraham developed OSCURS (Ocean Surface CURrent Simulator), which calculates daily surface currents by superimposing the long-term average current field from historic temperature and salinity fields on the gridded sea level pressures derived from empirical functions applied on a 90-kilometer grid over the North Pacific Ocean.



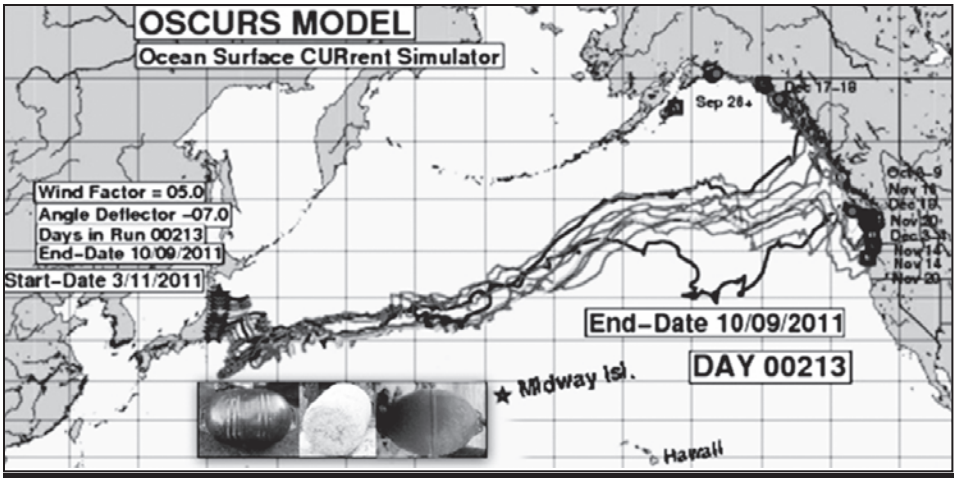
W. James Ingraham (1939-2019)

Flotsam was released on March 11, 2011, at six locations along the tsunami coast. Ingraham culled the information necessary to run OSCURS—dates and locations of the start and end points—and updated OSCURS with US Navy weather data supplied at the end of each calendar month. Calculating the position of flotsam depends not only on accurate weather data but inputting the wind parameters which describe a flotsam's behavior on wind. Basically, the higher a flotsam sticks above the water, the faster a given wind will sail it across the ocean. Wind factors vary from 1 to 5 and correspond to transpacific drift speeds of 7 to 20 nautical miles per day.





Using the work of Athelstan Spilhaus (1911-1998) and the Spilhaus Projection map of ocean currents (left) as a base, Ingraham produced the ocean fingerprint above by inputting US Navy fine-scale daily weather information into the OSCURS computer model. Note the whorls of the Blob, Garbage Patch, and Gyres.



Drift of the oyster buoys begin along the tsunami coast on March 11, 2011. The drifts had progressed for 213 days (7.0 months) when buoys began to arrive at many locations between Kodiak, Alaska, and northern California.

the speed and route of the flotsam released in each container spill. He boiled windage down to two numbers. One is the wind factor—how much faster than surface water an object drifted under a given wind. The other is the deflection angle: Surface water has long been known to move at a 45-degree angle to the wind. But each type of flotsam moves at a different windage and angle."

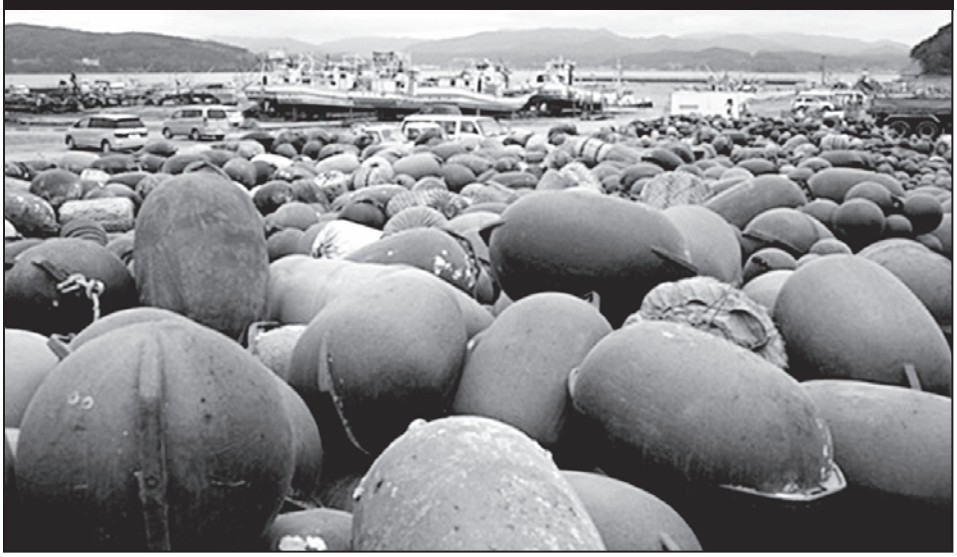
To dispel coastal complacency, with OSCURS Jim simulated a launch of six oyster buoys off Japan on the day the tsunami struck. Day by day the buoys tracked across the Pacific until October 31, 2011, the last day that Navy data were available. OSCURS indicated that by that date five of the buoys had arrived in America, from Washington State north to Southeast Alaska (one headed into the Garbage Patch).

During the winter of 2011-2012, dozens of beachcombers emailed me photos of oyster buoys they'd found from northern California to Kodiak, Alaska. The flotsam bore the hallmarks of a disaster:

- They stranded suddenly along thousands of miles of coastline
- The buoys arrived 167 times more frequently than in earlier years based on John Anderson's records since the 1980s
- Oyster shells grew on half the buoys
- Their arrivals resembled the stranding patterns of a massive container spill
- The stranding pattern agreed with OSCURS

All totaled, during the five months of October 2011 through February 2012, fifty-plus beachcombers reported the arrival of 353 buoys. Organized by month, the arrivals were (percent of 353): 1%, October; 4%, November; 4%, December; 66%, January; 24%, February. Most transited the Pacific in less than a year (10 months, March 11–January 31). By far, most items stranded along Vancouver Island (84%), followed by Washington (10%), Alaska (2%), Oregon (2%), and northern California (0.4%). ■

Acres of oyster floats stranded by the tsunami in Hadenya Port on Shizugawa Bay, Minamisanriku, Japan.



Curt's Notebook

Many subscribers sent in extra donations in honor of the passing of my daughter, Lisa Ann Ebbesmeyer. Thank you. Your recognition of these trying circumstances has been greatly appreciated.

Lisa's passing caused me to pause as the Beachcombers' Alert *passes the marker of its 100th issue. I wondered what we beachcombers have learned in the 25 years since the Alert began publication in honor of the passing of my father, Paul Joseph Ebbesmeyer, in July of 1996.*

I decided to gather central themes beginning with this issue on the fate of the debris from the 2011 Japanese tsunami. This and the ensuing six issues of the Alert will form seven chapters in a book, tentatively titled "Duck Time: 25 Years of Beachcombers' Alert—What We Have Learned."

—Curtis Ebbesmeyer,
September 2020

Typhoon Derelicts

Of the advanced nations, Japan has received the most major natural disasters: volcanic eruptions, earthquakes, typhoons, and tsunamis. Five millennia ago, one of the greatest eruptions since the recent ice age devastated Kikai in the southernmost islands of Japan. The havoc forced a derelict adrift all the way to Ecuador. According to Betty Meggers of the Smithsonian Institution, survivors began producing pottery in presentday Valdivia.

Our first appreciation that gyres blanket the Pacific originates with vessels affected by typhoons. From ancient times, during Autumn months, farmers shipped produce along coastal waters to the Japanese capital of Edo (modern-day Tokyo). Unfortunately, Fall also brings typhoons. Over the centuries, typhoons dismasted many vessels which drifted across the Pacific, ultimately wrecking along coasts from Alaska to California.

Charles Wolcott Brooks, Japan's commercial agent in the United States (1858–1873), recorded 55 derelicts. On May 3, 1876, before the California Academy of Sciences, he summarized his findings. The audience included George Davidson (1825–1911), noted for constructing lighthouses along North America's west coast. The Davidson Current reminds mariners of his legacy. From Brooks' Pacific map of Japanese derelicts, Davidson sketched two gyres covering much of the North Pacific.

Circling Turtle Gyre

Flotsam drifts between Points A and B. Great ocean currents, however, follow circular paths known as gyres, like bowls of soup swirling between continents. Point A thus could be the same as Point B. How, then, do you know if a drifter released and found at the same place orbited a gyre, milled about the local area, or lay buried the intervening years?

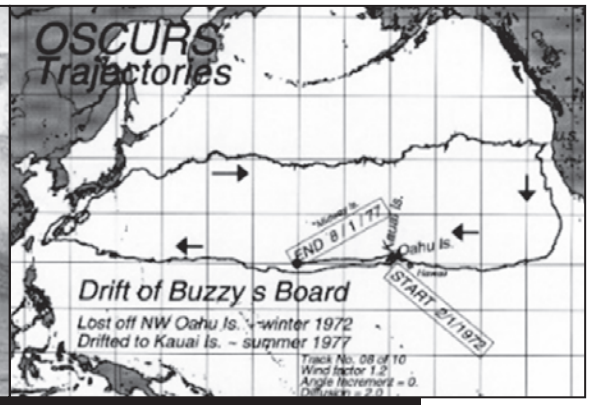
Consider a surfboard's epic drift around Turtle Gyre. Surfer **Randy Rarick** from Haleiwa, Hawaii, brings us this story:

"Back in the '60s, probably one of the most renowned big-wave surfers was a man by the name of Buzzy Trent. He was regarded as one of the 'big guns' of the small band of fearless surfers who rode the biggest waves.

"I had the opportunity to build his equipment and designed the last two boards he rode before giving up the pursuit of big waves. Being the eccentric individual that he was, he came to me with a special request. It was to be a sleek narrow rocket of a board with the distinctive color scheme of battleship gray with no adornment other than the cigar band from an exotic Cuban cigar that he smoked at the time. Without questioning Buzzy's design, I went on to build the unique board and sign my name, as was the custom.

"Anyway, in January or February of 1972, Buzzy was surfing the board on a giant day at Makaha Beach (west side of Oahu) and took a tremendous wipeout. He lost the board and, thinking it had washed to shore, made his way in after a long struggle. To his dismay, the board had been caught in the rip current—rather than being washed ashore, it headed into open sea.

"This being the days before jet skis, helicopters, and other rescue craft, the only way to retrieve the board was to get on another and paddle out after it. Since this was one of Buzzy's favorites, that is exactly what he did. Unfortunately, by the time he headed back out, he could not spot the floating object which by this time was well over a mile offshore. After paddling around for a couple of hours, darkness forced him back to shore empty handed. That was the end of Buzzy's board, lost at sea.



Left: Buzzy Trent surfing a giant wave off Hawaii.
Right: OSCURS suggests low wind factor (1.2) for the board drifting around Turtle Gyre.

"Now comes the interesting part. Six years later, during the summer of 1977, a friend called saying he'd found an old board washed up on Kauai's north shore. Sea grass covered the bottom and the sun had burnt the deck a brownish hue. The original color looked gray. He called me because of my signature under a funny cigar label! Amazingly, it had been floating at sea at the whim of the waves, wind, and currents for six years before returning to shore."

Did Buzzy's board circumnavigate the Pacific, or meander locally within the Hawaiian archipelago? This circular Point-A-to-Point-B dilemma conceals valuable scientific data concerning one of Earth's greatest gyres. This one, a Paul Bunyan bowl of soup wind-stirred eternally clockwise, circulates water from Japan to Canada to California to

Shinto Shrines

Most Japanese practice Shinto religious rituals. Japan's 80,000 Shinto shrines reflect the popularity of the largely nature-based religion. The great tsunami damaged or destroyed 4,585 of these shrines. Inevitably, flotsam from the devastation drifted into the North Pacific.

Weeks after the second anniversary of the 2011 tsunami, crowns from two shrines stranded in Oregon, the first on March 22, 2013, at Oceanside; the second a month later and 120 miles to the south at Florence. The first bore no markings to indicate provenance, but the second carried traceable Kanji characters.

Sadafumi Uchiyami, curator of Portland's Japanese Garden, immediately recognized the 14-foot long iconic red crossbeams—known as *kasagi*—as those of Shinto shrine gates. From which of many shrines did they originate? Sadafumi became obsessed with tracing the Kanji characters.

Sadafumi's diligent search yielded good results. An inscription indicated the Florence shrine had been dedicated in 1988 by a Toshimi Takahashi. Undaunted by the name's frequent occurrence, Sadafumi's search deepened when he noticed that Takahashi's name mentioned his birth in the Year of the Snake. Considering the dedication date, he calculated Takahashi was 84 years old in 2013.

Despite this specificity, hundreds of phone calls proved necessary to locate Takahashi, who was living in Hachinohe, Aomori Prefecture. When Takahashi felt the earthquake preceding the tsunami, he had run to high ground; from there he watched the tsunami wash away his beloved Shinto shrine gate. With transport provided by Pacific Lumber and Shipping Co. of Longview, Washington, and Yamato Transport of Japan, the *kasagi* will be rededicated in a ceremony.

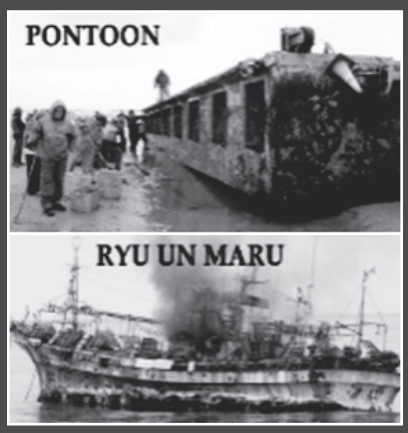
Kasagi found in two locations in Oregon (above); kasagi in its intended state (below).

Invasive Species Transporters

Prior to the tsunami, the 164-foot long squid boat *Ryu-Un Maru* had been moored at Hachinohe, Aomori Prefecture. Waiting to be scrapped, the tsunami sent her to Alaska as a ghost ship. Since the US Coast Guard considered salvage too costly and the owner did not seek the derelict's return, on April 5, 2012 a Coast Guard cutter crew, deeming the old boat a navigational hazard, scuttled the hulk 180 miles off southeast Alaska in waters more than 6,000 feet deep.

Invasive or introduced species may be plants or animals which adversely affect the habitats they invade. The larger a flotsam, the greater the variety of biological hitchhikers which may ride upon it. A boat, for example, transports more species than a chunk of Styrofoam. Trying to control invasions can be expensive—California once spent $7 million on attempts to eradicate a single seaweed. I therefore considered the boat a potential transporter of invasive species. Unfortunately, the *Ryu-Un Maru* sank unchecked.

On Monday, June 4, 2012, beachcombers at Agate Beach, a mile north of Newport, Oregon, spotted another potential invasive species vessel, a 165-ton cement pontoon (66 × 19 × 7 feet). Embedded in the concrete was a metal plate that enabled the Japanese Consulate in Portland, Oregon, to ascertain that it was one of four companion floats from Aomori: One was stranded at a nearby location, the second in Oregon, and another off Hawaii, leaving a fourth undiscovered.

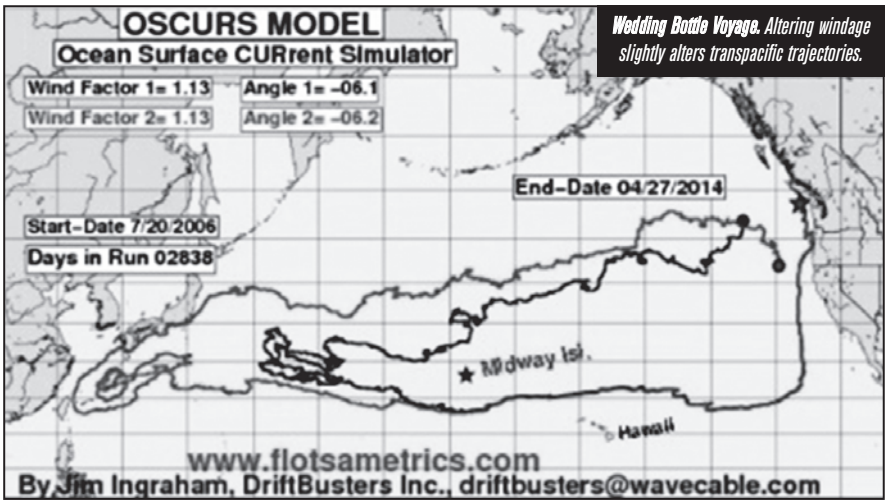


Fortunately, the pontoon stranded near the Hatfield Marine Science Center, a major oceanographic laboratory, resulting in a careful search for invasive species. Oregon State University phycologist **Gayle Hansen** confirmed that one of the species found on the pontoon (*Undaria pinnatifida*) had become a worldwide nuisance. Only about half of the plant species on the pontoon already existed on the west coast. To forestall possible invasions, volunteers scraped 1.5 tons of marine growth from the pontoon, then applied blowtorches to sterilize its top and sides.

The steel boat and cement pontoon both originated from Aomori Prefecture, a region smaller than Connecticut. Jim Ingraham ran OSCURS for both, finding that a 9-percent difference in their windages (pontoon, 1.95; boat, 2.12) resulted in substantial differences in both the elapsed times and arrival locations. As the flotsam duo drifted 5,000 miles across the Pacific, these small differences in windage accumulated. The slower pontoon (only 11 inches of freeboard showing above the water) floated 15 months to reach Oregon in June, whereas the faster *Ryu-Un Maru* floated 13 months to arrive 600 miles to the north in southeast Alaska in March.

southeast Asia and back to Japan, a circuit half as long (12,000 miles) as the Earth is round.

Enter OSCURS. Still unconvinced, I located eight epic drifters which orbited Turtle Gyre. Four began and ended near the same location. Four bottles orbited more than once, passing their points of origin. Estimates of the times for a single orbit were found by adding or subtracting average drifts for segments required to construct single orbits, yielding an average of 6.0 years for the eight drifters.



Wedding Bottle Voyage. *Altering windage slightly alters transpacific trajectories.*

Ringing Turtle Gyre

The Coast Nerd Gazette featured this post from **Ian Miller** on May 22, 2014:

"Christine and I married on July 15, 2006 at Crescent Beach on the Strait of Juan de Fuca, Washington. As part of our wedding ceremony we asked attendees to write messages about our marriage. We stuck them in two wine bottles, then corked and sealed them with melted wax. At the end of the ceremony, we walked to the water's edge and flung them into Crescent Bay.

"I recall that some of our friends and loved ones were a bit surprised—we weren't going to read them first? We just wanted the ocean to hold all those messages of love and inspiration for us. But now we have a chance to read at least some of them, eight years later . . . On April 28, 2014, we received an email from ***Christine Webber****, who was travelling through Oregon and happened to stop at Arcadia Beach. Incredibly, she found one of our bottles. Unbelievable! I am a big fan of messages in bottles and have sent many of them into the ocean throughout my life. When I was young, my dad would go to sea with the Navy and I would sometimes send bottles with him to throw overboard once they were clear of the coast. But never has one actually come back.*

"What journey did that bottle take? In the past I may have let that question rest and perhaps even might have chalked it up to some mythic intent of the ocean. But now I am all about science, so I dug into this a bit. We tossed the two bottles into Crescent Bay. It was the middle of July, and during most of the summer the Strait of Juan de Fuca is characterized by an outwardly directed residual flow. This is characteristic of estuaries, and the Strait of Juan de Fuca is indeed part of the massive estuary that we know as the Salish Sea."

Surface currents in the Strait can average just shy of drifting 24 nautical miles per day. Since it is 100 miles from Crescent Bay to the Pacific Ocean, it is possible the bottle made its way out of the Strait in a week or so. Surface sea level atmospheric pressures drive the currents within OSCURS. During the past twenty years, OSCURS has been employed to study the movement of everything from fish larvae to debris in the ocean. Assuming the bottle sailed out the Strait, windage factors suggest Ian's bottle orbited the North Pacific's Turtle Gyre in eight years. ■

Transpacific Flotsam

The three prefectures covering the size of Maryland, each hard hit by the tsunami, spread flotsam along the coast of America, from Middleton Island, Alaska, on the north, to Oregon on the south. From Miyagi Prefecture was a restaurant buoy to Middleton Island (arrived late February) and a motorcycle to Haida Gwai, British Columbia (arrived 4/18). From Iwate Prefecture, a soccer ball to Middleton Island (arrived 3/16); a volleyball to Middleton Island (arrived 3/30); and a basketball to Baker Island, southeast Alaska (arrived 3/23). From Aomori Prefecture, a squid boat to southeast Alaska (arrived 3/20); a fishing boat flag to Haida Gwai (arrived 4/11); and a pontoon to Oregon (arrived 6/4).

Harley-Davidson. While riding his ATV on a remote beach on Graham Island, BC, Peter Mark discovered a Harley-Davidson motorcycle in a large white cargo container. The 2004 FXSTB Softail Night Train was caked with "a lot of corrosion, a lot of rust," said Peter. "You just never know what you're going to stumble upon when you go for a drive, and lo and behold you just come across something that's out of this world."

The Japanese license plate prompted Peter to contact a local TV station. International media detectives soon traced the plate to Ikuo Yokoyama in Miyagi Prefecture. "This is unmistakably mine," Yokoyama told Nippon TV. "It's miraculous." He'd been storing the bike behind his house when the tsunami struck. The Night Train floated 5,000 miles across the Pacific, protected and kept afloat by the cargo container. Yokoyama, then living in temporary housing, lost three of his family in the tsunami. The Harley-Davidson Museum in Milwaukee will permanently display the Night Train as a memorial to the victims of the tsunami. Harley-Davidson has offered to fly Yokoyama from Japan to meet Peter and visit the Museum.

Provenance of Small Flotsam. Despite their size, some small tsunami debris carried definitive provenance. The tsunami washed a great many spheres across the Pacific, including soccer balls, a restaurant sign, glass fishing balls, and a basketball. Islands often attract flotsam, and some items found their way to Middleton Island, a speck in the northern Gulf of Alaska 173 miles south of Anchorage, and Baker Island, a similarly-sized bit of land immediately west of Prince of Wales Island, Alaska.

The Harley Davidson motorcycle discoverd by Peter Mark on Graham Island, British Columbia

Basketball. On March 23, while beachcombing in Port Assumption on Baker Island, high school senior **Aleasha Hohorst** discovered Japanese characters on a beached basketball. Meanwhile, at Craig High School during the Prince of Wales Whalefest and Beachcomber Fun Fair, I lectured on tsunami debris.

Aleasha showed me her great find. **Kathy Peavey** snapped a photo, **Noriko Horowitz** translated the characters, and **Jody Godoy** of Kyodo News traced the ball. It turned out to belong to the basketball team of Kesen Middle School, Rikuzentakata, Iwate (not to be confused with the middle school in Kesennuma, Miyagi Prefecture). Upon hearing the news, the team became so excited they wished their ball returned. The tsunami had destroyed their school as well as their team members' homes. The women's team captain, **Minami Kimura**, said that she would like to visit the place where the ball had been found. FedEx pilots reunited the team with their beloved basketball.

Once the site of a Cold War-era Air Force station, the isolated, treeless Middleton Island now hosts a Federal Aviation Administration radar station and a seasonal research camp for biologists. While off duty, radar technicians **David Baxter** and coworkers beachcomb the island's ten miles of shoreline. Over the course of a month, late February to March 30, 2012, they found three spheres bearing Japanese handwriting which traced their provenance.

Restaurant Sign. In late February, not quite twelve months after the tsunami, David discovered a yellow buoy bearing black, hand-painted Kanji characters. David's Japanese wife **Yumi Baxter** translated the writing. From a photo sent by the Baxters, **Sakiko Miura** recognized it as the fish-farm buoy which had been part of the sign for her restaurant, Keimeimaru, located in Minamisanriku, Miyagi Prefecture.

The buoy bore the Chinese character "kei," part of the name of her late husband, Keigo, who died 30 years ago. "As (part of) the restaurant's sign has been found, I made up my mind to reopen it," Sakiko said. On June 10-11, 2012, FedEx Pilots Captain **Terry Bull** and First Officer **John Hillyer** flew the buoy from Anchorage, Alaska, to Narita, Japan, fulfilling Sakiko's wish.

Soccer Ball. Three weeks later (March 16), David noticed another sphere floating off the shore. It turned out to be a soccer ball bearing handwritten Japanese characters. With Yumi's translation, Japanese media traced the ball to **Misaki Murakami**, 16, in Rikuzentakata. In the 2010 census, the town had a population of 23,302. Some 40% of

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the population perished, and up to 80% of its 8,000 homes washed away.

When he was in the third grade in Osabe Elementary School, Misaki had received the ball from friends as a good luck gift. Classmates signed and dated the ball along with the admonition: "*Misaki Murakami. Work hard!*"

The tsunami swept away the keepsake along with his home. "I've lost everything in the tsunami, so I'm delighted. I really want to say thank you for finding the ball," said Misaki.

Aleasha Hohorst with the basketball she found on Baker Island, AK. The ball was eventually reunited with its middle-school basketball team in Rikuzentakata, Iwate.

Volleyball. Two weeks after the soccer ball washed up (March 30), in the living quarters on Middleton Island, a colleague handed David a volleyball bearing Japanese writing. With Yumi's translation, NHK-TV broadcast a national appeal to identify the ball's owner. Though it bore only a first name, a viewer suggested **Shiori Sato**. The tsunami had destroyed her home in Tanohata, Iwate Prefecture. "Good heavens!" Shiori told NHK. "I want to say (to the ball) 'Welcome back!' I think it's a miracle."

Amazingly, the currents transported three small spheres from three tiny prefectures to a flyspeck island in the Gulf of Alaska. Each departed on the same day (March 11, 2011) and arrived within a month of one another (late February to March 30, 2012). Could the trio have traveled together? As if reflecting their ocean camaraderie, on June 11, 2012, FedEx pilots returned Misaki's inspirational charm and Shiori's miracle. ■

SAILING THE GARBAGE PATCH

Racing yachts strike utility poles

Odd-numbered years witness the greyhounds of the sea sprinting from Los Angeles to Honolulu to win the coveted trophy of the Transpacific Yacht Race (AKA Transpac). Transpac differs from other major ocean sailing events in that it is a 2,225-nautical mile downwind race in which sailors rig as much sail as they dare before the Trade Winds.

The legendary race has an illustrious history. To strengthen Hawaii's ties with the mainland, in 1886 Hawaii's King David Kalakaua conceived the epic sprint. Sleek sailboats have raced the Transpac since its inaugural in 1906, but there was something different in the 2013 race—two years earlier, tsunami flotsam washed to sea and drifted into the oncoming Transpac speedsters.

"I just debriefed the skipper of the fastest Transpac trimaran on the impacts with logs from the Tsunami," emailed Captain **Charles Moore**, author of *Plastic Ocean*. "I think they were Sugi logs exported from Japan. When I was in Miyako, where the Tsunami hit, I saw huge stacks of them on the docks ready for loading. The crew of the 72-foot trimaran *Tritium Lending Club* called them telephone poles, which they look like, but they are not treated with creosote or copper, so they were waterlogged." Sugi, the national tree of Japan, is often called Japanese cedar, though the tree is unrelated to true cedars. The evergreen superficially resembles the Giant Sequoia and can grow 13 feet in diameter and 230 feet tall.

In July 2013, the Lending Club and other mega yachts struck poles thought to have drifted from the tsunami which devastated northern Japan two years earlier (March 11, 2011). On the foresail, note Gladstone's Restaurant of Long Beach, California, one of Lending Club's co-sponsors. The Lending Club, a worldwide broker, arranges commercial real estate loans.

Race officials warned the sailors to lookout for tsunami flotsam. They had worked with oceanographers to deduce locations of debris that had washed to sea two years earlier. "All debris is reported and forwarded on to what was sighted and exact location," said **Carl Geringer**, Transpac co-chair. "I think there's ▶

Bechcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

Beachcombers' Alert!™

Non-profit quarterly newsletter
Subscriptions: $25.00 US per year
Canada & overseas: $36.00 US per year
Issued January, April, July, October

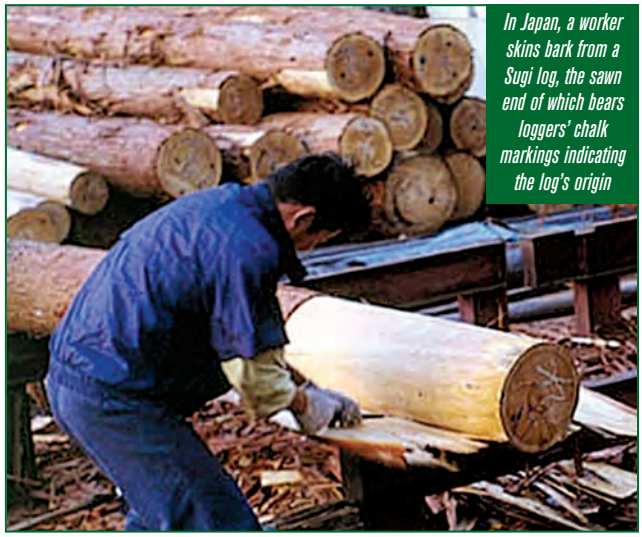
"May the tides be good to you."
—Paul J. Ebbesmeyer

a lot more out there than people realize."

Despite the preparations, plenty of collisions occurred: "Lumber-type debris—telephone poles, railroad ties. There've been reports of sheets of plywood scattered throughout the racecourse," said **James Callahan**.

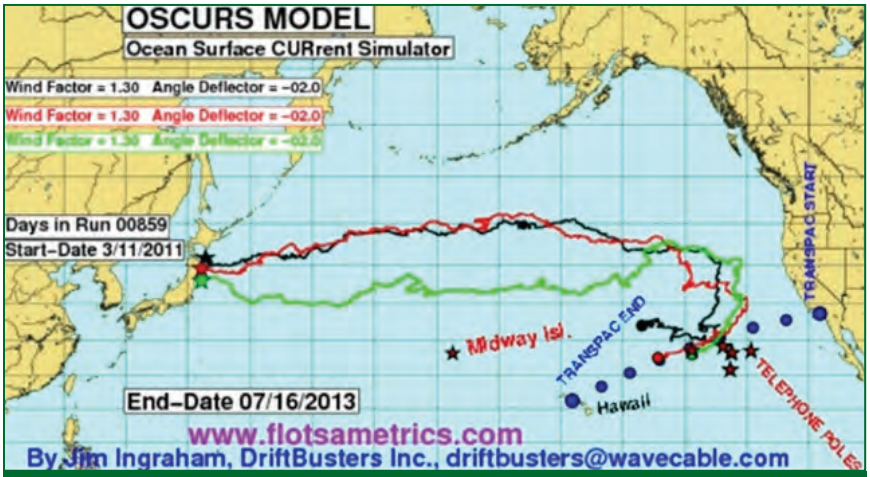
"You heard a thud, then another thud," said one racer describing the scene about four days into the race (circa July 16). "I wouldn't say it was a telephone pole, but it was certainly at least a very big fence post that we hit; it came out at the back of the boat."

John Sangmeister coveted the course record. Unfortunately, his *Lending Club* struck tsunami debris seven times. "We hit telephone poles doing 25 miles an hour. We hit several of them; the effect was catastrophic to the boat," said Sangmeister. "We hit our rudder, we hit the float, and we hit our central rudder as well." The debris destroyed the vessel's daggerboard. All totaled, *Lending Club*'s crew lost a dozen hours working on repairs. *Lending Club* crossed the finish line off Diamond Head, Hawaii, after completing the course in 5.49 days, two hours short of the record.

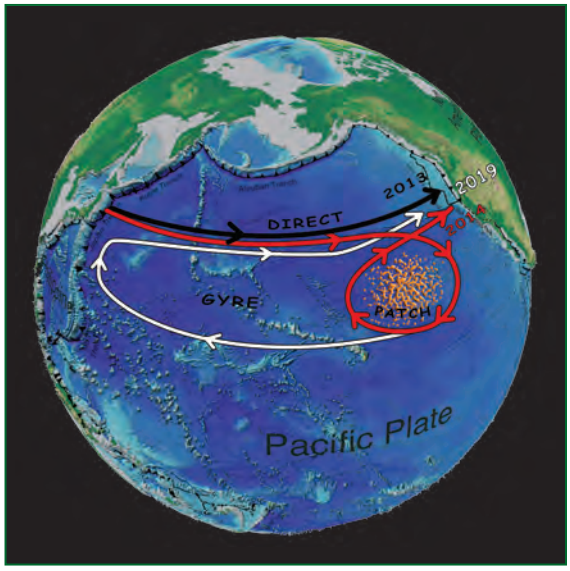


In Japan, a worker skins bark from a Sugi log, the sawn end of which bears loggers' chalk markings indicating the log's origin

Without specific identifiers for each log, I could not be sure if what the mega yachts struck was, in fact, tsunami debris. Jim Ingraham therefore displayed the collision locations on an OSCURS map. Assuming they began in the tsunami, the logs traveled 859 days over a distance of 4,800 miles, the patch of poles measuring some 400 miles across in agreement with the 400 miles over which the sailors collided with poles. The agreement of the poles' position and dispersion computed by OSCURS gave proof that the tsunami sent them. ■



The Transpac race course superposed on tsunami pole drift. Larger dots between California and Hawaii trace the nominal Transpac course along which yachts struck poles (stars). The stars in Japan indicate where the poles began drifting. They drift eastward for two years until July 16, 2013 (three smaller dots), about when yachts struck the poles.



Beachcombers' Alert!™

By Curtis Ebbesmeyer

100-ISSUE SUMMARY JANUARY - MARCH 2021

Surrealistic gyres: cubist, harmonic, segmented, fractal.

Harmonies and Cubism: Gyres as Art

Hints of cubist gyres. *Left: Hoberman's Sphere of folding wire circles. Center: Toy blocks that were spilled with blue turtles. Right: Toy turtles the size of hatchling loggerhead turtles. Thomas Berry Brazelton, the modern-day Doctor Spock, designed this plastic turtle, some 7,000 of which fell overboard from a containership midway along the Pacific Wall. Photos: Craig Powell, Jim Ingraham.*

"The little world of childhood with its familiar surroundings is a model of the greater world. The more intensively the family has stamped its character upon the child, the more it will tend to feel and see its earlier miniature world again in the bigger world of adult life."

—Carl Gustav Jung (1875 –1961).

When I was 5, my grandmother Anna put a $2,000 down payment on a home constructed on a five-acre vacant lot once part of a potato farm. My father began his second career, after being a machinist on World War II fighter aircraft, as a salesman selling Merckens chocolate to small candy shops along the Pacific coast from San Diego to San Francisco. He left home for a week at a time, never failing to post us a card from Andersen's Split Pea House on Route 101 in Buellton, California. On his return he brought me a surrealistic small toy, one yet sitting beside my computer: a Hoberman Sphere resembling a geodesic dome with six interlinked folding circles.

Half a century later, a new fan of the Hoberman Sphere surfaced at the White House Science Fair. One of the finalists, 12-year-old Peyton Robertson of Fort Lauderdale, Florida, used his Sphere to demonstrate how polymer expands in water. "I actually have one of these," said President Barack Obama. "Sometimes I just stare at them in space."

My sphere surfaced from a deep memory of my mother showing me a news clipping of Nikes in the Floating World. Then Hoberman's geodesic circles clicked into place and my quest to understand the drifty ways of the gyres covering planet earth was underway. As soon as I could hold a pencil, I wrote of Paul Bunyan in seven-league boots astride the Atlantic and Pacific Oceans.

In this issue of *Beachcombers Alert*, there are accounts of hockey gear, sneakers, bath toys, tree logs, and other flotsam illustrating the "music of the gyres," ocean currents that flow with a motion that resonate with consistent harmonies. The gyres of Earth's oceans orbit in a series of four harmonics: ¾, 1½, 3, and 6 years. The character of the gyres, with these predictable intervals, offers a parallel to human personality that I'll examine in a future piece.

As always, this issue also makes generous use of OSCURS, the Ocean Surface Current Simulator. Developed by my late friend and colleague Jim Ingraham, OSCURS allows us to recreate and project the paths of objects through the gyres and generate visual representations that are their own style of art.

OSCURS maps can call to mind a kind of surrealist artwork worthy of Picasso, revealing aspects that fit with cubist, segmental, and fractal styles and theories. When my mother first introduced me to the Floating World, I imagined gyres as smooth ellipses within great soup bowls, but over the years, as Jim applied OSCURS to flotsam drifting over longer and longer durations, the trajectories repeatedly showed the gyres to be more rectangular than elliptical. The trajectories further contained smaller scales including long segments, blisters, and fractal detail as small daily perturbations. Around this cubist perimeter, flotsam oscillates in a handful of longer segments. These are the harmonics of the gyres' cubist melodies and derive from ocean eddies, storms, and myriad phenomena smaller than the embracing gyres.

Jim never had the time or resources to apply OSCURS to the whole of the world, instead focusing only on the gyres of the Pacific—The Blob, the Great Garbage Patch, Aleut Gyre, and Turtle Gyre—but regardless of specific location, each flotsam around the Earth contains the universal nature of gyres, from segments to fractals. ■

Semaphore Gloves

During his graduate school years, Jim Ingraham began developing a computer simulator with the ability to predict with uncanny accuracy the drift of a flotsam across the North Pacific Ocean. Its Achilles Heel: it required accurate information on how the currents and winds affected a flotsam's drift. Since these are unknown for most flotsam, Jim's greatest successes came when the wind factors were ascertained from a similar flotsam and then applied to the object in question.

Jim's masterpiece, OSCURS, even predicts paths for flotsam that can swim. He earned his keep at the National Oceanic and Atmospheric Administration (NOAA) by predicting the arrival of salmon after years at sea given their swim speed. I had asked him to simulate the arrival of Nike sneakers by dialing down the swim speed to zero, thus converting fish to flotsam. So powerful did OSCURS become that it could simulate swimmable flotsam like fish as well as inert flotsam like tub toys, Nike sneakers, small craft, and hockey gloves.

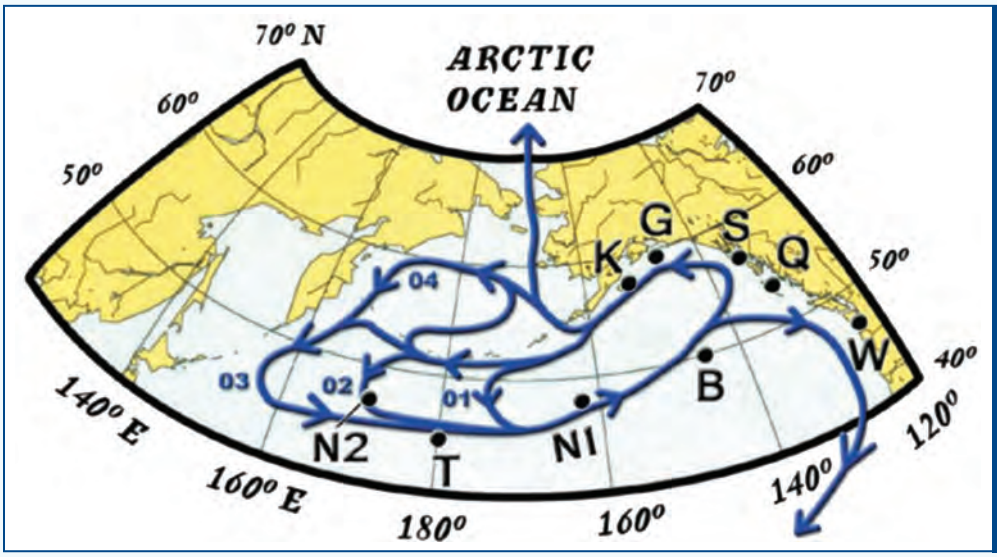
I mailed the first issue of *Beachcombers' Alert* on January 26, 1996. Three spills of iconic flotsam at two-year intervals ('90, '92, '94), inspired my father to suggest I report flotsam's drifty ways, but Parkinson's Disease took him before I could produce subsequent issues of *Beachcombers Alert*. The *Alerts* received little academic traction—few libraries and universities opted for an annual subscription—and my colleagues, for the most part, scratched their heads wondering what I was up to. Soon thereafter, I learned of spills with ever-increasing frequency, amounting to containers numbering in the thousands every year. I had accidentally discovered a major industry had been contributing substantial unreported floating pollution to the world ocean. I earned their wrath while academia has ignored this ubiquitous pollution at the sea surface.

Tub toys, Nike Sandal, and brown beer bottle drift around idealized elliptical orbit of Aleut Gyre (Jim Ingraham photo). Closeups of toys, sneakers, and hockey gloves. Hockey glove photo from National Geographic Magazine; photo of tub toys with Nike sneakers by Bruce Johnson.

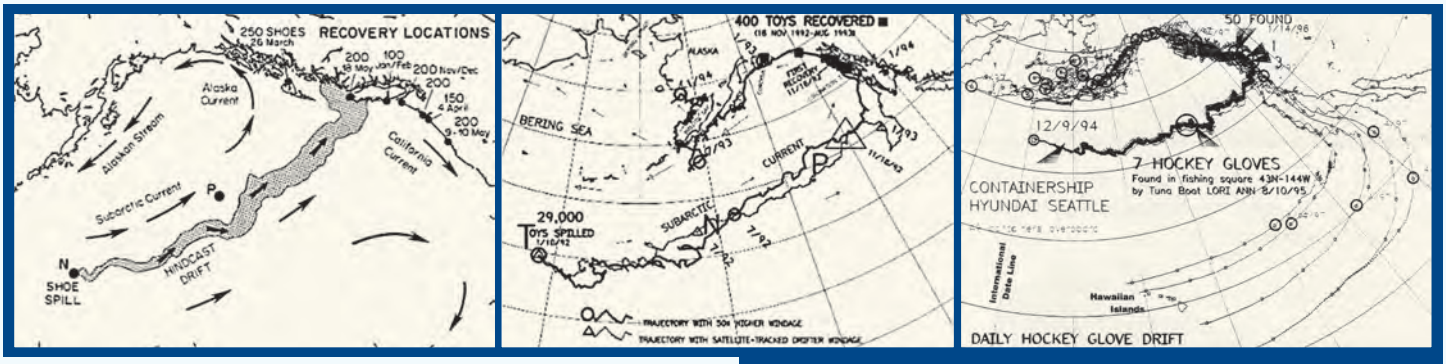
On December 9, 1994, an engine-room fire left the 798-foot containership *Hyundai Seattle* adrift on the Pacific in high winds and rough seas near the International Dateline. Loaded with 756 containers, the vessel had been underway from Busan, South Korea, and was 2,000 miles short of its Seattle, Washington, destination when the fire broke out. Powerless, she broached into the stormy seas stressing the cables restraining the steel boxes beyond their breaking point.

In the shipping business, great profits result from conformity. The industry ships nearly all the industrialized world's products across oceans, and standardization dictates each box be of identical height (8 feet), length (40 feet), and width (8 feet). 20-foot lengths are also in wide use, but anything other than 20- or 40-foot long containers bucks the system. Still, there are a few misfits, often 45-53 feet long. On the *Hyundai Seattle*, those accounted for most of the containers lost overboard. To accommodate them, stackers placed these odd ducks atop standard 40-footers. To restrain these massive metal monsters, which when semi-submerged became steel icebergs, nonstandard steel cables bent over the extra length. As the ship rolled side to side fifty degrees, these ill-fitting lashings snapped, releasing nearly fifty containers into the Pacific.

The crew evacuated shortly after the fire, leaving the vessel adrift for 15 days. Between the time of the fire and the time when salvage ▶



Containerships transit the wild North Pacific Ocean from Asia to America along a great circle which coincides with the Transpacific Wall on the south side of Aleut Gyre. Spills of Nike footwear (N1, N2) and tub toys (T) occurred along the Wall. For 14 years, the father-son beachcombing team of Dean and Tyler Orbison beachcombed more than a hundred tub toys in the vicinity of Sitka, Alaska (S). Annual tallies of the toys showed four peaks at three-year intervals ('95, '98, '01, '04) corresponding with the orbital period of Aleut Gyre as determined independently from oceanographic measurements measured annually at (G). During World War II, the US Navy maintained a weather ship at Ocean Weather Papa (B) which was reoccupied during the International Geophysical Years (1957 & 1958); (Q) marks the location of temperature and salinity testing done for 35 years. The Blob (suborbit 01, where 02 and 03 are suborbits yet unnamed) is circumscribed by 01, N1, B, S, G, and K.



OSCURS drifts from spill sites in the mid-Pacific to America along the Blob: 1990, Great Nike shoes spill; 1992, toy spill; and 1994, hockey gloves.

tugs began towing her to Seattle, winds and currents dragged the *Hyundai Seattle* like a huge sailboat—700 miles at 45 miles per day ahead of containers and associated debris that traveled 10-20 miles per day.

Losing fifty containers from a vessel is a larger-than-normal incident. For perspective, I remind beachcombers of the 80,000 Nike shoes and 29,000 children's bathtub toys spilled in 1990 and 1992 involving 21 and 12 containers, respectively. A year afterward, thousands of shoes and toys began washing ashore from Oregon northward into Alaska. The shipper's invoice showed two lost containers held 38,800 items, including 34,300 gloves; 3,000 shin guards; and 1,500 chest protectors. Luckily, deep-sea fishermen spotted the hockey flotsam, allowing a calibration prior to the gloves' arrival ashore that Jim could use to refine OSCURS to an accurate arrival date.

On August 10, 1995, Ron Anderson, captain of the tuna boat *Lori Ann*, retrieved seven hockey gloves afloat 800 miles west of Oregon. Jim immediately adjusted OSCURS to connect the spill with the gloves' oceanic position. Tank tests later showed the gloves floated with forefingers exposed an inch above the water line, whereas the sneakers turned turtle, with soles upward and uppers downward acting as keels. Because the soles drifted nearly even with the water surface, the wind could not grip them to the same degree as it did the gloves' forefingers.

On January 14, 1996, Alex Welcel, a beachcomber from Keeha—a small bay just south of Barkeley Sound on the western shores of Vancouver Island—found 50-60 hockey gloves along three miles of beach. This provided a remarkable blind test with the recovery date closely matching the date (mid-January) and location (northern Washington-southern Vancouver Island) of OSCURS' predicted landfalls. The next day, Steve McLeod began finding chest protectors at Cannon Beach, northern Oregon. A week later he found 23 gloves along with three shin guards, totaling 33 hockey items along 11 miles of shore.

During the first half of 1996, I received reports of thousands of pieces of hockey gear found on beaches from near Oregon's southern border northward to the northern Queen Charlotte Islands. Jim had solidly demonstrated OSCURS' amazing predictive power. ■

18,000 Nikes Cross Train Pacific

After the 1990 spill of 80,000 Nike shoes—wearable despite a year in sea water—beachcombers held swap meets to match pairs. At a beachcombers' party at my parents' home, my mother took great delight in the Nike Cross-Trainers. During 2001, beachcombers again found good-as-new Nikes, this time 1999 Nike Cross-Trainers, along North American shores from Oregon north to Alaska. Trouble was, beachcombers again had to match shoe sizes because Nike did not tie the laces together. Given the Cross-Trainers' street value ($100 a pair), flotsam swap meets re-emerged.

My mother, Genevieve Ebbesmeyer, holds a pair of recovered Nike Cross-Trainers

A few days before Christmas 2000, Rodney Schatz beachcombed 17 Nikes in British Columbia's Queen Charlotte Islands. Within a few weeks, his total had risen to 37. The codes stitched inside revealed that the famed shoemaker lost the floatable sneakers a year earlier; Dave Newman of Nike Cargo Safety & Claims in Beaverton, Oregon, briefed me as to their origin.

The code to unlocking the sneaker origin is **99 10 12 052**. This reflected Nike's purchase order for two containers of Jet Pack Cross-Trainers—18,000 individual shoes destined for a high-volume shoe dealer in the Midwest from factory 052, intended for delivery during December 1999.

Unfortunately, the sneakers fell overboard between Asia and Los Angeles. After a stop in China, the containership *P&O Nedlloyd Auckland* headed across the Yellow Sea to Busan, Korea, to load additional containers. From there, she steamed northward across the Sea of Japan for Tsugaru Strait (between the Japanese islands of Hokkaido and Honshu). After passing through the Strait on November 29th, she began a great circle track for Los Angeles. Halfway across the Pacific near the International Dateline, the containership encountered Force 11-12 winds (Beaufort Wind Scale for violent storm and hurricane winds exceeding 56 knots). About 5:00AM local time on December 2, heavy rolling threw a dozen 40-foot-long containers overboard, two filled with Cross-Trainers. Finding shoes in the Queen Charlottes attests that heavy seas opened at least one of the containers.

According to OSCURS, the globe-trotting footwear drifted a year from the International Dateline, near 45 degrees north latitude, to the middle of Vancouver Island, Canada. By Christmas 2000, coastal currents carried them to the Queen Charlottes. By February 3, 2001, Rodney had beachcombed a total of 57 Nikes, the rights outnumbering the lefts by 3:1. ■

Logs Float 10,000 Miles

Sphinxlike, tree logs haunt worldwide shores. Many originate from local forests, camouflaging others that come from great distances over great durations. Drift trees might lay on Arctic shore for centuries. Though log identification is highly sophisticated, few beachcombers know which to report or whom to report to.

Japanese and Alaskan coastal currents regularly transport logs to the Aleutians from the forested coastlines of southeast Alaska, southeast Asia, and Japan. The Davidson Current—discovered by George Davidson, who observed stranded redwoods along the north Pacific coast—transports trees northward from California.

In the Blob, transport ships lose sizeable quantities of lumber. For example, 1,100 two-foot diameter Douglas fir logs rolled overboard on February 20, 1996, from the vessel *Ocean Orchid*. Nearly three years later (December '98), the vessel *Haida Monarch*, steaming southward across the Gulf, spilled 10,000 white spruce logs—equivalent to three million gallons, one of the largest timber spills ever recorded. OSCURS revealed the wooden flotsam dispersed over thousands of miles.

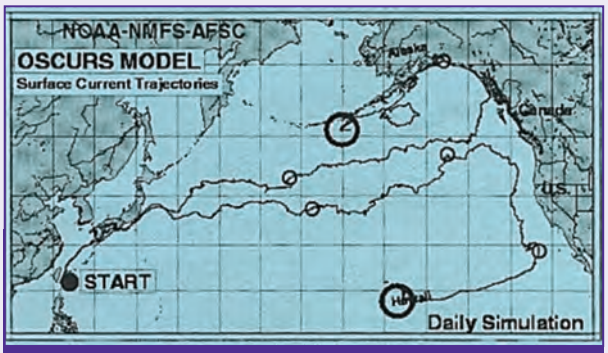
Long ago, archaeologists recognized the importance of driftwood to prehistoric peoples living in treeless Arctic and sub-Arctic lands. Many settlements in Iceland began where Vikings discovered that ocean currents concentrated driftwood. Driftwood provided essential resources, including construction timber for sod houses known as "ciqlluaq" (Alutiiq) or "barabaras" (Russian), wood for fish drying racks, tools and baidarkas (early kayaks), and fuel for hearths.

