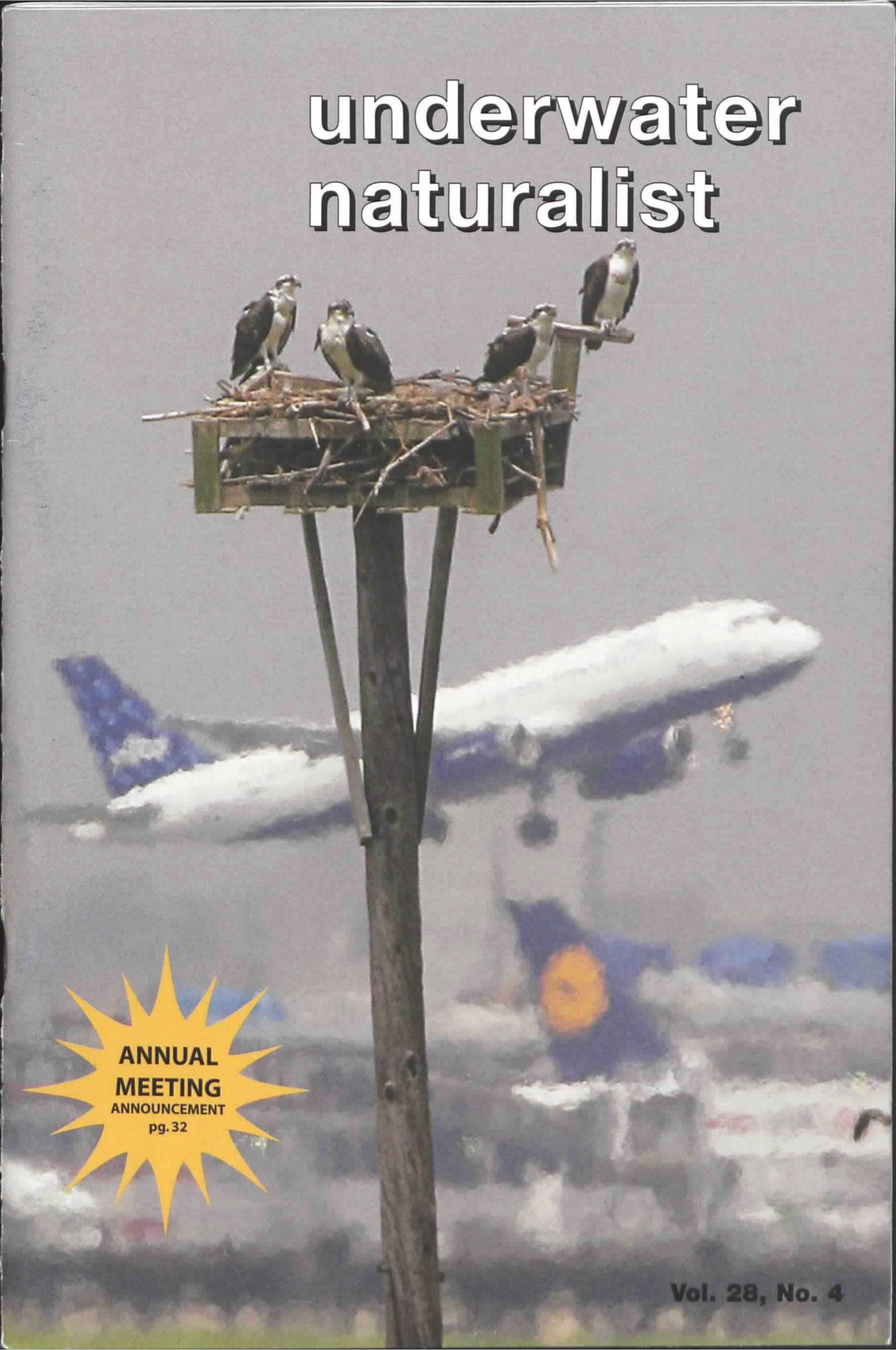
underwater naturalist



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AMERICAN LITTORAL SOCIETY REGIONAL OFFICES

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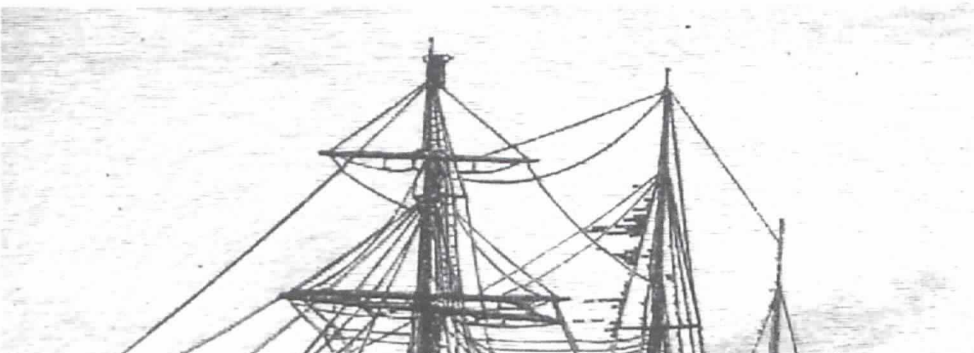

The Proteus at Discovery Bay, August 1881. *See page 3 for the story of this 19th Century polar exploration.*

BULLETIN
OF THE AMERICAN LITTORAL SOCIETY

Volume 28 Number 4

Cover Photo by Don Riepe
JFK Airport: Jet Blue takes off; four ospreys stay put, Queens, NY.
For more details, see Field Note, page 43.

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The First Page

The Last *Last Page*

This issue of the Underwater Naturalist contains the last, "Last Page," Dery Bennett's signature column. As most Society members know, Dery died on December 15, 2009. We lost a great friend and mentor, conservationist and educator. He was also the editor of the Underwater Naturalist for the 41 years he worked at the Society. It was a work of passion.

In this age of word processing, computer-aided graphic design and Google, Bennett was old school – literally cutting and pasting the submitted articles himself, the materials spread out across the conference table at Sandy Hook like a messy jigsaw puzzle. The articles he had culled from "over the transom" unsolicited submissions, regular contributors or, just as likely, someone he had tracked down after reading about an issue, discovery or project they had a hand in.

Dery Bennett (Reprinted with permission from the Asbury Park Press).

In the past, Dery had been part of an editorial staff here at the Society – looking back through our collection of UNs (Vol 1: Number 1, November 1962) it is hard to tell how the tasks and responsibilities were allocated. But for most of recent history, it was clearly Dery's personal bailiwick. We all pitched in, but the vision was his. From answering Letters to the Editors (a straight answer was a rarity) to the Last Page, it reflected his unending curiosity about the ocean, coast and marine life as well as his insights and humor.

The UN will continue without him but, undoubtedly, its character is bound to change under different hands. We hope you will savor this final work as we have.