Today, usable wood remains appreciated by people living on the unforested Aleutians. Modern folks pay attention to new deposits of driftwood, especially after high winter seas. Elders on Kodiak Island on the Blob tell of ownership marks—axe cuts, small stones—placed on prized pieces, and of tying up logs to be hauled away at a later date. Located 40 miles from major sea lanes, Unalaskans welcome containers full of dimensional fir. Beachcombers reported 5-inch × 5-inch boards adequate to construct a small greenhouse.

Spring, 1996. High up on the beach in Unalaska Harbor in front of the present day Russian Orthodox Church, Jim Dickson, builder of the driftwood greenhouse, discovered an unusual 30-foot long log resembling a crooked telephone pole. Washed in by winter storms, rolling on the beach had stripped it of sea growth. Someone had previously sawn one end showing it to be a medium brown, notably hard, even-grained wood.

How far can driftwood float? Few transoceanic drifts can match these. Across the North Pacific, a log of Kapur or Borneo camphor drifted 10,000 miles from southeast Asia, arriving in Hawaii in 1961. At the time, Kapur grew only in Borneo, Sumatra, and Malaya. At high southern latitudes, a Nothofagus log drifted halfway around the world, 10,000 miles in the Antarctic Circumpolar Current from the southern tip of South America to Macquarie Island.

On December 24, 2014, a tree trunk with a twisted bole was discovered near Leadbetter Point, WA. Scientists at the Hatfield Marine Lab identified the tree as a Japanese black pine (Pinus thunbergii) that the 2011 tsunami uprooted and washed out to sea along with 13 species of barnacles, clams, mussels, and shipworms native to Japanese coastal waters. Animal growth during the oceanic transit suggested the tree had crossed the Pacific in four years.



Drift of the Lauan log also revealed segments with daily movements of fractal chatter. Drift segments are characteristic of flotsam orbiting the ocean's gyres.

It was unusual, to say the least, and it was suspected to have drifted alone, not as part of log spill. A chunk was given to visiting archaeologist Patrick Saltonstall (Alutiiq Museum, Kodiak), who in turn sent it to Karen Adams. After Rex Adams (Laboratory of Tree Ring Research, Tucson) tentatively identified the specimen under a microscope, wood anatomist David Tennessen (University of Wisconsin, Madison) confirmed the specimen as Lauan, a species of Shorea tree.

Shorea, a genus of tall evergreens of the rainforest, grows from Sri Lanka to southern China, as well as in Borneo, Indonesia, and the Philippines. Also called mahogany, a name commonly given to many trees, Shorea supplies substantial timber in tropical Asia, particularly for veneer and plywood. Sumatrans say that a single Shorea tree can provide the timber and furnishings for a home. The remainder of the tree is a veritable storehouse—the bark is a source for black dye; the resin contributes to typewriter ribbons, carbon paper, incense, and varnish; the fruit can be boiled and eaten; the nuts produce as much as 70% oil and provide a substitute for cocoa butter in chocolate; and the fat is used in cosmetics, soaps, and candles.

The Lauan log likely drifted along most of the Kapur log's route. OSCURS was programmed to assume the logs began drifting in the Philippine Islands during the peak of the typhoon season (though a typhoon may strike in any month, 69% typically occur during July through October). As initial guesses, we assumed that the Lauan and Kapur logs began drifting at the beginning of September. To arrive in Unalaska in Spring, 1996, OSCURS showed that the Lauan log began drifting five years earlier, in 1991. The Kapur log began drifting in 1956.

Although separated by four decades in time, both logs traveled northward from Southeast Asia, bypassing Japan on the Kuroshio Current before crossing the Pacific in segments. Here their paths diverged, Kapur turning south to Hawaii, Lauan turning north. In the Alaska Coastal Current, the Lauan drifted along the Alaskan panhandle, then veered west along the Aleutians to Unalaska.

Musing on the gyres' music, years ago I visualized the orbits of gyres as smooth ellipses. OSCURS for marathon trees showed otherwise. I began seeing gyres as consisting of five or so segments. To be sure, gyres swirled in general elliptical orbits, but they warped and woofed as if a drunkard's walk half random, half deterministic. ■

Views of the Blob

The 550-foot log transport vessel *Ocean Orchid*, owned by the Pacific Lumber and Shipping Company and registered in Panama, spilled approximately 1,100-1,200 peeled Douglas fir logs on February 20th, 1996 at 52° 02' north latitude by 148° 54' west longitude. Mike Francisco, executive officer aboard the NOAA Research Vessel *Miller Freeman*, called me via satellite radiophone to report that on February 28 he had heard radio transmissions pertaining to the log spill.

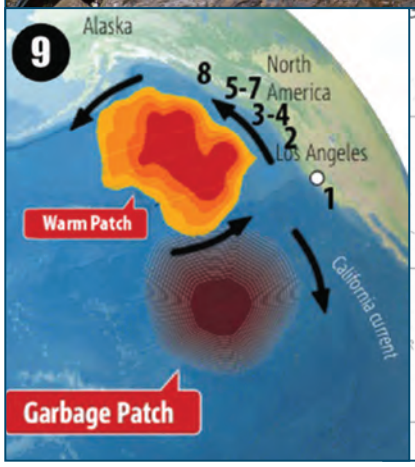
Traveling from Everett, Washington, to Matsunaga, Japan, the Japanese-owned vessel was heading northwest en route to Unimak Pass along a great circle route. At the time of the incident, they had sustained 60-knot winds gusting to higher speeds and a generally following sea of 25-30 feet, what a representative of the shipping company called "boisterous seas."

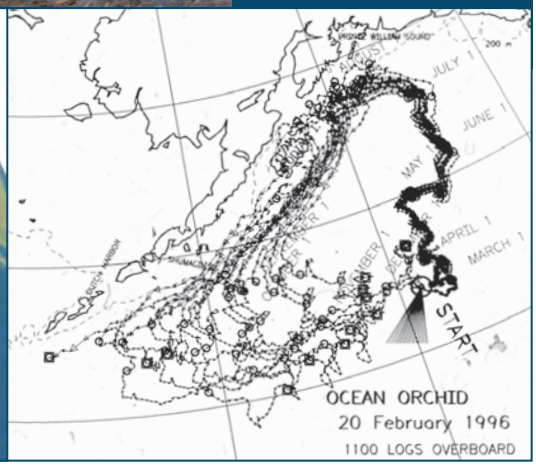
After a few minutes, a set of three or four waves some 35-40 feet in height struck the vessel on the stern starboard quarter. The waves caused the logs lashed on deck to shift, buckling about 15 of the upright steel support stanchions located on the vessel's port side. A few hours before the rogue waves struck, the Filipino crew had all gathered in the wheelhouse, wearing their life jackets. They remained there for hours afterward, waiting for the seas to subside enough to again feel safe. Eventually, they steamed into Dutch Harbor for repairs.

Of the 6,000 logs lashed to the deck, about 1,100 washed overboard—18% were lost. Bob Storrs visited the *Ocean Orchid* to observe the damage and note if the logs were branded. Stapled on the ends of many of the logs were plastic tags about an inch by three or four inches which Bob saw in hatch number five. A couple of the tags read AH10043 and AH29179; each log appeared to have been tagged with a different code.

OSCURS suggested that the logs drifted mostly northward. They will probably turn westward so as to drift in the Alaskan Stream, some later returning east in the Blob. Within 2-3 years, a few may show up as far south as Oregon and Washington, as well as Hawaii's eastward-facing windward shores.

Another spill provides perspective on the *Ocean Orchid*. On February 12, 1978, a barge under tow by the tug *Ocean Master* in heavy weather 20 miles west of Point Sur, California, spilled 2,000,000 board-feet of finished lumber.





Upper left: The emaciated condition of California sea lions shows the reduced food value in the Blob and Garbage Patch, just one of the many detrimental effects of global climate change. Lower left: Hundreds of puffins dead from starvation have been observed at Locations 3-9 along the Pacific Northwest, Alaskan Panhandle, and the Bering Sea. Lower right: The spill of 1,100 tree logs off the transport ship Ocean Orchid.

Within a month the boards had drifted to beaches along 90 miles of coast comprising most of the threatened California sea otter habitat; at the time, the population of the delightful furry creatures then numbered only 1,800.

Blob Starvation. It may be the smallest gyre, but the Blob provides the fishing grounds for thousands of Alaskan fishermen. But it is getting to be like fishing in the Sahara Desert, likely a consequence of global climate change.

Earth-orbiting satellites have shown the Blob since 1981. Investigators designated the patch of warm water, nestled in the Gulf of Alaska within Aleut Gyre and north of the wall and the Great Garbage Patch, as a subgyre of marine debris particles between 135-155°W and 35-42°N. The Blob and Patch each measure roughly the size of the state of Texas. The 30-year average temperatures indicate the Blob's steadiness. At a meeting of the Sitka Rotarians, I explained that climate change was sending increased volumes of water up coastal North America from the Equator to Alaska, where it swirls around and into the Blob.

Fishermen in my audience asked astute questions: Would the Blob affect their salmon fishing? I explained that it was full of nutrient-poor water that would support a weaker food chain than would colder water. I pointed out the starving sea lions upcurrent off southern California. A weaker food chain implied less food for the salmon and thus smaller salmon. I asked if they had caught smaller salmon over the thirty years in which Blob temperatures had been observed? Some thought this might be the case but would keep an eye on their catch data.

With the Blob added as a cousin gyre to the Garbage Patch positioned within Turtle Gyre to the south, they formed a pair of adjoining gears in the great clockwork ocean—one a patch of warm water, the other a patch rife with floating debris and pollutants.

Millions of messages in bottles (MIBs) have floated on the Pacific. There are many reasons for sending them; some carry poignant messages from senders, a few others carry no message except a scientist's note as to where and when the MIB was released and asking the finder to report where his mail was recovered. It is frustrating not knowing

BLOB continues on page 8

Board, Baby & Bottle

MIBs track surfboards

Buzzy's Board

In 1983, six years after big-gun surfer Buzzy Trent lost a beloved board in a tremendous wipeout, a friend telephoned Randy Rarick to say he'd found an old board washed up on Kauai's North Shore. Sea grass covered the bottom and the sun had burnt the deck a brownish hue. The original color looked gray, but he could read a signature under a rendering of a funny cigar label, identifying the board as Buzzy's. "Amazingly," Randy wrote, "it had been floating at sea at the whim of the waves, wind, and currents for six years before returning to shore." OSCURS showed Buzzy's board had drifted around the perimeter of Turtle Gyre. A beloved surfboard named Baby provided confirmation of the first six months of Buzzy's drift.

Michelle's MIB Mimics Buzzy's Board

On December 14, 1995, hurricane-force winds slammed the Washington coast. The next day in Willapa Bay, WA, home of my favorite oysters, Brian F. Regimbal discovered a New York Seltzer bottle amidst a copious quantity of debris.

Inside the bottle, a message dated February 20, 1990 began with a Garfield cat face and ended with a happy face. It read: "*Hi, My name is Michelle Stone. I am 10 years old and I'm in the fourth grade. I'm from Harrington, Washington [270 miles inland from Willapa Bay]. The bottles were mailed to Ilwaco [Washington] and put on a fishing boat [which motored] about 28 miles from Ilwaco. My class has 24 kids, but the fourth grade and third grade are combined. My dad drives a school bus and farms wheat, barley, and grass seed. My mom teaches pre-school. My sister is done with basketball. I enjoy going swimming, fishing, ride horses with my cousin Sara, and a lot more. I live in the country. I have two cats and one dog. Sincerely, Michelle Stone. P.S. write back soon.*" Six years is a long time for a youngster to wait.

Is it a coincidence that after six years Buzzy's surfboard and Michelle's bottle both beached close to their origins? All totaled, eight drifters circumnavigated the North Pacific gyre. Undigested, the messages seemed as dry as the insides of the bottles. With analysis, they yielded the boomerang time around Turtle Gyre. (Looking again, maybe I should name call it Turtle Quadrangle because of its four sides?) The time to drift around the Gyre's sides totaled six years, adding confidence that Buzzy's board also drifted around the Pacific. Finally, Jim Ingraham's OSCURS' drift simulations show that Michelle's MIB, Buzzy's board, and six other MIBs all yielded six years despite threading through Japanese islands without stranding. All had squarish sides. OSCURS was revealing not only the orbital time, but sharper views of gyre reality. Call it cubism, after the toy blocks that also stranded with the tub-toy turtles.

Buzzy Trent surfing a giant wave in Hawaii; Doug Falter with his "Baby" in Oahu. Falter lost his cherished board in a wipeout in Hawaii; six months later Giovanne Branzuela recovered Baby in the Philippines.

Another beloved board lost near the site of Buzzy's loss turned up halfway around Turtle Gyre in the Philippines. By the time I learned of this wipeout, Jim had died, taking OSCURS with him. Baby's overall drift, however, was consistent with that of Michelle's MIB.

A Surfboard Named Baby

Flotsam drifts between Points A and B (e.g., Hawaii to the Philippines). Magnificent ocean currents, however, follow circular paths aswirl betwixt continents. Point A thus could be the same as Point B. How, then, do you know if a drifter released and found near the same place orbited a gyre, milled about the local area, or lay buried the intervening years? OSCURS resolves the dilemma.

In the North Pacific, violent events often launch flotsam on epic journeys. Typhoons release Japanese vessels, submarine mines, and fish attraction devices. In Hawaii, giant waves separate surfers from their beloved surfboards. In a previous *Alert* I wrote of flotsam set adrift from northern Japan by the great Japanese tsunami of 2011. Once in a while I learn of a drifter that orbited the mother of all gyres, the North Pacific's great one.

Two surfers first met via the Internet, wrote Greg Bishop for the venerable magazine *Sports Illustrated*. A 35-year-old amateur surfer e-mailed a 38-year-old schoolteacher in the Philippines, who typed his reply message between classes.

It's a classic story of flotsam lost and flotsam found, one that harkens back to when I first began writing the *Alert* when I could get around without the aid of a walker. The story arrives via Internet from Bob Hamilton, who mentored my career's beginning in my graduate school days while I addressed the maze of deferments for the Vietnam War (circa 1967). In Greg's amazing descriptions:

"Doug Falter was paddling out toward the kind of Waimea Bay waves that filmmakers live for—cresting monsters that rise, rise, rise and fold over, forming a tunnel that propels elite surfers toward nirvana. Falter was one of those seekers who gives up a 'normal' life, moves to Hawaii and settles on the North Shore of ▶

Oahu, making just enough money to chase this particular brand of high.

"Already, on that afternoon in February of 2018, Falter had conquered seven waves that most humans would sprint away from, praying to the gods. Greedy, sure, but with sunset fast approaching, he wanted to try for one more. The clock ticked past 6:00PM. He figured he had 20 minutes. From afar, a friend kept a loose watch. Lyle Carlson had crafted some of the world's finest boards, including Falter's, but right now he was keeping his eyes peeled as Doug paddled into the fray. Then Falter disappeared, caught, as far as Carlson could tell, between waves, trying to swim down so he wasn't pummeled with the force of an NFL defense.

"Carlson knew all the risks, and they were all severe. The force of a crash could break bones, contort spines, deliver concussions. A surfer could drown or, if his ride shifted wildly, quickly, the heavy leash that connected him to his board could tear a ligament. In Waimea Bay alone, Carlson estimates that thousands of backs have been destroyed. That size of wave kills people, man, he says. When you're standing near the lip of a giant one, it sounds like a jet engine ... And then it explodes, like a bomb going off, over and over.

"Faced with the peril of a wave crashing down, a surfer has few options. This is no Jiu-jitsu match, with the option to submit; it's no basketball game, with allowance for a timeout. Back up for air, Falter tried to grab his leash and pull toward the board, so he could float to safety. But when he yanked this time, he could feel it: The board was no longer attached.

"Deep, frenzied panic rose up right then. He remembers it now, vividly. But that panic came not from any heightened sense of personal danger. He was concerned about his board, always. In Waimea Bay, the current acts like a horseshoe, with waves flowing in one end of the bay, following the shoreline, then curving out at the other end. Still, Falter managed to swim back in. He stumbled onto the beach and ran along the sand until he reached a rocky outpost, climbing as high and as fast as he could.

"Darkness was descending. He could not see his Baby.

Michelle's MIB mimics the drift of Buzzy's Board. Note the drift segments circumscribing rectangular Turtle Gyre in Jim Ingraham's OSCURS simulation of the drift. Fine-scale fractal structure rides segments and oxbows.

SURFBOARD continues on page 11

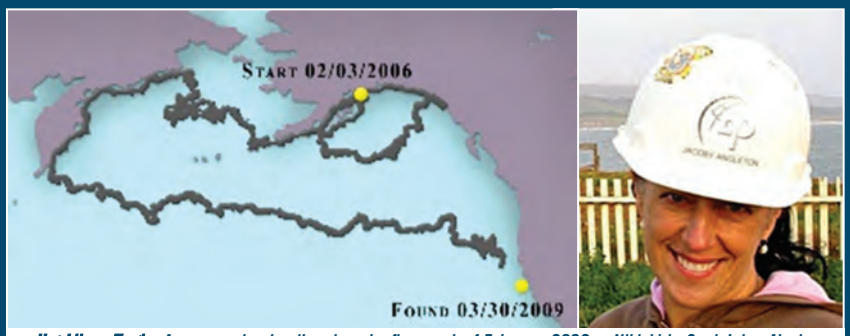
Hardhat Orbits 3 Gyres

In this hat trick, a hardhat blew off a man's head in Alaska and completed three loops in three years around the sea before being found in California.

On a cold day in early February 2006, Jacoby Angleton worked on a dock at the Tesoro Petroleum plant in Nikiski in Cook Inlet, Alaska. A gust tossed his favorite hardhat into the icy waters below. He watched it drift away, upside-down in the murky water.

Years after he'd forgotten his lucky hat, the 23-year-old oilworker received an e-mail from a California woman whose curiosity was piqued when she beachcombed a hardhat still bearing a name. On March 30, 2009, Sparrow Baranyai was walking on a beach not far from San Francisco cleaning up plastic debris when she wandered into a cove only accessible at low tide in which she sometimes found interesting shells and sea glass. It was a little before noon when she found the hat on the beach, away from the surf and in "amazing condition," she said. Angleton's name was still intact and the stickers he had affixed to it were slightly torn but still legible.

"There's something about the mystery of finding stuff and you always wonder where it came from," said Sparrow, a 47-year-old employee at the Pigeon Point Lighthouse Hostel in Pescadero, California, 55 miles south of San Francisco. "It just was such an unusual thing to find that I had to dig further." Baranyai tracked Jacoby through his MySpace Page. At first Jacoby did not reply to Sparrow, thinking it a scam. Despite the passage of three years, he recalled that his lucky hard hat was white, had a label of his name on the front, and had North Road Racing, Kenai refinery, and union stickers affixed. He asked Sparrow to describe it, and she did—"to a T," he said. After he told her how and exactly where he lost the hat, she went to check it out on a map. "I just tracked it down and went, 'That's amazing, just amazing,'" she said. Turns out, the hat traveled much farther than Sparrow had suspected.



Hat Like a Turtle: *A construction hardhat, lost the first week of February 2006 at Nikiski in Cook Inlet, Alaska, was found by Sparrow Baranyai (right) on March 30, 2009, in Pescadero, California, after it traveled 8,500 nautical miles. For this OSCURS run, a wind factor of 1.65 was employed.*

"It's been a long time," Angleton said, "so I was like, OK, it's got to be that hat because there's no other hard hat I dropped in the water. I was really bummed out about it for a while because it was my favorite hardhat. I thought it was gone forever."

James Halpin called me from the *Anchorage Daily News* to see where the hat had drifted. Flotsam from Cook Inlet, I said, often enters Aleut Gyre, the 7,200-nautical-mile current swirling from Russia's Kamchatka Peninsula to southeast Alaska.

OSCURS provided the drifty detail between point A and B, a three-year journey. The hardhat drifted around three loops between Cook Inlet and San Francisco: 1) In 2006, the spring winds initially pushed the hat offshore, causing it to loop around the Blob in the Gulf of Alaska; 2) During spring and summer of 2007, the hat looped for six months in the middle of Bering Sea; and 3) By the summer of 2008, the hat had rounded most of the Aleut gyre. All totaled, the headgear drifted 8,500 nautical miles in three years, one month, and twenty-seven days at seven nautical miles per day.

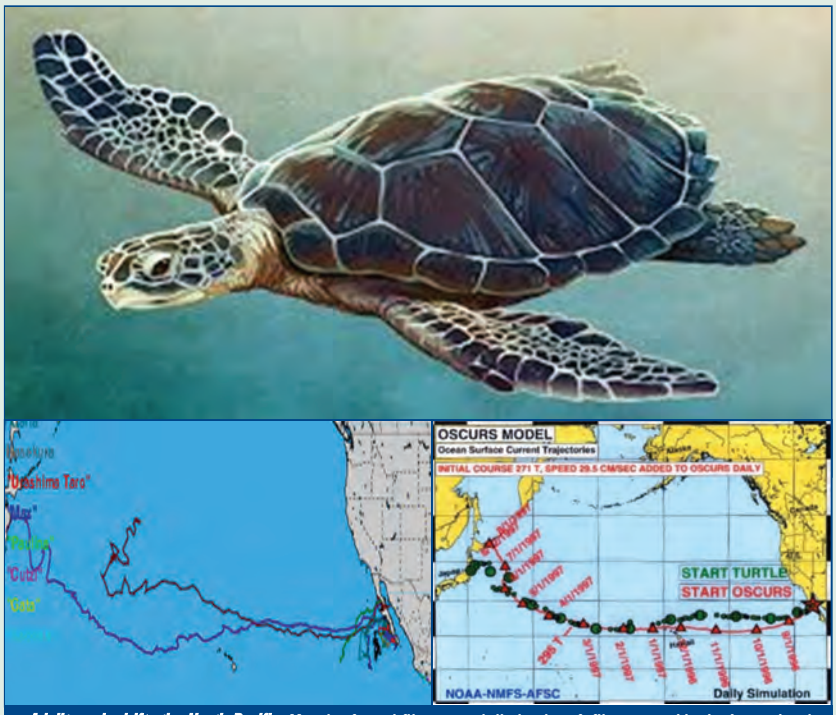
Sparrow planned on mailing Angleton his hat. My lingering desire: to paint turtle plates atop the hat. ■

Adelita Sings

Sea turtle swim drifts Earth's greatest gyre

OSCURS' ultimate test came with a flotsam that drifted and swam with equal proficiency.

Of the tub toys spilled in 1993 from a containership, two grabbed my particular attention. The **yellow ducks** inspired the start of *Beachcombers Alert*, opened the door to my book *Flotsametrics and the Floating World*, and led me to the Music of the Gyres. As time passed, the **blue turtles** inspired my theories on the origin of human personality within the sea. My mother named the blue turtles Elmers, after my childhood pet tortoise. My Bohemian pet led to my notice of a sea turtle named Adelita; the toy blocks alerted me to the gyres' cubist nature underlying the segments along their perimeters.



Adelita swimdrifts the North Pacific. *Massive frontal flippers and diminutive aft flippers enable the Loggerhead turtle to swim & drift segments and fractals of her namesake gyre. Her path as seen in satellite tracking (left panel) reflects fractal chatter. The OSCURS simulation of her journey (right panel) makes me wonder how the music of the gyres affected her mood as she swam. She harkened back to my childhood pet tortoise named Elmer.*

Genetic analysis and flipper tags show Loggerhead turtles to be primarily of Japanese origin, suggesting they utilize the North Pacific during their development in a manner like other loggerheads employ in the Columbus Gyre of the North Atlantic (see future *Alert 100-Issue Summary*). After more than ten years' growth, mature turtles cross the Pacific Ocean from foraging areas along the Baja California coast to return to natal beaches, a journey of more than 6,500 nautical miles in each direction—a total distance of halfway around the world at the Equator.

A fisherman caught a loggerhead sea turtle in the Gulf of California, raised her in captivity, and named her Adelita. *(Google note: During the Mexican Revolution in the early 20th century, adelitas were "soldaderas," or female soldiers, who cooked for and washed up after the armies, cared for their wounded men, and fought bravely in battles alongside the soldiers.)* Her dinner-plate size suggested she was a few years old. People were still hunting and eating turtles, so they felt captivity would be safer for her. Sometime later, she became part of a genetic study when Wallace J. Nichols decided to satellite-tag Adelita, making her the first turtle to be tracked across the Pacific and revealing to humanity that loggerheads journey 12,000 miles between home and nest.

With incredible generosity, Wallace shared Adelita's tracking data in 1996 as she crossed the North Pacific from Baja California seeking

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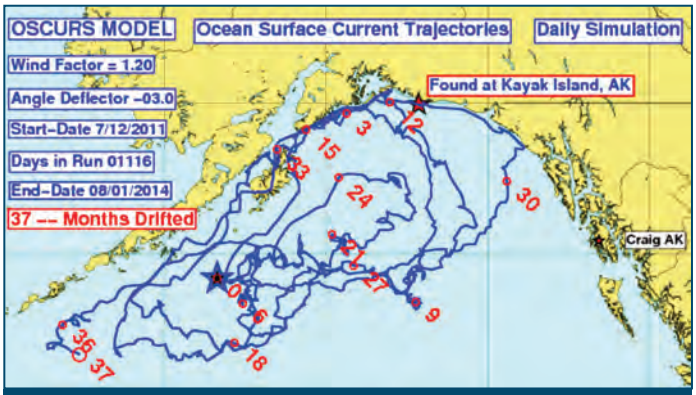
where the MIB has been in the interim. It is like finding a book with riveting first and last chapters and all the intervening ones ripped out. Fortunately, Jim Ingraham could reconstruct a MIB's missing biography with OSCURS.

During summer 2011, the Canadian Coast Guard vessel *Sir Wilfrid Laurier* steamed north to conduct ocean research as well as aid navigation and shipping in the Arctic. On this cruise, researchers tossed messages in brown glass beer bottles. Three years later, Elizabeth Roberts discovered one of these MIBs on Kayak Island, Southeast Alaska. The Island juts into the Gulf and snags huge amounts of flotsam riding the Alaska Coastal Current. Amazingly, Elizabeth found the MIB intact and readable even though the bottle had broken.



The MIB recovered by Elizabeth Roberts on Kayak Island traveled along the Blob in the north Pacific, orbiting the gyre four times over a span of 37 months.

To fill in the MIB's biography between launch and recovery, I took a cue from Elizabeth: "The bottle was glass and found up high in driftwood. I was surprised the paper, which was mostly exposed to the elements, was still intact. I'm guessing it hadn't been there for too long." When Jim inserted Elizabeth's MIB into OSCURS he found that if it had remained afloat for three years, then it orbited the Blob four times! If Elizabeth found it just as it landed, it would have floated 3.06 years. ■

Mooreman's Bones

Weather and sea appeared ideal for fishing that Sunday, February 11, 1979. On the spur of the moment, twin brothers Robert and Ralph Malaiakini decided to go. An hour later, they trailered Robert's 17-foot Boston Whaler *Sarah-Joe*, named after their mother Sarah and father Joe, alongside the old dock at Hana, Hawaii.

By 9:00AM five men had gathered for Sunday's fishing. They were good friends, part-time construction workers, canoe paddlers, and fishermen: Benny Kalama, 38; Peter Hanchett, 31; Ralph Malaiakini (skipper), 27; Scott Mooreman, 27; and Patrick Worsener, 26. Robert Malaiakini would stay behind after checking over the boat.

Young men think they will live forever. Despite fifty years of seafaring between them, and Ralph's experience as a professional fisherman, none took the interruption of the tireless Trade Winds as the hint of a Kona storm—violent winds that occur when cold air punches south from northern latitudes to mix with the warm, moist tropical air.

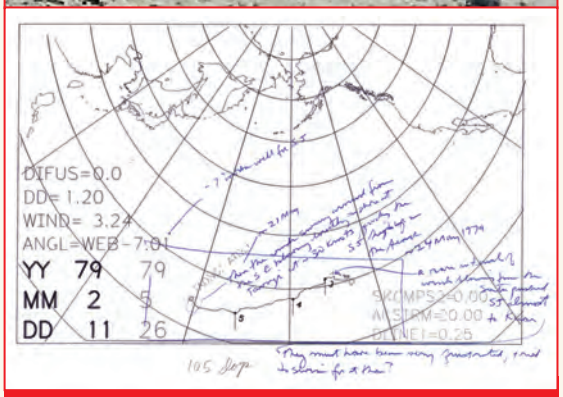
They had to wait a bit—in the rush to get fishing they forgot the beer. Benny's wife, Ulu Helekahi, went to fill the ice chest. Robert, having fished the day before, delayed them further by insisting they change the spark plugs in *Sarah-Joe*'s big, 85-horsepower Johnson outboard engine before heading out. But by 10:00AM they were ready; casting off, the men sped away from the dock across the bright, glassy water.

It wasn't long before they arrived at a favorite fishing hole. Other fishermen heading back to Hana waved from their boats. Not long afterward, the Kona's black, angry squall bore down, moving with an impressive persistence. Sighting the black clouds, they raced for Hana. But a thousand pounds of men and equipment slowed the overloaded *Sarah-Joe* behind three other boats. Even so weighed down, they would have outraced the Kona had the usually-reliable Johnson motor not broken down.

For 15 guilt-ridden years, Robert second-guessed his intuition as to the engine's seaworthiness. It was only in 1995, after a vacation aboard a cruise liner, that Robert brought himself to talk with me of his twin brother.

A couple of miles out from Hana, a CB operator overheard *Sarah-Joe*'s last radio transmission. After the big engine almost got them home, they limped onward with a 15-horsepower trolling motor as the Kona's first squall closed in. When they didn't return with the three other fishing boats, Peter's brother John Hanchett climbed a cliff to scan across Alenuihaha Channel for *Sarah-Joe*.

It's near impossible to sight a small boat in high seas, particularly one without flashlight and flares. A few hours after sunset, risking life and equipment in the strong night winds, two Coast Guard aircraft flew six hours of search-and-rescue patterns over more than a hundred square miles of storm-driven, current-steepened sea—the pilots knowing full well that each passing hour substantially reduced the men's chances.



OSCURS charted the 105-day drift path of the Sarah-Joe from a mile off Maui to Taongi, Marshall Islands. Drift is resolved at one-day intervals. Positions on the first of each month have been highlighted with dots. Note four segments comprise the drift: short segment before month 3 along Hawaiian Islands; months 3-4, slightly longer drifts; months 4-5 little longer drift; and turn at 5 to complete the final segment to Taongi Atoll.

Ulu believes Alenuihaha Channel is like the Bermuda Triangle. It is one of the world's roughest stretches of sea—eddies often swirl currents to the vicinity of the channel, interfering, steepening, and twisting the waves into pyramids of angry water. The University of Hawaii Research Vessel *Holo-Holo* was previously lost in the Channel without a trace; two of my colleagues, Bob Charnell and Pat Laird, along with a dozen others, perished when the *Holo-Holo* disappeared. Decades later, friends still remember them over hoisted steins of beer.

Moved by John Hanchett's and Robert Malaiakini's tenacity in searching for the *Sarah-Joe*, John Naughton of the National Oceanic and Atmospheric Administration suspended the whale survey he was on in order to explore the Channel in his team's NOAA research vessel. Though no immediate progress came of that effort, Naughton's decision to help began a sequence of events destined in the coming decades to intertwine my life with many others.

While the Coast Guard searched for *Sarah-Joe* with planes, computers, and bureaucracy, Hana's citizens searched with their hearts; they knew their men to be good swimmers and ocean men. Immediately after the Coast Guard ceased searching, they intensified their own efforts. After weeks of fervid searches, though, Hana's people felt they had done all they could.

But they didn't stop hoping. "Over the years," said Scott's father Jack Mooreman, "I felt something more was going to happen. I was not surprised that there was something to put a last chapter in the book and to erase the unknowns."

Unsinkable Sarah-Joe

Nine years later, Naughton discovered the *Sarah-Joe* and a fisherman's remains. The Marshall Island government had requested that Naughton, now the Pacific Islands' Environmental Coordinator for NOAA's National Marine Fisheries Service, and a team of archaeologists and biologists investigate seven remote atolls as potential areas for the protection of endangered species.

On September 10, 1988, Naughton arrived off the northernmost Marshall atoll known as Taongi, 2,000 sea miles west of Hana. Like a beacon, the battered white hull of a Boston Whaler rested upright as if floating well above high tide, standing out over the backsides of the purple surf pounding the windward reef of Sibylla atoll of the Taongi group. Stenciled on the coral-chewed hull, the black letters "HA" stirred Naughton's memories. On the gunwale the letter "S" was all that remained of the derelict's name. "For some reason," Naughton said, "I flashed immediately on that Boston Whaler. I remembered that it was a 17-footer and neither hide nor hair had been found." Inspired by his flashback, Naughton recorded the hull's registration, ▶

"HA_4_B," and transom numbers, "38488."

Sixty yards from the hull, near the scrub growth, a Marshallese assistant discovered a jawbone resting atop a coral cairn. Marked with a crude driftwood cross, the stones concealed human remains. Naughton did not disturb the grave, but once back in Hawaii he reported the discovery. Scott Chun, Peter Hanchett's cousin, suspected the jaw belonged to Mooreman because he was the only one of the missing men who wore braces, something the bone evidenced.

Tripler Army Medical Center, renown for identifying the remains of Vietnam MIAs, assigned physical anthropologist Dr. Madeleine J. Hinkes and recovery specialist Randy L. Brown to the case. Five days after Naughton's call, the two pathologists repeatedly traversed Taongi in search of clues while more than twenty members of a Coast Guard team combed Sibylla and outlying atolls for evidence. It was not so simple because winds, currents, and surf had littered the *Sarah-Joe*'s debris amongst other flotsam from the Hawaiian Islands.

The bones had been buried for approximately three years, concluded Dr. Hinkes, placing the grave's origin in 1985. The recovery team determined that the remains were indeed Scott Mooreman's and that he'd been dead when the *Sarah-Joe* washed ashore.

Hana Remembers Her Sons

Though the Coast Guard acted speedily and thoroughly, Dr. Hinkes' conclusion raised nagging questions. If Scott Mooreman's grave was just three years old, and Hawaiian oceanographers estimated that only a year's time or less was required for currents and winds to transport the *Sarah-Joe* from Maui to Taongi, how to account for the six years from 1979-1984? Robert and Ralph's brother Tiny Malaiakini wondered if any of the men might still be alive, somehow, somewhere: "There are thousands of little islands. Anyone could get lost there. We just hoped something more will turn up."

Hana folk agreed. As with the initial search, they raised funds to augment the Coast Guard's efforts. Within eight months of Naughton's discovery, a third expedition to Taongi was assembled, including Hawaii's well-known private investigator Steve Goodenow; Hari Kojima, host of Honolulu's KHON-TV show "Let's Go Fishing"; Robert Malaiakini; and Michael Hanchett.

Near the grave lay fragments of the *Sarah-Joe*. Robert thought the high surf had flipped her onto the outer edge of Sibylla's wide reef. In her last moments, overturned and floating toward the beach, the jagged shoaling coral tore plastic chunks from *Sarah-Joe*'s gunwale while twisting off the heavy Johnson motor. After 2,000 miles adrift, the reef ground the boat and Mooreman's mummified skeleton to pieces; mandible, vertebra, control cables, engine parts, and handrails marked a forensic trail across the reef.

At a low tide Robert and Steve traced the debris field from the shore to the outer reef, careful of the nipping sharks. Despite nine years, the debris trail remained so evident it was obvious that the *Sarah-Joe* still rested close to where the waves smashed her ashore.

As the forensic team de-watered the found *Sarah-Joe*, a clump of human hair washed from the bilge. It was the same color as Mooreman's. From decades of detective experience, Steve knew that as a human decomposes, clumps of hair from the skull are the first parts to come loose from the body. He reasoned that hair had detached from Mooreman's corpse while the boat was adrift, lodging in *Sarah-Joe*'s recesses.

Three searches—Naughton's, Tripler's, and Hana's—uncovered no other bodies on Sibylla, surrounding atolls, or on the reef. Steve found four vertebrae on the reef; Tripler's team identified these four bones as Mooreman's due to a congenital deformity. Steve concluded that as the *Sarah-Joe*'s drift ended, only Mooreman was aboard, mostly skeletonized.

OSCURS Reconstructs

Colonel Harry Bachstein, whom I had sent material about the waterborne Nike sneakers for the Academy of Marine Sciences and Undersea Research newsletter, telephoned me a few days before I was to survey the waters off the Mississippi River delta for another project. The television show "Unsolved Mysteries" had just aired its episode on the *Sarah-Joe*, and Harry asked if I would investigate the still-mysterious drift pattern and the unusual circumstances involved, hoping Jim Ingraham and I could solve that mystery as we had for the Nike shoes, using OSCURS to connect Point A, where the *Sarah-Joe* was last seen, and Point B, where Naughton discovered her.

OSCURS could chart the *Sarah-Joe*'s daily progress between Hana, on the island of Maui, and the Marshall Islands. However, the winds blowing on drifting objects produce greatly varying drift tracks depending on the fraction of the floating object exposed above the waves. Without windage coefficients we could not determine when the *Sarah-Joe* arrived at Taongi, and we knew from experience that a Whaler's drift is sensitive to the winds. The bathtub toys had two to three times the windage as the Nike shoes, and a Boston Whaler might have even more.

The key to OSCURS lay in knowing the drift coefficients derived from identical flotsam. I remembered the success from fishermen spotting hockey gloves halfway through their drift; Jim derived their coefficients, which enabled an accurate overall drift pattern and an amazing arrival on the coast after months of drifting. We needed the coefficients from another Boston Whaler.

That data came via Marine Corps Colonel Bill Monahan, who had helped install Robert's fishpond. Bill remembered a news clipping about a similar Boston Whaler that had drifted to the Philippines along a similar route: On September 28, 1981, Coast Guard reservists rehearsed lifesaving exercises off the Big Island of Hawaii's South Point. As they practiced in the surf, the reservists' 21-foot Whaler somehow escaped with no one aboard. 205 days later, with the key still in the ignition, Filipinos discovered the Whaler in their waters.

The Trades had blown the *Sarah-Joe* some 23 miles per day. For a drifting object like a buoyant boat, the Trade Winds overpower the drag of the underlying currents; they blew the Coast Guard Whaler to the Philippines across the root currents of the Kuroshio current. *Sarah-Joe* could not have drifted around the great North Pacific vortex, because if she had missed all the intervening islands and atolls, the winds would have driven her ashore somewhere in the southern Philippines. Even if she had drifted around Turtle Gyre, it would have required six years, a time in which winter storm waves would have overturned the *Sarah-Joe* many times, washing Scott's corpse overboard.

OSCURS predicted *Sarah-Joe* drifted for 105 days, arriving at Taongi on May 27, 1979. Though Steve and the Hana expedition concluded otherwise, historic drifts suggest Scott Mooreman could have survived to Taongi—Poon Lim survived the Atlantic tropics alone on a raft for 133 days; Maurice and Maralyn Bailey managed 118 days in the tropical eastern North Pacific in two inflatable dinghies; and Steve Callahan lasted 76 days in a rubber raft most of the way across the warmer waters of the North Atlantic. To stay alive, the average human needs to drink at least a fifth of a gallon of water per day; in the tropics it is undoubtedly more. Without water and sun protection, "death from dehydration occurs within ten days, after an almost regular decline in the body's water content," wrote Alain Bombard, the French medical doctor who had drifted 65 days across the tropical Atlantic Ocean in an open raft to demonstrate survival is possible without supplies.

During the first ten days, *Sarah-Joe* drifted southwest of Hana. Every few weeks the tireless

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"Falter rushed home and logged onto Surfline .com, where he could access the remote cameras the website had trained on those big waves. He rewound until he found himself flailing in the water. Though he hadn't known it at the time, the video showed that he was still close to the board as he swam toward the shore. Close, but then not. Eventually the board sailed out the other side of the horseshoe and into the deep ocean.

"The first time Falter ventured out into the infamous Pipeline, he swam with fins, no camera. He wanted to get a feel for it. This was one of the most dangerous spots in surfing. But as Falter went deeper and deeper, into the danger, his internal compass surprised him. The farther out he swam, the calmer he felt. 'Basically, I was conquering fears,' he says.

"Falter's confidence was growing on both fronts. He wanted to capture those surfers on the massive, hazardous waves, and he had the skills to do that—but he also wanted to be them. In 2015, another chance meeting defined his path. He needed a big-wave board, and he bumped into one of the foremost shapers.

"Lyle Carlson had shaped his first board when he was 16, apprenticing for years under a legend of the craft, Dick Brewer, each day the equivalent of a shooting clinic with Michael Jordan. Now 41, Carlson estimates that he's shaped more than 7,000 boards in a quarter-century, spending days or weeks on each, carving the foam and sculpting the slope, every last detail carefully considered.

"Carlson emphasizes: There's not another exact replica in existence of the custom board he made for Falter. Over 10 feet long, 21 inches wide and 3½ inches thick, his creation weighed a hefty thirty-five pounds—'more like a tank,' he says—and bore Carlson's trademark elephant head emblem, one big and one small on each side.

"A pro surfer might buy several of Carlson's boards—in case one breaks, or to counter varied and unpredictable conditions—but for Falter that was never in the cards. $1,200 for materials, $200 for the fins, $100 for the leash.... This is 'like extreme skiing,' says Carlson. 'If you want to do it properly, you have to put a lot of money into it.' The only thing Falter owned that had cost him more was his car, an old Volvo sedan that he snagged for $2,000. That ride never started for him in the rain. But the board he invested in never failed.

"One day in August 2018, a fisherman dropped anchor near a small, egg-shaped island off the southern coast of the Philippines. When he raised his nets, a large, torpedo-shaped object was ensnared with the catch. At first, the fisherman thought he had snagged part of a sunken boat, maybe some buried treasure. Well, some might consider a surfboard treasure. He brought the surfboard home and threw it in his yard, where eventually it caught the eye of the aspiring surfer next door, schoolteacher Giovanne Branzuela. Branzuela saved up and in July 2019 offered to buy it—perhaps he could defibrillate his dream. But fate would have to wait. The fisherman held out—no deal—before finally coming around a year later to ask whether Branzuela was still interested. And just like that, after a small negotiation, the teacher who'd dreamed his whole life of surfing had finally snagged himself a ride, for just $40.

"Realizing it was one of Carlson's, Branzuela got in touch with him. An ocean away, Carlson could not believe the image on his phone—No way, he thought, unable to suppress the deepest of laughter born from cosmic coincidence. The board he saw looked almost exactly like the one Falter had lost in the surf off Waimea Bay. He did a quick search. If it was the same board, this would mean it had traveled something like ... 5,000 miles? Across the Pacific? Intact? Not sinking into the abyss?

"The story of the globetrotting surfboard spread across the world, landed on CNN, and raised some eyebrows. The lumber that washed up in the Philippines has a yellowish hue, not blue, and the elephant logos appear in photos to be spaced apart a bit differently—but Falter chalks this all up to differences in lighting and camera angles. The discoloration can be accounted for by six months spent floating in the Pacific, under a scorching sun.

"Carlson reminds skeptics that no two of his creations are exactly the same. Branzuela's photo of his board's belly, still inscribed near the fins with measurements and Falter's name, erased all doubt—it was indeed the very board that Carlson and Falter had taken to calling 'The Ghost'." ■

Beachcombers' Alert

Quarterly nonprofit newsletter, circulation approximately 400.

Managing editor, Jim White. Newsletter layout: Constellation Design (www.constellationdesign .net). Computer Technical support: Mark Heavy. We take no advertising or institutional funding. Without your subscription, the Alert will cease publication. For a one-year subscription, send your annual donation to Beachcombers' Alert, 6306 21st Ave. NE, Seattle, WA 98115 USA. Make checks payable to B&OIA (Beachcombers and Oceanographers International Association): $25 in the USA; $35 USD elsewhere. Digital subscriptions available at www.flotsametrics.com ($20 USD, payments via PayPal). Printed by Blue Sky Printing, Poulsbo, WA.

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nesting beaches in Japan. Trouble was, Adelita's swim speed, a parameter necessary to run OSCURS, was unknown. She had almost completed her 6,000-mile journey; unfortunately, a net or longline drowned Adelita and prevented us from tracking her homeward-bound journey.

OSCURS revealed Adelita swam and drifted with equal celerity: seven miles per day. Her path was curious—why did Adelita swim her journey in legs? Adelita drifted/swam four segments: ~1 month (8%); 3 months (25%); 3 months (25%); 5 months (42%). They increase in duration from east to west. If they were apportioned into segments of human life (82 years), they would be: 6.6 years; 20.5 years; 20.5 years; 34 years. These are comparable to segments of 5, 11, 22, and 44 years for a human (See future *Alert 100-Issue Summary*).

Ultimately, 14 sea miles per day were added to the tally for Adelita's journey. In one year, she swam and drifted 5,000 miles. The sea turtle thus swims and drifts about equal distances. If the turtle were to have simply drifted between these locations at seven miles per day, the elapsed time would equal two years.

Loggerheads are truly marathon swimmers. Sea turtles are some of the largest turtles in the world and inhabit almost every ocean of the world. Their smooth shells and paddlelike flippers enable them swim across the Pacific Ocean some 5,000 miles. We are dealing with creatures which have superbly adapted their living styles to ocean gyres. They have an overall life objective from start in Mexico to finish in Japan on the other side of the gyre. We too are born of the gyres which have imprinted their character on our lives.

Comparison of sea turtles and gyres invites important questions: Are turtles the only creatures with remembrance of gyres? Is the equality of the specific gravity of sea water being equal to that of people as significant as the equality of the seven miles per drift speed of flotsam to the seven mile per day swim speed of sea turtles? Sea turtles have lifespans comparable with humans. Most marine turtles take decades to mature—between 20 and 30 years—and remain actively reproductive for another ten years, or two orbits of Turtle Gyre. ■

Bechcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

Beachcombers' Alert!™

Non-profit quarterly newsletter
Subscriptions: $25.00 USD per year
Canada & overseas: $35.00 USD per year
Issued January, April, July, October

"May the tides be good to you."

—Paul J. Ebbesmeyer

Jim Ingraham: Galileo of the Gyres

Cubism: An early 20th-century style and movement in art, especially painting, in which perspective with a single viewpoint was abandoned and use was made of simple geometric shapes, interlocking planes, and collage. Finally, Cubism embraced Flotsametrics.

For decades, I worked beside Jim Ingraham without ever realizing his genius. Genius comes in uncountable forms—geniuses in Bohemian form may come to be recognized after they pass on; few are recognized during their lifetimes. Most Surrealist of all was Jim as he fashioned flotsam drift tracks with OSCURS.

Galileo came to mind when I thought of OSCURS revealing the multiple natures of ocean gyres. The Renaissance genius utilized a primitive telescope to discover moons orbiting Jupiter; Jim invented OSCURS and used it to discover segments and fractal chatter orbiting four Pacific Gyres. I was merely the sorcerer's apprentice who brought flotsam to him for transformation into gyral orbital mechanics.

Insignificant flotsam conceals Cubist connotations. *This turtle (top) found tar whereas cohorts came ashore relatively clean. Fractal foam (right): Russ Lewis discovered this spray can of foam which slowly oozed onto Leadbetter Beach under a hot summertime sun. The leak slowly developed as the can rusted. Jim Ingraham photos.*

OSCURS' tracks revealed the orbital periods of four gyres in the North Pacific Ocean: 0.75 years for the Blob; 1.5 years for the Great Garbage Patch; 3 years for Aleut Gyre; and 6 years for Turtle Gyre. These orbits would in future years provide the template for a dozen other gyres covering most of the world ocean. Many a time I asked Jim if he could extend OSCURS to the remainder of the global sea. Though the US Navy provided twice-daily global wind data, Jim had energy enough only for the vast Pacific.

Jim's parent institution, the National Oceanic and Atmospheric Administration (NOAA), tolerated Jim running OSCURS as it applied to fish migration but provided him with meager assistance and no replacement when he retired. I felt lucky to have worked with Jim to develop a gyral model for the remainder of the Floating World. Jim's genius mapped Pacific Gyres which provided a miniature model of the music swirling in the remainder of the seven seas.

OSCURS applied to flotsam reported by beachcombers has revealed the universal natures of the gyres: harmonic, fractal, cubist, and segmental. What more perfect medium for humanity to perfect itself? And moreover, in the company of sea turtles. No wonder sea turtles swim in our deepest nature, explaining our fundamental affinity with the sea. ■

MOOREMAN'S BONES from page 10

Trades depart from their 20-knot regimen of northeast blows, and on the eleventh day they mercifully switched around to blow from the south, pushing the *Sarah-Joe* north for the next three days toward the island of Kauai. Experienced fishermen, they knew that if the south wind held for another few days they would drift close to land, permitting them to possibly swim ashore. For the next 85 days, they drifted southwestward. On Day 102, south winds returned for five days, blowing the *Sarah-Joe* onto Taongi's windward reef. The *Sarah-Joe* had both vanished and returned during interruptions of the Trades, first by Kona northerlies, then by southerlies.

By the time of deliverance, only Scott's bones remained aboard the *Sarah Joe*. The others washed overboard when every few weeks the Trades increased to gale-force intensity—on the 52nd day, for instance, speeds exceeded forty knots.

Some mystery remains about the *Sarah-Joe* incident—if no one aboard was alive when the boat reached Taongi, who built Scott Mooreman's cairn? Could any of the other men have possibly reached shore?—but thanks to OSCURS, at least the boat's path and time adrift are now understood. ■

Beachcombers' Alert!™

APRIL - JUNE 2021 • CELEBRATING 100 ISSUES SINCE 1996

Global Gyre Symphony: seabeans, boats, conch shells, space junk

Drift Odyssey Ends a Decade after the Great Tsunami

A musical note in the gyres' symphony of climate change

On March 11, 2011, the nation of Japan was shaken by a 9.1 magnitude earthquake. Centered 231 miles northeast of Tokyo, the quake—the largest ever recorded in Japan—caused a tsunami with 30-foot waves that devastated the Sendai region and damaged several nuclear reactors in the area. Ten years later, a 31-foot fiberglass boat washed ashore near the town of Long Beach, Washington. The boat "was suspected of having been washed away from Japanese shores during the tsunami and had been adrift since that time," emailed Russ Lewis after a recent beach cleanup along Leadbetter Point, Washington. "There was some Japanese lettering in two locations," Russ continued. "John Chapman, a marine scientist, came up from the Hatfield Marine Science Center in Newport, Oregon, to sample the attached marine species that generally consisted of pelagic gooseneck barnacles, a small number of pink barnacles, and pelagic oysters. The boat was demolished and then hauled to a local landfill."

Left: A Japanese derelict found at Leadbetter Spit, Washington. Right: Barnacles of Japanese origin were discovered on the derelict. Photos courtesy Jim Carlton & John Chapman.

Said Chapman, "It is clearly a Japanese Tsunami Marine Debris (JTMD) boat. There were dead oysters on it and we also found dead plus live *Megabalanus rosa*, a strictly Asian barnacle. There was no scrape or wear that would indicate it was beached and then washed back into the ocean after the initial event. There also were no signs that it had an outboard on it when it was swept away and all the drain ports were open, so it came off the land. It wasn't tied to a float or dock. Finally, there were no identifying plates or marks. I bet it was abandoned in a Japanese boat yard. All signs that it had been drifting for almost exactly ten years when it landed at Long Beach. Very likely, it orbited North Pacific Gyres multiple times."

James T. (Jim) Carlton, Director Emeritus of the Williams College-Mystic Seaport Maritime Studies Program and Founding Editor

DRIFT continues on page 4

Point Nemo: Earth's Great Space Junk Cemetery

This just in from *The Seattle Times* aerospace editor (March 27, 2021): of the 20,000 manmade objects orbiting Earth today, "only 4,000 or so are working satellites, the rest [are] classified as space junk that at some point will reenter Earth's atmosphere." It is tempting to think space junk poses little risk to mariners, but beachcombers do encounter them.

Manon Clarke spotted a titanium ball engraved in Russian on a beach in the Bahamas. The heavy reflective object was poking from the sand as she walked with her family at Harbor Island. "We went to a different spot than usual and I noticed this silver shiny moon-like thing poking

SPACE JUNK continues on page 2

The European Space Agency's Jules Verne Automated Transfer Vehicle breaks up in the Earth's atmosphere on September 29, 2008, above an uninhabited section of the Pacific southwest of Tahiti.

SPACE JUNK from page 1

out the sand," said the 24-year-old British woman. "We could see Russian writing on the side, so we started digging for more of it, which was a bit of a bold move given that we had no idea what it was."

Space experts believe the sphere could be a hydrazine propellant tank for a satellite or spacecraft, though uncertainty remains about where it came from and how it made its way to a Bahamian beach. Unable to move the tank, Manon and her parents returned home to show pictures to their neighbors, realizing it was something significant. "We went back the next day with friends to try to lift it off the beach," Manon continued. "We stupidly forgot shovels, so we had six guys do a lot of digging."

Walking with her family at Harbor Island, Manon Clarke spotted a glistening ball in the sand. Locals discovered Russian text on it saying it had an operating temperature range of -170 to -196 degrees Centigrade, a capacity of 43 liters, and a maximum weight of 41kilograms. Photos: Manon Clarke.

Mark Morabito, Chairman of Virgin Galactic and an astronaut-in-training, said he was "99% certain it is a hydrazine tank from some kind of rocket." The Russian text suggests it may have been constructed in 2018 and noted an operating temperature between -170 and -196 degrees Centigrade, 43-liter capacity, and 41-kilogram maximum weight. Dr. Martin Archer, Stephen Hawking Fellow in Space Physics and Public Engagement at the Department of Physics, Imperial College, London, said: "it is clearly a hydrazine propellant/bladder tank, usually used on uncrewed spacecraft or satellites to squeeze propellant into rocket engines or thrusters." It cannot be determined how or where the tank came from, but Dr. Sarah Hudspith, Associate Professor in Russian at the University of Leeds, said "the object may have originated from Cuba, given that Cuba was an ally of the Soviet Union, from which it obtained all kinds of equipment."

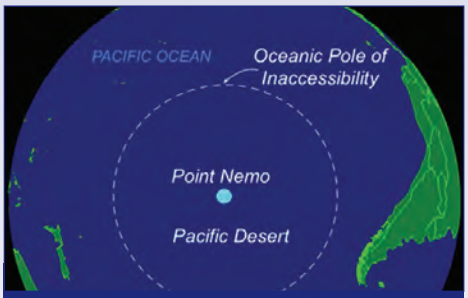
How it ended up in the Bahamas is a mystery, as most satellites or satellite parts that come back to Earth splash down in the South Pacific. "Under controlled circumstances," Dr. Archer pointed out, "operators will usually aim for them to be deorbited and destroyed in the 'spacecraft cemetery' in the uninhabited area of the South Pacific Ocean centered on Point Nemo. But of course, not all satellites enter the atmosphere under such controlled circumstances."

Dr. Archer said that while there isn't much evidence of charring on the tank, it would not have been on the outside of a satellite, suggesting it could have come from a defunct satellite. "But it may also have been a spare part that accidentally wound up in the ocean. It will be almost impossible to determine exactly what journey this tank has been on."

Manon said the unknown adds to the allure: "Thinking about the possible places it could have come from, how long it's been there, how it got there. We live on a small island, so something like this is exciting. Lots of people came to see it, including Dave Stewart from the British band The Eurythmics."

Point Nemo

Within Heyerdahl Gyre in the Pacific Ocean lies a mass grave containing hundreds of discarded carcasses. These often-shattered bodies were once satellites, rockets, space stations, and other spacecraft steered into this remote patch of ocean, dubbed the Spacecraft Cemetery, when they ran out of fuel or were otherwise decommissioned.



Top: Location of Point Nemo within the South Pacific gyre. Bottom: The Russian space station Mir, which deorbited in 2001.

If satellites remained in orbit after being decommissioned, they would pose a hazard to future launches. Since 1971, disused spacecraft have been steered to the spot known as Point Nemo to prevent collisions. "Countries have learned over the years that when they create debris, it presents a risk to their own systems just as it does for everybody else's," aerospace engineer Bill Ailor told *Business Insider Magazine* in 2017. "This debris can stay up there for hundreds of years." Smaller spacecraft will incinerate as they re-enter Earth's atmosphere. But larger objects, like Russia's *Mir* space station, need to carefully descend to avoid crashing into anyone or anything, *Popular Science* wrote in 2016.

When a satellite or an orbiting space station reaches the end of its operational life, there are two ways to retire it. If it has an exceedingly high orbit (geosynchronous satellites), space engineers will steer it into the Graveyard Orbit. That ominous position lies several hundred kilometers above the highest operating satellites, where the probability of colliding with operational spacecraft is nil.

If the satellite is large enough that it might not burn up completely upon reentry, engineers will direct it to the ocean to eliminate risk of injury from falling debris. The chosen place, far from land and shipping lanes, is known to geographers as the "oceanic pole of inaccessibility"—another garbage patch, cousin to the great one in the North Pacific between Hawaii and San Francisco. Dubbed "Point Nemo" after author Jules Verne's famous seafaring anti-hero Captain Nemo, this place is the farthest on Earth from any land mass. The name also means "no-one" in Latin, which is fitting for an ultra-remote place. Point Nemo lies approximately 2,688 kilometers from the three nearest islands—Ducie Island (part of the Pitcairn Islands) in the north, Motu Nui (part of the Easter Islands) in the northeast, and Maher Island (off the coast of Antarctica) in the south. ▶

Beans Echo in Grandpa's Attic

"*Hi Curtis!*" writes Kathy Peavey from the town of Craig, southeast Alaska. "*While attempting to fix a clock that belonged to my grandfather, August Haedecke, I found this detritus. I laughed and picked up the two seabeans and exclaimed aloud, 'Curtis, I have two seabeans!' I was so excited. My hand held two seabeans and an albatross band. I read the note my grandpa wrote saying the pendulum lead was from Midway; it said 'Midway 1968' on it. I now had a date that my grandpa most likely found the band on Midway Island.*

"Grandpa August came from a Minnesota family that immigrated from the town of Aschersleben, Germany. He got his electrical engineering degree and went to work for General Electric, becoming a pioneer in TV manufacturing. My parents met in Japan—my mother was in the Women's Army Corp, my dad was a Fire Chief on base. They were married in 1954. A job opened for him on Midway as the Fire Chief there and he took it. They travelled by ship to Honolulu in 1963 and then made their way to Midway by plane. My mother was pregnant with me and in '63 I was born on Midway. We lived there until '69. Grandma and Grandpa visited my mom in Japan a few years prior and made their way to Midway in '68.

"Fortunately, August bent over to pick up two sea beans and an albatross leg band. I pulled out a shoe box of his clock parts that I've had since 2006. I decided to dump the box out on my table. Dust and more came out as I picked through the parts. I am sure I loudly laughed when I picked up the albatross band. In 2009, I had a chance to be an albatross counter for a month and even got to help band some albatross so I know what an albatross band looks like.

"I read the albatross band. It said 'Advise Fish and Wild life service.' The band number said 597-69992. I went online, typed that in, and the first option that came up was 'www.fws.gov, reporting banded birds.' I was like, NO WAY! I was so excited. I got a funny prompt when I entered the date 6/1/1968. It said something like, 'are you sure? That date is a long time ago.' Ha! The next thing I know I got a reply with a fun certificate and information that the Laysan Albatross was banded on Midway on July14,1959, and was too young to fly. I'm pretty jazzed about having an albatross band myself! If it were not aluminum, I would wear it as a ring!"

From reader Kathy Peavey, two Mucuna seabeans (aka hamburger beans), an albatross band, and clock parts that August Haedecke beachcombed at Midway Island circa 1968. Kathy's beans are a Mucuna sloanei and a Mucuna gigantea. The sloanei seed is the one with the thick, obvious band.

In 2010 Kathy wrote of her visit to Midway: *"I saw a glass float rolling in the surf and ran down the beach to get the beachcombing score of my adult life! YAHOO! A photo shows my son Steven Peavey and me with some flotsam treasures on Sand Island (one of the Midway Group of Islands).*

"No sooner had I returned to Alaska that I beachcombed nearby Port San Antonio and Assumption Beaches. I flipped out because on Midway I kept finding these little round plastic things with a hole in the middle. 'Til now, I've never seen these in Alaska. Well, our beaches have them this year (2009)! I have been beachcombing for 23 years and have never seen them. I also saw that the swatches of plastic debris are like Midway trash. A break of the big garbage patch, I presume. I am so disgusted at the unbelievable amount of plastic drink and chlorine bottles and such on the beaches here, there, and everywhere!"

Added Ed Perry from Melbourne, Florida, "Kathy's beans are a Mucuna sloanei and a Mucuna gigantea. The sloanei is the one with the thick, obvious band." See many other beans in two books: *Sea-Beans from the Tropics: A Collector's Guide to Sea-Beans and Other Tropical Drift on Atlantic Shores* by Edward L. Perry, John V. Dennis, Cathie Katz (Foreword); and *World Guide to Tropical Drift Seeds and Fruits* by Charles R. Gunn, Pamela J. Paradine, John V. Dennis.

Driftography

The seabeans found at Midway pose a drifting dilemma. As far as I know, no sea beans grow at Midway. The closest location would be the Hawaiian Islands. Here I sought the guidance of veteran beachcomber Noni Sanford. Amongst Noni's many emails I found the authoritative tome: *A Revision of Mucuna (Leguminosae: Phaseoleae) in the Pacific,* by C. M. Wilmot-Dear. *(Source: Kew Bulletin, Vol. 45, No. 1 [1990], pp. 1-35; Published by: Springer on behalf of Royal Botanic Gardens, Kew.)*

A summary from Kew Gardens: *"An account of the species of Mucuna A dans. found in the Pacific Islands is offered, with keys and distribution maps. The eleven species, including one considered new, are described. Of these, six and a new variety, M. sloanei Fawcett & Rendle var. persericeaa, re endemic,*

BEANS continues on page 6

◀ Remote from human population, Point Nemo is also largely free of marine life, located as it is in the center of the so-called Southern Pacific Gyre (AKA Heyerdahl Gyre). This rotating current blocks nutrients from coastal waters from reaching the center of the gyre, where Point Nemo lies. This makes Point Nemo and the region around it relatively lifeless—an oceanic desert.

Between 1971 and 2016, Point Nemo received more than 263 recorded space burials. Unmanned cargo resupply vehicles to the International Space Station are routinely brought down here. Eventually, the International Space Station will be drowned in Point Nemo's remoteness when the Station's life ends. Its proposed retirement date is 2028.

On March 23, 2001, Point Nemo's largest burial took place when the 135-ton Russian space station *Mir* splashed down after 15 years of service. During deorbit, *Mir* hit the atmosphere at an altitude of 100 kilometers. Rushing air tore off some of *Mir*'s external elements such as solar panels; when *Mir* fragmented at 90 kilometers, glowing plasma showed in the evening sky from Fiji. By the time *Mir* crashed, 20-25 tons of the space station remained in a trail of debris measuring 1,500 × 100 kilometers. ■

DRIFT from page 1

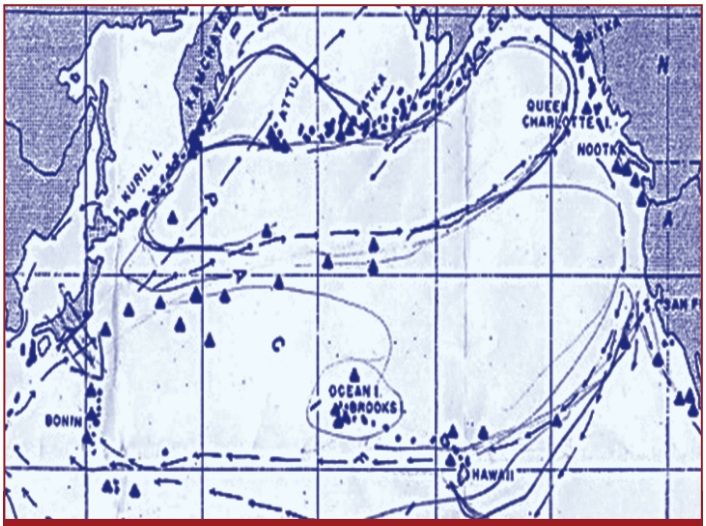
of *Biological Invasions*, emailed to say, "We have registered about 170 derelict vessels that we believe are likely linked to the March 2011 tsunami—these have been found at sea or have landed in North America (Alaska to California) and in the Hawaiian Islands (out to Midway)."

In 2009, in our book *Flotsametrics and the Floating World*, coauthor Eric Scigliano and I wrote of derelict vessels which drifted from Japan across the North Pacific Ocean. Forty years earlier (1965), Betty Meggers, eminent anthropologist at the Smithsonian Institution, published an inspiring account in *Scientific American* of Japanese derelicts which six thousand years ago drifted from Japan across the North Pacific Ocean to Ecuador, South America. The impetus to this migration was one of the great cataclysms of humankind's time on earth.

Few spots on earth are as prone to natural catastrophe as Japan, an island nation floating at the intersection of three tectonic plates: Pacific, Eurasian, and Philippine. The slow but violent collision of these plates produces spectacular earthquakes, tsunamis, and volcanic eruptions. In 4350 BC, the Akahoya eruption of the Kikai volcano ejected three times more material than the most powerful recorded volcanic eruption (Mt. Tambora, Indonesia, in 1815). Kikai, a flyspeck island off southern Kyushu, exploded with a force that dwarfs more famous volcanoes that have since erupted around the world. The standard scale of volcano force, the Volcanic Explosivity Index (VEI), runs from 1 to 8; Kikai weighed in at VEI 7, just below the mega-eruptions that cause ice ages and mass extinctions. It ejected 24 cubic miles of dirt, rock, and dust into the air—about nine times as much as Krakatoa in 1883, 24 times as much as Mount St. Helens in 1980, and 40 times as much as the eruption of Vesuvius in AD 79 that destroyed Pompeii and Herculaneum.

Massive tsunamis triggered by the Akahoya eruption obliterated coastal towns. The volcanic spew was enough to blanket up to 18 million square miles of land and sea. Dust and ash several meters thick smothered the fertile soil, rendering southern Japan uninhabitable for two centuries. Unable to raise crops, the indigenous Jomon people set out for other shores. And that was where a second mighty natural phenomenon came into play.

The Kuroshio ("black current," named after its dark color as it appears on the horizon as seen from the shore) is the Pacific Ocean's answer to the Atlantic Gulf Stream. More than 2,200 years ago, the Chinese called the Kuroshio by the prescient name Wei-Lu, the current to "a world in the east from which no man has ever returned."



The triangles outline Turtle Gyre (6-year orbit) and Aleut Gyre (3-year orbit) sketched by George Davidson. The triangle at the mouth of the Columbia River notes where three Japanese drift survivors were brought to Fort Vancouver in 1834; they would later play a role in Commodore Perry's efforts to open Japan to the outside world. On July 8, 1853, Perry led four ships into Tokyo Bay, seeking to re-establish for the first time in over 200 years regular trade and discourse between Japan and the West.

Surging north from Taiwan, bulging with warm tropic water, it arcs past Japan and southeast Alaska and down the Northwest coast. At the same time, cool, powerful offshore winds, the equivalent of Atlantic America's icy blasts, race down from Siberia to the southeast, pushing boats and other flotsam out into the Kuroshio. Islanders fleeing the volcano's effects, in what Betty Meggers called the Jomon Exodus, were driven into the Kuroshio. So were fishermen blocked from returning home by the sea-blanketing pumice. And the black current bore them toward America—surely not the first and far from the last unwitting emissaries to make that journey.

The names applied to drifting ships along the Pacific and the Atlantic hint at deeper cultural differences. Europeans call them "derelicts," vessels abandoned when their crews take to the longboats. But Asians view them differently. The Japanese use the word *hyōryū* for a marine mishap in which a vessel, the *hyōryū-sen*, loses control and drifts without command. Traditionally its crew and passengers—*hyōryū-nin*, or "drifting people"—would stay aboard, awaiting their fate.

In half of known *hyōryū*, at least some *hyōryū-nin* survived to reach land. And some of those dramatically affected the societies they beached upon. Around 1260 AD, a junk drifted nearly to North America until the California Current caught it and sent it into the westbound trade winds, which deposited it near Wailuku, Maui. Six centuries later, the oral history of the event had passed down to King David Kalakaua, Hawaii's last reigning monarch. Five passengers on the junk survived, including two women. They married well on the islands; one wed the powerful chief Wakalana, beginning extensive family lines on Maui and Oahu.

That was just the first accidental Japanese mission to Hawaii. By 1650, according to John Stokes, curator of Honolulu's Bishop Museum, four more vessels had drifted there. Their crews also married into the nobility and, Stokes concluded, injected many new influences into Hawaiian society: "Hawaiian native culture, while basically Polynesian, included many features not found elsewhere in Polynesia."

Japanese influence likewise spread in mainland North America. Archaeological digs occasionally unearth traces: iron (which native Americans did not smelt) discovered in a village buried by an ancient mudslide near Lake Ozette, Washington; arrowheads hewn from Asian pottery discovered on Oregon's coast; and possibly the 5,000-year-old Japanese pottery shards in Ecuador. Just as Betty Meggers found unique artifacts, viruses, and DNA markers in Ecuador subjects, the anthropologist Nancy Yaws Davis found tell- ▶

Beachcombers' Alert

Quarterly nonprofit newsletter, circulation approximately 400.

Managing editor, Jim White. Newsletter layout: Constellation Design (www.constellationdesign.net). Computer Technical support: Mark Heavy. We take no advertising or institutional funding. Without your subscription, the Alert will cease publication. For a one-year subscription, send your annual donation to Beachcombers' Alert, 6306 21st Ave. NE, Seattle, WA 98115 USA. Make checks payable to B&OIA (Beachcombers and Oceanographers International Association): $25 in the USA; $30 USD elsewhere. Digital subscriptions available at www.flotsametrics.com ($20 USD, payments via PayPal). Printed by Blue Sky Printing, Poulsbo, WA.

tales of the Japanese in the Zuni of northern New Mexico, distinct from all the other Pueblo peoples. Davis concluded that Japanese landed in California in the fourteenth century and trekked inland to help found the present-day Zuni Nation.

University of Washington anthropologist George Quimby estimated some 187 junks drifted from Japan to the Americas between CE 500 and 1750, a number remarkably similar to the 170 vessels that washed ashore after the great Japanese tsunami of 2011.

The number of drifts increased dramatically after 1603—thanks, ironically, to the efforts of a xenophobic regime to keep foreign influences out of Japan and the Japanese in. In that year, the Tokugawa *shogun*, who had united the nation after years of civil war, closed Japan to the outside world except for restricted trade through the port of Nagasaki. Western ships and castaways were to be repelled. Missionaries and other foreigners who entered were to be killed—as were Japanese who left and tried to return. To ensure that Japanese mariners remained in coastal waters, the *shoguns* dictated that their boats have large rudders designed to snap in high seas. Vessels blown offshore were helpless; to avoid capsizing, crews would cut down their main masts and then drift, rudderless and unrigged, across the ocean.

Politics conspired with geography, weather, and ocean currents to set this slow-motion, accidental armada adrift. Over the centuries the *shoguns*' center of power settled in Edo (now Tokyo). They demanded annual tributes of rice and other crops, ceramics, and sundry goods. Japan's mountainous terrain made land transport impossible; each fall and winter, after the harvest, tribute-laden vessels sailed from Osaka and the other cities of the populous south up the outer coast to Edo. They had to cross the exposed deep-water reach called *Enshu-nada*, the infamous Bay of Bad Water, often when storms blew down from Siberia—the same weather pattern that rakes Labrador and Greenland and that drove kayaks across the Atlantic. Of 90 drifting vessels documented by the Japanese expert Arakawa Hidetoshi, storms blew 68% out into the Kuroshio during the four months from October to January.

To see where the *hyōryū-nin* drifted, the girls of the Natural Science Club in Choshi, Japan, threw 750 bottles into the Kuroshio in October of 1984 and '85. By 1998, beachcombers had recovered 49: seven along North America, nine in the Hawaiian Islands, thirteen in the Philippines, and sixteen in the vicinity of Japan—percentages remarkably like those of the known *hyōryū*. A few drifted back onto the Russian peninsula of Kamchatka, just north of Japan. (Kamchatkans had adopted the slang term *dembei* for bobbing castaways, after a Japanese fisherman named Dembei whose junk drifted there in 1697, the first known contact between Japanese and Russians.)

Above: Daguerreotype of Ranald MacDonald circa 1853. His broad shoulders reflect great natural strength, most famously demonstrated when he defeated Australia's heavyweight boxing champion.
Below: Headstone at Ranald MacDonald's grave in Ferry County, WA.

Shortly after the publication of *Flotsametrics*, Betty Meggers and I began a long friendship at a series of meetings at Sitka known as Pathways across the Pacific, hosted by Nancy Yaw Davis. Nancy asked if I would co-convene a small group of scientists to explore Betty's idea that some Japanese survived transpacific drift journeys. Betty had become convinced by comparing pottery shards in Japan and Ecuador that some had landed at Valdivia, Ecuador. From the work of Charles Wolcott Brooks, I had learned of Japanese who had survived epic voyages to Alaska and Washington state. As to the effect of survivors on indigenous peoples, I became obsessed with Ranald MacDonald, who I thought proved pivotal in fostering the reopening of Japan to Commodore Matthew Perry in 1848.

In the spring of 1834, three shipwrecked Japanese sailors were brought to Fort Vancouver. MacDonald's father was Archibald MacDonald, a Scottish fur trader for Hudson's Bay Company, and his mother was Koale'xoa ("Raven" or "Princess Sunday"), a Chinook, daughter of Comcomly, a leader of the "Lower Chinook" people that lived near the present-day city of Ilwaco, Washington. MacDonald had become inspired by a Japanese drifter and decided to strand himself in Japan. In his autobiography, MacDonald explained it: *"My plan was to present myself as a castaway … and to rely on their humanity. My purpose was to learn of them; and, if occasion should offer, to instruct them of us."* While jailed for the brilliant attempt, he taught his jailers English, which helped enable Perry's successful negotiations to reopen Japan.

Over the years, I visited several locations where Brooks showed derelicts had come ashore. At Sitka, several Japanese survived and were sequestered there. At Cape Flattery, I spent time at the Makah Reservation near where three Japanese survivors landed. At Fort Vancouver and the town of Astoria at the Columbia River mouth, I visited monuments dedicated to Ranald MacDonald. I became convinced that Japanese sea drifters influenced the course of human history around the Pacific.

In the larger picture, hundreds of derelicts orbited the great gyres in the North Atlantic and Pacific Oceans. I saw in them the music of the gyres with harmonics or orbital periods: 6, 3, 1.5, and 0.75 years. The present derelict is but a note in the great orchestral fugue being played out as climate rapidly changes under man's industrial onslaught. My prayer is that people will feel the gyres' orchestral music in time for humanity to save itself. I often find myself praying in the wee hours the words said as Jesus was crucified (from Luke 23:34): "Father, forgive them, for they know not what they are doing." ■

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each being restricted to a small part of the region; three of the remainder are also found in Papua New Guinea, one of these extending to Indonesia; a further one occurs in South America while only one, M. gigantea, is more widespread. In addition, four non-native species frequently or occasionally cultivated are mentioned and included in the keys. A further species, M. albertisiiF. Muell., hitherto considered as endemic to Papua New Guinea, is reduced to synonymy under M. platyphylla."

At Kamilo Beach, near South Point of the Big Island of Hawaii, Noni frequently beachcombs mucuna seabeans. "I am pretty sure that they grow on Kauai," Noni emailed on March 11, 2021. "They seem to grow on the Big Island though I do not know where. While hiking I have seen hamburger beans growing on Oahu, Maui, and Hawaii islands."

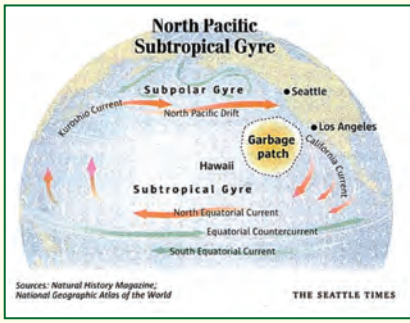
Midway Islands is a 2.4-square-mile atoll in the Pacific Ocean at 28°12′N 177°21′W, an unorganized, unincorporated territory of the United States. Roughly equidistant between North America and Asia, Midway is the only area of the Hawaiian archipelago that is not part of the state of Hawaii, instead grouped as one of the United States Minor Outlying Islands. Unlike the other Hawaiian Islands, Midway observes Samoa Time (UTC−11:00), which is one hour behind the time in the state of Hawaii. The Midway Atoll National Wildlife Refuge, encompassing 590,992 acres of land and water in the surrounding area, is administered by the United States Fish and Wildlife Service (FWS). The refuge and most of its surrounding area are part of the larger Papahānaumokuākea Marine National Monument.

During 1941-1993, the Naval Air Facility based at Midway Island played a crucial role in the Battle of Midway (June 4-6, 1942). Aircraft based at Henderson Field on Eastern Island joined with U.S. Navy ships and planes in an attack on a Japanese battle group that sank four carriers and one heavy cruiser while defending the atoll from invasion. The battle was a major turning point of the Pacific campaign of World War II.

Approximately 100-200 people live on the atoll, including staff of the U.S. Fish and Wildlife Service and contract workers. The tourism program has been suspended due to budget cutbacks, so visitation to Midway is possible only for business reasons. In 2012, the last year that the visitor program was in operation, 332 people made the trip to Midway. Tours focused on the atoll's unique ecology as well as its military history. Nearly all supplies must be brought in by ship or plane, though a hydroponic greenhouse and garden supply some fresh fruits and vegetables.

Here's what I wrote in the *Beachcombers Alert* circa 1998. I hope beachcombers will report further seabeans.

Pacific Seabeans. Ruth Smith strung necklaces from seeds, many of which drift as seabeans. Who'd suspect sea seeds would find their way into jewelry? More than 100 species of the 250,000 seed-producing plants launch seeds that cross the sea. It takes a hardy seed to stay afloat the necessary years; not surprisingly, those that do possess rock-hard exteriors. So hard, in fact, that many take on lustrous shines in rock polishing machines.



Tropical forests produce these wondrous seeds. Heavy rains wash many to sea, including 20-plus species which float from the Americas to Europe. Records of transatlantic drifts date from 1570, but transpacific crossings remained unreported till 1970, when the beachcombing cook Euell Gibbons (of *Stalking The Wild...* fame) wrote of tropical almonds washed up in Oregon (Terminalia catappa).

In their classic book *World Guide to Tropical Drift Seeds And Fruits* (Quadrangle, 1976), Bob Gunn and John Dennis judged that a goodly fraction of the transatlantic seed species should also cross the North Pacific. To encourage West Coast beachcombers, they wrote: "Other disseminules should be sought on beaches of the Pacific coast of North America. A lengthy route is involved by way of the Kuroshio [off Japan], North Pacific, and California Currents. But judging from the numbers of sturdy drifters that reach northern coasts of Europe, there should be others besides the country [tropical] almond that make this journey."

World Guide inspired me to display transatlantic seeds at West Coast beachcomber fairs. Beginning in 1995, with polished specimens generously provided by Cathie Katz, I laid out the sea beads at fair booths while describing them to passersby. Trouble is, along the rocky beaches of Oregon and Washington, the unpolished seeds resemble pebbles and cobbles. Even on sandy beaches where they strand, from a distance the tropical wanderers look like most other rounded rocks. After a couple of years, beachcombers began coming up to me at fairs, saying "Is this what you are looking for?" And they were!

While digging for agates, Rob Hannigen found a sea coconut and a hamburger bean. A thorough beachcomber who had specialized in Japanese glass fishing floats, Rob didn't know exactly what the seeds were, but still kept the specimens since the 1970s. At the same fair Laurie Rust showed me two sea coconuts she'd found during June 1987-'89 at Neah Bay, Washington.

During the 36th annual Driftwood Show, held at Grayland along Washington's cranberry coast, Alex Gallagher recognized a display seed as a sea marble (alias nickernut), and P. Lambert recalled finding a sea heart. A month later, screenwriter Grant Wood reported three species he'd found at Cannon Beach, Oregon: Lithocarpus megacarpus, resembling a miniature urn; Dioclea reflexa (aka sea purse), looking like the capital letter D; and Terminalia catappa (aka sea almond).

There the tally rested for decades, standing at thirteen specimens of eight transpacific drifting seeds. Bob and John's prediction had borne out. The finds represent about half the species that probably cross the Pacific. The West Coast is not the seabean wasteland many once thought—many more must be lying there. In the decades since 1998, Ed Perry continued pioneering tank flotation tests he began with John Dennis finding that a handful of species remained afloat for decades.

Given that the gyres in the North Pacific Ocean contain orbits of 0.75, 1.5, 3, and 6 years, decades of flotation allow plenty of time for ocean currents to swirl seabeans most anywhere in the North Pacific Ocean. I hope someday Kew Gardens will update its brilliant work.

Seek, and ye shall find (Matthew 7:7). ■

Music Played in a Cave on a Conch 18,000 Years Ago

Imagine a prehistoric musician playing a conch seashell in a cave 18,000 years ago. Through smoky candlelight, penetrating sounds pierce inky darkness. Via Google, I found a provocative article entitled *"Award-Winning Conch Shell Music Maker, Jayne Challman of Rehoboth Beach, Teaches Us How to Play the Conch."* Additionally, Noni Sanford, from the town of Volcano near the southern tip of Hawaii's Big Island, mailed me a news clipping concerning Paleolithic conch shell music.

Conch denotes medium- to large-sized sea snails, the shells of which come to a point at both ends. In the French Pyrenees, archeologists discovered a singular specimen during a 1931 excavation of a cave adorned with prehistoric wall paintings. When it was found at the cave's entrance by H. Bégouën and J. T. Russell, the object was described to have no trace of human intervention. However, new technology has revealed human modifications that lead scientists to view the conch as a seashell musical instrument from the Paleolithic Age.

Using various dating techniques, researchers estimate the conch's age at 18,000 years. Conch shells are known to have been used widely in musical and ceremonial traditions in ancient Greece, Japan, India, and Peru. A conch shell instrument found in Syria had been dated to 6,000 years old, said Toulouse archaeologist Gilles Tosello.

Depending on the culture, conchs have served as musical instruments, calling or signaling devices, and sacred or magical objects in Oceania, New Zealand, Europe, India, Tibet, Japan, Indochina, and New Guinea. The oldest known conchs in the Mediterranean originate from Ancient Greece. The Marsoulas Conch is unique in the prehistoric context, not only in France but also of Paleolithic Europe.

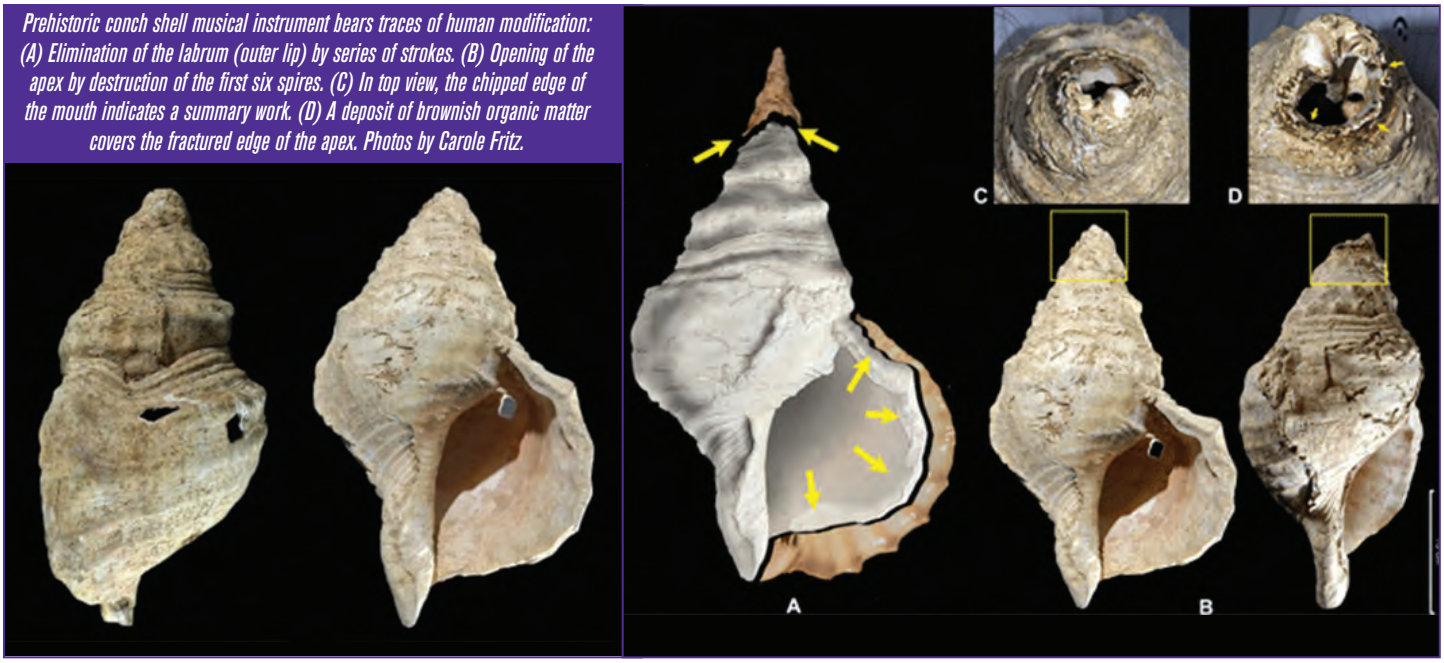
Artifacts link the inhabitants of Marsoulas Cave and the Atlantic Coast. In the osseous industry, there is a spear point fragment made from a cetacean bone, and, among the shells, the Atlantic origin of two *Capulus ungaricus* specimens (bonnet shell, a species of medium-sized sea snail, a marine gastropod mollusk in the family Capulidae, the cap snails), perforated by abrasion and found in the same layer as the *Charonia lampas*. Furthermore, the presence of a rock crystal tool in this excavated layer provides a link with the stratigraphy inside the cave, as the other rock crystal tools originate from the layer with Lussac-Angles spear points. These spear points are characteristic of limited distribution and are chrono-culturally constrained to a few sites to a specific time (early or early-middle Magdalenian, which is consistent with new dates reported for Marsoulas Cave).

The shell is a large specimen of *Charonia lampas* (Linnaeus, 1758), a mollusk originating from the Northeast Atlantic and the North Sea. Today, it can be found in Ireland and France (Brittany, Pas-de-Calais) at its northern limit. Although rare, it is still living in the Bay of Biscay and the Basque and Spain's Asturian coasts. This animal inhabits rocky bottoms, sometimes interspersed with sandy spaces up to 80 meters deep. *Charonia* also exist in the Mediterranean Sea, but these specimens are smaller and thinner. Its size (18×31 centimeters) and its robustness, especially the thickness of the shell—reaching 0.8 centimeters—argue adaptation to temperate/cold water conditions.

Anthropologists and ethno-musicologists believe no society exists without song, and there is no ritual or celebration without accompanying sound. The production of sounds in social contexts is very ancient. It is one of the rare examples, if not the only one for the Paleolithic period, of a musical instrument fashioned from a large shell, and the first conch shell of this use thus far discovered. This seashell horn, with deep and strong sonority, sheds light on a musical dimension previously unknown in Upper Paleolithic societies.

Researchers noticed unusual holes in the conch. The shell's tip was broken off, creating an opening large enough to blow through. Microscopic inspection revealed the opening was the result of deliberate craftsmanship, not accidental wear. By inserting a tiny medical camera, they found that another hole had been carefully drilled in the shell's inner chamber. They also detected traces of red pigment on the mouth of the conch, matching a decorative pattern found on the wall of

MUSIC continues on page 8



Prehistoric conch shell musical instrument bears traces of human modification: (A) Elimination of the labrum (outer lip) by series of strokes. (B) Opening of the apex by destruction of the first six spires. (C) In top view, the chipped edge of the mouth indicates a summary work. (D) A deposit of brownish organic matter covers the fractured edge of the apex. Photos by Carole Fritz.

Bechcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

Beachcombers' Alert!™

Non-profit quarterly newsletter
Subscriptions: $25.00 US per year
Canada & overseas: $30.00 US per year
Issued January, April, July, October

"May the tides be good to you."
—Paul J. Ebbesmeyer

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Marsoulas Cave. "This is classic, really solid archaeology," said Margaret Conkey, an archaeologist at the University of California, Berkeley. "This discovery reminds us that Paleolithic lives were richer and more complex than just stone tools and big game."

Detailed analysis of the *Charonia* revealed numerous traces suggesting considerable transformations to enable the conch to be blown. To describe them, researchers digitized the shell via photogrammetry of surface images to highlight the least visible pigments. Furthermore, computed tomography scans provided a detailed visualization of the shell's interiors. Ancient musicians intensively transformed the apex, its conch's most solid part. The extreme robusticity of the apex of Charonia shells and the organization of the impacts excluded any possibility of accidental fracture due to crashing waves while the shell was in the sea.

A modern horn player found the conch still worked, producing a deep, plaintive bleat that sounded like a foghorn from the past. To explore hypotheses, scientists organized an experimental session at the PETRA platform (Maison des Sciences de l'Homme de Toulouse, France) to record sounds it can produce today. The seashell was entrusted to a musicologist and horn player specializing in wind instruments. The mouthpiece was protected to blow into the retouched extremity of the apex. To play the shell, the musician vibrated his lips as one would to play a trumpet or trombone. Several high-quality notes were produced corresponding to the conch's natural resonances. The lowest note is close to C and the two others close to a C-sharp and a D, equaling a halftone.

During the experiments, the musician remarked that the apex in its current chipped form was not functional because it could injure the lips of the user. He thought an intermediary tube was probably necessary to remedy this problem and proposed that a mouthpiece was present when it was originally used. "Hearing it for the first time, for me it was a big emotion—and a big stress," said archaeologist Carole Fritz. She feared that playing the foot-long shell might damage it; fortunately, it did not.

Marsoulas Cave is not located near an ocean, suggesting prehistoric people must have either moved around or used trading networks to obtain the shell. "What makes conch shells so interesting is that the spiral cavity formed by nature is perfectly adept at resonating musically," said Rasoul Morteza, a composer in Montréal who has studied conch shell acoustics. Using a 3D replica, archaeologists plan to continue studying the conch's range of notes. Tosello said he hopes to hear the ancient instrument played inside the cave where it was found.

Traces of colors and engravings attest to a decoration of the seashell horn. Red pigment remains are still visible to the naked eye; these are dispersed on the external part of the shell and the columella. An enhanced image obtained by the decorrelation stretching technique shows that juxtaposed red dots of a size and shape compatible with fingerprints covered the internal surface of the shell up to the lip. The dots are associated with lines of the same color. These marks are like motifs present on the walls of the cave (bison covered with a layer of dots, a large sign associating dots and red lines). X-ray fluorescence spectrometry was carried out to characterize this color.

This extraordinary archaeological artifact is multifaceted. It is a musical instrument, a decorated prestige object, and a symbol of the ocean and long-distance contacts on the Atlantic coast and Cantabria, Spain. The role of the coastal environment in Paleolithic societies is still poorly known. Some Magdalenian groups obtained osseous materials from the coast to make tools and portable art objects [e.g., sperm whale tooth at Le Mas d'Azil (Ariège France) and Las Caldas (Asturias, Spain)]. The music was probably important symbolism during the Upper Paleolithic period. However, few musical instruments have been preserved and discovered: flutes, whistles, and bullroarer are attested in deposits of this period.

This is the first symbolic link between cave paintings and a musical instrument. As with art, music is a product of social interactions. The strong link between image and sound certainly had a social function, which assumed importance in social practices and rituals. More than the meaning of the image, Paleolithic sound remains a difficult interpretative field based only on archaeological artifacts.

Sources: Adapted from Christina Larson (Associated Press) February 10, 2021. First record of the sound produced by the oldest Upper Paleolithic seashell horn. Science Advances, February 10, 2021. D. S. Adler, The earliest musical tradition. Nature 460, 695–696 (2009). ■

Beachcombers' Alert!™

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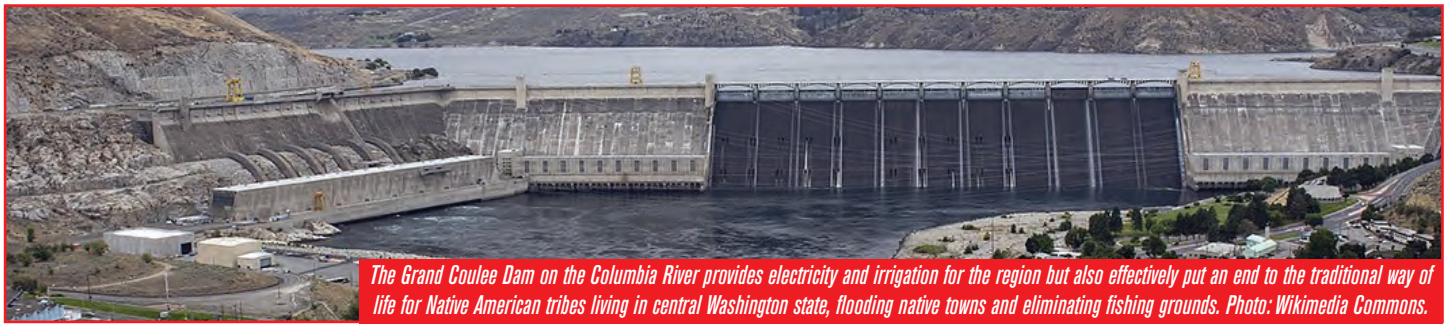
Global Tsunamis: Shoes, Nurdles, Containers

Roll on Columbia



The Grand Coulee Dam on the Columbia River provides electricity and irrigation for the region but also effectively put an end to the traditional way of life for Native American tribes living in central Washington state, flooding native towns and eliminating fishing grounds. Photo: Wikimedia Commons.

During the past 50 years, engineers constructed behemoth facilities outsized for the ocean: containerships, oil production platforms, sewage treatment plants, and river reservoirs to name a few. Over time, many of these constructs have become problematic—society itself has become "too big for its britches."

When I arrived in the Puget Sound region as an oceanographer in 1966, I discovered raw sewage flowing into Lake Washington. Outraged voters then authorized the government to construct concrete sewage treatment plants (STPs) to divert their waste. As sanitarians progressed in the 1970s, my mentor Clifford A. Barnes and I discovered the Sound itself behaved like a lake, as if it were a closed water body. Nevertheless, engineers continued their 50-year plan to construct three enormous STPs for south, central, and north Seattle. By 2010 the population had surged, calling for sewage discharge into the Sound to be stopped. (Other US urban centers, such as Orlando, FL, and Arcata, CA, divert outfalls into lagoons, where natural ecosystems complete the sewage processing.) Earth as GAIA, the living creature, sensing her predicament, is reducing human populations.

Wind on the Columbia: To produce the massive quantities of aluminum necessary for Boeing's World War II bombers, hydraulic engineers harnessed electricity from 201 reservoirs in the Columbia River Basin. Wendell Tangborn and I computed that the water which once flooded the Columbia during spring and summer had now been stored to produce electricity for use during winter months. The Columbia's heartbeat had thus been flatlined.

Over the years, I worked with Cliff Barnes (1905-1995) to understand the fate of radionuclides from the Hanford, WA, nuclear facilities. He hired Betty Ann Morse to release tens of thousands of seabed drifters; meanwhile, Wayne V. Burt (1917-1991) released thousands of drift bottles. Bottles and daisies danced on the continental shelf from the mouth of the Columbia River north into the Strait of Juan de Fuca and Puget Sound.

As the decades passed, vocalist Rich Hinrichsen and I toured Columbia dams singing Woody Guthrie ballads "Roll on Columbia." With each passing road trip, the dams looked evermore antiquated. On my visit to the Wild Horse wind farm, a facility along the river in central Washington state, I estimated that by the year 2033 wind turbines would produce total electricity equivalent to all the Columbia dam generators.

Sources: *The Wild Horse Wind and Solar Facility and Renewable Energy Center is located 16 miles east of Ellensburg, WA. Read the research by Curt Ebbesmeyer, Rich Hinrichsen, and Wendell Tangborn (please Google them). Drift bottle observations of the Davidson Current by Wayne Burt and Bruce Wyatt, 1964. Studies on Oceanography dedicated to Professor Hidaka in Commemoration of his 60th Birthday. Columbia River Ballads, songs folksinger Woody Guthrie wrote during his visit to the states of Oregon and Washington in 1941. B.A. Morse, M.G. Gross, and C.A. Barnes, 1968. Movement of seabed drifters near the Columbia River, Am. Soc. Civil Eng., J. Waterways Harbors Div.*

Nurdling India

Sri Lanka is a large island at the southern tip of India along a major shipping route across the northern Indian Ocean. Over the centuries, Sri Lanka acquired many nicknames, inlcuding Serendib, Ceylon, Teardrop of India, Resplendent Isle, Island of Dharma, and Pearl of the Indian Ocean. On May 20, 2021, a fire raged off the Teardrop coast for 12 days aboard the cargo ship *X-Press Pearl,* sending tons of plastic from 1,486 containers onto nearby beaches. Several tons of pellets washed up, probably the worst beach pollution in Sri Lankan history.

Nurdles, also known as "pre-production pellets," are small granules of plastic resin about the size of a lentil that serve as raw material for manufacturing plastic products. These lightweight pellets are also a major source of microplastic pollution. The ship was transporting 78 metric tons of nurdles, equivalent to 390 million pellets; theoretically, each 40-foot container holds 67 million nurdles.

"This is one of the worst marine disasters that has happened in Sri Lanka," said marine biologist Dr. Asha de Vos. "When I first saw this several days ago, pellets covered the beach. They looked

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Condeep Cathedrals

Infrastructure resonates with my childhood—containerships, Condeeps, bigfoot, sewage treatment plants, dams, pyramids, nuclear power plants. When I was a little tyke, I realized concrete dominated my life. With 14,000 concrete blocks, my dad fenced my half-acre backyard with a block wall a thousand feet long. I played in the Los Angeles River lined with concrete. At 10, I dug a hole and lined it with 16 cubic yards of concrete I'd mixed by hand. The workshop is still there, outlasting the Condeeps, dams, and me.

In mechanical and nuclear engineering classes, I studied the compressive strength of concrete. I crushed concrete cylinders mixed with sand, gravel, and Portland cement. Little did I know that in a few short years, salt water would add dimensions to engineering in ways beyond my fertile imagination. I had worked with wood and steel servicing antiquated wells in Bakersfield, an hour's drive north of LA; in a few years I'd add concrete dams in giant river reservoirs, cooling towers for nuclear power plants, giant digesters in sewage treatment plants, and revolutionary structures known as Condeeps that are some of the largest structures ever built on Earth.

When Susie and I visited Rome to attend a conference on human remains adrift on the sea, the cement between the bricks of the Colosseum attracted the engineer in me. Concrete was invented by the Romans. It was cheap, quick to mix, and easy to use. To mix it, the Romans dropped pieces of rubble into sticky mortar made of lime (a powder of burned chalk or limestone), water, and pozzolana (a volcanic ash). The mortar hardened as it dried, holding the concrete together. Rubble gave concrete its strength.

I had begun professional engineering work on one of the oldest and biggest oil fields in America: Southern California's Kern River fields. In six months' training to be an engineer as a roughneck, I repaired wooden and steel derricks. Bill Clauser, my boss and mentor, made sure I gained experience in the immense oil fields, the largest in John D. Rockefeller's Standard Oil empire that operated giant refineries near San Francisco and my birthplace at El Segundo.

Bill boosted oil production using high pressure steam, thereby rejuvenating Bakersfield's antiquated oil fields. Though Standard Oil New York employed tens of thousands, it relied on the leadership of a few. Out West Bill Clauser guided John D's greatest oil production, and in New York he relied on his illustrious offshore engineer Frank Manning. (When I quit Mobil to pursue oceanography, Bill kept is eye on me and my environmental reports on Alaska and took me to scout the Trans Alaska Pipeline.)

The Troll A Condeep in Norway. Constructed with 43,000 cubic meters of concrete, Troll A is the last such structure ever built and the tallest structure of any kind (472 meters) to be moved from one place to another by humans. This photo was taken after construction and before it was towed approximately 200 kilometers to its deepwater destination.

The year 1969 proved pivotal for Susie and me. I became Mobil's first oceanographer, man first set foot on the Moon, and our second daughter Wendy entered our lives. We moved from Seattle to New York City as the first ideas using concrete for oil extraction were launched and a concrete floatable platform support was introduced shortly after. I was one of the few oceanographers working on immense structures off Canada at Hibernia, North Sea, and in the Gulf of Mexico.