Tim Dillingham

WILLIAM H. WHISTLER, IPY 1882-1883

BY PHYLLIS MARSTELLER

The fourth International Polar Year began in March 2007 and ended in March 2009. The first of the IPYs that preceded it, 1882-1883, was also the first time that the United States participated in a cooperative international scientific research program. The Americans' most ambitious undertaking during the first IPY was the Greely expedition, charged with establishing a "permanent station...at the most suitable point north of the eighty-first parallel...near Lady Franklin Bay" on what is now Ellesmere Island, Nunavut.

I became interested in the Greely expedition many years ago when I discovered an old genealogy that included a distant relative, William H. Whistler, who had traveled north with Greely. For many years, the only information I had about the expedition was what I had read in the genealogy. From other accounts I have since learned that some of the details in the genealogy are inaccurate, but the bare outlines of the story are true:

William H. Whistler...was one of the...men who volunteered to go with Lieut. Greely's expedition to the Arctic regions....The expedition sailed from St. John's New Foundland, on July 7, 1881. From this point he wrote a letter to his friends, in which he realized the dangers that beset the enterprise. He asked the prayerful consideration of his friends and closed with a "good bye" that now seems sadly prophetic.

The entry says nothing about the expedition itself, skipping from Whistler's departure from Newfoundland to his death:

He...passed away May 24, at Melville Bay, 1884....His remains were brought to Delphi, Carroll County, Indiana, and lay in state in the rotunda of the Court House for several days. The remains were enclosed in a casket made of boiler iron, one-fourth of an inch in thickness, the ends and top firmly bolted and hermetically sealed....Throngs of people passed in and out to catch a glimpse of the coffin that held the remains of the heroic soldier....Services were held in the grove near the church, several thousand being in attendance....Many an eye was damp with tears for the dead hero boy who suffered privation and death so far from home and friends in a frozen clime.