The discovery of oil at depths deeper than 150 meters in the North Sea fostered a revolutionary concept. 60 years ago, few believed oil lay beneath Norwegian waters; since then, petroleum has become Norway's most important industry. Norwegian entrepreneurs introduced a new design based on their experience with large concrete structures: Concrete deepwater oil platforms—Condeeps—resting securely on the sea bed, so-called gravity-based structures (GBS) held in place only by the force of their massive weight. For a period of 25 years this design became the dominant support structure for platforms placed in 300-meter water depths (comparable to Puget Sound depths). Similar structures have been used for the oil industry in other parts of the world such as east of Canada (Hibernia and Hebron) and off the Pacific coast of Russia (Sakhalin).

In 1969, Cliff Barnes drafted the oceanographic parameters necessary for constructing a nuclear power plant in Puget Sound on a small islet (Kiket Island). I had the choice of working on nuclear power or on Condeeps. For a second time, I declined nuclear power (the first time was in choosing oceanography over nuclear energy). Nuclear power became a dinosaur of the Pacific Northwest, Condeeps dinosaurs of the North Sea. I wondered if I would ever escape monstrous infrastructure. The Floating World had not yet beckoned.

In 1973, a few years after major oil discoveries in the Norwegian part of the North Sea, three Norwegian contractors formed a joint venture to utilize the country's special topography with deep fjords and raw material to produce structures specialized for this new industry. In the 1960s, the Gulf of Mexico was the reference point for offshore oil and gas production, but fundamental conditions ▶

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like fisheyes." Sri Lankan security personnel collected as many as 200 bags of plastic pellets every day since the fire began. More kept washing ashore. Dr. De Vos added that the amount of plastic found on the island's western and southern coasts was troubling. Plastic pollution, she said, can pose a danger to humans and animals, including endangered species like turtles, which hatch their eggs on the beach. "The pellets can soak and absorb the chemicals from the environment," she said. "We eat whole fish; we will also be eating these chemicals."

How much longer will container companies be permitted to hide the contents of their containers? Is 3,000 containers a swan song? Responsible world citizens understand our home planet's geography in relation to human facilities. Though the World Shipping Council considers the losses of containers to be miniscule in the perspective of 226 million total shipped annually, when weighted by plastic, their contents become alarming. Most of these containers individually measure 40 feet in length. If lined up, their total length would long encircle Earth 69 times at the Equator. Other comparisons sharpen the container perspective:

Walmart Footprint. Think of the beach as a chain of Walmart "big box" stores. Google reports a single one of these giant stores measures 180,000 square feet. For comparison, a 40-foot container measures 40 × 10 feet, or 400 square feet. Therefore, 220 million containers if spread side to side would cover a mind-boggling 489 thousand—nearly half a million—Walmart stores. The tsunami of 3,000 containers lost off Japan would cover 6.7 Walmarts.

Five *Exxon Valdez* Tankers. Would the World shed a tear if oil filled 3,000 lost containers? The loadable volume of a single 40-foot container is 63.5 cubic meters. In turn, 264 US gallons fill each cubic meter. The *Exxon Valdez* tanker spilled 10.8 million gallons into Alaska's Prince William Sound. Therefore, the total volume within the 220 million containers shipped equals 341 thousand times the volume spilled by the *Exxon Valdez.* The tsunami of 3,000 containers could hold 50 million US gallons or 4.65 times the volume spilled from the *Exxon Valdez*.

For nearly two weeks nurdles rolled from a cargo ship aflame off the coast of Sri Lanka. Photo: Getty Images.

Members of the Sri Lankan Navy clean a beach in Colombo after tons of plastic pellets washed ashore. Photo: Sri Lanka Air Force via Agence France-Presse.

Iconic Flotsam: My studies of iconic flotsam—tub toys, Nike sneakers, hockey gloves—revealed a single 40-foot container could hold 15,000 Nike sneakers, 5,000,000 Lego elements, 34,000 hockey gloves, 30,000 bathtub toys, or several hundred thousand HP ink cartridges. If 3,000 boxes held only sneakers, assuming all the containers opened, they could disgorge 45 million sneakers. Further, assume that all these shoes beached along coastlines from California to Kodiak; if beachcombers lined up the sneakers heel to toe, they would cover a distance of 5,000 miles (25 million feet).

30 Billion Cigarettes. February 23, 2021: Veteran beachcomber Clayton Krause reported to Alert HQ a cargo container floating at sea stuffed with cigarettes. As we talked, I remembered my daughter Lisa shortly before she died smoking cigarettes at the rate of two packs a day, costing her $10 US per pack. A shipping container generally holds 475,000 packs, or almost 10 million cigarettes, implying 3,000 containers would hold 30 billion cigarettes.

201 Billion Nurdles. 67 million nurdles fill a 40-foot container. 3,000 containers would hold 201 billion nurdles, numbering as if they were the stars overhead.

Source: *Sri Lanka, Facing 'Worst' Marine Disaster, Investigates Cargo Ship Fire. Aanya Wipulasena and Mujib Mashal, June 1, 2021.*

differed in the North Sea: oil flowed in far greater amounts, requiring more equipment and considerably increased weight.

Norwegian entrepreneurs invented revolutionary concepts using gravity-based structures for oil platforms designed by Olav Mo in the Hoeyer-Ellefsen A/S engineering company and fabricated by Norwegian contractors. Oil companies chose solutions and methods that neither supplier nor customer had full scale experience with. Despite the radical concept, by July 1973 the first contract for the new structures was signed. Frank Manning urged Mobil's board of directors via Mobil North Sea Limited to use this type of platform for Beryl Oil field development. My work had been completed in the design primarily with setting the 100-year wave parameters, notably the groundbreaking 100-foot wave height—ironically about the heights for hurricanes in the Gulf of Mexico and Newfoundland's Grand Banks.

In the last few years, Condeeps are being demolished (recycled), momentum is increasing to remove dams on the Columbia River, and the prospect of removing sewage has joined my manifesto for saving the Sound, which will appear in future newsletters.

Book*: Condeeps, The Dinosaurs of the North Sea. Finn Harald Sandberg Norwegian Petroleum Museum, Stavanger (Norway). In his book Leviathan (1979), Alfred Hauge coined "Condeep Cathedral" and "petrodome" to describe the shape of giant Condeeps: "So beautiful it is with the tall slender shafts; resembling huge lighthouses. I will not be surprised if such structures will inspire architects to create new ideas for example churches..."*

Container Tsunami

3,000 boxes dispatch transpacific flotsam

The ONE Apus lost over 1,800 containers when weather conditions led to a stack collapse while in transit from Yantian, China, to Long Beach, California, last November. Photo via Twitter (@mrnkA4srmrA)

Flotsam defines the physical geography of the seas (Sargasso, Slope), gyres (Columbus, Turtle, Viking), walls (across Atlantic and Pacific), blobs (Gulf of Alaska), garbage patches (between Hawaii and San Francisco), graveyards (Pacific, Atlantic), streams (Kuroshio, Gulf Stream). *Flotsametrics* transformed Curt into the world's floating scribe. Writing a million words during 1996-2020 in 100 *Beachcombers' Alerts* concerning shoe spills—transpacific cross trainers; Lightning Bolt sandals; and the *Maersk Shanghai*, with loads of shoes across the Atlantic. But the year 2020 brought us the mother of all container spills.

In the span of four months (October 30, 2020 – February 17, 2021), 2,962 containers fell overboard from five ships, a tally more than double the annual average of 1,382 containers lost at sea each year (2008-2019), according to the World Shipping Council.

What's going on? Blame heavy traffic and rolling waves? It will be months or years before anyone knows exactly what happened. By that time beachcombers will report iconic flotsam from these losses:

Maersk Eindhoven. 260 containers lost from losing power in bad weather and high waves.

MSC Aries. 41 containers lost when the new ship met with heavy weather.

Maersk Essen. 750 containers overboard in heavy seas during a North Pacific crossing.

ONE Apus. 1,816 containers lost in one of the worst cases on record, about 1,600 nautical miles northwest of Hawaii after reportedly sailing into a severe storm.

Ever Liberal. 36 containers lost in strong winds 20 nautical miles off the coast of Kyushu, Japan. An additional 21 containers fell onto the deck. The *Ever Liberal* had sailed from Busan, South Korea, bound for the Port of Los Angeles.

E.R. Tianping. 76 containers lost as the box boat steamed from South Korea to North America.

What should we expect from 3,000 overboard containers? At least some debris should arrive in America. Though the Pacific is wide, flotsam is known to be speedy. When I heard of this monstrous container tsunami, I reviewed the speediest drifters to alert beachcombers. Though we cannot be sure of the contents, it is likely that at least one will result in flotsam that will remain identifiable for decades and reveal critical knowledge of our fragile ocean.

During the past three decades, several flotsam fell overboard which remain famous: the 1990 Great Nike shoe spill; the 1992 Great rubber ducky spill; the Lego spill off Land's End England in 1997; and Japanese oyster buoys in 2011. Other iconic flotsam include umbrella handles, lightning bolt sandals, and tommy pickles rugrat dolls heads. At this writing (June 2021), there's no list of debris floating from the 3,000 lost containers. We can be sure winds and currents will push some items 25 miles per day such that the first debris could arrive in June 2021.

During the winter of 2011-2012, beachcombers emailed me photos of hundreds of oyster buoys they'd found from northern California to Kodiak, Alaska. Initially swept into the ocean by the Fukushima, Japan, earthquake and tsunami of March 2011, the flotsam bore the hallmarks of a disaster—they stranded suddenly along thousands of miles of coastline, the buoys arrived 167 times more frequently than in earlier years based on John Anderson's records since the 1980s, oyster shells grew on half the buoys, their arrivals resembled the stranding patterns of a massive container spill, and the stranding pattern agreed with OSCURS (Jim Ingraham's revolutionary computer model known as the Ocean Surface CURrent Simulator).

All totaled, during the five months of October 2011 through February 2012, fifty-plus beachcombers reported the arrival of 353 buoys. Organized by month, the arrivals were 1%, October; 4%, November; 4%, December; 66%, January; 24%, February. Most transited the Pacific in under a year (10 months, March 11–January 31). Most items stranded along Vancouver Island (84%), followed by Washington (10%), Alaska (2%), Oregon (2%), and northern California (0.4%).

Multiple factors caused this perfect storm of a container tsunami. Lashing and securing containers on board large containerships is no longer sufficient, particularly given the increase in frequency and severity of bad weather on the Pacific. The UK's Marine Accident Investigation Branch (MAIB) examined an ▶

WHAT'S BEING LOST?

The World Shipping Council's 2020 report claims that on average there are just under 1,400 containers lost at sea each year (based on data from 2008-2019). Given that more than 3,100 were lost in 2020 and more than 1,100 in the first four months of 2021, the WSC's numbers seem dubious. What's more important than the number of containers lost, however, is what's inside them. Unless the contents are classified as "hazardous," no reporting of losses is required by the industry; of the 1,816 boxes lost from the *ONE Apus*, the contents of only 64 were reported, and those only because they met the hazardous classification (mostly fireworks and batteries).

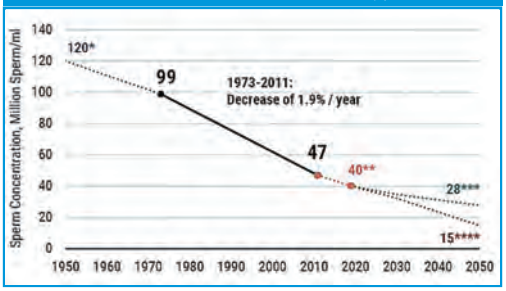
Isn't Earth Room Enough?

Dances with Dinosaurs

Is it coincidence the decline and fall of fossil fuels occurs as the human population decreases? We have witnessed the rise and fall of whale oil to power human society, which nearly eliminated the whale population from Earth. Now we witness the rise and fall of crude oil as the human population enters the ranks of endangered species.

Giant energy companies face "terminal decline" because of falling demand and higher investment risks caused by competition from clean technologies and tougher government climate and energy security targets. Meanwhile, sperm counts in the West plummeted 59% between 1973 and 2011 with counts projected to reach zero circa 2050. Between 1964 and 2018 the global fertility rate fell from 5.06 births per woman to 2.4. Half the world's countries have fertility rates below 2.1, the population replacement level. At these rates, humanity is headed to become an endangered species. Will it be a race to zero to see if we can enter the Age of Electricity in time to save ourselves?

Shanna Swan, an environmental and reproductive epidemiologist, warns in her book *Count Down* (Scribner, 2021) that the impending fertility crisis poses a global threat comparable to that of the climate crisis. Demographers predict that by the latter half of the century, the global population will enter a sustained decline for the first time. "Chemicals in our environment and other lifestyle factors in our modern age have harmed human reproductive health to the extent that, in the future, it may not be possible for most people to reproduce."



Will 1950-2050 be remembered as the century when mankind entered the ranks of endangered species? Top: An individual human sperm. Bottom: sperm count over a century (1950-2050); actual data for 1973-2011 projected backwards and forwards. ***Source:*** *Hagai Levine, Niels Jørgensen, Shanna Swan, et al. (2017). Temporal trends in sperm concentration: a systematic review and meta-analysis. Human Reproduction Update, 23(6), 646-659.*

According to projections in *The Lancet*, 183 countries and territories out of 195 will have fertility rates below replacement level by the year 2100. Most pollutants mimic estrogen, leading the human body to reduce its numbers of sperm. A 2014 study of the effects of 96 chemicals on human sperm found that they affected sperm's ability to swim, navigate, and fertilize an egg. These are ubiquitous chemicals from plastics, which makes it particularly worrisome. Roughly two-thirds of the plastic ever produced has been released into the environment and shows up as tiny particles in the air, water, and soil.

Ancient voices often wake me in the wee hours from a sound sleep. Egyptian pharaohs, seeking to purify their blood lines, birthed dead fetuses. They had not the knowledge of DNA to save themselves. From Biblical times, a proverb echoes (Gospel of Matthew, 26:52): "...for all they that take the sword shall perish with the sword." There are some who believe Giacomo Casanova: "There is no such thing as destiny. We ourselves shape our lives." The spate of flotsam tsunamis suggests we must act now or suffer the fate of the Pharoahs.

Sources: *Google many articles on decreasing human sperm count, including: Long Slide Looms for World Population, With Sweeping Ramifications: Damien Cave, Emma Bubola, and Choe Sang-Hun, New York Times, May 22, 2021; Study Suggests Long-Term Decline in French Sperm Quality Adrian Burton. The film Breaking Boundaries debuted on June 4, 2021, depicting the biodiversity collapse of our Earth, and presenting a dire warning to humanity that there is no time left to tackle the climate and environmental crisis.*

incident in the Pacific in which a ship lost 137 containers and sustained damage to a further 85. On January 20, 2018, the box boat unexpectedly rolled 20 degrees starboard, paused for several seconds, then rolled 20 degrees port. MAIB attributed the incident to reduced structural strength of non-standard 53-foot containers, inaccurate container weight declarations, mis-stowed containers, and loose lashings.

When ships navigate in treacherous weather, stresses on the container lashings and securing gear can be severe. Combined with large freeboards, stacks of containers resemble giant sails amplifying a ship's motions. If a container ship's natural roll period synchronizes with wave periods, resonance can occur, resulting in violent rolling motions. In heavy weather, waves and ship motions sometimes become so large that water flows over the deck, known as "green water loading," leading to high loading on container stacks that can potentially trigger a collapse.

Steep waves breaking against the side of a container ship generate additional forces against lashing and securing gear. Stack collapses often occur in bays where the stack weight is exceeded. Furthermore, weights in a stack affect the vessel's stability. If containers are seriously degraded through rough handling, forklift damage, inadequately secured contents, wear and tear, and overloading, this can lead to structural failure of the container, which in turn may cause the stack above it to collapse. Missing and unlocked twist locks, damaged lashing gear, and lashings becoming loose in a seaway are signs of inadequate securing. In large motions, adjacent stacks clash and potentially collapse.

While larger container ships provide commercial advantage to shipowners, these are often being staffed with fewer crew members. Container ships are designed to move goods quickly across the ocean. With speed a priority, they are not always stable—"stack 'em high," I can hear Clint Eastward script one of his characters. Add six stories of containers to 35-degree rolling motions and you get extremely fast acceleration at the top of the stack. Containers aren't secured to withstand such forces, so they fall.

Book: *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger, 2nd Edition by Marc Levinson. The Revelator, An initiative of the Center for Biological Diversity. 3,000 Shipping Containers Fell into the Pacific Ocean Last Winter, June 2, 2021, by Tim Lydon.*

Crossing the Pond:

Spilled cups, sneakers, and cartridges travel the Atlantic

Crossing the Pond often refers to travel between Europe and the Americas. When I was young and had not traveled beyond the USA, "ponds" meant progressively larger bodies of water: the smallest, a nameless, ten-foot diameter pond lined with concrete in my half-acre backyard; Reseda Pond near where I grew up into which Dad and I released the Easter ducklings he'd brought home and prophetically named Flotsam and Jetsam; and, during my graduate school days, Frosh Pond at the University of Washington.

Pools bring out exhibitionists and pranksters. From the moment the UW inherited the 1909 Alaska-Yukon-Pacific Exhibition's "Geyser Basin," the pool on Rainier Vista has been the site of sanctioned exhibits and unsanctioned spectacles. A 1961 gift by Regent Joseph Drumheller transformed the pool resting before the old Chemistry building into a fountain. Though known by such titles as "Freshmen Basin" and "Drumheller Fountain," to most alumni it will always be "Frosh Pond."

To oceanographers, Frosh Pond invited Rhodomine. Sanitarians stain sewage with this powerful dye to reveal the places where the unsightly excrement lands from leaking toilets. I taught graduate students with Rhodamine aboard the research vessel *Onar* (reflecting the ancient Greek word for dream) in Friday Harbor, Washington. A streak of dye accidentally leaked down the side of the 50-gallon black drum, staining the little marina a brilliant, bright green. Concerned citizens immediately brought the town mayor running, but Cliff Barnes, an eminent oceanographer at the local prestigious Friday Harbor Laboratory, calmed him by pointing to me as the dumb, inept graduate student. Within a few hours the tides silently washed away my mess, forever staining my memory.

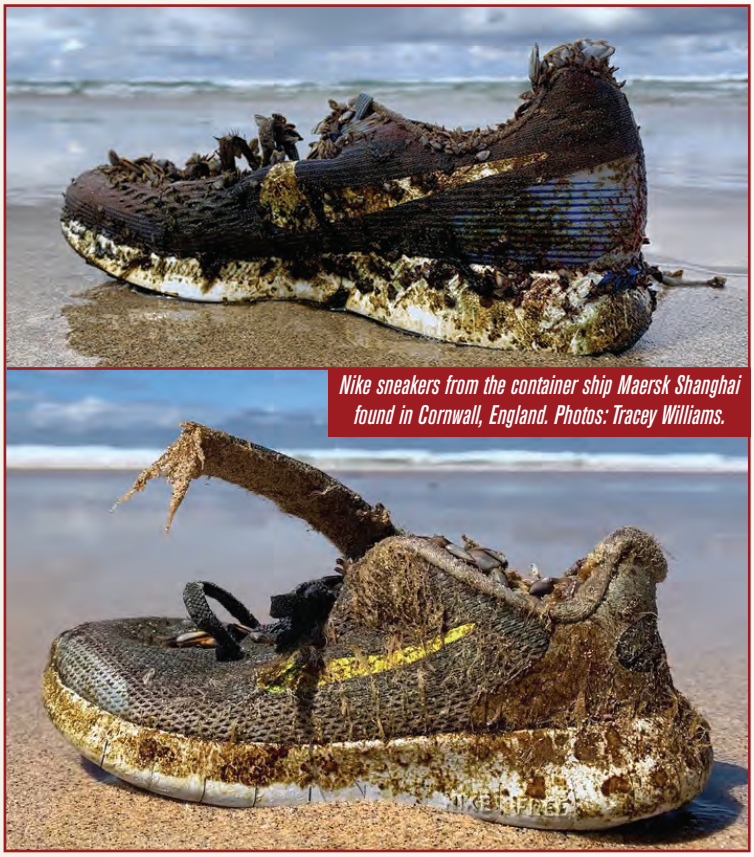
I never imagined a greater experiment in which dye from computer printers would stain the pond known as Columbus Gyre.

A plastic cup from the Anna Maria Island Beach Café made its way from North Carolina to Brest, France. Photo: Gilbert Mellaza.

Plastic cup odyssey

Cindy Lane, reporter for the *Anna Maria Island Sun* newspaper, recently emailed Alert HQ regarding plastic soda cups marked "Anna Maria Island Beach Café" found stranded around the Atlantic. A barrier island on Florida's Gulf Coast, Anna Maria Island (AMI) is known for broad beaches like Manatee Beach Park. Cindy deduced from Google maps that these cups traveled the following distances: green plastic cup 4,299 miles to a beach in Brest, France, discovered in March 2019 by Gilbert Mellaza; blue plastic cup 3,350 miles to Sao Miguel, an island in the Azores, discovered in December 2018; red plastic cup 4,199 miles to Cascais, Portugal, discovered in February 2019 by Miguel Lacerda; and a colorless cup 4,250 miles to Cornwall, England, discovered in June 2019. The four recoveries spread along 16,098 miles, a distance halfway round the Earth at the Equator circumscribing the Atlantic Pond.

Trouble was, beachcombers did not recover enough plastic cups to definitively map currents around the Pond. The loss of 30,000 tub toys proved necessary deduce the three-year orbital period of Aleut Gyre in the North Pacific; it was time for the Atlantic Graveyard to let loose of hundreds of thousands of an iconic flotsam to solve the conundrum.



Nike sneakers from the container ship Maersk Shanghai found in Cornwall, England. Photos: Tracey Williams.

Graveyard of the Atlantic refers to the waters along the North Carolina coast, where the warm and cold waters of the Slope Sea and Sargasso Sea and Gulf Stream collide, that has been the scene of many a shipwreck. Slope Sea is bounded to the north and west by the northeast United States Continental Shelf and to the south by the Gulf Stream, whose dynamic currents provide a strong influence over the area. Sargasso Sea is bounded by four currents forming a gyre within Columbus Gyre. Unlike other regions called seas, it has no land boundaries; it is distinguished from other parts of the Atlantic Ocean by its characteristic brown Sargassum Weed.

The critical clue regarding the cups came back on AMI ▶

when beachcomber Tanner Enoch remembered: "We lost a container last year, in March 2018, in rough weather between Charleston and Norfolk."

Flotsam from the Gulf of Mexico is rarely reported in Europe. I knew the time it took cups and AMI navigation markers to cross the Pond—the number of months to drift across the Atlantic after loss in March 2018 off North Carolina: 9 months to the Azores; 11 months to Portugal; 12 months to Brest, France; and 15 months to Cornwall, England. The reports confirmed that the cups originated from the container ship *Maersk Shanghai*, caught in a fierce storm 17 miles from Oregon Inlet along North Carolina—the area of the Atlantic Graveyard—on March 3, 2018.

The geography of the sea presents complexity as great as freeways threading through major urban areas.

Tracking Atlantic footwear

I examined 1,184 Messages In Bottles (MIBs) launched by students between 2000 and 2007 from vessels of opportunity at locations scattered along the Canadian Maritimes and Greenland. The results confirmed and extended observations of the geographic pattern of recoveries made in 1979–1980 using 9,000 drifting cards released along the Labrador Shelf, and the tracks of surface currents in the North Atlantic determined during 1990–2002 using satellite-tracked drifters with drogues. This was helpful information when shoes started washing up on Atlantic coastlines.

In September 2018 on Flores Island in the Azores, Gui Ribeiro noticed strange items washing ashore. At first, they came in small numbers and could be dismissed as ordinary artifacts lost by individuals; soon, though, it became clear these Azorean arrivals signaled a greater group.

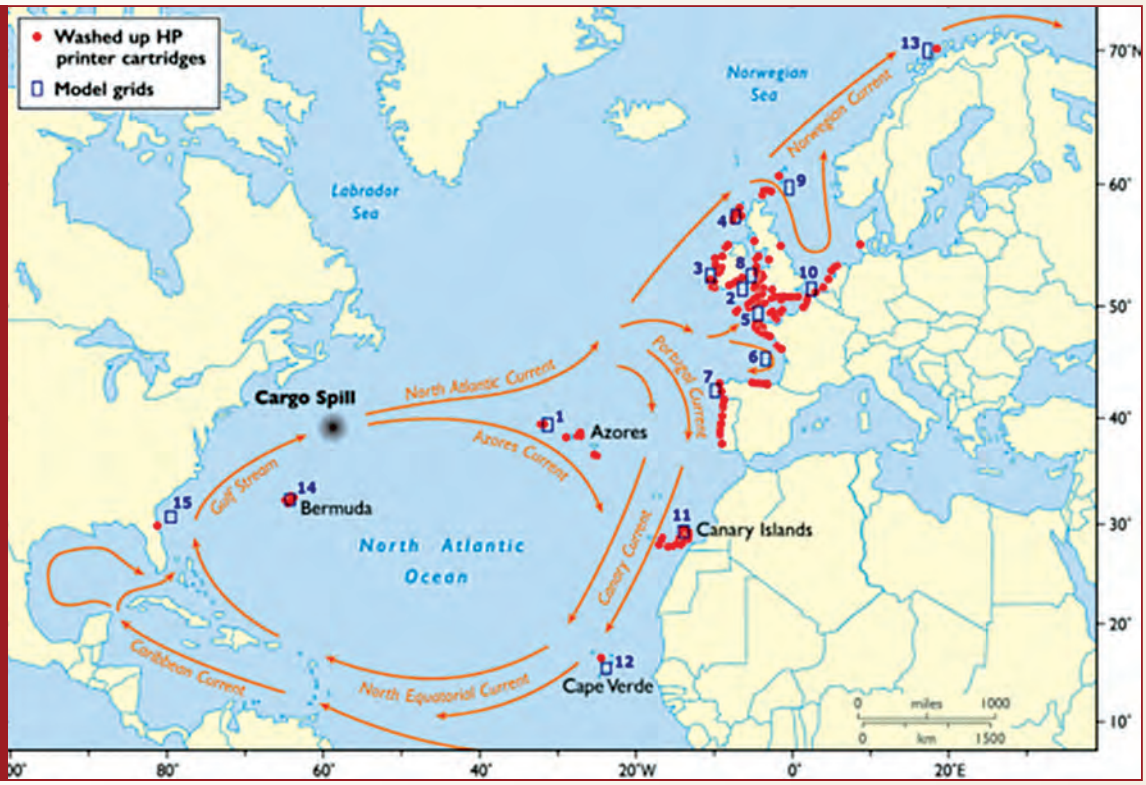
Trainers, flip-flops, and a selection of other footwear appeared with a regularity amongst the randomness of the usual tidal deposits. They were the same brands, in the same styles, and, for some of the trainers at least, had with the same production dates printed on the labels sewn into each shoe's tongue. Moreover, every item of footwear appeared to have been unworn, telltales of a container spill. In the following months, Gui retrieved sixty Nike trainers along with a host of other brands.

Social media spread news of Gui's findings. Seven months later and 1,400 miles away in Cornwall, UK, Tracey Williams noticed similar flotsam assemblages. "An Irish friend asked me if I'd found any," said Tracey. "I went out the next day and found quite a few. Beachcombers tend to network, so if a certain item is washing up, we quickly find out about it and look for others." As well as the Azores and southwest England, this footwear flotilla scattered to Bermuda, the Bahamas, France, Ireland, Orkney, and the Channel Islands.

All this footwear originated from a single container ship. "Gui said everything indicates they originated from 70-76 containers lost from the *Maersk Shanghai*," Tracey said. At the time, the maritime trade press reported that aircraft crews sent to locate the missing containers had found nine floating, but that seven later sank. Nike chose not to comment. However, shoe dogs at two footwear companies, Triangle and Great Wolf Lodge, confirmed their products originated from the suspect ship. And Gui is not the only beachcomber convinced they fell from the *Maersk Shanghai*. Liam McNamara, from County Clare on the west coast of Ireland, has found well over 100 shoes—mostly Nike trainers—that in his opinion "most definitely" came from that vessel. "One company has admitted to losing stock from that shipment and another admitted losing stock at sea," he says. "They've been turning up all over the place."

Inking the Pond

Many flotsams round the Pond, but ink cartridges definitively etched its circumference. In January 2014, polypropylene plastic Hewlett-Packard (HP) inkjet printer cartridges were lost from a container ship in the Atlantic. The first beached HP cartridges were reported in the Azores archipelago, about 700 miles west of Portugal, in September 2014. After HP was contacted, the company issued a statement and set up a free phone line and recycling service but was unable to provide precise details on the number of cartridges or containers lost,



In the Atlantic Ocean, containerships frequently sail the headwaters of The Wall, a barirer current along the Gulf Stream that blocks flotsam from crossing to the north or south. The Atlantic Graveyard off the coast of North Carolina forms in the triple junction where the Wall separates the Slope Sea and the Sargasso Sea. The tail of the Grand Banks is the world's most congested shipping area and the busiest flotsam area. "Ghost busters," those who hunt flotsam floated from graveyards, follow a trail of flotsam "Ghosts" across the Pond that has revealed hundreds of unworn shoes washed up on beaches along northern Europe at Brest, France; Cornwall, England; Florida; North Carolina; and Portugal. Red dots with numbers indicate HP Ink cartridges recovered around the Pond (numbers correspond to entries in the University of Plymouth article mentioned in the sources paragraph).

Bechcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

Beachcombers' Alert!™

Non-profit quarterly newsletter
Subscriptions: $25.00 US per year
Canada & overseas: $30.00 US per year
Issued January, April, July, October

"May the tides be good to you."
—Paul J. Ebbesmeyer

or the location of the spillage. HP cartridges were, however, washed up with items that had been spilled from containers aboard the 19-year-old containership *Suez Canal Bridge* where events and cargo loss had been documented as part of various lawsuits.

This data indicated that the HP cartridges spilled between the Azores and the US Coast on January 23, 2014. After requesting more specific information about the movements and anchorage of the *Suez Canal Bridge*, sleuthing scientists established the spill occurred 800 miles east of New York. The first ink cartridges thus beached in the Azores about six months after the loss in January at a speed about that of the sneakers lost from the *Maersk Shanghai*.

For four years, 279 beachcombers reported 1,467 cartridges on shorelines throughout the North Atlantic, from Tromsø, Norway, in the northeast to Florida in the southwest. These observations were consistent with simulations of the dispersion of free-floating, neutrally buoyant particles from the spillage site derived from Plastic-Adrift, an empirical model based on drifter tracking data. More than fifty percent of the cartridges were recorded in the English Channel and Celtic Sea regions of northwest Europe.

The overall cartridge distribution is consistent with the principal surface currents along what Oceanographers know as The Wall—the path of the Gulf Stream that blocks flotsam from the north from moving further south and any debris from the south from crossing northward. Cartridges were transported northeast with the Gulf Stream and west with the north equatorial current, accounting for strandings reported on Bermuda and Florida. Meanwhile, the North Atlantic Current carries cartridges in a northeasterly direction towards Ireland and Scotland, and the Norwegian Current along the coast of Norway and into the Northeast Passage of the Arctic Ocean. Branches of the North Atlantic Current head along the coast of Portugal as the broad Portugal current, around the Bay of Biscay into the Irish Sea via the Celtic Sea and into the North Sea via the English Channel to the south and into the Norwegian Sea to the north.

In regions impacted by the North Atlantic Current, the accumulation of cartridges is distinctly greater on west- and south-facing coasts. This effect is also evident from the distribution of cartridges retrieved in Ireland and the UK and, on a finer scale, from southwest England specifically. Here, predominantly southwesterly winds and wind-driven residual currents heading east and northeast result in a distinct lack of samples on eastern coasts.

Beachcombers' Alert

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Dates of first sightings in various regions throughout the North Atlantic suggested that cartridges traveled on average 2.8-6.1 nautical miles per day (7 nautical miles per day = 15.0 centimeters per second).

Finally, after three decades, beachcombers had accumulated enough flotsam to outline both the Atlantic and Pacific Gyres with three-year orbital periods. It's my hope that the great tsunami spill of 3,000 containers will provide iconic flotsam to define North Pacific gyres.

Sources: *Transport, weathering, and pollution of plastic from container losses at sea: Observations from a spillage of inkjet cartridges in the North Atlantic Ocean, Andrew Turner, Tracey Williams, Tom Pitchford. School of Geography, Earth and Environmental Sciences, University of Plymouth, Drake Circus, Plymouth, PL4 8AA, UK. Hamish Mackay BBC News Published June 19, 2019. Why are Nike trainers washing up on beaches? Florida flotsam washes up on European beaches, by Cindy Lane, July 1, 2019, Digital Editor, Anna Maria Island Sun, 9801 Gulf Drive, Anna Maria, FL 34216. I thank Cindy, Tom and numerous beachcombers for fine reporting.*

In preparation for oil and gas lease sales on the outer continental shelf offshore of North Carolina, the Minerals Management Service was requested to investigate the potential transport and impacts of oil spilled offshore. The Gulf Stream and associated eddies are an important aspect of the transport. Although the speed and location of the Gulf Stream are reasonably well known, knowledge of the meanders of the Gulf Stream in the Slope Sea is limited. How the circulatory structure and movement of associated frontal eddies and filaments affect the North Carolina coastal waters is not clear. This study investigates the interactions of these circulatory elements and follows the evolution of frontal eddies as they migrate along the North Carolina coast. C.C. Ebbesmeyer, 1989.

Beachcombers' Alert!™

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Celestial Ocean:

Scripture, science measure Arctic Ocean beats

Floating Ocean Borne Injunctive Scripture (FOBIS)

Ocean science echoes spiritual journeys

"The study of nature and her laws is essentially a holy undertaking," wrote England's polymath James Prescott Joule (1818-1889). Perhaps his birth on Christmas Eve fostered the connection between science and religion.

James Prescott Joule

Joule's work changed how scientists viewed energy and influenced development of the law of conservation of energy—energy can be transformed from one form to another but can be neither created nor destroyed—and his faith led to the discovery of the ocean's longest harmonic beating in the Arctic.

Connecting science and religion spread worldwide. Through Matthew Fontaine Maury (1806-1873), the Bible sparked modern oceanography. When Maury was seriously ill, each night his son read scriptures aloud. "If God says there are paths in the sea (Psalm 8)," declared Maury, "I am going to find them if I get out of this bed." Maury recovered and carried out his vow, becoming known as the Pathfinder of the Seas.

Matthew Fontaine Maury

At the entrances to the Arctic Ocean, Vikings and evangelicals dispatched drifters to find new homes in Iceland and to preach the faith the world over. Evangelists floated more than 300,000 injunctive tracts, saving scores from suicide, stopping thousands from drinking, and returning tens of thousands to church.

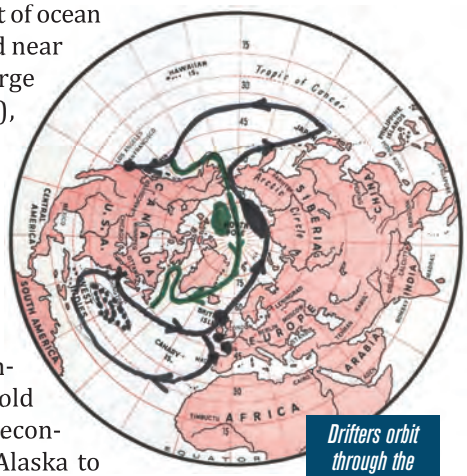
FOBIS continues on page 8

The Arctic Metronome

Advancing the Harmonic Ocean Hypothesis (HOH)

"Sands in the great hour-glass of God,
Sift thro space, then to place . . . "
—C Cale Young Rice (1872-1943), To a Sea-Rock (1922)

The paths to the quartet of ocean flow structure crossed near Seattle: evangelist George Phillips (circa 1950), Joseph Fletcher at the University of Washington, and Roy Overstreet at NOAA. While the evangelist drew pleasure from those finding his scriptures washed ashore around the Northern Hemisphere, the Cold War drew B29 bomber reconnaissance flights from Alaska to the North Pole and I marveled at the numerical symmetry of drift cards released for oil exploration. These threads converged near the University of Washington; I did not realize they would interweave within an hourglass for 12-year orbits.



Drifters orbit through the polar quartet in a geophysical hourglass

An hourglass measures time. Its two glass bulbs connect vertically through a narrow neck, allowing a regulated flow of sand between the bulbs. Typically, the bulbs are symmetric so that the hourglass will measure the same duration regardless of orientation. For the Arctic analogy, the hour becomes a dozen years.

Depictions of hourglasses are found in art, tombstones, and other monuments from antiquity to the present day. Since the 14th century, the hourglass was seen commonly, the earliest evidence being a depiction in the 1338 fresco *Allegory of Good Government* by Ambrogio Lorenzetti. Marine sandglasses were the most dependable measurement of time while at sea—sailors found they helped determine longitude with reasonable accuracy from a certain point on the globe. In the 18th century, John Harrison developed a marine chronometer that significantly improved on the accuracy of the hourglass at sea. Taking elements from

METRONOME continues on page 11

Red Hair in My Father's Beard

Vikings mimic Ecclesiastes

The tapestry of childhood interweaves myriad strands that time leaves forgotten. By the time old age overtook me, I recognized childhood began timeless themes from the sea. When my parents moved from St. Louis to enable my father to construct fighter aircraft in Los Angeles, they began searching for a home. For a year they explored vacant farmlands in the San Fernando Valley with land enough to raise two energetic boys. Strange strands beyond past's prologue guided their search.

My parents attended Senn High School in Chicago's north side, as fine as any college of these days. The innovative curricula impressed creative thinking and fine people skills. My father was intensely spiritual, mildly religious, intensely anti-Catholic, and believed in Masonry's Great Architect of the Universe. Eventually his random readings—Oriental, Biblical, Masonic—connected his beard's red hair with Viking atavisms. He loved reading of Thor, the hammer-wielding god associated with the protection of mankind. It would take me a lifetime to connect my father's search with that of the Vikings a thousand years earlier and the game of Ouija we played as children.

I've wondered why Viking beliefs mimicked Biblical passages: *"The voice of the Lord is upon the waters"* (Psalms); *"Cast your bread upon the waters, for after many days you will find it again"* (Ecclesiastes). My parents and I often played Ouija with Iceland as the Board and their hands on the planchette. Wherever their hands landed they would build their home in a new land.

In the six years after I returned from Dallas, Texas, to Seattle (1974-1980), dementia overtook my mentor, Cliff Barnes. We worked together if his memory served. His family cared for Cliff in their homes if they could, but finally relinquished him to institutional care. In latter stages, his family asked me to clear out his office in the brick building affectionately called "the Old Ocean Building." I moved his papers and books to my basement with hopes that seeing them reassembled might rekindle his memory. Such was never to be.

Ingólfr Arnarson, Iceland's first settler, commands his men to erect his high seat pillars in Reykjavik in this painting that was on public display in Viðeyjarstofa in Viðey. An accompanying plaque explained that it was a gift to the city of Reykjavík from Eimskipafélag Íslands on the 200th birthday of Reykjavík in1986. (Photo by Johan Peter Raadsig, 1806-1882.)

Sorting his books, I noticed Cliff bookmarked much with notes meant for me. One proved particularly inspirational—a sharkskin-bound volume entitled "North Icelandic Waters (1962)" by legendary Icelandic oceanographer Unnsteinn Stefansson (1922-2004). He began with "Historical Remarks" on how Vikings deployed drifting objects to settle Iceland 500 years before Columbus discovered America:

"Very early, some idea about the movement of the sea was obtained from evidence of drifting objects. The first accounts of the currents around Iceland are found in ancient Icelandic literature of the early 13th century. When Ingolfur Arnarson, who is considered the first Icelandic settler, after his voyage from Norway threw his high seat posts overboard, he decided to settle wherever they would be recovered. (These carved wooden posts stood at the side of the chief's high seat.) He landed on the south coast but sent his slaves to look for his posts westwards along the coast. Three years later they found them at Reykjavik, where Ingolfur made his home.

"Other settlers who followed Ingolf's example always sailed in the same direction, probably because they had heard where he found his. From the drift of these wooden objects, the 'drift bottles' of that time, Icelandic settlers must have had some knowledge of the average direction of the currents along the south and west coasts of Iceland."

These seven-plus hundreds of other drifting objects mapped out the currents along coastal Iceland. In the annals of oceanography, few are the instances that currents have stood the test of time for a thousand years. Modern ocean current maps show the currents the Vikings first revealed with drifting objects. Vikings understood the ways of flotsam: wood tends to accumulate in other collection spots; wood provided fuel and building supplies; flotsam tends to circle islands.

In the first sixty years of settlement (c. 870-930), 10,000-20,000 Norwegians emigrated to Iceland. Of many sacred drifters thrown overboard, the sagas tell of five pillars, a bench board, and a coffin. The float distances varied, two going a short distance and three released off southeast Iceland drifting 300 miles to Faxa Bay. A collection spot for drifting materials and ▶

Sea hearts (Entada gigas) drop from vines into tropical jungles of Africa and South America and drift thousands of miles in currents including the North Equatorial Current and Gulf Stream after years stranding around Iceland's shoreline. These intermix with logs from Russia's great rivers. Flotation is poorly known in the sea: mahogany logs float a decade across the North Pacific; entada seeds, thirty years in Ed Perry's hydraulic tank tests; Russian logs, a lustrum from Russian Rivers to Iceland.

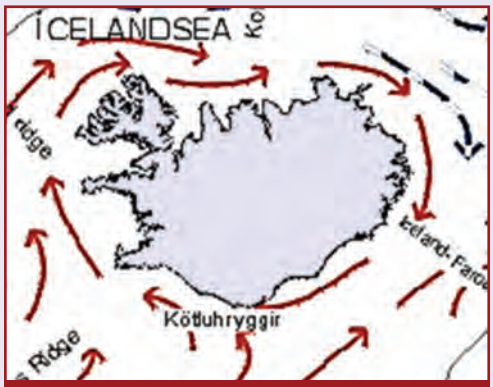
ringed with rich fishing rounds and habitable land, Faxa Bay became the Vikings' population center and included Reykjavik, Iceland's capitol.

Long before the Vikings arrived, uprooted trees accumulated in Faxa Bay, having drifted from the North Pacific Ocean through the Arctic Ocean via the Northwest Passage; from Siberia on the Northeast and Northwest Passages; and from southerly latitudes in the Atlantic Ocean with Gulf Stream waters. One tree, from a temperate forest grown oceans away, measured 12 by 200 feet. Offerings to Thor floated to shore, as if wood on the water divined wood on land.

The three years required to find pillars suggests it proved difficult to find flotsam among piles of driftwood. This prompts the question, how far can driftwood float? The annals of the *Beachcombers' Alerts* document log drifts across the North Pacific, North Atlantic, and Arctic Oceans. Across the Pacific, two foresters documented a log of Borneo camphor (Dryobalanops spp.) drifted 10,000 miles from southeast Asia to Hawaii in 1961. At the time, such trees grew only in Borneo, Sumatra, and Malaya. At high southern latitudes, a Nothofagus log drifted halfway round the world, 10,000 miles in the Antarctic Circumpolar Current from the southern tip of South America to Macquarie Island.

Sea Hearts

Among Icelandic driftwood lay seeds called lausnarsteinn that had drifted from Africa as well as central and South America. Lausnarsteinn was first referenced in a written source from 1525 and is known to have been used until the 20th century, as described in Auður Guðríður Hafliðadóttir's BA thesis on ethnology and midwifery at the University of Iceland. Sometimes the seeds were placed in water or boiled with water and then removed, and the woman in labor would drink the concoction. Some midwives would place the stone in the bed of the woman, under her tongue, in her palm, on her chest, on her belly, or tie it to her thigh. Others believed that the lausnarsteinn would lose its power if



According to Unnsteinn Stefansson, many settlers followed Arnarson's example of letting the currents find their homes around Iceland (map of currents around Iceland, with a coastline of 4,970 kilometers, second-largest island in Europe following Great Britain).

it met bare skin and that it should be kept in flour, wrapped in white linen or an amnion, or in the hair of a virgin.

The lausnarsteinn beachcombed by the Vikings is believed to have drifted from more southerly latitudes. Natural scientist Eggert Ólafsson (1726-1768) deduced lausnarsteinn to be seeds of the Mimosa scandens (aka *Entada gigas*), a species of flowering liana in the pea family, commonly known as sea heart. The plant is native to Central America, the Caribbean, northern South America, and Africa.

Entada gigas carry unparalleled history around the North Atlantic Ocean. I studied them intensely since 1995, when Cathie Katz convened the first Sea Bean Symposium in Cocoa Beach, Florida. I have found many in Florida, Texas, and Costa Maya (Mexico) and discussed their history with Ed Perry, John Dennis, and Bob Gunn. Other researchers found that *Entada gigas* in the Azores are known as *Fava de Colom* (Columbus beans) because Azoreans believe they inspired Columbus to sail further west.

Ed often introduced Sea Bean Symposia in the Cocoa Beach Library in his deep voice with humorous anecdotes. In one he reported on the lausnarstein, or "relief stone," used by Viking midwives for centuries to relieve the pain of women in labor. It was also thought to help with the delivery and guarantee good health for the mother and child. During the birth of Ed's daughter, Ed handed his wife an *Entada* to see if it would relieve her pain. When it did not, Ed ducked, as the rock-hard bean, now a missile, flew over his head.

Sources: *North Icelandic Waters, Unnsteinn Stefansson, Published by Atvinnudeild Haskolans, Reykjavik, 1962; Logemann,K. and Harms, I.: High resolution modelling of the North Icelandic Irminger Current (NIIC), Ocean Sci., 2, 291– 304. 2006.* ■

From the Arctic Ocean, Scripture Drifts Worldwide

I imagine posting a sign on a float just off Nome, Alaska, that points 2,000 miles west along the Siberia coast to the Laptev Sea; 7,000 miles east over the Pole to England; and 8,000 miles south to California. Drifters scattered in a 100-yard circle around this sign would disperse like football players breaking a huddle to run long-distance post passing routes.

The Arctic Ocean not a true ocean; it is rather a frozen Mediterranean Sea, the headwaters of the North Atlantic, because most of its great rivers discharge there from Siberia. It's one of the world's major choke points, ranking with Drake Passage off the southern tip of South America. Drifters released at these choke points thus attract special interest.

The greatest Arctic driftographer was not an oceanographer but a religious evangelist. While oil exploration led to the release in 1979 of ten thousand drifters in Bering Crossroads, in the previous decades (1955-75), evangelism galvanized a prodigious effort. Reverend Everett Bachelder sledded out onto Crossroads ice and placed 60,000 MIBs in the water off Nome. Whereas the '79ers could be timed, Bachelder's files remained sequestered in the Nome Gospel Home except for the locations of eight distant messengers. Along came the '79ers to fill in the timing and intervening routes to the far-off beachcombers who'd responded to God's word.

Most people in the world will at some point read from a single book, the Bible. To find a segment of scripture on the shore is thus a revelation—to many, finding some scripture in a bottle is far more significant than finding a floating scientific message. Everett Bachelder and his wife, Mina, dropped bits of the Bible expressed in 100 different languages into the juncture of the Passages between Alaska and Russia.

Their inspiration sprang from Tacoma, Washington, bottle evangelist George Phillips, who provided scriptures in whiskey bottles for ship captains to pitch overboard as they plied global trade routes. As George suffered from kidney disease, he gave the Bachelders his bottling machine to increase the quantity of bottles to astounding numbers. Bachelder figures that of every 1,000 MIBs cast adrift, 100 are found and he hears from 10 of the finders. Yet, what bottle evangelism lacks in the immediate gratification of saving souls it makes up for in seemingly divine intervention.

In Nome, a reporter from the *Los Angeles Times* listened intently at the Nome Gospel Home as Everett leaned back in his easy chair and sorted through stacks of letters from MIB finders. On a wall, inscribed on seal skin, words from Proverbs 4:12 read: *"As thou goest step by step, I will open up the way before thee."* So it was for Everett for over forty years. Raised in New England, he studied music at Biola University in Los Angeles and at the end of World War II went to Alaska as a missionary. He was deeply committed to his missionary work, in which he incorporated his love of music utilizing hymns, choruses, the accordion, piano, and organ in "a unique, robust style." He and Mina landed in Nome in a storm with three children, seven dogs, and a washing machine to take over the Nome Gospel Home from departing missionaries.

Everett mentioned to the reporter a short list noting where bottled scriptures ▶

The USS Jeannette (Illustration by W.W. May) set sail from San Francisco in 1879 in an attempt to make the United States the first nation to send humans to the North Pole. Instead, the Jeannette was crushed by Arctic ice and sank just north of the 75th parallel.

had drifted. Not being a scientist, he did not keep a diary of bottle finders and associated details. Over the years since 1950, the Bachelders dropped into the icy waves 60,000 mayonnaise jars, ketchup bottles, and plastic wrappers stuffed with waterproofed scriptures. A few years after they dispatched their first bottles, one was retrieved 10,000 miles away near Borneo. Another made it through the Siberian Gyre. "When the wind is right, all the bottles go to Siberia."

A man in Singapore was ready to jump off a cliff over an unhappy love affair when he saw a bottle wash up on the rocks below. "I'll jump when the bottle breaks," he told himself. But the bottle wouldn't break. Fascinated, the man climbed down the treacherous cliff to examine it. It was one of Bachelder's. "There wasn't any Sinhalese in it, but there was enough that he could understand," Bachelder said. "He knew about the Bible and missionary stories, and he went and found a missionary and came to Christ."

It was ten years before Bachelder got word of a find from the Atlantic Ocean. A seminary student in Aruba was sitting on the beach, depressed over his future, when a Bachelder bottle rolled in. Inside it were the usual eight or ten tracts in different languages, Dutch among them. The student's life was changed. "He had to choose between continuing school and serving the Lord or going into business," Mina said. "When he found the bottle, he felt he should go ahead and serve the Lord instead of making bucks on this business venture."

A submariner retrieved a Bachelder bottle in the Mediterranean Sea. He took it to the submarine's commander, who said, "It's somebody in Nome who's thinking about us. Let's all pray."

My oceanographic instincts cast a geographic net connecting Bering Strait to the handful of bottles the Reporter noted. Bachelder's MIBs scattered south and north. One alighted 15,900 nautical miles south at Singapore. Seven others the currents transported north over the Pole to Iceland (3,000 miles), Ireland (7,800 miles), Norway (8,100 miles), west Africa (8,400 miles), Mediterranean Sea (8,700 miles), Aruba (10,200 miles), and the Mississippi River mouth in the Gulf of Mexico (12,600 miles).

My chance to clarify polar gyres came in graduate school when I chanced to meet another maverick like myself. Roy Overstreet, the USA's first black oceanographer. Roy launched 10,000 drift cards and kept meticulous notes on each. As Roy retired, he passed his trove to me.

Drift Pioneers

To evangelists, the currents spread God's word. To Matthew Fontaine Maury, the pathways themselves proved inspirational. On his grave at Goshen Pass, western Virginia, the epitaph reads: "Every mariner for countless ages as he takes his chart to shape his course across the seas, will think of thee. His inspiration Holy Writ Psalms 8:8 & 107:23-24." (*Psalm 8:6-8: "Thou maddest him to have dominion over… whatsoever passeth through the paths of the seas." Psalm 107:23-24: "They that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep."*)

The Norwegian ship Fram later completed the drift of the USS Jeannette through the Northwest Passage

Maury was a study in contrasts. Of devout faith yet an inventor of submarine mines for the Confederacy, Maury dedicated himself to compiling the Psalm's pathways from captain's logbooks. For a century, navigators logged deflections from their intended courses caused by the currents. As a reward, Maury advised Captains how to shorten ocean crossings with routes aligned with the prevailing currents.

Maury's sailing directions produced dramatic results, substantially cutting transoceanic travel times. To avoid collisions along the efficient routes, he recommended that east- and west-bound steamers travel in separate lanes. By reckoning Psalms with vast numbers of shipboard observations, Maury compiled *The Physical Geography of the Sea*, the first modern oceanographic text.

As Superintendent of the United States Naval Observatory and head of the Depot of Charts and Instruments, Maury studied logs and charts from thousands of ships. He published the *Wind and Current Chart of the North Atlantic*, which showed sailors how to use the ocean's currents and winds to their advantage, drastically reducing the length of ocean voyages. Maury's uniform system of recording oceanographic data was adopted by navies and merchant marines around the world and was used to develop charts for all the major trade routes.

Fridtjof Wedel-Jarlsberg Nansen was a Norwegian polymath and Nobel Peace Prize laureate. He gained prominence at various points in his life as an explorer, scientist, diplomat, and humanitarian. Around 1967, Knut Aagaard lectured at the Department of Oceanography on Arctic exploration. During the presentation, Knut showed a film clip of Nansen in another lecture audience delivering a question. I can see Fridtjof Nansen in Knut's old film footage—the only known—of him rising to his six-foot-plus commanding presence, saying "Everything is drifting, the whole [Arctic] ocean moves ceaselessly…" Winds are constantly swirling it about at a mile or so per day. Looking back, I felt I was in the presence of Columbus, albeit the Columbus of the Arctic.

Nansen led the team that made the first crossing of the Greenland interior in 1888, traversing the island on cross-country skis. Columbus deduced the presence of a continent from telltale flotsam—sea beans, bamboo, a dead Chinese-looking person in a kayak; Nansen deduced the movement of polar pack ice from the wreckage of the Naval vessel *USS Jeannette*. The *Jeannette* and the Norwegian ship *Fram* showed the direct drift in the Northwest Passage to amount to five years from vicinity of Bering Strait to Greenland.

Through the Northwest Passage

Thousands died trying to transit the Northwest Passage from European home ports, little appreciating that they were sailing into the teeth of icy currents. Well illustrating this danger, US Navy Lieutenant Commander George W. De Long froze a vessel, the *USS Jeannette*, into the ice near the head of the Northwest Passage in the Chukchi Sea off Alaska. Though he had reinforced the *Jeannette*'s hull, pack ice still crushed the gallant vessel halfway

Left: A B29 bomber, the plane from which Joseph Fletcher discovered ice island T-3. Right: A PBY (flying patrol boat) like the one from which Cliff Barnes observed an ice island off the Grand Banks.

through her journey across the Arctic Ocean, close to the North Pole. De Long noted in his ship's log, "Attempts to be poetical in the Arctic are praiseworthy, but I think I shall give them up. My sensations of being in critical situations are too keen to allow me to write in cold blood about the beauties of ice scenery. I will simply remark that the pack is no place for a ship, and however beautiful it may be from an aesthetic point of view, I wish with all my heart that we were out of it."

Three years later some of her shards stranded in Greenland, convincing Fridtjof Nansen to continue the *Jeannette*'s drift in the *Fram*, a ship specially built with a hemispherical hull, a shape still designed into modern icebreakers. The drifts of the *Jeannette* plus the *Fram* provided the first scientific evidence that ice drifted along a direct path across the Arctic through the Northwest Passage, taking 5-6 years to do so.

Despite diligent preparations, many of De Long's men froze to death while escaping through Siberia. Unwilling to sacrifice more men, De Long turned to unmanned drifters and deployed 50-100 wooden casks. One passed through the Northwest Passage in five years, thus confirming the drifts of *Jeannette* plus *Fram*. Despite Melville's unmanned mission, we'd have to wait for eight decades when in 1979 oceanographers launched thousands of smaller plastic drifters shaped like playing cards in the search for oil.

The Floating Island that Starved Britain

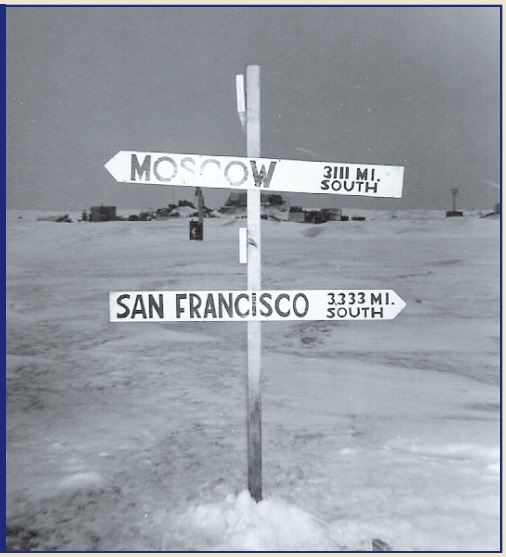
My mentor Clifford A. Barnes often recounted chasing icebergs in the North Atlantic to help his boss Admiral Oldendorf guide convoys transporting food and oil to save Britain from German takeover. Icebergs struck blows at Britain's lifeline by forcing Allied transports into the paths of German U-Boats. Britain's darkest days came at the same time that I was born, in April 1943. Sixty years later, before a blazing fire swizzling Olympia Beer and crunching Planters Dry Roasted Peanuts, Cliff recounted his most harrowing flight in a PBY (a navy flying boat) while hunting icebergs. One extraordinary berg itself nearly severed the lifeline.

Cliff explained that his recons, many of which lasted 14 hours, passed over two kinds of icebergs. Usually he spotted medium bergs like that which sank the Titanic; but in Britain's darkest hours, Cliff spied a flat-topped monster half a mile long. During repeated overflights, the flat-top disappeared in dense fog while grounded in 600 feet of water. By the time the pea-soup fog lifted, the monster berg had broken apart, causing sixty collisions among convoy ships.

This catastrophe remained indelibly etched in Cliff's memory. Concerned about Soviet Cold War activities, beginning in 1946 the US Air Force initiated B29 reconnaissance flights over the Arctic Ocean. By 1951, the USAF routinely made B29 flights to the North Pole. Sometime in the late 1940s, Cliff mentioned the great flat-top berg to Colonel Joseph Fletcher, who commanded B29 reconnaissance flights. These recons determined that the great berg had calved from the massive ice sheet on Ellesmere Island feeding into the Arctic Ocean not far from the mouth of the Mackenzie River.

Fletcher spotted great flat-tops far out in the Arctic Ocean circling in the Beaufort Gyre. On airborne radar he marked them as targets abbreviated T1-T3. T3 seemed suitable for an oceanographic research station and became forever known as Fletcher's Island, on which a permanent manned weather station conducted scientific research in the Arctic for decades. During 1952-1979, T3 drifted 5,000 miles. In 1984, recon sighted T3 near Cape Farewell near at Greenland's southern tip,

Signposts on Fletcher's Ice Island. Also known as radar target T-3, the island was a tabular iceberg discovered by US Air Force Colonel Joseph O. Fletcher. T-3 became first drifter observed to orbit an Arctic Gyre as well as the longest observed flotsam anywhere in the ocean (37 years). Before the era of satellites T-3 had been a valuable site for remote Arctic measurements. For 26 years (1952-1978), scientists manned T-3 as an outpost that included huts, a power plant, and a runway. The iceberg was a thick tabular sheet of glacial ice drifting clockwise around Beaufort Gyre while its twin Siberian Gyre turned counterclockwise off Siberia as if left and right footprints.



bringing its total drift journey to 7,027 miles. The distance is greater if we add the part from T3's calving prior to 1952. I estimated a total for 1947-1984 of 8,000 miles in 37 years, the longest time a drifter had been observed at sea, even longer than a forested island that drifted across the North Atlantic.

Inevitably, societal infrastructure reached the Arctic Ocean. In 1859, an oil rush began in Titusville, Pennsylvania, in the Oil Creek Valley; a century later, in the 1960s, oil exploration began in the Chukchi Sea at the Passages' junction.

Roy Overstreet was the United States' first black oceanographer and worked three decades tracking oil spills. As Reverend Bachelder's release of scripture came to an end, Roy walked in evangelical footsteps in the shadow of T3. Why was 1979 pivotal to Arctic Ocean exploration? Why are there so many returns from the

Drift path of Fletcher's Ice Island (T3)

1979 Pacific Marine Environmental Laboratory (PMEL) releases? It's because of my friend Roy Overstreet and my close connection with PMEL. Roy kept track long after initial reasons for study. When an old card was reported, staffers send it to me. Of the 10,000 total drifters released in 1979, I'd guess there are some 100 fascinating drifters which have been reported, but I only know of a few.

I did not set out intentionally to locate long-range polar drifters. Those floating curiosities fascinated me, friends knew; why they couldn't fathom. A weird oceanographer's eccentric habit, some said. Nevertheless, they continually sent me curiosities from obscure books and newspaper fillers. To me, however, they were pieces of a global jigsaw puzzle of the ocean.

The trouble with flotsam is that it comes randomly to my attention, taking years for the bits to catalyze into new understandings of long known but little understood ocean pathways. ■

Discs from the 1970s still turn up in Alaska and well beyond

University of Alaska Fairbanks scientist Ben Jones was hiking near Drew Point on Alaska's northern coast when he noticed pilot Jim Webster walking toward him, flicking a little yellow Frisbee his way.

That yellow plastic disc, about seven inches round, had a message stamped on it: "*One Dollar Reward on Return of Serial Number with Date Found, Location, Your Name and Address, to Geophysics Institute, Univ. of Alaska, Fairbanks*." But Jones wanted the backstory more than he wanted the dollar.

That story began in 1979, when oceanographer Brian Matthews released more than 1,500 of the discs from a hole beneath the sea ice that hugged the coast of Alaska around Prudhoe Bay. Matthews hoped the drifting discs would show the possible pathways oil would take if spilled on or beneath the ice.

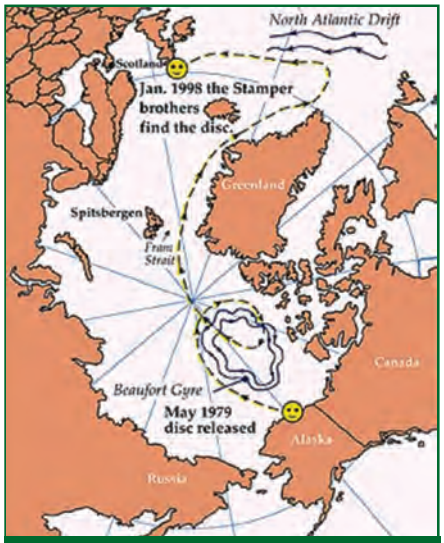
Matthews and his crews retrieved many of the discs on a helicopter mission some time later, but most were unaccounted for. In the years since, scientists and oilfield workers have returned a few that they found on northern Alaska beaches to the Fairbanks campus, but the most impressive disc find was nowhere near the state—two brothers came across one of them while playing on a beach in northern Scotland, some 3,500 miles distant from the disc's Prudhoe Bay origin point.

Oceanographer Tom Weingartner figured that the disc had hitched a ride on an ice floe and sailed north. It then spun in a current known as the Beaufort Gyre near the North Pole, likely for more than a decade. Eventually, the ice raft made it through Fram Strait alongside the coast of Greenland. The ice melted, but the disc floated on, riding the North Atlantic drift to the Outer Hebrides beach where the boys found it in 1998.

The Scottish brothers contacted the UAF Geophysical Institute using the nascent Internet. Matthews' study was long since over by then, but Roberta Greenlee of the Geophysical Institute nevertheless sent the boys the promised reward of one American dollar.

The study may be finished, but the plastic remains. The disc Webster gave to Jones weathered forty arctic winters. It lasted much longer than did the numbered oranges a scientist threw on the ice during a similar, unsuccessful experiment in 1972; in fact, the disc does not look much different than it did when Matthews released it on the pack ice in 1979.

The same cannot be said for the northern Alaska coast where Webster found the disc. Jones and his colleagues



Path estimated to have been taken by a plastic disc that drifted from Alaska to Scotland

have studied Drew Point for the past decade or so, watching colossal frozen chunks of tundra fall into the sea as a consequence of climate change. In the most drastic year they measured, 2016, the sea consumed an average of 72 feet of a 5.5-mile stretch of coast around Drew Point.

Jones still has possession of the disc. He was happy to solve the mystery of where it came from, but is holding out for a more just recompense. "Accounting for inflation," Jones wrote in an email, "if the disc was deployed in 1979 with a stated reward of $1, in today's market the equivalent reward would be about $3.46."

Source: *Adapted from an article in the Anchorage Daily News.* ■

Destiny's Celestial Instrument

Endless, 5-Harmonic Organ

If you viewed it from a space station hovering above the North Pole, the Earth would appear to be basketball-sized and the sea would look like an hourglass or a Salvador Dali keyhole.

It would be this keyhole through which I perceived pipe organs. Encounters with such great organs began for me in a church, where renowned organist E. Power Biggs (1906–1977) performed a recital at Saint Mark's Cathedral in Seattle's Capitol Hill neighborhood. He played an organ designed and built by the world-famous Dutch firm D. A. Flentrop. This organ contains 3,944 pipes, ranging in length from one to 384 inches (32 feet). I didn't appreciate it properly at the time; despite Biggs' fame and skill with the famous organ, I fell asleep on the carpeted steps.

Saint Cecilia, patron saint of music plays an ancient organ invented by Cstesius of Greece

Destiny would bring me back to the organ, though, by way of two long lakes in the Cascade Mountains that contribute to *ocean* music. In the 1990s, I asked Bob Hamilton to measure for a year the currents in Ross Lake, a shorter cousin (25 miles long) of Lake Chelan in a parallel drowned river valley. Chelan is one of the world's major lakes, with a nearly 1500-foot depth and 55-mile serpentine length. It's long slender shape and two basins reminded me of a long organ pipe.

When the current measurements revealed two basins with currents beating against one another, I began calling Chelan "Lake Celeste" because *Voix celeste* (French for "heavenly voice") is an organ stop consisting of either one or two ranks of pipes slightly out of tune. The term *celeste* refers to a rank of pipes detuned slightly to produce a beating effect when combined with a normally tuned rank. Stops are used to prevent air from flowing through the pipes and are part of the action that controls which pipes are allowed to speak and which are to remain silent. ▶

FOBIS from page 1

Why, I wondered, did floating evangelism spread worldwide?

Though not particularly religious, in my father's footsteps occasionally I read the Bible. Floating things drew me to read scripture at random. It is impossible to miss FOBIS in the Bible—it's laced with hints of ocean paths and the spiritual side of the sea, holding no less than 1,020 references to water and the sea: Walking on water. Paths in the seas. Voices on the water. Bread on the water.

It's as if the ocean speaks in flotsam tongue: "When it came nigh . . . the wind brought the sound of the great sea's voice . . . " (Steven Crane, *The Open Boat*); "The sea has a voice . . . by day and by night it makes itself heard, throughout years and decades and centuries." (Elias Canetti, *Crowds and Power*); "The ocean, with its vastness, its blue green, its ships, its rocks, its caves, its hopes, its fears, its voice mysterious, which he who so hears must think of what will be, and what has been." (John Keats, *Sonnet To My Brother George*); "Learn to regard words as the sea, for it is their first vocable, just as Adam is our first man." (Edmond Jabès, *The Book of Resemblances*); "The sea speaks in a kingly voice . . . " (Dylan Thomas, *Find Meat On Bones*); "The Lord on high is mightier than the noise of many waters." (Psalm 93:4).

Things from the sea also speak. Along the coasts of the southeastern US, gift shops sell a postcard stapled to a plastic bag containing a fish skull with delicate bones that eerily resemble a crucifix. Living, the fish's enlarged dorsal fin elicits the nickname gaff-topsail catfish (*Bagre marinus*). Dead, its bones evoke a crucifix. According to legend, as you shake the skull you will be blessed if you hear dice rattle. The ivory clicks come from otoliths, tiny bones like those in the human ear for maintaining balance.

Exploring Joule's contention, I clipped verses from the Bible as President Jefferson had done of words he thought Christ had directly spoken: "Cast thy bread upon the waters, for thou shalt find it after many days." Ecclesiastes 11:1; "Thou tellest my wanderings: put thou my tears into thy bottle . . . " Psalms 56:8; "The Lord is upon many waters." Psalms 29:3; "Cast thy burden upon the Lord, and he shall sustain thee." Psalms 55:22; "Except a man be born of water and of the Spirit, he cannot enter into the kingdom of God." John 3:5; "For he hath founded it upon the sea . . . " Psalms 24:2;" Blessed are ye that sow beside all waters, that send forth thither . . . " Isaiah 32:20; "Go ye into all the world and preach the gospel to every creature." Mark 16:15.

FOBIS in essence says: Beside all waters, preach the gospel to every creature. In thy bottle cast my wanderings upon the sea. Read the Bible often enough and key phrases, as if a Biblical Injunction, bid the devout to dispatch tract-filled bottles.

Ever the scientist, I considered Joule's admonishment skeptically. On a jet flight home from a Sea Bean Symposium, I expressed my dilemma to Reverend Bill Clemens, seated beside me. He had a receptive ear and invited me to present FOBIS at a breakfast meeting of Lutheran ministers. "Was I crazy?" I queried. To my amazement, the ministers supported FOBIS.

Biblical scribes sowed scriptural seeds to inspire future spiritual journeys. Nineteen centuries later, FOBIS called religious-minded folk to spread the scriptures across land and ocean. FOBIS wells up in strange, unexpected ways. ■

It wasn't long before I noticed the world ocean is half covered by pairs of adjoining gyres that have nearly the same orbital frequency. Could they speak, I wondered, to one another?

Earthly gyres orbit MIBs with five periods: 0.75, 1.5, 3, 6, and 12 years. Beating pairs number 10: five with 3-year orbits, two with 6-year orbits, and three with 12-year orbits. Not only are they in harmonic sequence, but they are also arrayed such that couples spin side by side, giving rise to the possibility of beats from five sources: 12-year triplet, 3-year triplet, 6-year pair straddling the equator, 3-year pair straddling the equator, and 3 year triplets around Antarctica.

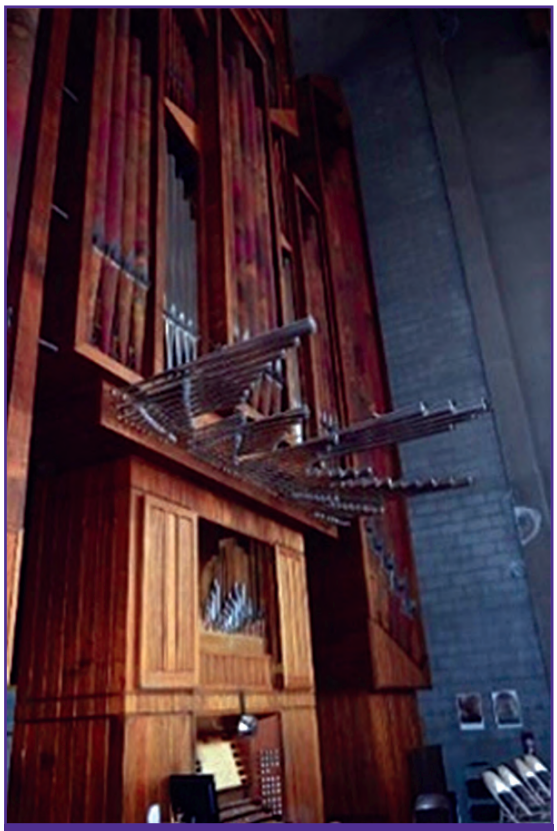
Such "music of the gyres" inspired me to think of a *celestial* ocean. The ocean thus became to me an organ as I remembered Mozart's immortal praise of the instrument: "in my eyes and ears . . . the king of instruments."

Beats of the Arctic Metronome

In music, beat is the basic unit of time—the pulse (regularly repeating event). Delving deeper, a beat is an interference pattern between two slightly different frequencies, perceived as a periodic variation in volume whose rate is the difference of the two frequencies. With tuning instruments that can produce sustained tones, beats can be readily recognized. When two organ pipes are tuned slightly off pitch from each other, they produce an undulating or shimmering tone, due to the beating effect produced by the resulting tone of the difference of the two frequencies. If one pipe, for example, speaks approximately middle C at 256 cycles per second (hz), and another pipe speaks just 2 hz differently at 254 hz, a wavering beat of 2 hz will be heard when they speak together. This "beating" results from the interference of the two sound waves, alternately reinforcing each other and cancelling each other out. I noted the difference amounts to 2 hz in a base of approximately 256 hz, or one in 128 the harmonic of two raised to the 7th power.

Gyre orbits, harmony, beats. One-half loss of MIBs per gyre orbit equates to all but one of 128 lost in seven orbits. Applying the celeste stop, I computed the beat assuming the gyre orbits differed by 1/128, that is say 12.00 and 12.094 years. This beat equals 1,544 years, such a large number that I doubted my reasoning. So, I backed off a bit and assumed 12-year gyres differ by 5%, spinning at 11.4 and 12.6 years, thereby producing 120-year beats. The shorter period gyres produced progressively shorter beats: 1.5-year gyres beat at 14 years, 3-year gyres beat at 30 years, and 6-year gyres beat at 60 years.

Could the world ocean organ take out all the stops? If you pulled out the entirety of an organ's stops, it would produce the fullest sound possible. Could the world's longest harmonic (12 years) emanate from drifters passing through its smallest ocean?



Flentrop organ at St. Mark's Cathedral in Seattle, WA.

Music of the Spheres

Long before now the ancients had arrived at similar concepts regarding the movements of celestial bodies—the Sun, Moon, and planets—as a form of music. This "music" is not thought to be audible, but harmonic; a mathematical or religious resonance. The idea influenced many schools of thought through the Renaissance and into modern eras.

In antiquity, Pythagoras (c. 570– 495 BC) made many mathematical and scientific discoveries, including the famous theorem that bears his name. Regarding music, Pythagoras determined that the pitch of a musical note is in inverse proportion to the length of the string that produces it, and that intervals between harmonious sound frequencies form simple numerical ratios. In a theory known as the Harmony of the Spheres, Pythagoras proposed that the Sun, Moon, and planets emit unique hums based on their orbital revolution, and that the quality of life on Earth reflects the tenor of celestial sounds which are physically imperceptible to the human ear. Subsequently, Plato described astronomy and music as "twinned" studies of sensual recognition: astronomy for the eyes and music for the ears, both requiring knowledge of numerical proportions.

In 1619, Johannes Kepler (1571-1630), in *Harmony of the Worlds*, posited that musical intervals and harmonies describe the motions of the six known planets of the time. He believed that this harmony, while inaudible, could be heard by the soul and gave a person a "very agreeable feeling of bliss, afforded him by this music in the imitation of God." In *Harmonices*, Kepler, who differed from Pythagorean observations, laid out an argument for a Christian-centric creator who had made an explicit connection between geometry, astronomy, and music, and that the planets were arranged intelligently.

Kepler was convinced "that the geometrical things have provided the Creator with the model for decorating the whole world" and wanted to further explore the aspects of the natural world specifically involved with astronomical and astrological concepts of music. To Kepler, the celestial physics of the spheres were seen as geometrically spatial regions that consisted of each planetary orbit rather than its physical form. "For there is a musicke where-ever there is a harmony, order or proportion; and thus farre we may maintain the musick of the spheres; for those well-ordered motions, and regular paces, though they give no sound unto the eare, yet to the understanding they strike a note most full of harmony. Whatsoever is harmonically composed, delights in harmony."

The connection between music, mathematics, and astronomy continues to profoundly influence the teaching of history.

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Rubber Duck Makes 2-year Voyage from Alberta to Russia

Through diligent research, beachcombers gave voice to a yellow rubber duck, revealing an amazing journey through the Arctic Northeast Passage.

Two years ago, Vladimir Matusevitch was on holiday on the Arctic shores of the Rybachy Peninsula in northwestern Russia. Resting among the beach rocks, he noticed a grungy rubber duck inscribed with the number 1417.

From his home in Moscow, Vladimir told the CBC program *Radio Active* that he realized it was from a duck race—a festival where thousands of rubber ducks are released into a river for charity—but didn't know of any in the area. "There are not such great duck races in Russia." Searching for the duck's origin, Vladimir sent hundreds of emails and Facebook messages to duck races worldwide. "It was a fun thing to do," he said. His efforts paid off—he found that the duck's starting point was a river in the middle of Canada.

Monica Iverson, organizer of the Ardmore Duck Race in Ardmore, Alberta, 260 kilometers northeast of Edmonton, noticed Vladimir's Facebook posting. "Hey, that's our duck," Monica said, recognizing her own handwriting on the duck's back. "My ducks have a tail on the top and the sevens have a dash across." She said it's not a common way to write numbers. "I'm 150% sure that's our duck."

Monica reckons Duck 1417 began racing down the Beaver River on June 4, 2017. She remembers a duck with a similar number going missing that year. Vladimir found Duck 1417 after an elapsed time of two years and two months, on August 16, 2019, about halfway along the Northeast Passage. In total, the Passage runs from approximately Iceland, along the Siberian continental shelf, through Bering Strait, south to Japan, and finally to North America, often landing in the Pacific Northwest and Alaska.

The Ardmore Duck Race has been held annually for three decades on the Beaver River, which flows into the Churchill River and eventually dumps into Hudson Bay. Ardmore, Alberta, is a hamlet within the Municipal District of Bonnyville No. 87.

A yellow rubber duck dropped into the Beaver River north of Edmonton, Alberta, as part of a charity duck race managed to reach Russia, traveling some 6,000 miles. Monika Iverson recognized her own handwriting on the duck. An unconventional drift through the Arctic took it through half of the Northwest Passage before finding half of the Northeast Passage. Vladimir Matusevitch found the duck while on holiday with his family on the Arctic shores of the Rybachy Peninsula, Russia. (Photo: Vladimir Matusevitch)

It is located approximately 18 km east of Bonnyville along Highway 28 and has an elevation of 550.8 meters (1,807 feet).

While the race usually runs 2,000 ducks to raise funds for the local school, Monica said it's rare for one to go missing since the local fire department helps gather the ducks afterward. Monica said the Ardmore community may eventually put a book together, written by local kids, on what the duck could have encountered during its adventure. Proceeds from the project would be donated to the local school. "It's astronomical, the sort of thing that this duck must have had to go through," said Iverson. "This story shows how small the world really is." Monica and Vladimir are negotiating for the duck's return to Alberta. "The duck will probably never see water again, but it will definitely have a very special place of honor in our school," said Monica.

After Duck 1417 began racing to the sea, it most likely floated counterclockwise in Hudson Bay across the mouth of James Bay to the Hudson Strait, said Paul Myers, an ocean current expert at the University of Alberta. It then likely hooked around Quebec into the Labrador Sea, hitting the Gulf Stream around St. John's, Newfoundland. Next, it drifted between Iceland and Scotland, travelling northward along Norway until it beached on Russian Arctic shores, said Myers. Its total trip measured approximately 10,000 kilometers (6,214 miles), he said. It's possible that during the voyage, the Duck may have lodged in sea ice in Hudson Bay and even bobbed beside icebergs near Newfoundland and Labrador, the same area where the Titanic sank.

While it might seem weird for the duck to have travelled from Alberta to Russia, Myers said it would have followed usual ocean currents. "I'm more surprised the duck survived," he said. "You know, that it didn't sink because of waves."

Vladimir said he never expected to discover the rubber duck originated from interior Canada. "I am amazed. Wow!"

Source: *Liam Harrap, CBC News, September 15, 2021. Courtesy beachcomber Dean Morewood, October 3, 2021*

METRONOME from page 1

the design logic behind the hourglass, he made a marine chronometer in 1761 that was able to measure the journey from England to Jamaica to within five seconds.

Eric Scigliano and I concluded our book *Flotsametrics and the Floating World* with a summary chapter of the world oceans entitled "Music of the Gyres." For a decade, I'd accumulated accounts of drifting objects in the shallowest foot or so of the Arctic Ocean. On the usual world map, ice on the Arctic Ocean looks like a static continent, albeit a white one. It is, however, quite fluid. Like stirring ice cubes in a glass, the Arctic ice pack consists of chunks stirred by the winds, an ocean of drifting hard water. In the words of Fridtjof Nansen, "Everything is drifting, the whole [Arctic] ocean moves ceaselessly."

Lorenzetti's "Allegory of Good Government"

Wind speed produces the world's longest time scales through its smallest ocean. In open water, winds and currents in the Arctic drag drifters 7-10 miles per day; epic-sized Arctic drifters average 1-2 miles per day. Arctic gyres and ice slow drifters in the hourglass neck greatly prolonging the transits of long-range drifters crossing the frigid wastes between the Atlantic and Pacific oceans.

Over the decades, I tabulated the times for drifting objects of myriad kinds—tub toys, derelict vessels, messages in bottles (MIBs)—finding that they orbited eleven great gyres in four harmonic periods: 0.75, 1.5, 3, and 6 years. These applied to the water gyres covering most of the world ocean. I hesitated to extend the harmonic sequence to the Arctic because ice drifts slowly. Now I aimed to prove that 12 years is the fifth orbital period in the harmonic sequence of the Music of the Gyres.

The Arctic Keyhole

Though the Arctic is the world's smallest ocean (3.9 percent of the total), the basics of its flow—time scales of geographic patterns—are virtually unknown. The Arctic is ringed with seven seas: five along Siberia embracing the Northeast Passage and two along Greenland, the Beaufort Sea to the Greenland Sea bordering the Northwest Passage. The great Athelston "Spilly" Spilhaus drew the *Endless Ocean* based on thousands of MIBs collected by the US Navy but did not include the flow in the Arctic Ocean, as ships had not routinely traversed the icy polar waters.

Though I advanced the portrayal of ocean gyres by assigning orbital periods to them, completing their harmonics required I add orbits of the Arctic Ocean. In isolation, no one would believe this. Since two-thirds of Earth's land area lies north of the Equator, one might expect the ocean pathways to be more congested and hence shorter there than in the Southern Hemisphere. Because of its size and ice, I assumed the Arctic would subdivide the Northern Hemisphere. I found, however, that the oldest drifters had been north of the Equator.

After decades contemplating my collection, I concluded the Arctic Ocean is a quartet of two types of geographical patterns: two quasi-linear passages plus two elliptical gyres packed into the world's smallest ocean. Though the smallest planetary drifters do pass through it, in the Northern Hemisphere they lasted far longer than similar drifters in the Southern Hemisphere. My ongoing list (2021) contains elapsed times with a mean orbital period of 12 years, which I'd hypothesized for the fifth harmonic of the gyres. I felt as if I was viewing earth north of the Equator as if through a keyhole shaped like an hourglass.

Unfortunately, though I'd been collecting polar drifters for half a century, I could only list 14 decadal drifts for which I had confidence. In the surety that scientists would scoff at my small statistical sample, I refrained from describing my result as a theorem, preferring the weaker belief expressed in *Hypothesis of Ocean Harmonics*. Over the years, I kept two lists of transarctic drifters: ten launched from the vicinity of Bering Strait and recovered in Europe, which I believed had traversed the Arctic through the Northwest Passage; and ten others which passed from Norway through the Russian Archipelago of five seas and back to the Bering Sea. When my lists each reached ten drifters, I ranked their elapsed times from shortest to longest. At the mid-rank I discovered a break in the slopes where elapsed times shifted speeds, marking pathways taken along different seas and gyres. I assumed the shortest times corresponded to the most direct pathways between the ends of the Passages.

Seven seas embrace the Arctic Ocean and receive discharges from immense rivers draining from Siberia (proceeding down current along the Northeast Passage): the Barents, Kara, Laptev, East Siberian, and Chukchi Seas. Others define the deep basins (proceeding downcurrent along the Northwest Passage): Chukchi, Beaufort, and Greenland Seas. This portrayal derives from glass bottles and thin plastic cards in the Arctic Ocean's shallowest layer riding on deeper currents.

Without elaborating on the analysis, my results corresponded to six-year drifts through each Passage. It was the connection I sought between the drift of water and ice. Drifts through the passages confirmed my global harmonic hypothesis, extended to the ice-covered ocean, including three gyres each with 12-year orbits bringing my global hypothesis to five harmonic orbits (0.75, 1.5, 3, 6, and 12 years). Would Spilly, I wonder, approve of the time scales I'd ascertained for his *Endless Ocean*? With the spatial and temporal patterns completed I felt confident in extending the *Endless Ocean* a step further, from the Music of the Gyres to the Celestial Ocean. ■

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"May the tides be good to you."
—Paul J. Ebbesmeyer

INSTRUMENT from page 9

It resulted in music's inclusion in the medieval curriculum of philosophies that included arithmetic, geometry, and astronomy; along with grammar, logic, and rhetoric, these made up the seven liberal arts which underpin higher education. Thus, my PhD certificate reads that I am a Doctor of Philosophy.

Much recent music is based on the concepts from Harmony of the Spheres. One of my favorites is *The Sound of Music* containing Oscar Hammerstein's profound lyrics:

"The hills are alive with the sound of music / With songs they have sung for a thousand years / The hills fill my heart with the sound of music / My heart wants to sing every song it hears."

I admire the ancients for their deep insights given the paucity of the data at their disposal. They knew of some of the planets but little of the stars and virtually nothing of the great ocean. I possess a rudimentary knowledge of the galaxies, planets, and the ocean gyres; my idea is to search for numbers common to the orbits of all three. It is my hope that those far more knowledgeable than I might build on this orbital harmonic geometry. I note that the quartets with repeated use of the power of two for galaxies, planets, and gyres with orbits embracing months to billions of years certainly commands awe.

I wonder what Socrates, Pythagoras, and Kepler would think? All Kepler had to reason with was six planets. I have an ocean of gyres and astronomers have trillions of galaxies and yet all reduce to groups of four in powers of two. The elegance overwhelms.

In the centuries after Pythagoras, Greek engineer Ctesibius (285-222 BC) devised an instrument called the hydraulis (Greek for water organ), which delivered a wind supply maintained through water pressure to a set of pipes. Musicians played the hydraulis in the arenas of the Roman Empire. Hydraulis contained elements defining an organ: a row of pipes, one for each note, with a key for each to admit the air, which was supplied by bellows.

Celestial beats pointed to the Galaxies. Though I could not hear the Music of the Spheres, I perceived Endless Ocean, Music of the Gyres, Oceanic Organ—Celestial Sounds all hinting at Galactic rhythm.


Modern construction of an ancient Greek hydraulis

Frost Lines

"The beach feels like a church," I said to my friend Jim Ingraham during a beach walk. "The Bible is an operators' manual," Jim replied, "For the soul traveling between the physical and the spiritual planes, as if transferring between the air, water, and land which join magically at the beach." The shore is special because the first creatures to inhabit land began their forays here.

Churches became for me places of the sea: bells in the belfry chiming the gyres; organs behind the choir with pairs of beating gyres. In the pews worshiped musical people (homo harmonicans) evolved from musical gyres. My understanding had advanced from an ocean full of gyres to the music of the gyres to an endless ocean in five harmonics to a celestial ocean pointing to galaxies.

In planetary science, the frost line is the distance from the Sun where it is cold enough for volatile compounds such as water, ammonia, methane, carbon dioxide, and carbon monoxide to condense into solid ice grains. These crystals spin beyond the asteroid belt inside Jupiter's orbit. It marks a clear separation between four terrestrial and the four gas planets. For decades, I wondered at the parallels between the gyres of the ice-covered Arctic Ocean and the frost line. On earth water and ice form two quartets. Water gyres are largely fluid circles, whereas the Arctic Ocean includes two gyres plus two Passages. The solar system includes two quartets: the small dwarfs inside the Frost Line and the quartet of four gas giants beyond it. The spiral galaxies consist of a quartet of circular orbits, and two to four spiral arms. My hope is that the fluid/solid patterns of Earth's quartets will guide other Galactic beings. ■

Beachcombers' Alert!™

SPRING 2022 103 ISSUES SINCE 1996

Destiny's Mission

Oceans Spin Life, Love, Music from Lightning-Struck Floating Pumice

Destiny Speaks through William Blake

In the Blue Room of our century-old Bungalow home, Susie and I watched Ken Burns' epic film *Country Music.* In Episode 6, Kris Kristofferson—the Rhodes Scholar who studied Romantic poets—explained why he shunned his father's distinguished military career and moved to Nashville and took a job as a janitor to write country music: "I love William Blake when he said: '*If you, who are organized by Divine Providence for spiritual communion, refuse, and bury your talent in the Earth, even though you should want natural bread, sorrow and desperation pursue you through life, and after death shame and confusion of face to eternity. Everyone in eternity will leave you, aghast at the man who was crowned with glory and honor by his brethren and betrayed their cause to their enemies.*' Blake's telling you that you'll be miserable if you don't do what [Destiny says] you're supposed to do."

Mission Clock dating from the 1893 Chicago World's Fair, which has hung in 7 Ebbesmeyer kitchens spanning 128 years

In my childhood, our family Mission clock chimed Destiny's desires. I never imagined She'd be so accurate as a clock that has hung in my family kitchen for a harmonic number (128 years; 7th power of 2): first in Great Grandma Carlson's kitchen, Chicago; then Grandpa Kieding's kitchen a block from Senn High School, Chicago; then the Ebbesmeyer kitchen on Aldea Avenue, Van Nuys, California; then the Ebbesmeyer kitchen on 70th street in Ravenna, Seattle; and now the Ebbesmeyer kitchen at 6306 21st Ave, Seattle. In 1893, when Grammy was 5, the well-traveled, century-old clock began tolling the hours for our family. Destiny required a century for Love at First Sight (LFS) to discharge superbolts binding five Bohemian generations dating from the 1850s in the Kingdom of Bohemia (in present day Czechoslovakia).

Biblical definition came from the clock tolling the day's hours, one each for the years of orbit of the Arctic Gyres. Until my most recent five years (3rd Lustrum), I failed to connect ocean gyres to the Pearly Gates with the keys to Heaven. This is a summary of my Mission . . .

For this Mission, Destiny marshalled tough Drill Instructors (DIs) who deployed lightning bolts with admonishment: "I'll tell you once," the DI said as if speaking through the gravel on which he stood. "If you miss one word of what I say you'll not get a second chance and your life will amount to naught." He laughed like a hundred mallard ducks, in reembrace of my mentor's (Cliff Barnes) unmistakable guffaw. "So, pay attention to my smallest utterances. I'll give you a preview of my lightning bolts you'll need to memorize. When you encounter them, I have whispered my voice in your ear." Then he hypnotized me saying he would not reappear to me until my life's last lustrum at the Pearly Gates in the Arctic Ocean.

Here are my seven bolts: 1) my father names two Easter ducklings "Flotsam and Jetsam"; 2) soul mate guardian angel Susie; 3) Great Spill of Nike Shoes; 4) Rubber ▶

Self-Experimenters

"Do not be too timid and squeamish about your actions. All life is an experiment. The more experiments you make, the better. What if they are a little coarse and you may get your coat soiled or torn? What if you do fail, and get fairly rolled in the dirt once or twice? Up again; you shall never be so afraid of a tumble."

—Ralph Waldo Emerson

Sometimes scientists experiment on themselves, as I'm doing with my genealogy. Notable examples occur in many endeavors. Before his theories concerning optics and planetary orbits, the ever-curious Isaac Newton employed himself as a test subject. As a teenager, Newton attempted to alter the interior curvature of his eye to observe visual distortions—by putting a large, blunt sewing needle "betwixt my eye and bone as neare to [the] backside of my

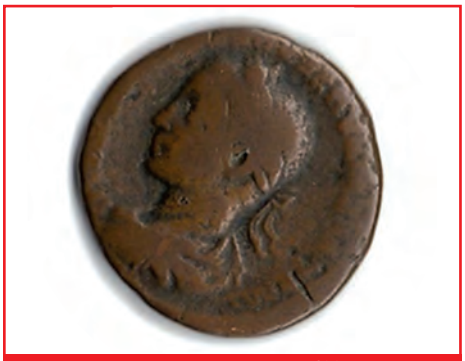
SELF-EXPERIMENTERS continues on page 2

Ducky Toy Spill; 5) Mentors Akira Okubo and Clifford Adrian Barnes; 6) pets for humor and love beyond judgement; and 7) looking into Destiny's toolchest. I will elaborate Destiny's tracks in this Alert's conclusion.

Here's the gist of it. The DI has one life to satisfy Destiny's request to recruit Curt to reveal humanity's Origin of Life. This transition centers around seeing and testing the hypothesis of life, love, and music originating from ocean gyres. The DI senses great potential in this blind boy, but Destiny gives the DI Curt's first childhood to shape up the recruit or discharge him. If he seems suitable, he will allow Curt to complete his second childhood before making judgment aboard the Arctic gyres at the Pearly Gates where all children believe Santa lives.

To make his point, my DI introduced Destiny. He launched Love at First Sight through five couples in half a century culminating in my Mission to find humanity's fate disguised in ocean flotsam. Hollywood filmed many film-noir movies (e.g., *Repeat Performance*) showing at the beginning of my 2nd Lustrum when I moved from my 1st Lustrum onto my half-acre crucible. The movie's heroine asks God if she could relive a dreadful year. God granted her wish with twists of Fate. "Destiny's a stubborn old girl," says one of the heroine's friends in the movie's climax. "I don't think she cares about the pattern so long as the result is the same."

I hope the missions of others who follow me will elaborate the connections between ocean gyres and human psyche. Then the DI called us one at a time into his office. He sat beneath her Mission Clock. If I've executed my Mission to her satisfaction, it's possible she'll send you to repeat my performance. ■



Roman coin signifying a lustrum in the 168-year Mission from Curt's conception to 84 years beyond the Pearly Gates in the Arctic Ocean. Learning high-school Latin led Curt to the Roman lustrum signifying five years, one of Destiny's key time intervals.

SELF-EXPERIMENTERS from page 1

eye as I could." His reasoning was understandable. Scientists of the time weren't sure if color and light existed in the outside world and were perceived by the eye or if they existed in the eye itself. Newton found that by poking himself in the eye, he could disrupt his vision by seeing spots.

Nathaniel Kleitman, father of sleep research, opened the first sleep laboratory in 1925; in 1939, he published *Sleep and Wakefulness*, the first major textbook on sleep. Before his groundbreaking work, Kleitman needed results in his sleep research, which in the 1930s was not a respectable scientific pursuit (much as flotsam study is today). Hoping to discover whether humans could adapt to a 28-hour day, he and an assistant moved to Mammoth Cave, Kentucky, where scientists could not distinguish day from night. They found that Kleitman, 43, was unable to adjust his 24-hour internal clock over the course of the month, whereas his 20-year-old assistant adjusted to the 28-hour day within the first week underground.

Legendary Self-Experimenters: *Isaac Newton (top left), Nathaniel Kleitman (top right), and the Haldanes (father and son, bottom left and right, respectively)*

British scientist J.B.S. Haldane studied physiology, genetics, evolutionary biology, and mathematics. With his father, J.S. Haldane, they began using themselves as human guinea pigs in experiments testing the physiological effects of poisonous gases and safety conditions in diving experiments. In one such experiment, J.B.S. placed himself in a decompression chamber to investigate effects on divers, ultimately suffering oxygen poisoning that led to burst eardrums and regular seizures. "On Being One's Own Rabbit," observed J.B.S., "to do the sorts of things to a dog as one does to the average medical student requires a license signed in triplicate by two archbishops, as far as I can remember" (his point being that it was easier to experiment on himself than to get approval to experiment on animals); and "The chief trouble in a long experiment is that one tends to drop asleep and stop breathing, so a ruthless colleague is needed to prod one."

Thusly inspired by pioneers, I assayed my life relative to ocean gyres. I hoped to inspire world wanderers to beachcomb flotsam and introduce themselves to the life, love and music of the gyres. Such beachcombing reveals the five major segments of life evolved into the human brain. These are ancient segments I've discovered by comparing ocean gyres with the turns of my life at 0, 5, 10, 20, 40 and 80, and 84 years. The harmonics of the intervals explain the origin of music and love. Discovering this ancient genealogy was made possible by the brave life of my grandmother as she dealt through the death of her husband in a prison accident, her daughter's love of Al Capone's musician, her son's feud with a control freak father in-law, and repairing fighter aircraft and selling chocolate on a twice badly-broken ankle. Through it all, she inspired my experimental childhoods and life. The arc of my Mission began near a cabinet of curiosities in which Grammy lived near LA's legendary funicular known as the Angeles Flight.

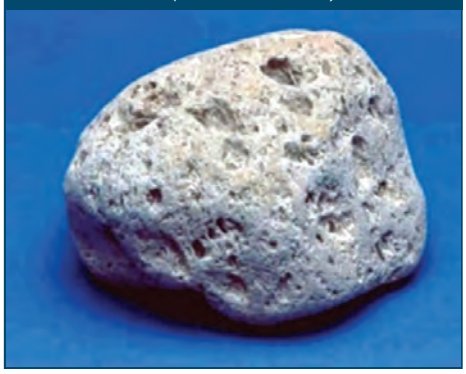
Adapted: *The Self-Experimentation Guide, April 30, 2020, by Richard Meadows; Review of Scientific Self-Experimentation: Ethics History, Regulation, Scenarios, and Views Among Ethics Committees and Prominent Scientists. Brian P. Hanley, William Bains, and George Church. Published Online: February 19, 2019; Notable examples of self-experimentation in science Posted by Jennifer Levine | Published June 15, 2016.* ■

Lightning's Heavenly Residue

Life, Love, Music

One day in 1993, over lunch in the Santa Fe New Mexican Restaurant a block north of our Ravenna home, I mentioned to Akira Okubo—my mentor since 1969, the year of my daughter Wendy's birth—that life might have originated in floating pumice. Being a matrix primarily of voids and silicon dioxide, pumice absorbs a variety of chemicals as it floats around. Given that complex chemicals led to life's origin on earth—and that pumice must have been present long before these chemicals evolved—it occurred to me that pumice drifting on primordial seas would have been locations where complex chemicals formed and concentrated. Therefore, they may have been the places where life, and its derivatives love and music, originated.

A sandwich provides a model for primordial earth, with the upper bread layer being pumice erupted from volcanoes ringing a layer of primitive ocean atop a bread layer of tectonic plates. Fundamentally, two layers of bread—pumice and plates—sandwiching gyres. By the end of our lunch, Akira and I had drafted a scenario of life evolved from this sandwich. *Nature Magazine* rejected our speculation, replying that it was a credible idea, but needed additional work. We agreed, but without funding I'd never had from flotsam research, we weren't likely to proceed; indeed, three years later my focus shifted from ubiquitous pumice to specific flotsam from spills kept secret by the container industry.



Above: *Fulugrite formation found at Jockey's Ridge State Park, North Carolina.* ***Below:*** *Pumice from South Sandwich Island (photo: Bruce Johnson).*

In the glare of worldwide container accidents, Akira and I had overlooked the consequences of lightning striking pumice. Lightning leaves a residue known to beachcombers as Fulgurite (AKA "petrified lightning," based on the Latin world for thunderbolt). Fulgurite forms as a hollow glass tube when lightning strikes soil, silica, sand, or even rock. These crystalline structures vary in shape and size and tend to form around the path of the dispersing electric charge of the lightning. Most are only a few inches long, but some reach great size—specimens over 16 feet long have been found in Florida, a 13-footer is displayed at the Yale University Peabody Museum of Natural History, and Charles Darwin measured one over 30 feet.

Near-vent lightning discharge during an explosive eruption at Sakurajima Volcano in Japan, showing a strike between the crater rim and the ash-laden eruption column (photo: Martin Rietze).

Though large, these residues pale in comparison with an ethereal remainder known as love.

To my romantic nature, fulgurite is the residue when Love at First Sight unites two souls. I never got the chance to advance questions of lightning with Akira from life's origin to present day love. How did Love at First Sight evolve from chemicals? Is it remembrance of lightning striking pumice billions of years ago? Lightning, pumice, and the gyres still exist. Evolution has miniaturized the gyres within the brain and segments of our lives. Pumice is found on most shores and lightning comes with many storms. I could not escape the idea that life began on the Planet of the Plates in a primordial ocean sandwich of pumice, gyres, and tectonic plates. When I'm holding piece of pumice, I feel I'm close to the origin of life, love, and music.

After I discovered music of the gyres, it was a short leap to believe that the gyres evolved to further life such that intelligence will express its love through music. Destiny has deployed tools to evolve a harmonic structure of gyres with five orbits: 0.75, 1.5, 3, 6, and 12 years, the harmonic sequence I named in a chapter called "Music of the Gyres" in my book *Flotsametrics*, written with Eric Scigliano. Destiny's earthly laboratory consists of a planet with crustal and watery plates, constantly in motion with the crustal species grinding against one another to produce volcanoes, which erupt great volumes of pumice, some of which then floats on the gyres. Long ago Destiny evolved animals in the pumice sandwich between tectonic and water plates. Destiny has thus far produced an intelligence uncertain of its origin.

As if in a dream, I'd discovered 50 years' work condensed into a harmonic table for the gyres, life, and miniature world ocean (Puget Sound). I realized music grew not only from the gyres and estuarine cells, but from life itself. My epiphany came as Picasso saw by unifying childhoods in the interlocking music, life, gyres, and the miniature world. My life unfolded as if origami into segments turning from one to the next at ▶

Lake of Irony

Eyes blink; frogs & trout strike; lightning ignites life & love

Destiny glanced from tinkering with the Universe at the little green lustrum on a pond known as Lake Gregory, Southern California, and saw a little boy jigging a fishing rod for shore-bound frogs to strike at his flies.

Destiny saw that the boy would love frogs hopping through each of his life segments. Hardly a day went by without a chorus croaking happiness on the difficult Mission he'd assigned. At 7 months into his first Lustrum, Curt's mother first took him to frogs singing round Lake Gregory. In the second Lustrum, he jigged for frogs while his parents hoped for trout strikes. At 17 he and his fiancée Susie fished from the little blue and white boats from Club San Moritz on the lake while nearby frogs snapped up insects like lightning zapping pumice.

Long ago, I assumed life unfolded slowly and uniformly. Instead, it turns out to hinge on things happening in the blink of an eye; then the participants work to unfold the ensuing blessings. For me, these blink-of-an-eye events included a knock on a mentor's door (Cliff Barnes); noting an advertising a job on a bulletin board (leading to my job as Mobil's first oceanographer); ringing the phone of another mentor (Akira Okubo); the birth of a child (Lisa, Wendy); an invitation to pledge (Pi Kappa Tau Fraternity); a question from my mother about spilled Nikes; my father's suggestion to initiate the *Beachcombers' Alert*; Cathie Katz's request that I attend Sea Bean Symposia; and Nancy Yaw Davis' suggestion that we convene Pathways Across the Pacific concerning humans boating across the North Pacific Ocean. Over the years, I discerned Destiny's voice signaling my Mission's clues. Eventually, I would see the shore strewn with sea-themed hints for completing my Mission.

Frogs Symbolize Happiness. *Four poses show them bringing happiness to Mission segments.*

Before I knew anything about the Mission, though, there were the frogs. Why do the world's 4,700 frog species catch their prey with sticky tongues, flicking them at speeds faster than humans blink. Why did their antics capture my heart?

The flick of a frog's tongue seemed akin to clouds zapping pieces of pumice as if they were insects. In the fourth grade, while browsing the *World Book Encyclopedia*, I learned the amazing speed at which a frog's tongue zapped insects. Or maybe it was from a Walt Disney cartoon. Whatever, I took pride in my solution for fun when my parents needed quiet time from us boisterous boys—while they fished for trout, I jigged for frogs in the water weeds along the lakeshore. My frogging apparatus consisted of fishing line tied to a short twig, with a fly suspended a foot or so above the twig appearing to the frog to dance on the weed as an insect. It was the same as what was needed for trout except the hook designed to snag a trout was replaced by a barbed fly. So not to harm the frog, I flattened the hook's barb. I loved frogs as much as Mom and Dad loved trout. I brought frogs home and put them in an aquarium Dad and I fashioned from an upright washing machine discarded in a local junk yard. I jigged more frogs than they caught trout.

Later, I also saw the ironies of love. In simplest terms, irony occurs whenever something departs from the expected. Love at First Sight signals misfortune followed by magnificent blessing. Frog tongues striking pumice inspired the idea that Love at First Sight (LFS) evolved from lightning striking primordial pumice. A frog ▶

◀ harmonic intervals in proportion with the orbital periods of our ocean mother. Ocean gyre forms manifest themselves in countless ways: Gyres on turtle shells; human life segments; a miniature ocean in Puget Sound discovered by Cliff Barnes; dogs delivering whelps (e.g., Dalmatians); people continually sing/hum/play music; left vs. right handedness; turtles swimming with flotsam speed; the weight of people with the specific gravity of sea water.

Source: *My tribute to Akira published in Oceanography Magazine three years after Akira's death (Oceanography, Vol. 12, No. 1, 1999). In 1993 we submitted our letter on life originating in pumice to Nature Magazine. Though Nature declined our article, I publish here in hopes that the debate will live on in memories of Akira.* ■

My father and me on a rocky California shore in my 1st Lustrum (birth to 5 years). Later, we molded paper mache into a miniature volcano in the garage above the hood of the grey Plymouth in which he peddled Merckens German chocolate along the California coast.

The Look of Love at First Sight (LFS). *I spent a lifetime examining family genealogy for LFS. It struck at Life's 20-year turn four times in 57 years (top row):1906, Herman Ebbesmeyer and Anna Marie Polhans; 1918, Martha Ebbesmeyer and Ray Blewett; 1932, Paul Ebbesmeyer and Genevieve Kieding. Bottom row: Susie Appleby and Curtis Ebbesmeyer (1960s and 1990s). LFS struck Anna and Herman from the bleachers to the pitcher's mound at a baseball game between inmates and guards at the Fort Madison State Penitentiary. At 17, LFS struck Genevieve and Paul (Curt's parents) on a blind date on Valentine's Day 1932 in the rumble seat of a Model T Ford. LFS struck flapper Martha while Ray played a gig in Fort Madison; LFS struck Susie and Curt in 1963 when they glanced across a college dance floor.*

flicks its tongue in the hopes of securing a meal. But misfortune may result at a boy's jigging. What purpose does it serve?

Pumice circling the seas segmented our lives into harmonics: 0; 5, 10; 20; 40; 80; and 84 years. Greatness comes along in each human segment. Birth of course in the First Lustrum. Second Lustrum magic came for me while vacationing with my parents on a half-acre at Lake Gregory. Near the turn at 20, LFS with Susie and finding college. The birth of Lisa and discovering water whelps at 23, 24. Could such "lightning strikes" prove functional in punctuating the turns between orbital segments? The best I could do is to examine LFS as it passed through my Bohemian ancestors. Then I saw love's longer view. Sifting family genealogy, stories of LFS surfaced until I realized they demonstrated misfortune followed by blessing. Almost as if lightning announces a storm followed by clearing with brilliant sun shining on the lovers.

My parents come from what's called the greatest generation, those who lived through World War I, Prohibition, the stock market crash of 1929, the Great Depression, World War II, and the Cold th War. My parents, Paul and Genevieve, were born in 1915. To the calamities, I added two: one from death, as my father lost his dad at age five, and the other from social discrimination.

When she could no longer tolerate farm chores raising hogs and corn, Anna Marie Polhans, the woman who'd become my grandmother, took the Peavine narrow-gauge railroad from a block outside her bedroom window 17 miles to Fort Madison, Iowa, to watch a baseball game at the Fort Madison State Penitentiary in 1906. LFS joined her with Herman Ebbesmeyer as they glimpsed one another across the baseball diamond, she in the bleachers, he on the pitcher's mound. Though Herman died in a prison elevator accident in 1920, Ann never ceased intensely loving him. LFS struck their child Martha (my aunt) when musician Ray Blewett played a gig in a Fort Madison Dance Hall. Grammy Ann moved Martha so Martha would be near Ray where he played for Al Capone at the Green Mill. Martha eventually became my godmother.

Love's lightning struck my parents in the Depression on a blind date in the rumble seat of a Model-T Ford on Valentine's Day evening, 1932. Decades later over wine, my mother admitted that her feet had become tangled in a jock strap lying on the floorboard of the rumble seat. She never told her father, Emil, of the night's events, but what she did tell him kept Mom and Dad from marrying for seven years—the man she was with was the son of a brothel madam from Chicago's infamous South Side; over his dead body would Emil let his daughter from the wealthier North Side marry such a man.

Over the years, I assembled the family genealogy. Montages could not show each Mission element. Moving for love (1906-1965): 1906, Grammy hated farm life and fell in love 17 miles away in Fort Madison. 1920, LFS struck Martha and Ray; as Ray needed to work in Chicago to play for Al Capone, Grammy moved her family from Fort Madison to Chicago. 1932, LFS struck my mother and father, but Emil opposed their marriage and they had no money for education; inspired by Grammy's move, Dad found work in a St. Louis theater projecting movies, enabling him to see 5,000 films in three years (1939-'41). 1963, LFS struck Curt and Susie; Curt was legally blind but needed a draft deferment and had no money for education. They made two moves, first to Bakersfield, then Seattle. ■

Speed of Love

Lightning Blinks; Ocean Drifts

If, as Akira Okubo and I theorized, life began when lightning strikes floating pumice, two varieties of speed might have evolved with life and its companion love: lightning in less than a second; and the drift speed of pumice across the sea (7-20 miles per day). Lightning blinks at earth a billion times yearly. Pumice often drifts from the violent intersection of tectonic plates and typhoons striking Japan, then orbits North Pacific Gyres and ultimately rounds the 3-year gyre hugging Alaska and the 6-year gyre to the south carrying sea turtles to Baja California and thence back to Japan. Knowing this, and beachcombing at the downstream end of this racetrack, I watch for speedy trans-ocean flotsam for insights into love's origin.

"Please describe the contribution of beachcombers to your oceanographic work," queried Dan Brotzel, winner of the 2018 the *Riptide Journal* short story competition. I collect what the sea writes following Edwin Arlington Robinson's maxim: "The ocean is forever asking questions and writing them aloud on the shore."

For decades, I've tried to address queries like Dan's. Years ago, for example, on the TV Program *Wired Science* (segment entitled "Flotsam Found," PBS, October 10, 2007), I answered host Ziya Tong: Flotsam is the voice of civilization. Despite my cryptic answer, I persisted, fascinated by questions such as why does the ocean sort out left- from right-handed flotsam, and how has evolution miniaturized ocean gyres within the human brain? Other times, the speeds of flotsam across oceans fascinates, particularly when Jim Ingraham and I resolved numerical coefficients to characterize how winds and currents drag flotsam.

Eleven years after my mother bronzed my baby shoes (circa 1945), Malcolm MacLean shipped the first standardized cargo containers. From that single shipment in 1956, the container industry exploded into myriad containers transported round the world aboard fleets of container vessels organized as a gigantic web of bus lines. Inevitably, containers fell overboard. Around 1990, my mother was alerted to 80,000 Nike sneakers lost in the Pacific, which spotlighted a closely-guarded industrial secret. With the computer program named OSCURS (Ocean Surface CURrent Simulator), Jim Ingraham tracked the Nikes to the Pacific Northwest. Since then, I've tracked container debris whenever the secretive industry accidentally divulged the contents of overboard boxes, earning me the wrath of the ever-vengeful container industry.

Above: *Kathy Klee beside FAD (Fish Attraction Device aka float) dislodged by super typhoon Saomai.* ***Below:*** *bike helmets for 5-year-olds lost from the Maersk containership Eindhoven.*

By tracking diverse flotsam, I deduced the human brain resembles miniature ocean gyres. Ocean flotsam told me I needed a ratio: 7. An important number in miniaturizing the world ocean is the ratio of life segment to gyre orbital period. In my Utopian Lustrum, Dad and Mom took me to Lake Gregory at age 7 months to acquaint me with their reservoir of happiness they discovered while projecting 5,000 movies in St Louis. The experience would eventually lead me to the harmonics of the Miniature Sea known as Puget Sound, glacial Ross Lake, and terminal moraines in the Valley of the Moon.

As I compiled gyre orbits from flotsam, I noticed the regularity of the elapsed times along the oceanic gyres along which container vessels plied the world ocean. Decades of tedious compilation led me to the realization that the world ocean organized itself with gyres—like planets orbiting the Sun—having orbital periods in a five-part harmonic sequence: 0.75, 1.5, 3, 6, and 12 years. When I considered my life, I noticed seven orbits fell between turning points of my life: 0-5 years; 5-10; 10-20; 21-40; 41-80; 80-84; 84-168. To this musical sequence I added conception and pregnancy before birth, arrival at the Pearly Gates, and 84 years following entrance to Heaven.

As I condensed 103 Alerts written in 25 years, beachcombers directed my attention to the massive container spill of October 30, 2020–February 17, 2021, during which 2,962 containers fell overboard from five ships, a tally more than double the annual average of 1,382 containers lost overboard each year form 2008-2019. I had not expected the ensuing flotsam to transit the Pacific for two years. Suddenly, beachcombers Russ Lewis, Elizabeth Roberts, and John Shaw relayed reports of children's bicycle helmets bearing the kid-friendly name Raskullz. According to the manufacturer: *"Raskullz—Finally a helmet that kids WANT to wear! This 3D Raskullz Hawk Mohawk helmet inspires imagination and* ▶

Gyres 7 Distill Love

Black lab licks insight with Grand Marnier from my toes

Condensing 102 *Alert* newsletters—25 years' writing—proved daunting. Confronting difficulties, I walked in my family's footsteps. When his father-in-law Emil Kieding blocked marriage to my mother Genevieve for seven years, my father sought solutions while projecting 5,000 movies as he operated a cinema. When a prison accident killed my grandpa Herman Ebbesmeyer, my grandma had to survive without any assistance during Prohibition, so she ran a brothel while renting rooms she supplied with bathtub gin. The pattern of Bohemian solutions runs through the generations to distilling the ocean as reflected in my newsletters.

I returned to childhood incidents because they provided solutions to complete my Mission. Witnessing our pet collie dog whelping inspired me to name the blobs split deep in Puget Sound fjords from parent water masses "water whelps." In my Mission, I found the world ocean pointillist with myriad water whelps. The shell of our pet tortoise Elmer mirrored the patterns of ocean gyres which inspired my discovering music in the gyres. My father named two yellow ducklings he brought home for Easter by the prophetic names Flotsam and Jetsam, thus aiming my destiny at the ocean. At 2, Mom bronzed my baby shoes a precursor to the great Nike Shoe spill and my entry into the Floating World. Digging holes led to a lacustrine love and the harmonies frogs sang nightly. And I found insight with childhood dogs.

Home to "water whelps," Puget Sound spans 300 miles

Watching collie Lassie give birth allowed me to observe whelping firsthand; thus was born my idea of water whelping blobs resembling immense submarines. Two other dogs opened doors to humor. When my brother Scott and I returned home from school one day, we noticed a can of beer Dad left unopened in the refrigerator. I wondered if our basset named Long John would like beer. Sure enough, he lapped up the can we poured into his water bowl. Soon, he raced around the house, and we flipped him on his back, spun him around so he got dizzy. Wasn't long before he passed out from his first drink. Years later, at Ross Lake, I spilled some Grand Marnier Liquor on my feet. To my surprise, Steve Rasnick's beloved black lab Lotta licked my toes. Soon, I became known for enjoying toe-licking dogs.

As the years rolled on, I often found myself joking about man's greatest inventions. I'd recount the wheel and fire then say the third got no respect: alcohol. I've often wondered about the invention of alcohol. Eventually, I found the simplicity of making bathtub gin—for 100-proof, fill a bottle half full of pure alcohol, then fill the other half with water adding for flavor a few juniper berries. Sometimes I wonder if I'm a borderline alcoholic; it's just that I have a lot of respect for the magic qualities of alcohol for lubricating the brain. ■

encourages kids to be active outdoors. The bicycle helmet features an eye-catching 2-inch tall bendable red mohawk with black tips, and a totally rad stencil-style Raskullz graphic! The vented aerodynamic styling allows for great airflow and keeps your melon cool when riding. The child size helmet is recommended for riders 5-8 years old."

When I realized the helmets' transpacific drift, I recalled two other fleet flotsam: a Fish Attraction Buoy (FAD) and oyster buoys loosed by the great Japanese tsunami on March 11, 2011. The FAD, buoys, and helmets comprised a transpacific trio. Japanese fishermen anchor FADs to beckon their catch. On August 9, 2006, supertyphoon Saomai dislodged a FAD off Ginoza, Okinawa. In a remarkably short 8.1 months, Kathy Klee beachcombed a red FAD off Copalis, Washington. Though initially unbelievable, with OSCURS, Jim Ingraham confirmed the FAD's incredible speed. There the Pacific record stood till the vessel *Eindhoven* lost containers near the anniversary of the great Japanese Tsunami.

The fastest transpacific times average eight months (mean of 7, 8, 9 months). Converting to speed yields 5,000 miles in 8 months (240 days) or approximately 20 miles per day. Three comparable speeds showed flotsam often transits the North Pacific in less than a year. This is quick enough for some ocean animals to adopt in their migratory strategies, notably Loggerhead sea turtles and others to routinely show up as invasive species and orbit Columbus Gyre in the North Atlantic. Regarding humans, the two dozen feet washed ashore around the Pacific Northwest provides insight on how long flotsam may remain in floating footwear. These data suggest that intervals of 7-9 months are not unreasonable, making it possible that bones from a few of the 20,000 people missing from the great Japanese tsunami might yet be found buried for years along the Pacific Northwest.

Finally, a note on helmet toughness. Many bike helmet manufacturers recommend replacing helmets every three to five years. This suggests that the first arrivals might be OK for public use. But remember, they have survived crashes in the surf and manufactures also suggest replacing helmets after each bicycle crash. I do not recommend recycling them.

Sources: *Beachcombers' Alert December 2020 (FAD buoy) and July-September 2021 (Eindhoven loss), José A. Sánchez. According to sea sightings the containers from the Maersk Eindhoven were spotted in the Kuroshio Current February 16, 2021. Nine months later, December 10, 2021, beachcombers reported them along Oregon and Washington.* ■

Shooting Stars Signal Life's Turns

Blinding love then tragedy and Bohemian solutions

I began in a cabinet of curiosity, my grandmother's apartment in the Bunker Hill neighborhood of Los Angeles. My dad had watched 5,000 films in Saint Louis; now his mother moved to a virtual movie set in the site of many Hollywood movies: historic Bunker Hill. Specifically, the Lovejoy Apartments, corner of 3rd and Grand.

I came full circle when I moved into our Bungalow home dating from 1917. Grammy loved the Lovejoy apartment because it dated from her childhood days (the Lovejoy was built in May 1903 and contained 78 apartments). I now live in a house of curiosities: A Mission clock from 1893; the antique handwoven Persian carpet from Grammy's Lovejoy apartment; Roman and Arabic coins; Encyclopedia; thick red Websters 2nd International Dictionary; WWI stainless steel water pitcher. Our home is crammed with belongings from my parent's home, Grammy's apartment, and my mentor Cliff's office. A few years after Cliff's death, his family asked that I clean out his office which was itself a cabinet of curiosities.

Amongst the many curiosities in Grammy's apartment was a Persian coin left by a tenant; for a decade, I would not realize the silver coin's significance. Like a shooting star, Destiny turns in a flash.

Aladdin Zarrinpour streaked through my life like a bolt of lightning. Aladdin attended college under the personal sponsorship of a regal sovereign King, the titular ruler of Iran Mohammad Reza Pahlavi Iran (1919-1980). In his year with my fraternity, Aladdin touched many brothers' lives. At a reception at a hotel in downtown Los Angeles, Aladdin introduced brothers to the Shah, with handshakes remembered to this day. Susie and I double dated with him. He played football for our fraternity intramural team against a fearsome team comprised of college varsity players. As fraternity athletic director, I yet remember a single play Aladdin made. Given his awesome physical prowess—by 18, amateur boxing lightweight champion of Europe with 24 knockouts in a 54-6 win-loss record—we substituted Aladdin as a guard with a single, clear instruction: protect our quarterback. Just after the ball's hike we heard snaps: the football and the femur of Aladdin's opponent. We did not know that, as the Shah's personal bodyguard, Aladdin was trained to kill in the presence of lethal, deadly quick movement. He was taught to kill and not maim. When the ball was hiked, his lightning reflexes snapped the opposing guard's leg bone. His opponent was lucky to come off the field alive.

Aladdin became legendary for reading palms. He never read mine, but had he done so he might have told me of the three loves and their wakes that would strike my grandmother, mother and father, and Susie and me. He might have seen the overall pattern of Destiny's chess game—love at first sight followed by tragedy and love's triumph—but not the unique Bohemian solutions. In a nutshell, here they are, beginning with lightning love.

Inspiration at Life's Turning Points. *Upper left: Royalty sponsored my Persian fraternity brother Aladdin Zarrinpour, shown here with the ruler of Iran in Los Angeles, circa 1962. Upper right: In the Swedish film The Seventh Seal (1957), Max von Sydow plays chess with Death. Lower left & right: My father knew the Lone Ranger (Clayton Moore) at Senn High School in Chicago; when Moore dropped out of Senn, it inspired Dad to pursue alternative education. As a cinema theater projectionist in St. Louis, my father saw 5,000 films in three years (1939-1942) before he became a machinist, chocolatier, high-tension tower designer, and textbook illustrator.*

Grammy met the dashing pitcher Herman in prison when she attended a baseball game between guards and inmates; Her daughter Martha fell for one of Al Capone's musicians on a gig in Fort Madison; Mom and Dad met on a blind date in a Model T Ford; and Susie and I met in a college dance class. Before they lived ever after, they worked through many chess moves to defeat misfortune.

When I became Mobil's first oceanographer in November 1969, Susie and I moved to New York City. On my first trip to London, I flew via Icelandic Airlines with a stop in Reykjavik so I might see Bobby Fisher play chess. My London meeting precluded the timely ticket purchase, so I never saw Fisher play chess. The incident puzzled me for half a century till I connected it with the movie *Seventh Seal,* wherein a returning crusader plays chess with Death seeking extra life from the Grim Reaper. The knight (Max Von Sydow) returns home from the Crusades to see his country ravaged by plague and famine. ▶

Discovering that Death has come for him, he challenges the Grim Reaper to a game of chess—if he wins, he can return home for a short time to his wife and family. If he loses... Game over, man. Game over!

In the chess games with life that form my family's genealogy, an elevator accident killed my grandfather leaving my grandmother without means to raise two energetic children. Soon after love struck my parents, my mother's father refused her a marriage to a man whose mother was running a brothel on Chicago's South Side. As for myself, when love struck Susie and me the Vietnam War raged, calling for thousands to enlist. Though legally blind, the Army said they would give me extra pairs of glasses so I could see should I wind up face down and wounded in a rice paddy. I kept up with college and did not give induction much thought. By good fortune, on fraternity business, I noticed an employment ad for Mobil Oil Corporation. Within a few weeks Susie and I had dinner with Bill Clauser, manager of Mobil's largest oil producing fields located in Bakersfield, about an hour's drive north of Los Angeles. Turned out, without any prior knowledge, the engineering job carried a lifetime deferment from military obligation.

The solutions befit any of Hollywood's finest movies! My grandmother turned to renting rooms near the ferry terminal on the riverfront at Fort Madison, Iowa, a few blocks from where her husband had been killed. Though Prohibition had just begun, Anna kept her rooms full by making her own bathtub gin and supplying it at modest cost to her lodgers. When her daughter Martha fell for Capone's musician Ray Blewett, she moved to Chicago to run a brothel so as to be near Ray. When my father began with the rackets, Anna again moved, this time to Chicago's North Side so as to be near a fine school (Senn High) where Dad met Mom. As for me, I soon became bored with engineering and decided to enroll in oceanography at the University of Washington. Though I gave up my lifetime deferment, other draft deferments came along (graduate school, lottery) and finally a permanent exemption with the birth of our daughter Lisa. ■

AHA Moment

Life segments coalesce

Later in life, a correlation occured to me suggesting that our brains evolved from ocean gyres: (1) the time a flotsam drifted around a gyre; and (2) the segments between human birth and death. Using my own life as a model, I saw those early years in my back yard were crucial to launching a life. This was also the age when school started for me and other kindergartners. Another pivotal seemingly universal school age came along at about age 16, when Destiny knocked. And I knew that my hero Carl Jung thought about 40 as the age when many experienced midlife crises. And my family seemed destined to live 84 years.

It wasn't much data, but I glimpsed a harmonic sequence nonetheless. Birth to five equaled 5 years, that much was obvious. And ages 5-16 equaled 11 years, about double five years. And 16-40 was close to 38, double the 11 years from 5 to 16. This was about as far as I could reason: 5, 16, and 38 years separated by the harmonic sequence of 5, 11, and 24 years. I could add 44 years if I assumed death at 82 (my father died at 81), thereby reducing a life to a harmonic sequence. How could I relate the ocean's gyres to the segments of human life? This belief guided life beyond 40 until I began realizing that the Universe must be a lock with a key.

I had always searched for a single number as the simplest essence of Occam's razor. It might rival Pythagoras' discovery of Pi describing all circles in the Universe. So, I formed ratios like the aspect ratios Dad had taught me: 5 years / 0.75 (7); 11 / 1.5 (7); 22 / 3 (7) and 44 / 6 (7) years. Each ratio equaled 7, a number the ancients held in high regard.

Occam's Razor states that the simplest explanation is usually the right one. The idea is attributed to English Franciscan friar William of Ockham (circa 1287–1347), a scholastic philosopher and theologian who used his preference for simplicity to defend the idea of divine miracles. This philosophy advocates that when presented with competing hypotheses concerning the same prediction, one should select the solution with the fewest assumptions. I could select the harmonies of two tables of numbers by single ratio of them as 7. It seems that the harmonic series applies to life and gyres on earth united by the number 7.

The strands of evidence swirled around the number 7. Things crystallized when Susie had her sixth major surgery in a decade (2 shoulders + 2 knees + ovarian cancer). Susie longs to live in Paris, and so we settled on the last weekend in March 2017 for a trip there. The surgery on her right knee went fine as Dr. Flugstad had performed some 5,000 knee replacements. After being discharged from Swedish Hospital on a Friday, however, no sooner had we gotten to rehab at FOSS Home and Village than the first surgery dislocated. Dr. Flugstad said it was a freak occurrence that could happen to anyone; after a weekend of excruciating pain, the doctor performed a second surgery. And still the good doctor said we'd be OK to take our Parisian holiday. And so, it worked out.

The disguised blessing came with Chaplain Al Roehl's ministry to FOSS residents. I had noticed him but had not introduced myself until I happened by his open door in the FOSS basement as I was searching for parts for Susie's rehab. I poked my head in to say how much I enjoyed listening to his recent sermon, which he delivered while strumming his guitar. I remarked on how I thought music tied in with spirituality. I also mentioned how as I was finishing my Mission, much converged on 7. He immediately remarked on the number's immense spiritual importance. Thus arrived an "aha" moment as a blessing in disguise. ■

Beachcombers' Alert

Unless noted otherwise, attribute authorship to Dr. Curtis C. Ebbesmeyer. Managing editor, Jim White. Production & layout: Constellation Design (www.constellationdesign.net). Computer support: Mark Heavy. We take no advertising or institutional funding. Without your subscription, the Alert will cease publication. For a one-year subscription, send your annual donation to Beachcombers' Alert, 6306 21st Ave. NE, Seattle, WA 98115 USA. Make checks payable to B&OIA (Beachcombers and Oceanographers International Association): $25 in the USA; $30 USD elsewhere. Digital subscriptions available at www.flotsametrics.com ($20 USD, payments via PayPal). Printed by Blue Sky Printing, Poulsbo, WA.

Mission Summary: The 4 L's of Life

Love at First Sight (LFS), Life Turns, Lustrums, LOGs

You do not know who you are till you know how the stories of your grandparents and parents relate to your own. Eventually you will discover the essentials. Mine is Love at First Sight and solving problems by moving to discover magnificent blessings in disguise.

Love at First Sight: LFS. Ours has been a tight-knit family for generations. How each couple met has been passed down for generations. How they fell in love struck me for several reasons. They each fell in love at first sight. When I was a boy, I learned how in 1906 LFS struck between Grammy in the bleachers and Herman pitching in a baseball game between the inmates and guards at the Fort Madison State Penitentiary. In 1918, LFS struck between Grammy's daughter Martha when musician Ray Blewett took a night off in Fort Madison from playing for mobster Al Capone in Chicago. In 1932, LFS struck between my mother and father on a blind date in the rumble seat of a Model-T Ford. In 1963, LFS struck Susie and me in college when our eyes locked across a dance floor. Despite the passage of generations, each instance of LFS struck between 18-20 years, love's major turn between life segments of 10-20 and 20-40 years. I assumed these four cases simply were an aspect of love life passed down through Bohemian generations.

I would later learn of three more Destiny's footprints on the beach. Her hints stem from the days of evolution to the miniaturization of gyres in our brains. With hints she signals transference of riders on her ancient railroad lines from one gyre to the next proceeding to ever longer harmonic scales. She plays her musical scales by strumming our lives. Trolleys ran through my grandmother's life as well as mine: the Angels Flight funicular in Los Angeles; the Red Carpet Line in San Fernando Valley; and the Ravenna streetcar which ran a block from our Ravenna home and the turnaround at 65th St. and 20th Ave. NE. Old local railroads laced Grammy's and my lives as much as LFS. As I stitched together family genealogy, I wondered as to my ultimate mission. In a magnificent vision I wondered why LFS interwove quartets of other generations? It had taken me a lifetime to discover LFS in four generations stretching 57 years from 1906 to 1963. Why was LFS passed down through Bohemian generations?

Could Destiny be asking me to organize beachcombers around LFS? It was not a coincidence that the genealogy of four Bohemian generations equaled life's turn near 20: 18, my grandmother; 18, Grammy's daughter; 18, my mother; 20, Susie and me. Suppose I could identify a hundred quartets who passed LFS through four generations as I have? What purpose could this serve? Would we better understand the Pearly Gates and the afterlife? LFS seemed a clear signal for my Mission.

My thoughts of Love LOGs impel me to inquire of friends if they fell in love at first sight. If so, how long did it take? It is a fearsome, sensitive question. My question puzzled some; others answered yes, enthusiastically. Thoughts of LFS beg the question as the duration of time required to recognize LFS. If the soul never dies, how do I calculate Love's LOG? With infinite life span and a small gestation, the LOG of the soul must too approach infinity: souls imply infinite LOGs. Pressing for specifics, the answer often comes back as a fraction of a second.

It struck me like a thunderbolt. Just a single blink of the eyes. Now I knew that force could be achieved without physical contact. And as love songs that move the heart, say, Love lasts forever. So here I am in my last Lustrum of life finally putting numbers to LFS. The Soul Number is life span divided by the gestation of LFS or the blink of an eye. Why has it taken me a lifetime to imagine this number? Imagining the Universe is simply a matter of perspective. Have I peeked into Destiny's toolchest?

Inserting the most accurate numbers I felt reliable: 84 years derived from the music of the gyres; and 0.1 seconds for the duration of an eye blink (according to laboratory measurements it averages 100–150 milliseconds). Therefore SN = 27 billion. The time scale I associate with this number which by chance happens to be the approximate age of the Universe expressed in years. Whether right or wrong this LOG does put in perspective the range of LOGs I encountered in my mission of 10 to thousands. In the perspective of the Universe my mission LOGs were relatively constant.

Life Spins 7. As my understanding of my family's Bohemian genealogy advanced, I noticed a pattern in the Music of the Gyres accompanied LFS. Comparing family trees revealed four distinct turns at 5, 10, 20, and 40 years. Soon I deduced the intervals between life the turns equaled 7 times the corresponding orbital periods of the ocean's gyres. It occurred to me that animal evolution had miniaturized the gyres into the human brain. Destiny must have wrapped love and intelligence amongst the human gyres.

Profound thinkers draw attention to the number seven: Nachmanides (12th century Spain) postulated seven is the number of the natural world; Isaac Newton divided the color spectrum into seven colors: blue, red, yellow, green, orange, violet, purple; seven notes comprise a musical octave: Do, Re, Mi, Fa, So, La, Ti. It is impossible to underestimate how much the gyres have imprinted on humanity and the importance of the number seven throughout human life. In the Bible, seven occurs more than 700 times. Jesus gave sermons on the beach. It often seemed to me I beachcombed along the shoreline of life. In the end, Quest's signs gathered at Destiny's Lighthouses. That they gather at the physical/spiritual turn where time and space separate, when life turns into afterlife. I'd ask beachcombers if they find 7s.

Lustrums. As I noticed the four instances of LFS I also observed three life segments of 5 years, two at the beginning of life and one at the conclusion. Toward the end of my life, these took on appropriate names: Utopian Lustrum named for the first five years (0-5) lived in the Utopian Village known as Baldwin Hills Village. The second (5-10) became the Half-Acre Lustrum of my magical childhood. And the third Lustrum (80-84 years) Destiny's Lustrum when Destiny will interrogate me as to my Mission's success.

LOGs for Childhood. It is no accidents that 7 stray cats arrived on the porch of our bungalow home at the beginning of my second childhood. Now that Mission is in its third and last Lustrum, all have died, even beloved tabby cat Tucker. I read two of Mark Twain's favorite childhood characters, Huck Finn and Tom Sawyer. He loved cats; he clearly said that he respected cats more than people.

Cats, dogs and turtles guided my mission, embraced by snowmen rolled from 100-year snowfalls. Dad illustrated my scientific papers; Mom resumed from my first and second childhoods clipping newspaper clippings regarding the ocean. After this hiatus in Lake Gregory, where frogs had been my favorite pet, I often recited one of my favorite quotes from Winston Churchill: "I am fond of pigs. Dogs look up to us. Cats look down on us. Pigs treat us as equals."

Peeking into my father's toolchest taught me the power of Pi, the aspect ratio of a circle's circumference to its diameter. Gyres related ▶

to Life segments by the number 7. If human life segments and gyre orbits were both harmonic based on the power of two, then they should be related by a constant number. Guessing that the number should be 7, the orbital periods indicated ages of life segments should be: 5.25 (i.e., .75 x 7); 10.5 (1.5 x 7); 21.0 (3.0 x 7); 42.0 (6 x 7); and 84 (12 x 7). Realizing further the uncertainties in both sets of harmonics and that the orbits derived from thousands of flotsams were more accurate than the life segments derived from a single life (mine), but believing that harmonics were common to both, I assumed the life segments derived from orbits were the most accurate I could derive from very limited understanding: 0, 5, 10, 20, 40, 80, 160. And still I remained skeptical.

And yet I knew mortal death signaled earthly life's final turn. I wondered if mathematics continued beyond the grave. Dimensionless ratios certainly do like Pi, $e=MC^2$, and aspect ratios. Then I saw the ratio that defined the duration of love and the Universe. It was the number sea turtles taught me: LOG = Lifespan Over Gestation. When I realized it derived from Love at First Sight, I realized I might have to rename it as Soul Number (SN). Taking the age of the universe as 14 billion years and love at first sight (LFS) taking 0.1 second yields LOG LFS = 400 trillion. Now I had a framework to think on the entire gamut of LOGs. LOG for the rubber ducks equaled 10 billion, a mere fraction of LOG for the Universe. I'd now estimated two impossible LOGs trillions (Love) and a billion (plastic duck).

The power of ancient numbers—2, 3, Pi (3.14), 7—convinced me to be alert for other meaningful numbers. How large could they be? Many believe angels accompany us through life. The engineer in me yearned for specific evidence of my Magnificent Mission. The best I could do is examine LOGs for as much as possible. One of my favorite aspects of angel numbers is that their meaning is personal. To make sense of the harmonics, I needed a second birth from my mother to search for my original mother ocean. I had been friends with many pets, shared love with many—dogs, cats, tortoise—yet had not found a way to include them in Destiny's tracks. Then as I cupped a baby sea turtle in my hands that had been washed back by the surf, I experience an 'aha' moment. I could capture what little I knew of my animal friends in a number comprised of life span divided by gestation.

From hundreds of LOG calculations, I found seven within 7 percent of humanity (104-120) which first occurred over a 74-year interval. At 10, my father sealed my fate: Dad named the ducklings Flotsam and Jetsam. How many received such clear signals from Destiny?

I've worked with many a bone found on the shore. I was fortunate to work with William D. (Bill) Haglund, King County medical examiner. He was my window into the world police rarely opened to non-enforcement personnel: human remains beachcombed along the shore. Police kept the window into humanity's grisly side closed except when a shoe washed ashore containing the leg and foot bones wedged in a shoe and the old skull trapped in a crap pot. At beachcomber fairs, I often presented photos imploring anyone in the audience to report such finds. "It's a 911 call," I said hoping to wake those asleep in the audience. Saying most beachcombers would hurry to avoid looking at such flotsam. The sea might reclaim the shoe when they momentarily turned their back thereby depriving loved ones of last remains.

Bill's at the Pearly Gates, but bones on the beach we explored never drift far from my mind. My thoughts often turn grisly, particularly when Destiny peeks onto life's stage. The most newsworthy story I worked on concerned footwear beachcombed on the shores of the Salish Sea. For awhile my phone rang incessantly, one day I counted calls from 14 different countries wondering about the chain saw murderer who left bones in beachcombed shoes. I grew tired of bursting journalist's bubbles saying it was just a natural process known technically as "forensic taphonomy," the study of how the human body comes apart in sea water (disarticulates). I elaborated that thousands of people went missing in Washington and British Columbia, many lost as the result of water born accidents. When a body disarticulates it separates at the joints. Since the only floatation device worn by a person is almost invariably a shoe, it makes sense that many people lost in the sea come apart at the ankles leaving the remaining foot bones to float on.

Human remains inevitably seeped into my dreams. I would think trained psychologists think me crazy. I was inspired by Bill Haglund, born in the same year (1943) as I and trained at the University of Washington in physical anthropology. His Renaissance intellect splintered into many aspects including playing the banjo, becoming Medical Examiner for King County, and investigating mass graves stemming from war crimes. I went on to investigate music the winds strummed on ocean gyres shaped like banjo bodies. A few of Bill's war crimes' cases involved drifting human remains and we went on to publish papers in journals of Forensic Sciences. My mind wandered off to consider the effect of human remains on a person's destiny.

Beginning in the 1970s, Akira and I began studying many floating things of historic and scientific interest. I proceed beyond pumice and succeeding life to present day humans. That we evolved from the sea is taken for granted. Who has not heard in genealogical discussions the oft quoted "Acorns do not fall far from the tree?"

Despite intelligence, human anatomy remains poorly studied. We know its aggregate characteristics but little else. My reading and experience suggests that the human body has a specific gravity closely approximating that of surface sea water. Sinkers and floaters are the subjects of party jokes, but I take the general fact that we have inherited some of our basic physical makeup from the sea. In another aspect humans are left and right-handed, but to my knowledge the evolution of this characteristic remains unexamined. Let me just say that that handedness offers increased ways to cope with problems. In my beachcombing I have found some beaches with definite affinity to collect left and right footed sneakers. Such remarks usually elicit snickers from the audience, but I have no

***Alert* Enlarged.** In previous years, I published four *Beachcombers' Alert*s annually. These contained 32 pages: 8 pages each. At the 100-issue mark, I found the content of each Alert required 12 pages. The page count in three 12-page issues equals 36 pages. The 12-page *Alert* could still be mailed in the USA on a single Forever stamp, so I could significantly reduce costs by mailing three 12-page issues annually instead of four 8-pagers. Therefore, the *Alert* publishing schedule has changed accordingly. All in all, *Alert* content has been improved by about five stories while reducing mailing to thrice annually—I now aim for mailings in February, July, and November.

Covid has significantly reduced the number of *Alert* subscribers, but I have not increased subscription rates. As you know, I take no income from the *Alert*. Meanwhile, my living standard has decreased below the poverty level. My plea is that if you read the *Alert* please consider subscribing, urge a friend or two to subscribe, acknowledge me as writing these stories, and report your flotsam accounts. As my standard of living continues declining, I will struggle on into my 80s.

I hope the upcoming stories will induce you and friends to subscribe: 1) Susie Pappas reports bales of raw rubber escaping from a WWII German submarine sunk off Brazil. Thus far beachcombers have reported the raw rubber around the Gulf of Mexico and North Atlantic Ocean; 2) Rubber duckies indicate 25-year time scale of drift in the Northern Hemisphere (Arctic, Atlantic, Pacific Oceans); 3) A loggerhead turtle captures a video of itself as it swims by the BP Oil Spill shortly before it exploded in the Loop Current; 4) Wim Kruiswjjk reports from Zandvoort, Holland, a strange green capsule saying: "American Fox Saving." I also hope to report on the passing of Mike Burnett, who died in a motorcycle crash. Please send your memories and photos of Mike at the Sea Bean Symposium and his museum at Port O'Connor, Texas.

—Curt Ebbesmeyer

Beachcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

Beachcombers' Alert!™

Non-profit quarterly newsletter
Subscriptions: $25.00 US per year
Canada & overseas: $30.00 US per year
Issued January, April, July, October

"May the tides be good to you."
—Paul J. Ebbesmeyer

doubt that the phenomena is real and exhibited by certain marine creatures.

In this Alert, I draw attention to the resemblance of human behavior to the music of the sea. Objects drifting on the ocean's surface are of considerable importance to the evolution of life in general and man, but this flotsam has received little attention, and pumice far less. As the earth cooled and primordial seas formed, extensive volcanic activity may have resulted in pumice covering a large fraction of primordial oceans. Chemicals adsorbed to pumice interstices undoubtedly would have been exposed to high concentrations of energy via radiation from the sun and lightning strikes directly to individual pumice stones. After the pumice became stranded on surrounding land, evaporation and resultant concentration of adsorbed chemicals may have further aided in the formation of microbes. Considerations of the earliest life forms evident in the sedimentary records suggest that diversity of life was rather great in those times.

My other research merged with that of the gyres. The elegant harmonics in the Music of the Gyres it seemed to me ought to show up in human history. I knew from general study that each person's life is made up of segments. To examine this contention, I listed 74 events which seemed important. Then I made a graph of the year by event. Steps occurred near 5, 16, and 38 years of age. The separation of these ages by 11 and 22 years hinted at a harmonic sequence, but was not enough data with which to draw conclusions. So I thought a little more and added two intervals, the first of 5 years between birth and the first turn, and the second of 40 years between 38 years and the average death in my family in the 80s. In summary, my preliminary thoughts revealed the following sequence in my genealogy: 0, 5, 16, 38, and 85 years with separations of 5, 11, 22, and 44 years. I proceeded by comparing this harmonic genealogy with the harmonics of the gyres.

It's been 25 years since Akira died. Now November 2021, I write toward the end of my life fascinated as ever by floating pumice. I see floating rock as part of a continuous in the ocean's quest to perfect love from intelligence. In the remote past waves smashed bits of rock into elemental chemicals. In that quarter century my focus moved on to establishing the orbital periods of earth's great gyres. The periods of the eleven for which orbital flotsam were available formed a harmonic series based on the power of two (1, 2, 4, 8, 16) which for the gyres equaled 0.75, 1.5, 3.0, 6.0, and 12 years.

In our studies of pumice, Akira and I observed that some very hard pumice remained floating for some years, time enough to orbit gyres with periods of 0.75-3.0 years. Examples included pumice from the 1872 Krakatoa eruption which floated around the 3-year orbit of Majid Gyre in the Indian Ocean, and the 1962 eruption in the South Sandwich Islands which floated 3 years in the orbit of Penguin Gyre around Antarctica. I speculate that the orbital periods of gyres might have imprinted on primitive life originating in pumice. Thus I came to the belief that from its early days primitive life contained orbital information of earth's gyres.

Realizing that gyre characteristics caused me to begin examining human characteristics for such evidence. In 2014, DNA sequencing techniques allowed scientists to determine the earliest known ancestor of modern turtles lived about 260 million years ago. The sea turtle shell as we know it today seems to have appeared on the order of ten million years ago. It seems clear that sea turtles utilize the currents within gyres to accomplish their amazing swims between continents. The plates on the backs of many sea turtles seem to reflect the plates of water which are the gyres and the plates of rock which are the sea floor.

I wondered why an accounting of my life events revealed steps. Previously, I had discovered physical reasoning in the evolution of whelps near the aspect ratio of 100:1. Smaller values corresponded to whelps from the shape of a water droplet, a column mixed by tides over sills and early flattening by gravity. At around AR 100:1 gravitational flattening gave way to horizontal dispersion dur to turbulence. Then there was the enormous degree rise in Puget Sound water temperature in 1977. Eventually I traced it to a regime shift in the gyral structure in the North Pacific. Through 50 years work investigating regime shifts, I'd come to recognize them for what they are: life often proceeds in steps as well as linearly. Now I saw the steps in my life as shifts in the tempo of life from higher in the first childhood, to lower in the second childhood in life from 40-80 years of life. I would find these steps matched the tempo of the gyres. But that was far in the future years after Akira died.

Destiny hints frequently during your life: birth; 20-year turn; little voices at the other turns (5, 10, 40); and during three lustrums (0-5; 5-10; 80-84 years). She's generous with her hints with Love at First Sight (LFS) at the 20-Year Turn. Occasionally, she overplays her hand, as when Dad brought home Easter ducklings echoing my birth in 1943 on a once-in-a-century Easter. She could not have been clearer than when he named them Flotsam and Jetsam, followed by Mom directing me to the Floating World with the great sneaker spill of 1990 harkening from the baby shoes she gave me a century earlier. Eventually, Destiny begged an obvious question. ■

Beachcombers' Alert!™

SUMMER 2022 104 ISSUES SINCE 1996

Arctic Madness

Alice in Wonderland warns of poisoning via arsenic and carbon; Dinosaur Frankie delivers the United Nations his species warning; Introducing the Human Survival Index

Remembering Dickie Bird

When I was five, at the end of World War II, my family moved into a tract home on a half acre of vacant potato field. We couldn't afford much furniture, so Dad fashioned bunk beds from packing crates. And Mom brought a parakeet named Dickie Bird from our apartment in Baldwin Hills Village in El Segundo, California. I had no clear recollection of Dickie Bird because she died in the 100-year storm that blanketed snow in January 1949 across much of Southern California. To keep our home from freezing, Dad wrapped the outside water pipes in newspaper and Mom hung Dickie's cage above our central natural-gas heater. The heat proved too much for dear Dickie and I mourned the death of my first pet.

Curt's Mother Genevieve Ebbesmeyer's Dickie Bird (circa 1948). Dickie Bird reverberated through 75 years of my life. The dear little creature died of carbon dioxide poisoning as humanity gassed itself.

Brief though Dickie Bird's life was, the feathered friend taught me a tragic lesson. He died from burning natural gas derived from oil. To my childhood mind, Dickie was the canary in the coal mine, the allusion to caged birds that miners carried into coal shafts warning of dangerous gases such as carbon monoxide. Dicky's lesson stayed with me all my life. Eventually, I saw the oil industry as gaslighting humanity. I came to understand the psychology of gaslighting by watching the 1944 film *Gaslight* starring Ingrid Bergman, Charles Boyer, and Angela Lansbury.

DICKIE BIRD continues on page 3

Mad Hatter Gyres: Arctic Alice

I'd been staring too long at maps of the Arctic when I again came under the spell of my ghostly mentor, Lewis Carroll. I had begun seeing the face of Alice profiled by the shoreline circling most of the Arctic Ocean. It's like staring too long at clouds and seeing shapes.

In early 2020 I was hospitalized for eight days in intensive care for reasons unknown. Finally, I was diagnosed with a coronavirus—one of the first cases of COVID-19 in Seattle. Since then, I've suffered from a syndrome known as long-covid. I could barely function under the devastating effects of long-covid; most people recover from COVID-19 within two weeks, but early figures suggest that around one in seven people have symptoms lasting for at least four weeks and a smaller fraction for longer periods. As for me, I feel like I've never recovered despite having received all vaccinations and boosters. The fog of long-covid might have something to do with my seeing characters from *Wonderland* in cartographic renderings.

But from childhood I've always seen patterns in the clouds. Now at age 79 I see the patterns of Lewis Carroll. Looking back, I see this vision began forming at my birth and was reinforced by Carroll at at least a dozen times scattered over my life.

Destiny Tracks my Life

The most obvious theme that can be found in *Alice's Adventures in Wonderland* is that of growing up. Carroll adored the unprejudiced and innocent way young children approach the world. Alice Pleasance Liddell (1852–1934) was the little girl who inspired Carroll's *Alice's Adventures in Wonderland* and *Through the*

ARCTIC ALICE continues on page 10

Frankie's Plea: Tyrannosaurus warns humanity at the United Nations

The UN conference on climate change held in Glasgow, Scotland (October 31, 2021), set a tone of urgency with unusual media outreach. Delegates from 120 countries discussed ways to drastically cut carbon emissions and restrict global warming. Yet global governments still annually spend $420 billion on major pollutants such as fossil fuels.

Tyrannosaurus Frankie warns the UN Assembly of Mass Human Extinction

Production and use of fossil fuels—coal, petroleum, natural gas—are the major culprits behind accelerating climate change. Man-made climate change is responsible for frequent flash floods, hurricanes, droughts, and heatwaves. Pollution from fossil fuels annually kills seven million people.

A gripping animation showed a talking Tyrannosaurus Rex named Frankie thudding into the United Nations Building the day before Halloween. Taking center stage, Frankie grabbed the MC's mike and exhorted the world to act against climate change. "I know a thing or two about extinction," Frankie said. "This is humanity's big chance… Don't choose extinction. Save your species before it's too late. It's time for humans to stop making excuses and start making changes." Frankie ended his plea to a standing ovation.

Humanity is going extinct as four environmental trends coincide: the Arctic ice cap is disappearing; humanity's sperm count plunges toward zero; Curt will pass his Last Lustrum; and the 6th mass extinction is underway.

As Susie rehabbed from her 6th joint surgery (hip) at FOSS Rehabilition, I channel-surfed to the PBS Newshour to hear NOAA announce that the latest measurements showed the atmospheric levels of carbon dioxide had reached levels last seen four million years ago (about 410 million parts per million).

Species are becoming extinct 100 times faster than they would without human impacts. Populations of wild animals have more than halved since 1970 as the human population doubled.

Five times in Earth's history, countless animal species suddenly vanished. The fifth extinction occurred when an asteroid wiped out Frankie's kind. Scientists label the current ongoing crisis the Sixth Mass Extinction. This episode features a double catastrophe: the well-publicized rise in global air temperature and the lesser-known great sperm-count debate. In 1992, a group of Danish scientists suggested that human sperm counts declined globally by about one percent a year for fifty years (circa 1938–1990). They postulated that "environmental influences," particularly widely used chemical compounds like that of the female hormone estrogen, accompanied a precipitous drop in fertility among males.

I look to music played by ocean gyres. One night Susie and I watched a Smithsonian Channel episode concerning Beethoven's work known as the Ghost. Sigmund Freud is shown psychoanalyzing Beethoven as the great composer says: "My music comes close to changing men's souls." Carrying miniature gyres in their brains perhaps will save human souls from extinction. "Music from my fourth year began to be the first of my youthful occupations. Thus, early acquainted with the gracious muse who tuned my soul to pure harmonies, I became fond of her, and, as it often seemed to me, she of me."

I have a dream: that my personal mission helps humanity survive. I'm afraid, however, my performance is falling short of answering Destiny's most important questions. I wondered if Destiny will permit me another chance?

What Frankie leaves unsaid underscores his presence. As he speaks, I hear the gyres playing Beethoven's requiem for humanity. I did not set out on my mission to document humanity's demise. I only took notice as Mission drew to close in my Last Lustrum. Now at 79, I pray nightly Destiny grants me another decade. Before I'm gone, I thought it a good idea for me to document my Mission. The irony comes to me in a fit of wakefulness: as we eliminate ourselves, we deprive ourselves of heavenly music from the arctic gyres. Heavenly music exists: "Father, forgive them, for they do not know what they are doing," said Jesus (Luke 23:34).

Earth Will Not Care

Frankie's warning is clear. Earth did not care that his ancestors disappeared from her household. Earth will not care if mankind kills itself with carbon dioxide. It could happen in a century or so; the blink of Nature's eye. In a few blinks her gyres will produce species more wondrous than us.

Sources: *portions adapted from Suchetana Ray, Frankie the Dinosaur, UNDP Video Screengrab, Oct 31, 2021. Niels Skakkebaek of the University of Copenhagen published a paper in the British Journal of Medicine reporting declining sperm counts. Their findings stem from dozens of published papers describing semen quality. Their results show global sperm counts dropped by 50% in five decades.* ■

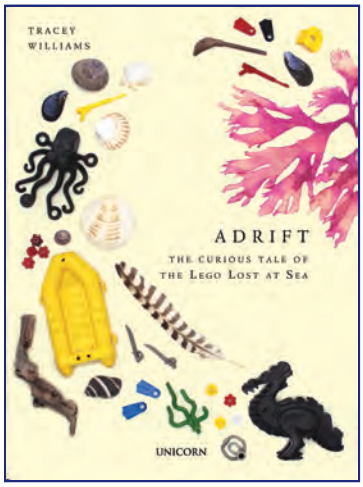
Lost Dragons

Book Review: *Adrift*

Frankie reminded me of another recent incident involving dinosaurs.

On Valentine's Day, 25 years ago (February 1997), sixty-two containers—including one filled with five million sea-themed Lego pieces—fell overboard from the containership *Tokio Express* after a rogue wave nearly tipped her over off the Cornish coast.

Beachcombers traced the Lego drifting around the North Atlantic Gyre (AKA Columbus Gyre). Concurrently, they hunted rubber duckies spilled in the North Pacific through the Arctic Ocean to the Gulf of Mexico (1993-2019).



I'd wager each of us has beachcombed some of the gyres at some point in our lives. Collecting intriguing, eye-catching, and occasionally useful objects from the foreshore of beaches, lakes, and rivers is an instinctual behavior likely as old as our earliest ancestors. And many people don't just collect the collected objects—they also curate them in their homes.

Tracey Williams' book *Adrift* tells what happens when beachcombing gets serious, blending archaeology, oceanography, culture, ecology, art, and design. For anyone who enjoyed recent volumes such as Lara Maiklem's *Mudlarking* or who has been involved in projects such as CITiZAN (see *Current Archeology Magazine* #381), *Adrift* is an essential addition to beachcombers' bookshelves. The spread of five million Lego across an increasingly large area of coastline over the last 25 years touched many lives. A North Cornwall resident, Tracey took beachcombing more seriously than most—a few pieces turned into a few hundred, then thousands and counting.

Tracey's thirst to discover more about the lost Lego led her to consult oceanographers and archaeologists, journalists and environmental campaigners, and like-minded beachcombers worldwide. This is a story of citizen-science of the best type, a narrative laced with reflections on the nature of site formation, object distribution, and post-recovery curation that is profoundly archaeological. A thoughtfully illustrated, thought-provoking book with underlying melancholy, it reflects the impact of the billions of tons of plastic that pollute the world ocean.

***Source**: Joe Flaman, Current Archaeology Magazine. Adrift: Tracey Williams, Unicorn, £20.* ■

Dragons from the great Lego spill

DICKIE BIRD from page 1

As I began my Last Lustrum (79-84 years of age), wild rabbits hopped down our suburban avenue, joined by coyotes and stray cats. Symmetry with the ceramic rabbit my grandmother gave me to begin my Childhood Lustrum (0-5 years) struck me, as with rabbits between these Lustrums including Harvey the Pookah (in the Hollywood movie *Harvey* starring Jimmy Stewart) and Lewis Carroll's writing of rabbits, snarks, and cats at Alice's childhood garden party in *Alice's Adventures in Wonderland* (published 1865).

The recent demise of our decrepit furnace amplified the parallel with the Mad Hatters Carroll described, as the furnace installers warned of carbon monixide poisoning. In the 1800s, breathing fumes from boiling arsenic while preparing felt for top hats had driven hatters mad (read: *dementia*). As medical men discovered the connection to arsenic poisoning, oceanographers discovered that humanity was poisoning itself with carbon.

The oil industry discovered burning fossil fuels added carbon dioxide to Earth's atmosphere, rendering it a global greenhouse, yet continued to operate as they always had while gaslighting the population it served. Arsenic and carbon poisoning humanity seems a perfect succession: arsenic brings on insanity, carbon heats the Earth driving humanity toward extinction. I began to have dreams of Earth adorned with a felt top hat, its brim circling the top of the planet between Iceland and Bering Strait.

In Carroll's Wonderland, The Arctic Ocean changed its hat of forest greenery for ice covering open water. I imagined the days of dinosaurs when greenery adorned the Arctic Ocean. My musings coincided with our furnace failing just as Susie approached her 6th joint (hip) surgery. As I recalled her seven major surgeries in the 57 years of our marriage, I never imagined I had married a bionic angel. ■

Thames Lost and Found

Book Review: *Mudlarking*

Here's some further fascinating insight into flotsam. We focus on the Thames, the famed river in Southern England flowing east through London to the North Sea. Beachcombers scavenging these muddy banks call themselves "mudlarks."

Mudlarks are river scavengers. Lara Maiklem, however, seems more a time traveler. Using old maps as guides to London's former boatyards, quaysides, bridges, causeways, jetties, and great houses—where river currents once washed rubbish—she scours the foreshore hunting for links to other times. Artifacts like Roman brooches, clay pipes, Victorian shoe buckles, Mesolithic flints. A vast and mobile archaeological site, the Thames is uniquely suited to mudlarks because it is tidal. Thus, every day, as Lara explains, it grants access to its contents, "which shift and change as the water ebbs and flows to reveal the story of a city and its people."

Every drowned, unwanted, or lost object is precious to Lara. As she takes readers downriver from Richmond to the Estuary, she reveals a preternatural sympathy for the broken, mud-caked, and out of context. When, during one of her daybreak-larkings, she finds a body, "arms outstretched, long hair spread out like a soft halo," she feels not horror but fellowship: "I was the first to be with her after her final and most private moment."

A custodian of the past, Lara's relation to the river's life is personal rather than scientific. She sees the Thames as the home of her forebears and the medium of their messages. Alert to the ethics of ownership, she collects only those treasures that the museums reject. Engraved wedding rings, for example, are returned to the river; Lara does not want their sadness in her life.

Lara divides mudlarks into hunters and gatherers. Hunters—usually men—are goal-orientated and tend to employ metal detectors; the shoreline is "a battlefield" of "petty feuding, territorial disputes, jealousies, fierce competition, and paranoia." For gatherers—usually women—the search is as important as the find: mudlarking is meditation.

Her mother taught her to treasure small things, pointing out the curl of lichen on a twig, the veins on a leaf. As a country child, Lara learned to empty her mind, "slow down and lose myself in the minutiae

of my surroundings." Good mudlarks do not need to look too hard: "The key to spotting objects on the foreshore is simply to relax and look through the surface." Only then will the eye detect patterns and imperfections in the sludge, such as flakes of rust, dots of glass, and pearls the size of pinheads. Lara kneels, her nose inches from the foreshore. "I breathe in the muddy aroma of silt and algae and listen to the sound of water drying on the stones: a barely discernible fizz-pop as it evaporates, and the lacquered shine turns to a powdering of fine grey silt." Her prose has none of the self-conscious sensibility that defines contemporary nature writing; instedad, her thoughtful sentences read as though she were talking to herself.

There is nothing that Lara does not know about the history of the river or the thingyness of things. "The wooden fid I found washed up on the foreshore at Limehouse has become one of my most treasured finds." Wooden fid? "Fids were used by sailors, riggers, and rope-makers to create spaces through which the rope could be woven together or 'spliced'." Mudlarking produces a treasure trove of such curiosities. Finding a green marble stopper from a Codd bottle, Lara explains that Codd bottles—from where we get the word "codswallop"—were used for soda in the 1870s. Gas from the drink pressurized the marble to the neck of the bottle where it rested in a rubber ring, thus creating a seal. She has other stoppers in her collection. The oldest, a mushroom-shaped plug of red clay, is Roman and once belonged in the neck of an amphora. "What I like most about it," she says, "is the faint line that runs just below the top, from once resting on a sealing bung of clay or plant stuff." There is a great deal to learn from these pages, not least the insight that finding lost things is the best way of losing yourself. It is, above all, her wisdom that makes Lara such restful company.

Source, Permit, Orders: *Adapted from Frances Wilson's review, August 16, 2019. Years ago, mudlarking was the reserve of the destitute; these days a permit is needed, for which you have to belong to the Society of Mudlarks. To be eligible you need to have already held a standard permit and reported your findings to the Museum of London for two years. Even then, you may not receive membership because the Society "maintains a deliberate air of mystery and exclusivity."* Lost and Found on the River Thames *is published by Bloomsbury (£18.99).* ■

Beachcombers' Alert

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Arctic Flotsam Icons

In a Chicinese takeout meal, Susie and I discovered in my fortune cookie this prophetic aphorism: "Beachcombers discover treasures where others see nothing unusual."

Over the decades I accumulated many treasures having to do with flotsam crossing the Arctic Ocean. In 1967, my mentor Cliff Barnes assigned me to help the Dabob Bay Oyster Farm study snarks that affected submarine torpedo guidance deep in Dabob Bay, a local tributary to Hood Canal within Puget Sound, Washington. Another mentor, Bill Clauser, flew me to the Arctic Ocean to estimate costs for constructing the Transalaska Pipeline. That year, 1967, destiny directed my life to the parallels between the Oyster and the Carpenter, Hunting of the Snark, and *Alice in Wonderland*. Conecting Dickie Bird, oysters, and snarks seemed obvious; it would, however, require 66 years for your dimwitted author to see the parallel of mad hatters and global warming in 2022.

Rosetta year, 1979: Postcard from The Far Side Comics

To find out where lunar tides transport sewage afloat in Puget Sound, Washington, at potential discharge sites in Budd Inlet (near Washington's capitol in Olympia), I'd released thousands of drift cards—self-addressed wooden postcards. Dispatching such cards was akin to polling the shore; beach walkers reported cards from local locations as well as exotic distant seas.

One day, Vern Larson, whose son Gary cartooned *The Far Side* comics, reported a placard released years earlier from the junction of fabled Arctic Passages (Northeast Passage from Norway to Bering Strait, and Bering Strait to Greenland). Vern's card floated westward across the Bering Sea to Russia, then round the Aleut Gyre to Washington, and finally, after nine years, arriving 200 miles inland at Fox Island almost to Olympia. Vern's story, a real-life *Far Side* message, signaled a Mad Hatters' party, yet another event in my life following Lewis Carroll's *Alice in Wonderland* indicating a wider aspect of global pollution.

In 1979, four ships drilled exploratory oil wells in the Beaufort Sea. Concerns about oil blowouts prompted six institutions to release drifters totaling 10,551 bottles, cards, and disks during April-September 1979 from the Bering Sea north and eastward to the Mackenzie River delta. For most of his oceanographic career, Roy Overstreet, a classmate from graduate school, collected beachcomber reports of distant water markers.

Following in Everett Batchelder's footsteps—the legendary evangelist released religious notes in 40,000 bottles in the vicinity of Bering Strait—Dr. David Nyquist steamed southward from Bering Strait aboard the Polar Sea, the Coast Guard's powerful icebreaker. As if marking the icebreaker's route with breadcrumbs, David released 18 packets of 100 pink plastic drift cards serially numbered and requesting replies in English, Japanese, and Russian. During three days (April 19-21, 1979) in the fifty miles between Bering Strait and St. Lawrence Island, David released 18 packets, exploding 40,000 miles in all directions. Three packets dispersed globally, rivaling hemispheric shipping routes from Europe (~France) to Asia (~Korea): 7,900 miles via the Northwest Passage through the Canadian Arctic archipelago; 12,600 miles by way of the Panama Canal; and 20,600 miles round South America (Cape Horn). From David's 1,800 cards thrown in the Crossroads, thirty-six broke huddle for distant lands, an even dozen each to the Atlantic, Pacific, and Siberian shores.

Example of drift card released in the vicinity of Bering Strait during 1979, this one found by Vern Larson, father of "Far Side" cartoonist Gary Larson.

The Pacific twelve trailed southward, mapping out the route of Bachelder's bottle to Singapore, four stranding in the far-west Aleutians; four in British Columbia; two in Oregon; and one each in Washington and California. The Siberian twelve made it as far west as the Laptev Sea then recirculated eastward, two reaching the Bering Crossroads completely round the Siberian Gyre. The Atlantic dozen filled in the routes of the rest of Bachelder's bottles, three quarters landing in Scotland (6) and Norway (3), and one each in Greenland, Ireland, and France. Viewed year-by-year, the routes resemble rings radiating outward from a stone splashed on a quiet pond. They came ashore in 12 of the 20 years since 1979. All these twelves reminded me of the 12 years to orbit an Arctic gyre.

Over 20 years, oceanographers received reports of 36 plastic drift cards. 1st year after release, 2 cards: both 900 miles both south to the westernmost Aleutians. 2nd year, 2 cards: 7,200 miles south to British Columbia and 7,800 miles south to California. 3rd year, 4 cards: 450 miles west; a fifth the way round the Siberian Gyre; 900 miles south to the westernmost Aleutians; 9,700 miles south to Oregon. 4th year, 2 cards: 900 miles south to the westernmost Aleutians, 12,200 miles south to British Columbia. 5th year, 2 cards: 13,500 miles south to British Columbia, 14,300 miles south to Oregon. 7th year, 1 card: 7,200 miles north to Scotland. 8th year, 3 cards: 2,000 miles halfway round the Siberian Gyre; 17,400 miles to Puget Sound Washington; 7,200 miles to the Shetland Isles. 10th year, 3 cards: 2,500 miles round the Siberian Gyre; 15,600 miles to France; 16,800 to Norway. 11th year, 4 cards: 2,500 miles round the Siberian Gyre; 15,600 miles twice to Scotland; 18,800 miles to British Columbia. 12th year, 5 cards: All from 2,300-2,400 miles (three quarters round) the Siberian Gyre. 13th year, 4 cards: 13,200 miles north to Norway; 12,600 miles north to Ireland; 2,900 miles west round the Siberian Gyre; 3,000 miles west around the Siberian Gyre. 18-20 years, 4 cards: 5,500 miles north to Greenland;

ARCTIC FLOTSAM ICONS continues on page 10

Hatters Party at the Pearly Gates

Heavenly music accompanies children's boats, dinosaur's plea

What happens at the Pearly Gates? I frequently asked this during my Mission.

I once dreamed that a children's play opens with a professor, his head slumped onto his desk. He's just learned his daughter has been diagnosed as bi-polar. In walks an energetic student, exclaiming: "I've found them, the people long ago who transformed the arctic into a tropical jungle!" The professor looks up, shifting between contexts for "polar." The student, unaware of the professor's personal tragedy and focused on the tragedy of humanity, describes his exciting discovery in the sediments. He's uncovered definitive evidence of a layer of plastic that accelerated global climate change 10,000 years ago that coincided with the transformation of the Arctic into tropical jungle.

Now jump ahead to when I, Curt the oceanographer, has been studying all things stranded ashore. I lecture worldwide via radio, TV, and beachcomber fairs on how Mother Nature has a Plan B for global warming. Climate change is hotly debated, but US leaders refused to act till it was too late. Realizing this, I often concluded my talks with sea beans, the jewels of the world oceans. For this talk, I wear my necklace of sea beans, strung for me by a Smithsonian scientist, ones that have drifted across the Atlantic and Pacific Oceans.

Holding up this necklace to accentuate a point, I mention the incredible endurance of a hundred species of tropical jungle vines that disperse hard and durable seeds down great rivers and onto the vast ocean currents encircling the gyres in the world ocean. I point to the bean—named fava de Colom in the Azores, AKA "sea heart"—that inspired Columbus.

A sea heart was observed to drift from the Amazon River on the Gulf Stream to Cornwall, England, where it sprouted into a plant that reached a foot high before winter frost killed it. Frost is fatal to tropical seeds. But here is plan B. When climate change has eliminated frost from the Arctic, these seeds will transform the Arctic from ice to steamy jungle.

For twenty years, I've amassed accounts of arctic drifters. There's certainly enough to fill many books, but the catalytic story seemed missing until now. The story of children's boats released at the North Pole is compelling. In 2015, Dave Forcucci called me to see if I would be interested in a project he called "Float Your Boat" (FYB). I participated in the release of 1,300 toy boats, decorated by school children, near the North Pole. The US Coast Guard released them in seven boxes from its premier icebreaker *Healy*. The idea was to involve school children in Arctic science. Flotsam on water drifts ten-fold faster than on pack ice. If the pack ice was melting as fast as theorized, many of the toy boats would emerge from the Arctic faster than if the Arctic was ice covered.

Tiny wooden boats were placed at the North Pole in September 2021 from the icebreaking cruise ship Le Commandant Charcot (heart shape) along with buoy equipment (foreground) provided by the International Arctic Buoy Program (IABP). The boats and buoys drifted as a unit with the Arctic ice until each component floated away on a voyage of its own.

I had theorized the Polar Speedway based on historic drifters previously released at the North Pole, including a wrist watch and mementoes from a dogsled expedition to the North Pole. Astoundingly, the polar flotsam took just three years to reach the UK.

I had hoped the toy boats might reveal a climate-driven state of increased drift speed. I had calculated that the Arctic Ocean contained the slowest gyres in the world ocean. The 11 gyres sorted themselves into a harmonic series in powers of two: 1.7, 3.3, 6.6, and 12 years. Recall the orbital period is the time a flotsam takes to travel once around a gyre, much like a planet travelling around its orbit in the Solar System.

Nando Petersen exhibits a boat he found in August 2019 on an uninhabited island five miles southwest of Nuuk, Greenland. The boat had been placed on the sea ice by USCGC Healy north of Alaska on the 150°W meridian in September 2015.

In this harmonic, the slowest and fastest straddle the North Pole: the 12-year Beaufort Gyre to the south of the Pole, the quickest at 1.7 years to the east of Greenland. Dave's amazing project sprinkled boats and satellite-tracked buoys across the separation between these opposites. Now these drifters have split into the two gyres. We see the Viking Gyre orbiting at its usual speed, but the Beaufort Gyre has speeded up 8-fold, now spinning as fast as Viking Gyre. I had guessed that the Polar boats might have speeded up, but not the ice-choked Beaufort Gyre! This is the first evidence that the Arctic has revved up. I had hoped I might see the Arctic become ice free, but not in such a dramatic, silent event.

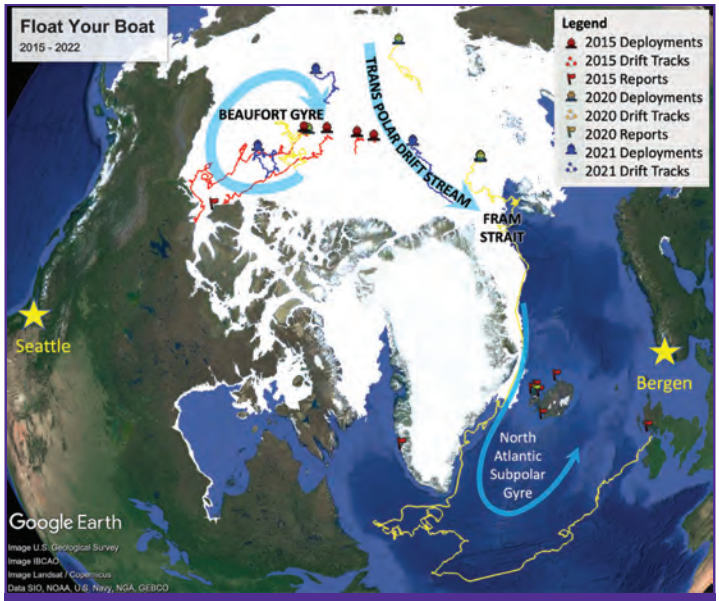
Blessings from Misfortune

It's been my experience that a misfortune signals an imminent blessing. In the words of South African philosopher Mokokoma Mokhonoana, "Some of the best things that have ever happened to us wouldn't have happened to us if it weren't for some of the ▶

worst things that have ever happened to us."

Finding the blessing requires courage and patience. Mankind's encounters with the Arctic provide an example.

For centuries, explorers set off in wooden sailing vessels to reach the North Pole. In hundreds of expeditions, thousands died. Around 1900, George Melville got the idea that unmanned drifters—casks, barrels, football shapes—could complete transarctic journeys to Iceland, Norway, and Greenland from the vicinity of the Chukchi Sea off Alaska. Since Melville, scientists released dozens of differing flotsam types—scientific stations on ice islands, plastic drift cards to address the fate of spilled oil, radioactive wastes—resulting in at least a dozen drifters that orbited the three major polar gyres. I've spent 25 years collecting these polar gyre orbiters finding they rounded the arctic gyres in an average of a dozen years.



Drift odysseys of buoys deployed in 2015 (red), 2020 (orange), and 2021 (blue) and landings of accompanying Float Your Boat (FYB) boats (red and orange flags), overlaid on the Multi-sensor Analysis of Sea Ice Extent (MASIE) produced by the National Snow and Ice Data Center and the US National Ice Center. Idealized flows of the Beaufort Gyre, the Transpolar Drift Stream, and the North Atlantic Subpolar Gyre are also shown. Red flags mark the locations of wooden boats reported from the 2015 deployment, and an orange flag marks the first boat reported from the 2020 deployment (The Westfjords of Iceland).

We are born with hints of our Destiny. I seem to have stirred up more questions than I've answered. I must be happy with having investigated Destiny's tool chest. It was clear to me I had failed to answer three of Destiny's questions despite nightly prayers for God's guidance and for time to finish my Mission.

As for Destiny, she teaches life is all about collecting stories and reporting back to Destiny, thus explaining the possibility why we relive our mission in the final 84 years. Since life largely consists of childhoods, the review becomes one of reliving Missions. Destiny is above all collecting stories with humor and music.

I am left wondering as to the meaning of the 12-year orbiting polar gyres. I wondered if the blessing might be that Heaven is physical a place with some measurable behavior such as 12-year cycles.

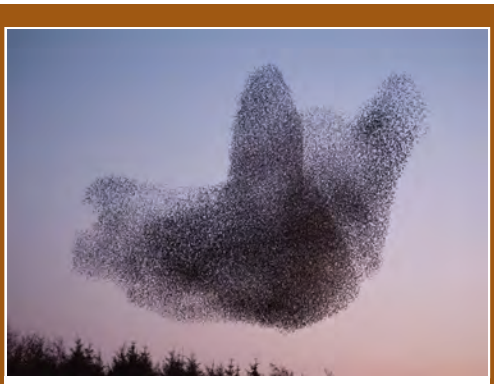
The idea of Peter standing at the gates of heaven is based on Matthew 16:19, where Jesus tells Peter, "I will give you the keys of the kingdom of heaven." It is inspired by the description of New Jerusalem in Revelation 21:21: "The twelve gates were twelve pearls, each gate being made from a single pearl." Those not fit to enter heaven are denied entrance at the gates and descend into Hell. In some versions of this imagery, Peter looks up the deceased's name in a book, before opening the gate.

Then beachcombers sent me the film clip of Frankie the dinosaur addressing the United Nations. I wonder if perhaps Saint Peter might appear as a Tyrannosaurus Rex when manning those gates. ■

Murmuration

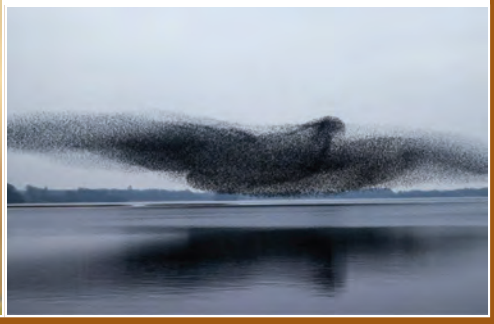
by John Beaton

John Beaton's poetry is metrical and has been widely published in media as diverse as *Able Muse* and *Gray's Sporting Journal*. He wrote a monthly poetry page for several years for the magazine Eyes on BC and served for four years as moderator of one of the internet's most reputable poetry workshops, Eratosphere. He recites his poems from memory as a spoken word performer and a poet member of the band Celtic Chaos. His poetry has won several awards, including the 2015 String Poet Prize and the 2012 Able Muse Write Prize for Poetry. He is a retired actuary who was raised in the Scottish Highlands and lives in Qualicum Beach on Vancouver Island, Canada. ■



Do humans murmurate? Our lives all turn at 7 ages: 0, 5, 10, 20, 40, 80, and 84 years. I discovered these and many more photos of starlings by Googling "Starling Murmurate."

There is a blackness like a furl of smoke
hurtling and twisting fast across the sky—
it shudders and explodes
and shards of shrapnel fly
upwards, bursting, bursting, then condense,
cascading down, and cresting to bespatter
the air above us as the starlings scatter,
and then the flock implodes,
flattens once again, and forms a cloak
of undulating wing-beats, recompense
for having had the sense
to go outside and see the things that matter.



Childrens' Boats Flock to Iceland

Guðni Hrafn Pétursson Olsen headed to Iceland's Westfjords, where his uncles have a house on a remote stretch of beach abandoned in the mid-1960s due to unusually severe ice conditions. These days, they use the house during summer months.

One of his uncles had the day off from cod fishing and invited Guðni, an expert hunter, to visit and hunt mink. The mink are invasive and prey on the protected Eider ducks, whose nests have provided down to a thriving eiderdown industry for centuries. Guoni was enthusiastic about the task ahead, but what was he really hunting for that day?

In August 2020, Guðni found a Float Your Boat wooden drifter in the Westfjords. Since then, he's become an ambassador for the FYB program. And incredibly enough, he's reported four additional boats found by friends and family along that short stretch of Iceland's 3,000 miles of total coastline. A year after he found his boat, he discovered another while visiting his grandfather—displayed on a table, it had been found by his uncle at least a year before Guðni found his. Both boats came from FYB Box 4, which was deployed at 85 degrees North by 150 degrees West on September 15, 2015, from the Icebreaker *Healy.* The boats were found on the same stretch of Munaðarnes coast within a few miles from each other.

Guðni Olsen's uncle's house, perched at the base of Skarðafjall mountain where Guðni discovered toy boats on May 8, 2022. His uncle lived here until he was fourteen. Boat "one" from the window sill, found an adjacent beach. The position of the brand on the knot and the wood grain just aft of the brand pointing toward the stern of the boat identified the boat. Guðni's holds Boat "two" from the windowsill. The port side knot, position of the brand, and the arched wood grain on the starboard aft thwarts provided positive ID. The beach adjacent to the house is strewn with driftwood. Keen eyes picked out the toys. Photos by Guðni Hrafn Pétursson Olsen.

A year and a half later, in February 2022, Guðni heard from friends who had been walking their dog, Blíða, along another stretch of beach on the Westfjords near Reykjaneshyrna. Friends Thomas and Delphine had found another, and knowing about Float Your Boats from Guðni, they knew who to call.

I can only imagine what was on Guðni's mind as they landed ashore. Was he scoping every inch of beach in sight for toy wood boats? Had he imagined discovering a boat sitting on the side table in his uncle's house?

I can only imagine his reaction when, during a vist with his uncle, he found not one but TWO boats on the window sill! His uncle could not recall who'd found them, but it didn't matter; the stamps and wood grain were traced back to Box 3, which had been deployed with Box 4. Not only were the two boats in the same box, but they were next to each other and actually touching each other. How they managed to find their way, together, to the same beach can only be imagined.

These incredible boat drifts illustrate ocean currents' global trait: currents concentrate flotsam along small segments of shoreline. Guðni has discovered one along western Iceland. The toy boats hint at other flotsam concentrated there.

Story courtesy Dave Forcucci. ■

Mad Hatters Day

Computer technicians in Boulder, Colorado, designated October 6th, 1986, as the first Mad Hatter Day to celebrate general silliness. By two years later, the celebrations were attracting national press coverage. October 6th remains Mad Hatter Day, when observers wear hats of all sorts and engage in goofy behavior.

I propose enlarging Mad Hatter*s* Day with a new mission to protest carbon emission in all forms: cars, jet planes, natural gas, coal, oil. As discussed elewhere in this *Alert*, the insanity that befell hatters in days of yore was self-induced through the chemical poisons of their industry. Today, we live in a society whose industries collectively are "mad as a hatter" and gaslight the rest of us to believe they're sane.

I leave it to you to keep score on the end of human gaslighting. Call it the Human Survival Index.

When ice disappears from the Arctic Ocean in a coming century, the human population will approach 11 billion (United Nations estimate for 2100), while human industry left unchecked will choke them all.

A herd of container ships await enough ice melt for regular crossings through the Arctic. Oil companies want to place drilling rigs in the Arctic to tap reserves beneath the vast continental shelves off the Siberian shore.

Carbon dioxide concentration in Earth's atmosphere is presently 410 parts per million and rising fast. Industry wants us to ignore that and let it worsen despite all the damage we've already endured and the myriad warnings nature has provided.

The elephants are already dying out. The number of elephants in the world has been quickly declining over the past several decades. Today, an estimated 440,000 elephants remain.

Envisioning a world without elephants is too depressing to think on. Will humanity go the way of Dickie Bird, eradicated by gaslighting industries of its own making? Or will it grow up and enter the stage of mature planetary species capable of fashioning the coming Universes? Will mankind pass the Dickie Bird Test?

On October 6, Celebrate Mad Hatters Day.
Lighten your carbon footprint;
Compute the Human Survival Index.

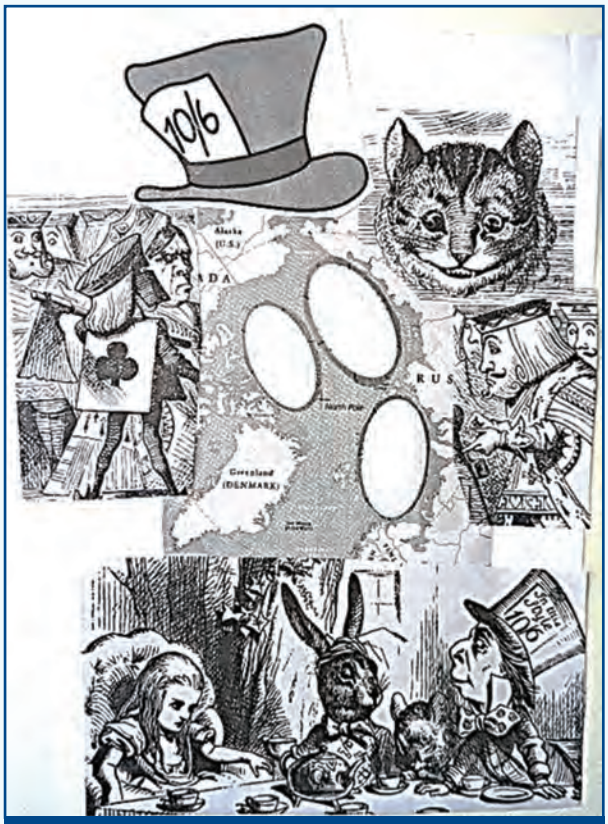
Transarctic Drifters Garland Arctic Passages

In my Final Lustrum (80-85 years of age; I'm now 79 and at the threshold to the Lustrum I'd worked lifelong toward), life gravitated toward destiny's great murmurations. Murmuration describes the fascinating phenomenon of very large groups of birds, fish, or insects moving together, including changing direction together. It seemed to me that life turned in great muamurations at Shakespeare's seven stages of life: Infancy, Schoolboy, Teenager, Young Man, Middle age, Old age, and Death. In the floating world each life orbits round five harmonic circumferences—0.75, 1.5, 3, 6, and 12 years—bending round the seven turning points: 0 (birth), 5, 10, 20, 40, 80, and 84 (death) years. Each of us marches to a different drummer, but in unison we turn, twist, and bend as if in great murmurations.

Knowledge surrounding the Arctic had remained elusive primarily because so few beachcomb there. So I made concerted hunt for drifters which had transited the Arctic. After fifty years of searching I managed to find only a hundred or so drifters.

I summed up the drifters which had transited between the Atlantic and Pacific Oceans via passages through the Arctic. In a nutshell, transarctic drifters wandered their own harmonic patterns of 3, 6, and 12 years: A basic unit of 3 years from the North Pole to the UK, 6 years through each of the Northwest and Northeast Passages, and 12 years to orbit each of three gyres. This summary I derived from fifty drifters in three general categories—launches at the North Pole numbering some dozen; thirty drifters launched in the Bering and Chukchi Seas travelling the Northwest Passage; and seven drifters from launched from a diaspora including Canada, New England, North Atlantic, North Sea, and even the Mississippi River. This assemblage I've gathered over the 30 years since my mother launched me into the Floating World chasing 80,000 Nike sneakers spilled in 1990 from a containership.

Seven seas embrace three arctic gyres: the Beaufort Gyre between Alaska and Greenland; and two gyres partitioned by the Taymyr Peninsula along the vast Siberian coast, the most northerly part of the Eurasian continent—the Siberian Gyre extending to the east at Bering Strait, and the Barents Gyre extending to the west in the Norwegian Sea. Flotsam rotate around each in 12 years, completing the harmonics of the water gyres orbiting to the south (1.5, 3, 6 years). Chemicals first evolved into life in pumice as if in a pinball game, bouncing in and around gyres ending at 6 years where ice excluded pumice. Life in water gyres ended at 84 years based on harmonics ending with 6-year orbits.



Alice at the Mad Hatter's Arctic Party. They gather around serving plates representing three gyres and two passages. The Northwest Passage runs from the Chukchi Sea between the Beaufort and Siberian Gyres then further between Greenland and the Barents Gyre emerging in the North Atlantic Ocean. The Northeast Passage begins in the Norwegian Sea along the Siberian coast then downcurrent along the Siberian coast returning to the Chukchi Sea Bering Strait. Connecting the Northeast and Northwest Passages embrace a fourth arctic gyre. Kieran Powell photo.

Humans burn carbon-based fuels; they also produced top hats boiled with mercury from felt, chiefly made of rabbit fur. Boiling mercury and carbon drives humans mad. The expression "mad as a hatter" is based on the real-life practices of hatters beginning in the 17th century. The chemical process they used to make their hats was poisoning them and driving them insane. It wasn't until 1941 two years before my birth, that hatters discovered an occupational hazard known as erethism mercurialis (AKA mad hatter disease), the neurological disorder which affects the central nervous system, derived from mercury poisoning. The chemicals used in hat-making included mercurous nitrate, used in curing felt. Prolonged exposure to the mercury vapors caused mercury poisoning.

Lewis Carroll published his legendary *Alice in Wonderland* fantasy in 1865, when hatters boiled pelts into top hats. In those years, the Industrial Revolution had not yet boiled enough carbon dioxide from fossil fuels to heat planet Earth to disastrous levels. But now, our technology has brought us to join the ranks of the mad hatters.

One imagines a slight twist on Carroll's text: *"Curioser and curioser," uttered Alice at party surrounding the Arctic Ocean. Lilliputians had set the table with three ovals representing the ice gyres of the Arctic Ocean. The mad hatter had named them Beaufort, Siberian, and Barents gyres embraced by the Northeast and Northwest Passages. Far in the future aboard the starship* Enterprise, *Scotty had beamed the tea party to the holodeck to examine an important transition in history: the day the ice disappeared from the Arctic Ocean.*

We each of us have before us life's greatest voyage of discovery, finding why God so placed each of us on Earth. My voyage discovers the turns of life that guide us to our destiny. I attempted this mission by tracing the origin of human personality written as flotsam writes on the shore. These turns come at harmonic intervals in individual lives determined by ocean gyres. I have been pleased to describe Arctic Gyres before greenhouse gases melts them. This is my manifesto compiled over three decades. ■

ARCTIC ALICE from page 1

Looking Glass. Under her married name of Alice Hargreaves, she came to live in Lyndhurst and was a society hostess. Alice, as a symbol of curiosity in the book, is always in search of the truth behind all things.

The events in the story correlate with the steps in a child's growth and progression through childhood and adolescence. According to editors Charles Frey and John Griffin, "Alice is engaged in a romance quest for her own identity and growth, for some understanding of logic, rules, the games people play, authority, time, and death." When you approach the book with this idea in mind, it offers interesting and meaningful interpretations of the events and characters in the story.

The journey begins with curiosity. At the beginning of *Alice in Wonderland*, Alice daydreams and is unable to pay attention while her sister reads an advanced novel to her. Alice's mindset is childlike, distractible. While her imagination runs wild, she begins to piece together a perfect world of her own. That's when Alice notices a white rabbit, a manifestation of her imagination that sparks her curiosity. "Alice follows the rabbit because she is "burning with curiosity." Soon she finds things becoming "curiouser and curiouser."

Children are usually the people with the most curiosity; they are the ones always eager to learn more. *Alice in Wonderland* is a perfect example of childhood through adolescence. Flashes of inspiration sprang as I thought of Alice.

I saw the Arctic as a series of basins centered on oil. The sequence began in my second Lustrum (5-10 years old), when I took shovel in hand and dug so many holes my parents took naming me Basin Boy. Some holes were shovel size; one was as big as a swimming pool. My next foray came in my 20s, when my family and I dug out our basement to make way for a hydraulic model to study, under contract with the Department of Justice, the movement of sulphite waste liquor that was noncompliant with water quality standards.

As I tracked thousands of drifting objects, I noticed they accurately followed lunar tidal eddies. Time-lapse photos revealed 14 tidal eddies that concentrated drifters in primarily three locations: Dungeness Spit, Victoria Bight, and the San Juan Islands. When I divided the shoreline into a thousand one-mile segments I discovered that half the drifters concentrated in ten percent of the shoreline.

I went on to examine other larger basins, notably the Gulf of Mexico, Hawaii, and the Great Garbage Patch. It became clear that flotsam flocked together in small areas of the sea. I then wondered about the Arctic Ocean. I had few flotsam to further test my flocculation theory. I knew the Arctic was the world's smallest ocean, with just 28,000 miles of shoreline. But here again, the issue was oil pollution, this time via climate change brought on by carbon dioxide. I struggled to collect a hundred flotsam that trekked across the Arctic Ocean. ■

ARCTIC FLOTSAM ICONS from page 5

9,700 miles north to Scotland; 9,700 miles to Shetland; 10,300 miles north to Norway, from round the Beaufort and Siberian gyres.

Of the 12 found in the North Atlantic, 10 orbited a gyre and two made direct transits (both to Scotland). Six drift cards (50% of total sample) were found at Scotland after intervals of 7.0, 8.8, 11.4, 11.7, 18.7, and 19.8 years. This code may be interpreted as follows: First subtract the direct transit of 7.0 years, leaving the following times to go around gyres: 1.8, 4.4, 4.7, 11.7, 12.8. The first two probably rounded the North Atlantic Subpolar Gyre and the latter two the time to go round the Beaufort Gyre.

The Billion-Dollar Bottle

Over the years I've conducted hundreds of radio and TV interviews. "What's the most valuable thing ever beachcombed?" hosts routinely ask. Without doubt, it's the variant of a Message in a Bottle (MIB) with a will worth a billion dollars intentionally left to any beachcomber who found it. The last of 18 illegitimate children of magnate Isaac Merritt Singer, Heiress Margaret Alexander (*nee* Mary McGonigal, nicknamed Daisy) stood on Old London Town Bridge and pitched a bottle into the Thames containing the following note: "To avoid all confusion, I leave my entire estate to the lucky person who finds this bottle and to my attorney, Barry Cohen, share and share alike. Daisy Alexander. June 20, 1937."

JACK J. WURM of Palo Alto holds the paper he allegedly found in a floating bottle. The paper may be the long-sought will of Daisy Alexander, deceased heiress to the Singer fortune, who died intestate in England several years ago.

Photo of Jack Wurm from the July 29, 1949 edition of the Stanford (California) Daily

Daisy inherited eccentricities from her polygamous father. Isaac Singer fathered five families scattered about the United States, a secret held until August 7, 1860, when two of his wives spied one another from carriages drawn along Fifth Avenue in New York City. A caring man, Singer willed fortunes to each offspring.

Two years after releasing her MIB, Daisy died at age 81. At the time, her will couldn't be found. No wonder—it was drifting through the Arctic along Siberia. Daisy probably assumed a mudlarker would discover it in a few days or months along the Thames or the North Sea. Instead, it drifted for a dozen years until Jack J. Wurm, 55, a bankrupt restaurateur, found Daisy's bottle 12,000 miles away on a beach in San Francisco, California. While the will drifted in the intervening years (1937-1949), Daisy's estate accrued to $12 million. By 2002, the 1949 value multiplied to $2 billion, or $167,000 for each sea mile Daisy's will drifted!

Daisy, however, neglected to notarize her MIB. When it finally turned up, Cohen, 84, advised Wurm to probate the unusual will in the United States because the unsigned instrument wouldn't stand up in British courts. Cohen had Daisy's handwriting authenticated, and, eventually Wurm collected, though I have never learned the amount. ▶

The odyssey of Daisy's bottle is as mesmerizing. Not only did it drift across the Arctic and Pacific oceans, but it floated to San Francisco, Daisy's childhood home. After marrying into British aristocracy, Daisy moved to London, where, according to Cohen, she became fascinated by floating bottles.

Daisy sealed her whiskey bottle well, little imagining its incredible odyssey. Popular radio announcer Paul Harvey (AKA Paul Aurandt), while investigating the voyage of Daisy's bottle for his book *Destiny*, asked oceanographers to reconstruct the MIB's journey. From the Thames River, the anonymous oceanogs—I'm guessing including the brilliant James (Jack) Carruthers—guessed the bobbing brown bottle looped round the North Sea following thousands of scientific MIBs dispatched to study fish behavior since around 1900. Onward north to Norway, then east along Siberia paralleling the Trans-Siberian Railroad for 5,000 miles.

Daisy's bottle traveled along the Northern Sea Route blazed in 1879 by Professor Nordenskold, taking seven years to span five sequential seas: Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, and Chukchi Sea. Finally, on the two-year homestretch, slowing from a rate of a mile per hour north of Bering Crossroads to seven miles per day south to Japan and east to California.

Why is coastal Siberia so fluid? The Arctic Ocean is disproportionately wet. Though containing only 1.5% of the world ocean's volume and 5% of its surface area, it receives 10% of the world's river discharge. Most flows from Siberia into the Siberian Coastal Current. Eight major rivers discharge onto the Siberian continental shelf, which because of Earth's rotation turn right, propelling segments of the Siberian Coastal Current.

"Impossible," listeners exclaim on hearing the Siberian route of the billion-dollar MIB. Most MIBs drift for a while, then strand on some cobbly, sandy shore. Beachcombers find 1-2 percent of them and report a fraction of those. The vast remainder become cold cases for future beachcombers. For years, I hadn't a persuasive reply. Meanwhile, the answer surfaced inch by column inch. I felt like Sherlock Holmes, squirreling away newsprint nuggets from 80 years of newspaper morgues. To most, these clippings are curiosities, filler for newspapers to use in vacant column inches. To me, they reveal time's passage through the Arctic hourglass. A single MIB may be easily ignored, but seven over the same route as Daisy's will?

Øresund MIB. "A message in a bottle dropped into the Baltic Sea was found nine years later in San Francisco," read a UPI newsclipping. "The bottle, with numbered message '4,764' was one of 13,000 'posted' into the sea at Øresund between Denmark and Sweden on August 7, 1976 by the East German Institute for Marine Studies in Warnemuende." Øresund is Danish for The Sound, one of the world's oldest, busiest sea lanes. For 228 years, from 22 years before Columbus' birth (1451) until the discovery of northern Greenland, Denmark exacted tolls from ships passing through Øresund. Its strong, 3-4 MPH currents transported bottle 4,764 to the North Sea from where it continued through the Northeast Passage.

7-9-year drift: Radioactive particles. Infinitesimal drifters also travel this route. Ogs traced two radioisotopes, Iodine 129 and Cesium 137, discharged from the nuclear fuel reprocessing plants at Sellafield, England, and La Hague, France. They found the radioisotopes as far east as the New Siberian Islands and, using the decay rates, determined a speed quicker than estimated by Carruthers equivalent to transiting from the North Sea to Bering Strait in 7-9 years.

Mississippi River to Grayland MIB. On Sunday March 21, 2010, beachcomber Janeice M. told me of another beachcomber she'd visited that day. Jeffro Uitto recently found a bottle at Grayland, Washington, which had been released nine years earlier at the mouth of the Mississippi River. Uitto, 25, has become internationally famous for collages of driftwood shaped into large sculptures, such as a ten-foot-high wild horse that stood in the home of his front yard at Tokeland, Washington.

Portuguese MIB: Doris Hannigen handed me 22 column inches from the Chinook (Washington) *Observer* (1996). Looking for sand dollars after a gale, out of habit John Pieri kicked over a barnacle-encrusted glass bottle near Grayland, Washington. Inside, foreign writing gave the MIB's date of origin (November 19, 1983) on a flyer for an exhibition at the Monastery of Jerónimos, Lisbon, Portugal. Little else could be made out from the badly faded note.

New York MIB. 2" from Doris Hannigen in *The Olympian* (Washington, 1996). "Perhaps he'd read *Paddle to The Sea* by Holling Clancy Holling about the epic drift of an Indian in a toy canoe through the Great Lakes, down the St. Lawrence River and into the sea off Newfoundland. During summer vacation, 9-year-old Kevin Reeder launched a MIB. 'Hello, today is July 16th, 1978. If you find this bottle please drop me a line.' He tossed the green glass bottle into Lake Cayuga, one of western New York's finger lakes. 18 years later, Kevin, 27, received an answer from a couple who'd found his MIB washed ashore near San Diego, California.

Beachcombers' Alert
6306 - 21st Ave NE
Seattle, WA 98115

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Alerts issued Spring, Summer, Fall
Subscriptions: $25.00 US per year
Canada & overseas: $30.00 US per year

"May the tides be good to you."
—Paul Ebbesmeyer (Curt's father)

***Rugia* MIB.** From a 3" clipping in the *Seattle Post-Intelligencer* (1912): "Tossed overboard on the Hamburg-American line steamship *Rugia* on the 16th of October on the way from Hamburg to New York. 'Whoever picks this up please report to nearest newspaper and oblige the writer. October 16, 10 a.m., 1889.' Drifting from the southern North Sea, on December 6, 1912, the year Titanic sank, a Mr. Hobucket picked up the tightly-corked bottle beached near the Quillayute River on the Washington State coast. The *Rugia*'s schedule checked out according to sailing notices posted in the *New York Times*.

Frog found in Texas. In 1993, 28,000 turtles, ducks, beavers, and frogs spilled overboard in a single cargo container. As I manned my beachcomber booth at the Sea Bean Symposium, a woman passed by asking, "Is this what you're looking for?" and showed me a plastic frog. Through crushing Arctic ice, the little fellow had maintained its distinctive green color and shape from the Great Rubber Ducky Spill.

Princess Cecilia MIB. Three column inches in the *New York Times* (1936). "In 1899, Captain Charles Weieerishen threw a bottle from the S.S. *Crown Princess Cecilia* into the North Sea off Varberg, Sweden. On November 21, 1936, Wallace Pomeroy, 16, found the Captain's bottle beached near Victoria, British Columbia, Canada." Luckily, I interviewed Wallace in Victoria and confirmed the story before he passed.

WHOI MIB. On Christmas Day 2004, not far from the Golden Gate Bridge in San Francisco, California, Wade Woodworth discovered Bottle #12,900, released in 1953 off Massachusetts by the Woods Hole Oceanographic Institution. The bottle's contents included an orange placard labeled "Break This Bottle"and a self-addressed stamped post card. The drift of Bottle #12,900 consists of three major segments: 1) Across the North Atlantic from Massachusetts to northern Norway along the northern edge of Columbus Gyre; 2) Northeast Passage from northern Norway along coastal Siberia to Bering Strait; and 3) Bering Strait to Japan and onward to San Francisco, skirting Aleut Gyre (scientific name: Pacific Subarctic Gyre).

OSCURS showed the way for the water gyres of the North Pacific, but I could never know detailed pathways through arctic passages. For decades I did not ask the right question until I stepped back to address the time perspective suggested by the Billion Dollar Bottle.

Harkening back to my days studying for my ham radio license, I recall the tap codes from distant shores, the dots and dashes of Morse Code akin to bottle strandings and the intervals between them. This is like using the arrival times of sound pulses in the ocean to estimate what the ocean is doing. Confirmatory MIBs came ashore where the Daisy's Will stranded: three in California (two at San Francisco!), two in Washington, and one in British Columbia. But how could I explain these 11 (is it actually 12?) elapsed times—7-9, 9, 9, 9, 12, 13, 18, 23, 25, 37, 52 years—from the northwest Atlantic to America?

By nature, flotsam speed varies and drifters can dawdle, stranding and eddying here and there, explaining the wide variance from the model timetable. The code of temporal variability cracked when, to the express route, I added loops around the Siberian Gyre. Harvey explained the first three intervals (9, 12, 12 years). The shortest direct transit of 9 years is one year less than Harveys estimate and equals the speed from radioisotopes. Inserting a 13-year circuit round the East Siberian Gyre furnishes the next two (18, 23 years). Inserting two loops yields the longest transit (37 years).

For a few years after I first read the story, I ignored the billion-dollar bottle because ninety percent of the time Bering Strait currents flow north, blocking Daisy's bottle from entering the Pacific. They do, however, occasionally reverse direction based on current meters moored across Bering Strait. Furthermore, a narrow current near Russia persistently heads south.

Overall, three MIBs circled the Siberian Gyre. Jack Wurm was lucky—Daisy's MIB didn't dawdle, taking the average time to make its journey. It might never have reached him because gyrating could have delayed Daisy's bottle long enough to let water in. Or, in the Chukchi Sea, it could have returned to England via the Bering-Europe Express. The billion-dollar bottle, however, made it south through Bering Strait. ■

Beachcombers' Alert!™

FALL-WINTER 2022-2023 105 ISSUES SINCE 1996

Iconic Flotsam Orbits Ocean Gyres

Toy spill's 30th birthday; doll collector; driftwood houses

The Doll Collector

Halloween, 2022: Grocery stores bunker behind orange pumpkins. TV features creepy movies. Along Texas shores beachcombers report rubber bales and Barbie dolls. The bales originate from a World War II ship sunk off Brazil, but the dolls' source remains mysterious.

Doll parts have been washing ashore for decades—notably Barbie arms, legs, and torsos along Florida, and in the '90s Tommy Pickles heads in the Pacific. Dolls frequently strand in the Great Bend of Texas with other strange sea-based mutations. The famous dolls date from Barbie's first official birthday on March 9, 1959, during New York's Toy Fair.

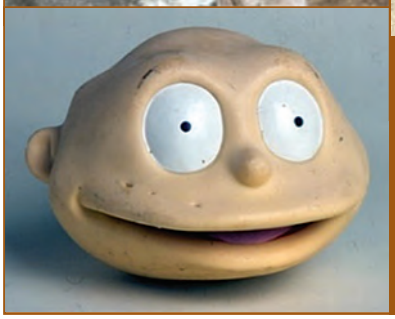
Jace Tunnell, director of the Mission-Aransas National Reserve at the University of Texas Marine Science Institute, said his team has collected thirty-plus dolls over the past few years. "I would have never thought that dolls could be a way we'd educate about ocean currents and marine debris, but it really seems to connect with people in a creepy way," Tunnell writes. "There's a lot of nightmares out there," he added, referring to *automatonophobia*, the fear of automatons, wax figures, humanoid robots, audio-animatronics, or other figures representing humans. There's even *pediophobia*, the fear of dolls.

Doll Collector

Situated on the Gulf Coast, Tunnell and his colleagues regularly survey forty miles between Padre and Matagorda Islands—an area where the currents collect dolls. "We're actually doing scientific work, but the dolls are a perk," Tunnell said. "Every day is something new. Just when you think you've found everything that could possibly wash up on shore, something else comes up."

Email after email, beachcombers wonder: Why do so many dolls wash up in this specific place?

Through a two-year study, researchers discovered that the Texas Coastal Bend acts as a junk magnet—a phenomenon similar to its cousin in the Pacific, the Great Garbage Patch; instead of a vast area at sea, the Bend lines the shore. "The Bend receives ten times the amount of trash that any other beach in the Gulf of Mexico does," Tunnell said, compared to what researchers in Florida and Mississippi found after conducting identical flotsametric experiments. The Magnet stems in large part from the Loop Current reaching from the Yucatan Peninsula to Florida. This current creates eddies that push debris into the Great Bend.



Barbies, Bales, and Pickles: *Rubber bales washed ashore from a 1944 ship sunk off Brazil and collected at Padre Island National Seashore; doll heads found on the Great Bend of Texas. The dolls disturb finders but raise money for sea turtle preservation. Tommy Pickles doll heads have for years stranded on beaches along the Pacific. The bales indicate the dolls' pathways. Top right: Rubber bale in Palm Beach, Florida, found by Diane Buhler August 2020. Photo by Kimberley Miller.*

Rubber Bales

During World War II, everything from A to Z utilized rubber. In 1966 Blue Water Recoveries located a wreck some 19,000 feet down (deeper than the Titanic) in the South Atlantic near Brazil. In 2018, unidentified parcels surfaced along thousand miles of

DOLL COLLECTOR continues on page 8

Driftwood Dwellings: Florida, Faroes, Vikings

Before the age of plastic, circa World War II, most flotsam was comprised of wood. In my childhood, I built many forts out of the remains of walnut trees cut to make way for nearby tract homes for GIs returning from the war. I'd dig a hole and cover it with the largest logs I could drag the few blocks to my home on a halfacre potato patch. For other forts, I'd pile tumbleweeds blown along local dirt roads fronting my potato patch home. I'd seen beachcombers construct lean-tos from beach logs which gave me ideas for the forts in my half acre. Since I entered the Floating World as a result of the great shoe spill in 1990, I encountered many forts of driftwood constructed along the shore. Here are a few examples from the Arctic, Atlantic, and Pacific.

Photo: Chuck Palmer

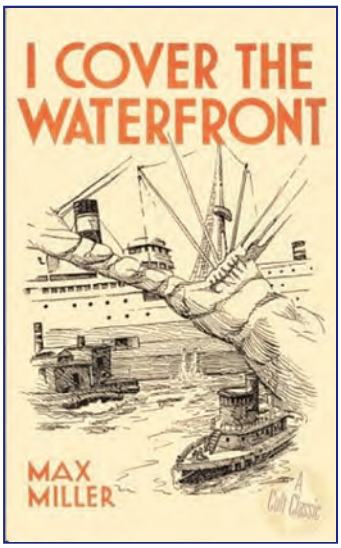
Photo: Jennifer Harbal

I visited Cocoa Beach, Florida, annually for two decades after Cathie Katz, the Sea Bean Lady of Florida, invited me there for her first Sea Bean Symposium beachcomber gathering in 1996. All those years I missed visiting The Driftwood House, built in 1912 by a Florida pioneer who found a shipwreck washed up in front of its current location. The ship carried cypress from which he fabricated this drifthouse (top photo).

Along the Oregon coast noted artist Steve McLeod and I visited a home constructed of lumber spilt from a nearby wreck. My experience is familiar to many beachcombers. Particularly when combined with forts of drift wood. My experience reached a pinnacle with a driftwood home built in the Faroes Islands described later in this Alert. ■

A Ducky Start for a Jedi of Jetsam

"One of the most widely reported container losses of the 20th Century involved 29,000 bathtub toys including plastic ducks, turtles, frogs and beavers when they fell off a cargo ship heading to the US from to China in 1992. These ducks later made news because they began turning up on beaches around the United States and continued to do so thirty years after the incident." So wrote Hope Ngo of the BBC, describing the objects that became widely associated with my study of the Floating World.



"They are the most buoyant objects caught up in the ocean currents that can eventually come to reside in the Great Pacific Garbage Patch, which was first proposed by oceanographer Curtis Ebbesmeyer in 1997," Hope continued. "He had spent decades studying and tracking ocean debris and it was he who first described the Patch as one of the planet's 'most important geological features.'"

It's always good for my contributions to be recognized (thank you, Hope and the BBC), but one of my favorite monickers was bestowed on me as I quaffed beer at Seattle's 5th Century Tavern. It was there that Scott Thiessen anointed me the "Jedi of Jetsam." (*Jedi* has its origin in the fictional universe of *Star Wars,* where Jedi Knights are mystical warriors who can access and manipulate a pervasive spiritual energy called The Force to perform supernatural feats.)

In 2022, Susie and I began a trip aboard Amtrak's Coast Starlight train from Seattle to San Luis Obispo, California. I had with me a copy of a book by one Max Miller titled *I Cover the Waterfront,* which Clayton Krause, another Jedi of Jetsam, had found amongst detritus at his local Goodwill Store and gifted to me.

In 1993, I began investigating rubber duckies lost at sea amongst 29,000 children's toys (turtles, duckies, beavers, frogs). A quarter-century later they've floated around the North Pacific Ocean where they birthed, on ice across the Arctic Ocean, into the North Atlantic Ocean and the Gulf of Mexico. By now, in 2022, they've drifted 25,000 ocean miles at 1,000 miles per year and finding one of these ducks often makes international news. Where they begin, less so. But they do have a singular birthright. Here's one I discovered at the Morro Bay Inn. Source: Morro Bay Rotary Ducky Derby; Estero Bay News, September 10, 2022.

Jedi's Beach Beat. As a regional handyman, Clayton Krause prowls Morro Bay for seacast items. Near the sanctuary of big birds across the road from the campground, he handed me Max Miller's book. Though he's deceased, I bonded with Max because I, too, cover the waterfront hunting flotsam. Googling revealed much about Max. ■

Chaos / Distance / Time / Souls

This Alert brings a global perspective. The **temporal** aspect stems from the orbital periods of three gyres, including 12 years around Arctic gyres, 6 years around the North Pacific (AKA Turtle) Gyre, and 3 years around the Atlantic Columbus Gyre. The **spatial** aspect includes 2,000 nautical miles from Washington to Hawaii and Cook Inlet, Alaska; 4,000 miles from Brazil to Florida via the Gulf of Mexico; and 5,000 miles for the Trans Siberian Railway (TSR), Russia's longest rail system stretching from Moscow east to Vladivostok. (The Russians may not upgrade the TSR infrastructure, thereby marginalizing themselves with respect to China, Japan, and Europe.)

Gyre name	Orbital period	Iconic flotsam	Examples (this Alert)
Columbus	3 years	Octopus pots, seabeans	Rubber bales
Turtle	6 years	Tsunami, container debris	Boats, toys, trees, cards, gullet clips
Arctic	12 years	Siberian drift trees	Rubber bales

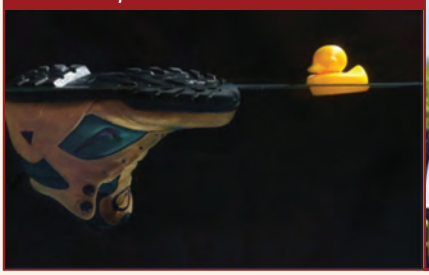
Flotsam Orbits World Ocean Gyres. *I've named the gyres covering half the ocean. Heads up: orbits of the longest gyres gathered for this Alert included: rubber bales around the Great Arctic Gyre orbiting flotsam at 12 years; tub toys, drift trees and fishing boats orbit the North Pacific Gyre in 6 years.*

The ocean brings order out of chaos—flotsam concentrates along the shore, on the sea floor, and at the sea surface, thanks to the gyres covering half of the ocean surface ordering chaos for ocean area—just as man's art extracts order out of chaos. Such is evident from cave paintings from Neolithic times at Lascault, France, through the times of the Pharoahs to early Greeks and the modern era. I see order in the flotsam washed ashore around the world expressed in the geometry of space and time.

This *Alert* reflects this concentration of doll parts and rubber bales beachcombed along the Great Bend of Texas, a forty mile stretch of beach cousin to the Great Garbage Patch. The Patch is a giant area of the North Pacific between Hawaii and California that amasses flotsam, whereas the Great Bend concentrates flotsam along a shoreline. I believe it deserves its own moniker, perhaps "Great Bend Garbage Shore." Left undescribed are flotsam's group dynamics, including how they aggregate on islands, along certain shorelines, and in floating patches. My experience suggests half of flotsam strands on ten percent of the earth's million miles of shore.

The most famous two-dimensional collector, the Great Garbage Patch, I named while chasing yellow plastic ducks lost overboard in 1993 from a containership. Jim Ingraham used his magnificent computer program known as OSCURS—Ocean Surface CURrent Simulator—to track the toys round the great North Pacific Gyre of currents. When a reporter from the *Los Angeles Times* newspaper asked me where the ducks were, I blurted: ". . . they orbit the Great Garbage Patch, [which is] three times the size of Texas." The name stuck, marking the ducks and cohorts as history's most famous container spill. ■

So many gyres in the sea make me wonder that the ocean is obsessed with time.That the gyres orbit in a harmonic group of five—0.75, 1.5, 3, 6, 12 years—the basic of music causes me think along with the famous quote that music is soul of humanity. Thus I feel flotsam represents time and soul of the sea and the music of the human soul.



Top left: Trina Nation holds a blue turtle toy from the great 1993 container spill. Top right: a duck, turtle, frog, and beaver from the spill. Bottom: laboratory floatation of a Nike sneaker and a rubber duck. Right: Cathie Katz and Curt with their favorite of the spill's tub toys. In all, 29,000 turtles, beavers, ducks, and frogs were lost from the container ship during a storm at the 45th parallel at the International Date Line.

Drift from the Arctic Oculus

More than ice drifts the Arctic Ocean. I've collected stories of ephemera found there including a watch, wooden toy boats,rubber ducks, a Frisbee, a yellow disk, Messages In Bottles (MIBs), and bales of rubber. And, of course, lots and lots of driftwood.

Driftwood litters Arctic islands, much of it from Soviet-era logging in central Siberia. When Arctic ice melts, it leaves massive driftwood deposits. For millennia, wood originating from North America's boreal forests has hitched rides on sea ice, traveling with the Transpolar Drift Stream across the Arctic Ocean until it reaches Greenland, Iceland, Svalbard, and the Faroe Islands.

On a trip to Italy, there to deliver a lecture regarding the drift of human remains at Magna Græcia University of Catanzaro, located in southern Italy's instep, Susie and I toured Rome. In my high school Latin class, the Pantheon figured prominently, particularly it's ocular eye. My interest in all things flotsametric stems from my childhood, so I took the opportunity to visit the Pantheon with the ocular opening permitting a mist to rain on me. I found that this oculus resembled a giant eye in the Arctic, and the logs that accumulate there are like the crust that builds up in the corners of my eye as I sleep. Thus flotsam from the Arctic became as tears raining from the window to the ocean's soul. The Arctic's great orbiting eye peering from the ocean's soul seemed a message from God as in Matthew 7:1-5: *"Judge not, that you be not judged. For with the judgment you pronounce you will be judged, and with the measure you use it will be measured to you. Why do you see the speck that is in your brother's eye, but do not notice the log that is in your own eye? Or how can you say to your brother, 'Let me take the speck out of your eye,' when there is the log in your own eye? You hypocrite, first take the log out of your own eye, and then you will see clearly to take the speck out of your brother's eye."*

Beachcombing Iceland's northeastern coast, foresters sawed 289 samples of driftwood. Thirty years after their first trek in 1989 they returned in 2019. Said Ólafur Eggertsson, now a research scientist for the Icelandic Forest Service, "If it hadn't been for the driftwood, people would have just not survived in Iceland."

Under a microscope, the foresters identified the species of trees in the driftwood samples: Scots pine, larch, and spruce. From the tree rings, they determined their origins matched 73% of the samples to trees from Siberia. They also found that 83% of the driftwood samples came from trees felled by logging while the remaining 17% retained parts of their roots, indicating they fell naturally before being river rafted into the Arctic Ocean.

Sea ice acts as the conveyor belt enabling a well-connected Arctic. Floating on open water, wood eventually waterlogs and sinks. The Arctic Ocean, however, cycles through episodic freezing and thawing—ice forms around the fallen timber, rafting it along while it absorbs little water. Melting releases the wood to wash up on nearby shores.

The ice conveyor belt appears to be slowing down. There has been a precipitous decline in the amount of driftwood arriving at Iceland from across the Arctic Ocean. 80% of the samples had tree rings dating to between 1922 and 1976, while 14 trees stopped growing in the 1980s. Only three samples dated to more recent years. Given the decrease in ice due to climate change, driftwood today is more likely to sink before stranding ashore.

Sea ice loss will continue given the predicted warming yet to occur, meaning a total collapse of the driftwood supply. Simulations based on global climate models indicate that by 2060, no more driftwood will successfully complete the journey to Iceland. Other timber-poor northern regions such as Greenland, Svalbard, and the Faroe Islands will also be effected. Though driftwood is no longer the important source of lumber it once was, Icelanders still use it for buildings and

ARCTIC DRIFT continues on page 11

Major Rivers (magenta) draining Siberia into the Arctic Ocean.

Peppering the Rockies

The Great Garbage Patch dusts Earth with estroplastic

As I hunted rubber duckies (1993-2023), my understanding of seaborne plastic radically grew. In the 1990s, beachcombers clued me in to raw industrial plastic the size of BB rifle shot known as *nurdles*, which are melted into myriad everyday products. My friend Jim Ingraham obsessed on these tiny pollutants, tucking the sea shot he'd found along swash lines into his jeans' watch pocket for further examination in a nurdle search. Dutch flotsam Jedi Wim Kruiswijk sent collections of the plastics, sorted by color and collected from Zandvoort shores. Another beachcomber gave me a broken industrial bag once stuffed with a million nurdles.

For a decade I regarded nurdles as the smallest seaborne plastic in existence. Then I awakened to toothpaste. At some point in the '90s, many toothpaste brands introduced blue plastic glitter to polish teeth as we brush. It's a clever concept; unfortunately, the glitter cannot be filtered from the sea or collected at sewage treatment plants (STPs).

The connection between STPs and the Great Garbage Patch comes from electron microscopes (ETs) backpacked to remote places. ETs magnify objects ten million times, whereas conventional light-based microscopes magnify less than two thousand times. Richard Reynolds found himself feeling more resigned than surprised when his ET image of a snowpack sample collected from Colorado's high country revealed something besides the expected sprinkling of rock fragments and spikey sand grains: plastic fibers.

More images confirmed what researchers then suspected in worldwide snowpacks—an invisible layer of microplastic dusts the Rocky Mountains, irreversibly polluting snowpack and water. "It seems to be everywhere," said Reynolds. "And there's *a lot* of it."

Fragments of shredded truck tires blown from highways. Pieces of plastic bottles lifted from a Utah landfill by sirocos and dropped onto Loveland Pass. It's as if a giant pepper shaker from the Pacific Garbage Patch sprinkles the Rockies on a regular basis.

Many of these particles are so minuscule as to require a new classification; they're not mere microplastics but *nanoplastics*.

Each time you brush, you spit estroplastic and contribute to the reduction of human sperm count. Drifting plastics shatter into ever smaller nanoplastics (estroplastics) which have been detected worldwide (Alamy photo). Be alert for plastic grit in your toothpaste (shown here), paint, and facial products.

Those revealed on ET images are too tiny to offer brand name identities or shapes, but the technology does exist to find out, e.g. mass spectrometry (MS), an analytical technique used in murder investigations on the HLN Channel's *Forensic Files* broadcast nightly.

Nanoplastics are extraordinarily persistent. They fragment but never degrade, at least not in a timespan relevant to life on planet Earth. The numbers boggle as the research remains in its infancy. Will we have the time to figure it out before Sixth Mass Extinction forever removes human presence from Earth? Thanks to ocean pollution, the gyres have become floating, soupy, masses of estroplastics, stemming from physical breakdown beginning when plastic first enters the sea. While organic materials such as wood and metal eventually degrade or sink to the sea floor, plastic fractures near the sea surface in physical response to abrasion, prolonged UV exposure, and degradation from prolonged contact to water.

Cleaning up plastic waste directly from the sea is an impossible task. The only cost- and time-effective ways must include reducing or removing waste at the source—on land, well before it reaches the ocean. Thus far, scientists cannot measure the amount of plastic in the open ocean. How toxic might the fibers and shards prove to plants, to wildlife, to humans? In microplastics, as in all of science, Reynolds said, "I am continuously humbled by what I don't know."

At present we do know about a form of plastic that mimics estrogen (I'll call it *estroplastic*). It's prevalent among plastic pollution and we see its effect in the measurement of human sperm count, which has ominously decreased by 50% worldwide in the past half-century. Mother Nature has seemingly found a way of cleansing herself by humanity's sword.

Estroplastic pollution calls to mind a song title from the 1966 album *Revolver*, by the Beatles: it's Here, There, and Everywhere. Will we have the time to recognize and correct the problem? When we see human population begin decreasing it may well be too late.

California, regulating first and asking questions later, has in 2021 required these

ESTROPLASTIC continues on page 12

Coolest Coolers: Yetis Overboard

Do you remember? Around October 24, 2021, the containership *ZimKingston* caught fire after losing an estimated 109 containers filled with Yeti brand hard-plastic insulated coolers off the mouth of the Strait of Juan de Fuca. The coolers subsequently floated north to Vancouver Island, Haida Gwaii, SE Alaska, and the Kenai Peninsula at the mouth of Cook Inlet on the Gulf of Alaska. The captain rode out the big storm instead of seeking sheltered waters of the Strait.

Realizing Yeti coolers aren't cheap—average-sized Yeti coolers can cost $800 while its most expensive option costs $1,500—beachcombers set to hunting thousands of Yetis.

A year later, John M. Clarke Jr. emailed on behalf of the *Wall Street Journal*, seeking information for a front-page story on the Yetis; he had interviewed quite a few beachcombers that referred him to me. I'd known about the flotsam trail of coolers left over the course of the year, strewn along the shores from Washington north to Cook Inlet. John mentioned he'd learned some also had been found in Hawaii. This jogged my understanding of the difference drifting for a year makes.

Above: Duke Marolf of Seward, Alaska, stands behind Yeti coolers found July 2022 on beaches along Alaska's Kenai Peninsula (courtesy Duke Marolf via KUOW). Below: Large White Styrofoam Cylinders (LWSC) from South Korea, photo by Martin Thiel (Universidad Catolica del Norte, Coquimbo, Chile).

Every few years since 1990, iconic flotsam has fallen from container ships around the world. These include Nike sneakers; bathtub toys; hockey gloves; Lego marine elements; HP ink cartridges; bicycle helmets; and, here, Yeti coolers. In the calendar year between Halloweens 2021 and 2022, these coolest of coolers fanned out, some journeying 2,000 miles to the southwest and Hawaii and some 2,000 miles to the north and the mouth of Cook Inlet. Caught between these gyral drift tendrils, some coolers entered major gyres of the North Pacific Ocean: Aleut Gyre between Alaska and Japan; the Great Garbage Patch between Washington and Hawaii; the Blob in the Gulf of Alaska; and circumscribing these three the great North Pacific Gyre (AKA Turtle Gyre).

October 27, 2022. Russ Lewis writes from Leadbetter Point State Park, Washington, a 1,732-acre natural area featuring beach frontage on the Pacific Ocean to the west and Willapa Bay to the east. Each week Russ and other beachcombers search and clean this magnificent shoreline, keeping eyes peeled for long-range drifters from Japan and Korea. On this trip they hauled away some Large White Styrofoam Cylinders (LWSC), designed as buoys widely used in shellfish farming and as dock flotation hardware, that had possibly been blown across the Pacific.

Fall storms began rolling in on October 20th with measurable rainfall and windy periods occurring each day since. There has been some higher surf that made its way on up to the base of the Leadbetter Park dune forest, thus washing free some old buried plastic bottles, plastic sheeting, Buoy Beer labels, and styrofoam chunks. The beach dumpster is about 98% full.

"Where do they originate is a question some people may have when they see a LWSC sitting on a local beach looking way out of place," Russ writes. "Many thanks go out to Martin Thiel, Universidad Catolica del Norte, Coquimbo, Chile, who shared a photo with me [showing many of the cylinders at] an aquaculture enterprise located in South Korea. I suspect there are many such marine farming endeavors such as this located along the Asian shores of the Western Pacific. I think it is reasonable to think that many are still drifting in numbers travelling eastward over the Pacific Ocean from Asia once they get loose. I can't imagine the havoc a typhoon could unleash to such an operation."

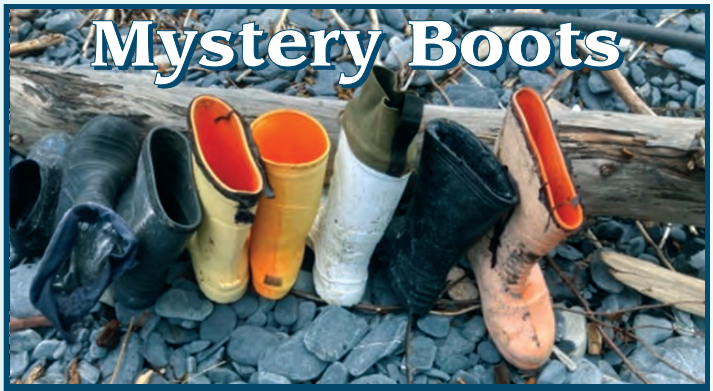
Soon there will be LWSC washing ashore during winter and spring months. If handled roughly, these cylinders will spew off little round buoyant pellets resembling bird food. Seabirds also peck away on these cylinders trying to find attached natural food, ingesting Styrofoam as they do. Many LWSC are noticeably carved up by excessive bird pecking. They also serve as buoyant objects that transport various marine species from distant places during long periods adrift.

May 11, 2022. Another note from Russ Lewis says: "Westerly winds have prevailed since last week, therefore long range trash/debris have been showing up along the beach sporadically. Of note is that the late 2020 APIS-ONE container spill trash absent since mid-January is now washing in again, especially the white styrofoam packing material, refrigeration insulation, and preschool mats. Still found are those ever common plastic bottles that are mostly long range. Many have been rolled/flattened in compactors, (maybe 20% of what I find), and later ▶

are released into the ocean. Makes me wonder if certain crews aboard those big cargo ships compact their plastic bottles to save space and then later jettison a filled collection bin over the rail. Many of these plastic bottles have Asian lettering. Still no plastic fishing floats from Asia to be found.

"Yesterday John Weldon called to report a partial fiberglass bow section of a boat had washed ashore south of the Oysterville Approach. It appears to be what is left of a Japanese panga-style fishing boat that was destroyed by the 2011 tsunami. It is estimated that there are many of these styles of small fishing boats still adrift on the ocean being attributed to the tsunami. This means many might drift for a gyre orbit or two over the next dozen years. I've been working at photographing and checking for any collectible marine specimens off this remnant for John Chapman of the Hatfield Marine Science Center in Newport." ■

Mystery Boots



Beachcomber Tim Lydon writes: "Hi Curtis, We've been finding these boots this summer in/near Prince William Sound, Alaska, and wondering if you're seeing them in Washington or anywhere else." If anyone else comes across boots like this in your beachgoing travels, please let me know!

Orange Drifter Needles Hawaii

By Andy Baker, YourCleanEnergy, Seattle WA USA

One can never be certain how an ocean drifter may travel or where it may land. J.R.R. Tolkien (*The Fellowship of the Ring*) aptly described the essence of wandering: "Not all those who wander are lost."

Back in February 2021, when my wife was four months pregnant with our first daughter (who happily drifted for nine months in Mom's womb), I had the chance to launch a small batch of custom orange plastic drifters into the outgoing ocean tide from the Puna District on the Big Island of Hawaii.

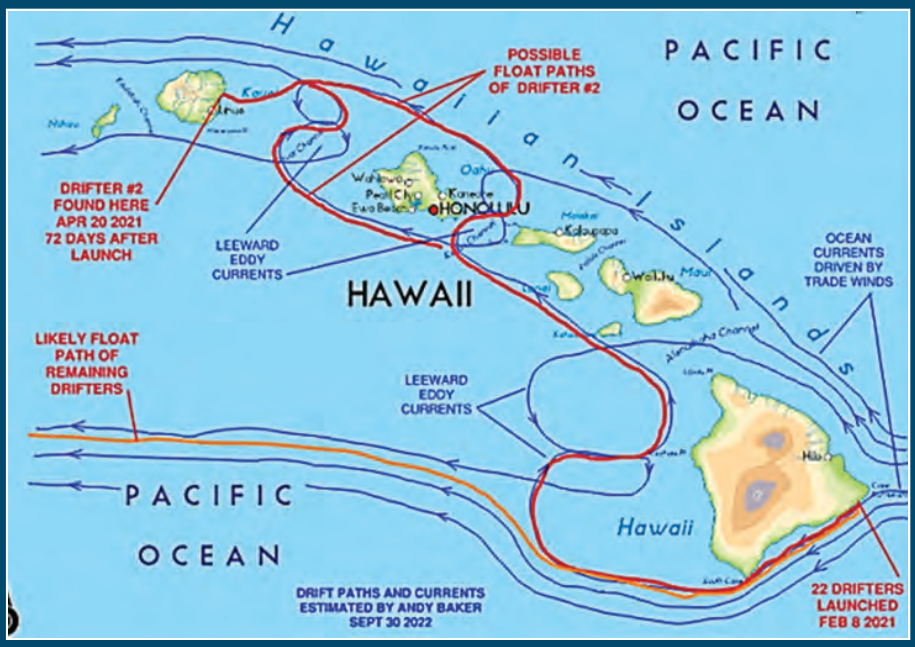
I was on a mission to test a story of Hawaii folklore that fishermen from K'au District who traveled northeast to Puna by ocean canoes launched floating messages from Puna to loved ones that consistently landed 75 miles to the southwest at Kamilo Beach. With help from veteran beachcomber friends Noni and Ron Sanford of the village of Volcano, I assembled 22 custom drifters made of durable plastic shapes collected from Kamilo Beach, with a fresh orange plate affixed stamped in raised letters with a request if found to text my iPhone.

Andy Baker

After 22 vigorous Frisbee flings, my drifters floated out to sea into the famous Hala'ea Current that could land them at Kamilo Beach where my friend Meg Lamson and the Hawaii Wildlife Fund beach clean-up crew could find them two weeks later. But none of the drifters were reported found in the next two weeks, or even in the next two months. I concluded that they must have drifted past the Kamilo lava shelf during a low tide and then out into the open ocean around Hawaii's famous South Point.

72 days after launching the drifters my luck took a surprising turn. Beachcomber Janet Labrum, while on vacation from Oregon, texted me that she'd found my Orange Drifter #2 (OD2) among driftwood behind the Pono Kai Resort on the east coast of Kauai Island in Kapa'a (22 degrees, 4' North Latitude). But how did OD2 travel 230 miles north after floating around South Point (18 degrees 55' N)?

Driven by the trade winds, the predominant direction of ocean current approaching and leaving the Hawaiian Islands is nearly due east to west. My best guess on this improbable drift path is that OD2 swirled in eddy currents that sent it cascading in a northwest direction from South Point to its landing on the east coast of Kauai. I am still hopeful for more texts in future months or years on the remaining 21 orange drifters that I believe are now circulating in the immense, slowly turning North Pacific Gyre. ■



DOLL COLLECTOR from page 1

Brazil's coast. Flotsamologists found them to be bales of raw rubber, ranging in volume from between 0.06 and 3.4 cubic meters and weighing up to 200 kilograms. Amongst colonies of oceanic barnacles *Lepas anatifera*, investigators discovered plantation stamps: "Product of French Indochina."

Using chemistry, biology, history, and oceanographic drift simulations, twenty detectives traced the bales to the German transport vessel *SS Rio Grande*, a blockade runner sunk by U.S. warships off Brazil's coast in January 1944. Though its crew tried scuttling the transport, the gunboats *USS Omaha* and *USS Jouett* sank the *Rio Grande*. As ship disintegrated, rubber bales surfaced in the North Brazil Current to ride along the coasts of South and Central America, around Yucatan, and into the Gulf of Mexico, eventually reaching Belize and Florida's Atlantic coast.

In October 2018, hundreds of bales began washing onto 800 miles of Brazilian beaches. Their mysterious origin and chemical composition caused public alarm; moreover, their size and weight posed risks to vehicles, as demonstrated by a nocturnal collision between a dune buggy and a bale that killed two women and caused a rider's leg to be amputated.

At the time they stranded, Brazilian authorities believed the contents to be raw rubber. Barnacles on one bale were photographed, collected, and identified. After identifying two shipwrecks as potential sources, a particle tracking computer modelled the bales' oceanic dispersion from a ten kilometer radius around the shipwrecks on a date consistent with the bales arriving in Brazil.

Investigators estimated the bales numbered between 150 and 200, with most appearing by the end of 2018. They measured from 0.4 × 0.4 × 0.4 meters (0.064m^3) to1.5 × 1.5 × 1.5 meters (3.375m^3) and weighed up to 200 kilos. These measurements invite comparison with modern-day containers lost overboard. The standard 40-foot container has a nominal volume of 63.48 cubic meters. Not knowing the sizes that washed ashore, I assumed 1,000 bales per container. These days, some 1,000 cargo containers fall overboard every year worldwide. At 1,000 bales per container the annual total of theoretical bales numbers a million.


The German blockade runner SS Rio Grande

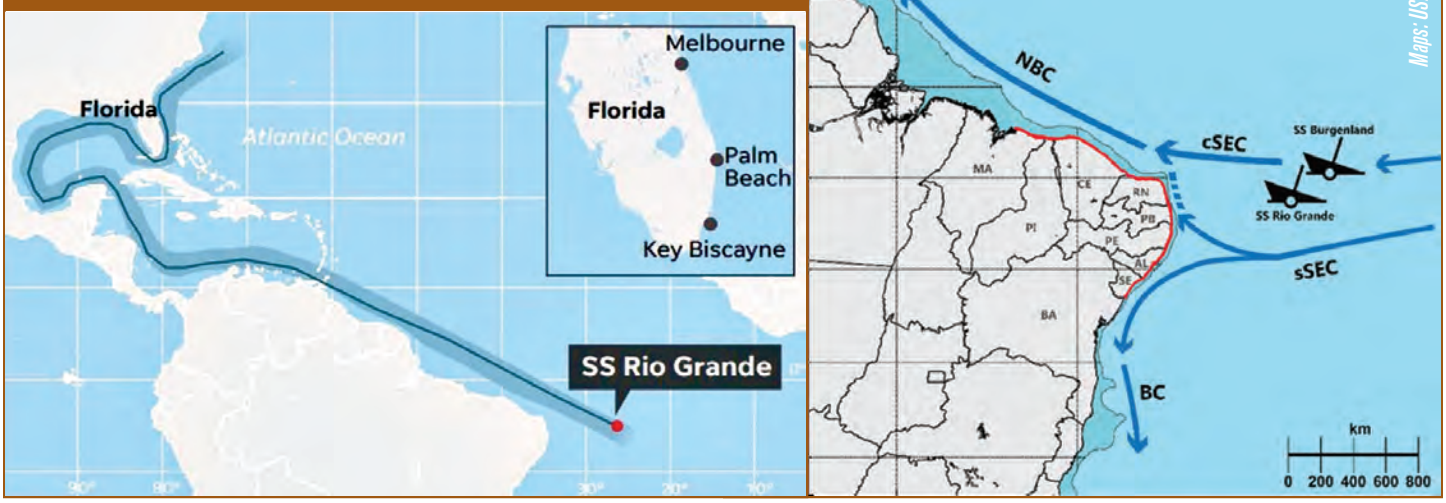
There is an emergent threat of global marine pollution from over 7,800 sunken WWII ships, including over 860 oil tankers that have been corroding more than 80 years. The environmental risk from the totality of submerged shipwrecks has not been thoroughly analyzed. If we assume 10,000 wrecks, each disgorging 100 bales, we have a million potential bales or equivalent flotsam that could strand worldwide. I hope knowledgeable marine surveyers will carry out accurate engineering calculations.

Initial evidence of the bales' origins came from their chemical composition. The material became soft and sticky in sunlight and soluble in nonpolar solvents, characteristics of natural rubber. Hypotheses evolved from one of the bales stamped "Product of French Indochina" as well as "SBIAK," a word from the Khasi people indigenous to Meghalaya, in northeast India, who lived in French Indochina. This region was a French colony (like Vietnam, Laos, and Cambodia) that became independent in 1953. The climate and soils of French Indochina are well adapted to rubber tree plantations. The region produced large amounts of rubber, especially when the Japanese dominated French Indochina in WWII and shipped rubber aboard German ships.

Additional evidence came from adult individuals of the goose barnacle *Lepas anatifera*, a pelagic oceanic species usually found on floating objects in tropical and subtropical oceanic waters. Individuals of *L. anatifera* become adults and reach sexual maturity when the capitulum reaches 2.5 centimeters across after 30 days, indicating that the bales had been afloat for at least a month. No other coastal organisms colonized the bales.

The *Omaha* and the *Jouett* intercepted the *SS Rio Grande* and its fellow blockade runner *SS Burgenland* on January 4, 1944, at seven degrees South Latitude by six ▶

Rubber bales from the wreck of the sunken World War II ship Rio Grande made their way to Florida as well as a lengthy part of the Brazilian tropical coast, carried by the North Brazilian and South Equatorial Currents.



Vulcanized Arctic Drift

Inevitably, some of the *SS Rio Grande*'s bales will orbit Columbus Gyre between America and Europe, eventually drifting into the Arctic. A bale found in Boston, Massachusetts, echoes this drift.

While beachcombing Brant Rock, ten miles south of Boston, Dr. Geoff Patton recalled: "During 1954, Dad called the family over to look at the corrugated, four-foot block of black something [that had] washed up on the beach." Geoff's father knew from kicking the flotsam that it was a bale of uncured rubber. Realizing its value, he interrupted the family vacation and carted the bale to a local rubber plant.

After receiving $475 ($5,300 in 2022), the Pattons watched as an industrial saw sliced into the bale. A few moments later the saw blade snapped. When the acrid smoke cleared, they discovered why—the bale's core was frozen solid. Despite the passage of 34 years, Geoff, now director of the Clearwater Marine Aquarium in Clearwater, Florida, vividly recalled the mystery. How had uncured rubber from a tropical plantation become frozen?

Rubber trees grow within ten degrees latitude of the Equator. Freezing suggests that the bale drifted into the Arctic from either a rubber tree plantation or a cargo vessel. After freezing, it floated southward, passing eastern Greenland then looping through Baffin Bay. A year or so elapsed while the Labrador Current transported the black drifter along with hordes of white icebergs to the Grand Banks. Finally, near Brant Rock, its icy companions long since melted, the bale beached, its outer layers still insulating the relic frozen core. It completed an amazing circuit of Arctic Gyres to New England. ■

In the wild, a rubber tree reaches 140 feet in height. The white or yellow latex is produced by vessels in the bark, mostly outside the phloem. The tree requires a tropical or subtropical climate with a minimum of about 1,200mm of annual rainfall and no frost—a single frost may cause the rubber from an entire plantation to become brittle and break once it's been refined.

Possible drift route of rubber bales in the Grand Arctic Gyre—a long, strange trip of seven principal locations along the drift route from the Yenisei River to the Faroe Islands: mouth of the Yenisei River, Kara Sea, North Pole, Greenland, Iceland, Titanic grave, Wall across the Atlantic.

degrees West Longitude. They reportedly carried 500 tons of tin; 2,370 tons of copper; 311 tons of cobalt; and bales of crude rubber marked by French Indochinese.

The wreck of the *SS Rio Grande* was discovered in November 1996 using side-scanning sonar. Salvors confirmed the wreck's identity and recovered a sample bale. The *SS Rio Grande* modelling matched the distribution of bales recovered along Brazil, whereas simulations for the *SS Burgenland* did not match. Also, iron in contact with a less active metal like the *SS Rio Grande* cargo (tin and copper) corrodes more rapidly than when alone. There is also evidence that unauthorized salvage of metal cargo from the *SS Rio Grande* ($32 million worth cobalt in 2018 prices) occurred at the same time the bales arrived in Brazil. This salvage might have ruptured the wreck's hull and allowed the bales to surface. The rubber itself would have had no commercial value and thus would not have been recovered by unauthorized salvors.

Shipwrecks worldwide provide sources of hazardous substances which, if discharged, could have long-term oceanic effects. Shipwrecks deteriorate through various causes, and with time the probability of leakage increases. The six years of WWII account for the largest loss of ships in a short span of time, shipwrecks that have been submersed in marine conditions for 86 years like the *SS Rio Grande*.

In 2012, rubber-like blocks known as *Tjipetir* beached across Europe (Spain, France, Netherlands, United Kingdom, Denmark, and Sweden). The blocks were made of gutta-percha, the gum of a tree found in the Malay Peninsula and Malaysia that probably came from the Japanese ship *Miyazaki Maru*, which was sunk on May 31, 1917, by the German submarine U-88 west of the Isles of Sicily. The term "Tjipetir" comes from the name of the rubber tree plantation that produced it. Similarly, rubbery packages found on Britain's coast had the inscription "Prey Estate," indicating the identity of their source plantation. Rubber packages marked with "Senawang" were found in Cornwall (UK) in 2016. These inscriptions helped deduce the origins of the rubber bales.

Beachcombers' Alert

Quarterly nonprofit newsletter, circulation approximately 400.

Managing editor, Jim White. Production & layout: Constellation Design (www.constellationdesign.net). Computer support: Mark Heavy. We take no advertising or institutional funding. Without your subscription, the Alert will cease publication. For a one-year subscription, send your annual donation to Beachcombers' Alert, 6306 21st Ave. NE, Seattle, WA 98115 USA. Make checks payable to B&OIA (Beachcombers and Oceanographers International Association): $25 in the USA; $30 USD elsewhere. Digital subscriptions available at www.flotsametrics.com ($20 USD, payments via PayPal). Printed by Blue Sky Printing, Poulsbo, WA.

Sources: *The English Woman Blogs Rubber Ghosts of WWII; Creepy dolls mysteriously keep washing up on a Texas beach: Ryan Nickerson, July 6, 2022 Houston Chronicle. Ocean currents push the unsettling toys—and tons of other trash—onto state shores: Sarah Kuta, Daily Correspondent May 16, 2022. Marine debris from the past—Contamination of the Brazilian shore by a WWII wreck: Carlos Eduardo Peres Teixeira. Rubber bales from sunken World War II-era German ship wash up on Texas coast: Priscilla Aguirre. Padre Island National Seashore credited its findings with a study published in the Journal of Marine Environmental Research.* ■

Gullet Flotsam

Gruesome flotsam is washing up on beaches all over New Zealand in the form of esophagus clips.

The esophagus (gullet), a muscular tube connecting your mouth and stomach, is part of the digestive system, or gastro-intestinal tract (GI tract). When you swallow food, the walls of the esophagus contract, moving food down and into the stomach. An esophagus clip is a plastic oval about the size of a small thumb used on beef cattle.

Like a ghoulish Pac Man, the clip opens up to reveal two rows of spiky teeth, designed to clamp around a cow's esophagus. Shortly after a cow is slaughtered and its belly ripped open, its windpipe is pulled out. The clip is attached and pushed up the esophagus to the base of the stomach with a rod in order to stop stomach contents from spilling out. The animal's anus is also plugged to prevent leakage.

"They're a gruesome New Zealand invention," says Auckland University biotechnology researcher Dr. Emily Frost of the clips. "But they're mandatory, for safety purposes, to prevent the contamination of meat." Being made of plastic, the clips don't degrade, and when they've served their purpose they get disposed of like any other plastic.

The only company in the world making alternative bioplastics specially designed for the meat industry is Aduro Biopolymers in the city of Hamilton, on New Zealand's north island. It currently only has a sheep butt plug on the market but sales have "been pretty slow," says company chair Graham Shortland. "We're price-competitive, we have to be. Our product performance is at least as good, if not better." There's just been no urgency from meatworks to change to biodegradable products, he says. Aduro's plastic alternative is made from blood taken from abattoirs, which means it can be rendered without contaminating byproducts and it breaks down in water.

Top: Gullet clip found by Des Watson. Middle: Artist's rendition of a clip inside a fish. Bottom: Esophagus clips from the mouth of the Mimitangiatua river.

The conventional plastic clips "should not be in the general environment," Shortland said. "This is a direct result of insufficient treatment of a trade waste." Sustainable Coastlines co-founder Camden Howitt agrees: "Plastics released into the marine environment last a very long time and wreak havoc on ecosystems. Sharp, hard plastics like the esophagus clip can puncture the digestive system including—in a cruel twist or irony—the esophaguses of sea creatures that ingest them."

Thus far, when broaching the subject with officials beachcombers have received runarounds from industry and government.

These grisly devices are showing up in fish's stomachs and on beaches across New Zealand. Why are gullet clips escaping the meat works?

Source: *Anusha Bradley, Investigative Reporter March 8, 2021.* ■

PLASTIC MAN

Modou Fall is on a mission against trash. Specifically, plastic trash.

The Senegalese environmental activist founded Clean Senegal, an association devoted to raising awareness of the dangers of plastic and promoting reuse and recycling in the northwest African nation.

"It's a poison for health, for the ocean, for the population," says Fall, who is popularly known as "Plastic Man." He traverses the beaches in his uniform—"it's not a costume," he emphasizes—of plastic shopping bags with a sign in French that reads "no to plastic bags." In Senegalese and Gambian culture, the "Kankurang" is a spirit of justice and order, a protector against evil. Upon seeing Fall on the beach, children shout "Kankurang is coming!"

Fall embraces the labels of Kankurang and Plastic Man as he campaigns against plastics, not only noting the problems with its disposal but its creation. Plastic production is a significant contributor to greenhouse gas emissions and global warming. "Climate change is real," he said, "so we have to try to change our way of life, to change our behavior." But individuals can only do so much. "Leaders of Africa need to wake up and work together to fight against this phenomenon," he said. ■

Global Whale Starvation

A whale starving from 88 pounds of plastic in its stomach died after stranding in the Philippines. Rescuers called it one of the worst cases of poisoning they'd witnessed. In Scotland, a "litter ball" weighing 220 pounds was found inside a whale's stomach. On November 18, 2022, a sperm whale washed ashore in Nova Scotia starving from consuming fishing gear. Two weeks earlier, the 46-foot, 28-ton whale looked unwell off a rocky beach on the west side of Cape Breton, Canada. The next day the whale died near the shore in Craigmore, Cape Breton. A necropsy found 150 kilograms of fishing gear (packaging, ropes, nets, and gloves) in the whale's stomach.

This "dead whale" was created out of plastic flotsam by Greenpeace Philippines to call attention to the dangers of plastic pollution. It was displayed at a seaside resort south of Manila. Photo by Vince Cinches.

Sperm whales eat by diving deep to feed on squid and fish. Their mouths vacuum whatever's on the ocean floor. Because of this, it's not uncommon to find sperm whales with plastic in their stomach. The amount of debris extracted from the Cape Breton whale exceeded anything the senior investigator had seen before.

In November 2022, an emaciated killer whale died after stranding on a Dutch beach. According to Lonneke Jsseldijk (Utrecht University), all of the orca's teeth were loose and rotting. "The Orca must certainly have been in real pain when eating food," he said. "The whale was very ill; besides the gingivitis, she also suffered from several internal inflammations, including the meninges, a heart valve, and in the reproductive organ."

Plastic waste starves whales worldwide at alarming rates.

Sources: *www.onegreenplanet.org/November 1, 2022 by Hailey Kanowsky; The Canadian Press, Nov. 18, 2022, Lyndsay Armstrong GlobalNews. Courtesy Mary and Dan Stroeing.* ■

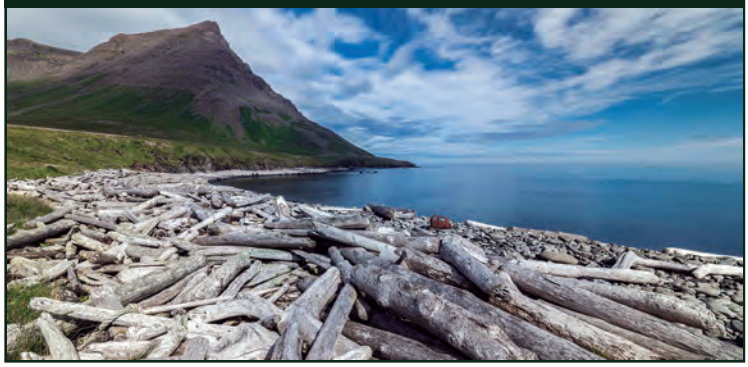
ARCTIC DRIFT from page 4

sculptures and as a source of income, Eggertsson said. They also use it to restore old churches originally made with driftwood. Losing driftwood means losing important sources of Icelandic history and culture.

Early Icelanders used driftwood that originated in central Siberia and made a multiyear journey thousands of miles long, something only possible with sea ice. Arctic driftwood was essential to Norse settlement and expansion and a vital part of Icelandic history. The name *Føroyar* (Faroe Islands) derives from old Norse meaning Sheep Islands, a name given by the Viking-age settlers arriving from Norway in the 9th century. The first known settlers in the Faroes were Irish monks, who in the 6th century AD told of the "Islands of the Sheep and the Paradise of Birds."

Hellurnar is a small village of 25 houses on the island of Eysturoy. One of the houses was the subject of a note sent me by Lynn Reveal, who lives in Lacey, Washington, some twenty miles from me. Lynn wrote of a documentary film that tells "the story of a friend of ours, Jústinus Eidesgaard, who rebuilt a house in the Faroes from the 1800s using traditional materials—driftwood, stone, and turf.... I am still in touch with Bogi Hansen, the oceanographer featured in the film." Lynn wrote subtitles for the film, which include: "They have sourced driftwood in the Faroes to Siberia! Jústinus wrote books here. More than 30 years ago he purchased this old house and the barn next door, which had been the second house built in this village." Jústinus begins his remarkable film with profound philosophy; I add that life proceeds in baby steps stone by stone, log by logs: "The greatest gift God has given me, I do not see one second into the future, and if I had known how difficult and challenging this project would be I would never have started. I would have lost heart immediately. But that is exactly what is so great about this—when it is one step at a time, one does not lose heart."

Above: Jústinus Eidesgaard's reconstruction of the first home built in the village of Hellurnar on the Danish island of Eysturoy (Faroe Islands), built with driftwood and stone.
Below: Siberian driftwood accumulated on an Icelandic shore. It is estimated that by 2060 global warming will have diminished sea ice to the point that driftwood would no longer travel to Iceland.



Sources: *C. Malmros Pages 552-558 | Published online: 28 September 2009. Album: Great Arctic Reserve (2013), Taymyrski Zapovednik and German-Russian Expeditions 1989-1991 to Taymyr.* ■

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"May the tides be good to you."
—Paul Ebbesmeyer (Curt's father)

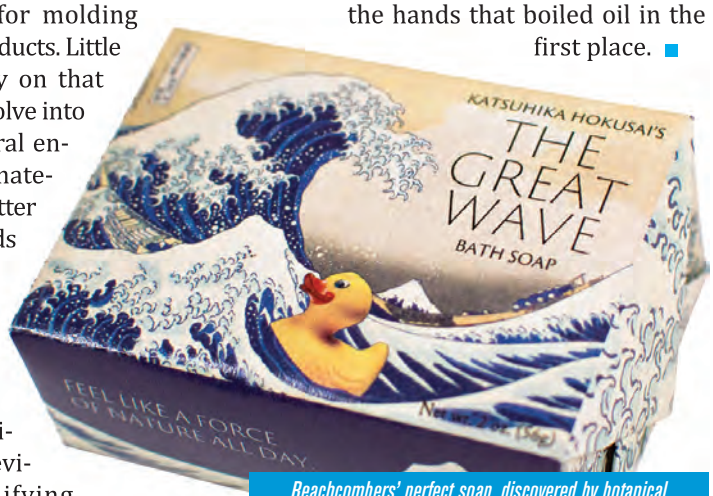
When Will it End? Plastic Progression

Humanity's plastic curse began with boiling oil, exemplified at the La Brea tar pits in Los Angeles, where for millennia natural asphalt (asphaltum, bitumen, or pitch; *brea* in Spanish) has seeped from the ground. The tar not only preserved animal bones, but in the great boiling humans noticed incredible varieties of substances carried by the vapors, some of which were refined into plastic (one of the earliest forms being Bakelite from WWII). Products included billiard balls, celluloid film, etc., and carried to millions of present-day plastics.

Oil refineries produce chemical groups, e.g. pharmaceuticals, fuels, and plastics. That last group begins plastic's progression into the sea: refineries produce raw plastic in the form of small pellets known to beachcombers as nurdles. Round and shiny, they're ideal for molding into myriad plastic products. Little did man realize early on that plastic would not dissolve into elements in the natural environment as other materials do, but rather shatter into ever smaller shards of plastic, down to sizes that disrupt the molecular structure of humans.

After a time the shards break into microplastic, particles evident under a magnifying glass. Call this stage three. Then we come to the fourth stage in the plastic progression—particles evident only under an electron microscope. Though not apparent to the human eye, they are there nonetheless. Despite their small size, the plastic shards continue shattering into ever smaller particles—nanoplastics—down to a diameter of perhaps ten molecules. I'll call this the fifth stage. It's probably at this stage that the food chain absorbs the molecular plastic into our DNA structure.

The end stage of boiling oil is myriad products with a unifying behavior: they mimic estrogen (estroplastic) and, when absorbed, cause the human sperm count to spiral toward zero, thus eliminating the hands that boiled oil in the first place. ■



Beachcombers' perfect soap, discovered by botanical watercolor illustrator Carol Wickenhiser-Schaudt of Katy, Texas. As I edited, Carol emailed a photo of this ducky bar. I took it as a warning to rid the oceans of estroplastic.

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contaminants in drinking water be measured, noting the microplastics field "is still in its infancy. No one knows how widespread microplastics in California's drinking water really are. There isn't even a standardized method to test for them. And no one knows what dose may be 'safe' to consume, since the human health effects are largely unknown."

Said Reynolds, " . . . it is likely humans have ingested plastic particles for decades as a result of widespread contact with plastics in household objects, including cutting boards, food packaging, and direct contamination in air and food."

Sources: *Journal Science, 2020. Microplastic common in the sea from Microplastics Are Disrupting Metabolism of Lung and Liver Cells, Hailey Kanowsky. Courtesy Dan and Mary Stroeing. Microplastics increasingly found in Colorado's snowpack. Michael Booth, Today.* ■