The entry concludes:

The most heart-rending discovery was made some time after when his friends had the remains exhumed to satisfy themselves that they really were the true remains of William H. Whistler. To their horror they found that cannibalism had been resorted to by the starving men of the Greely expedition; every portion of flesh had been removed from the body. The remains were easily recognized. The third finger on the right hand had been mashed a few years before and the nail grew down over the end of the finger, presented its usual appearance and was instantly recognized by his friends.

The author is a long-time Society member whose previous article in Underwater Naturalist (Vol. 27, No. 4) was "The Lunenburg Fish Project," about the Nova Scotia town's street signs decorated with fish sculptures. She lives in Rhinebeck, NY. The illustrations are from Adolphus W. Greely's two-volume expedition report unless otherwise noted.

Until I read several published accounts of the Greely expedition—many years after I read this brief story—I tried to imagine how Whistler had died. Had Greely's men drawn straws? Or had someone issued an order that Whistler be sacrificed? Or had he volunteered, to save the others? Could he have died a natural death before he was cannibalized? And had other men had been cannibalized as well?

When the Inuit run out of food for their sled dogs, they sometimes kill one or more dogs to feed the rest of the pack. Could starving men use the same tactics, for the survival of the group? For many years I suspected that Whistler had been singled out because he was at the bottom of whatever hierarchy he had been part of. As I imagined his situation, he was the omega in a wolf pack.

Recently, at the Civilisation Museum in Québec Province, I saw a film about a Northwest Coast tribe that included a ritual about cannibalism. A figure representing a cannibal was "killed," put into a pit, and set on fire. Then a group of men, all wearing masks that resembled the heads of ravens and raptors, danced around the pit. When they finished the ceremony, the cannibal was said to have no descendants except mosquitoes—bloodsuckers. It seemed like a nice explanation for the swarms that attack man and beast every summer in the far north, but it failed to explain what had happened to the survivors of the Greely expedition—and their human descendants.

Learning More about Whistler

My ideas about Whistler, really Whistler as victim, changed somewhat after I took a trip to Antarctica in 2000. The trip was organized by men who had served in the Falkland Islands Dependencies Survey, which became the British Antarctic Survey. The Fids, as they called themselves, included scientists, technicians, medics, and many men categorized as "meteorologists" and "general assistants." I gathered that the meteorologists trekked to weather stations at all hours of the day and night and in all kinds of weather conditions, including gales and blizzards, and that the general assistants basically did whatever they were asked to do, also in all kinds of weather.

When they were in their twenties, these men built research stations and refuges, mapped land masses, charted seas, collected data and specimens, and traveled thousands of miles by dog team and sledge. Most of the men on the trip in 2000 had lived through at least two Antarctic winters, some as early as the 1950s and the youngest of those on the trip during the 1980s.

In Antarctica I could see how precarious life would be when so much depends on weather and on the nature of ice—whether it's thick enough to hold up under a sledge, or whether there's enough space between floes to provide leads for a boat. As a summertime tourist, I found it difficult to imagine the effects of total darkness, frigid temperatures, and incessant winds, but for the first time I had a sense of what Whistler had contended with when he was in the Arctic.

The year 2000 was also the year that G.P. Putnam's published Leonard F. Guttridge's book *Ghosts of Cape Sabine: The Harrowing True Story of the Greely Expedition*. Based on his study of official records and reports as well as the letters and diaries of Greely's men, Guttridge's book describes the men's accomplishments and failures, the bureaucratic bungling that eventually sabotaged the expedition, and the misjudgments and miscalculations of their leader, Adolphus Washington Greely.

Since 2000 I have also read Greely's

two-volume report, and have traveled to the high Arctic to see the remains of Fort Conger, the station that Greely built at at 81° north, and Pim Island, at 78° north, where the expedition ended. I have also contacted the Carroll County Historical Society, in Delphi, Indiana, to learn more about the Whistlers.

According to Greely and Guttridge and others who have written about the expedition, Whistler spelled his name Whisler, without the *t*. I recently learned that when Whistler lived in Pennsylvania, the family spelled their name Whisler, but when they moved to Indiana, they added the *t*. When Whistler enlisted in the U.S. Army, he spelled his name without the *t*, but when his remains were collected in 1884, his name was listed as Whistler, and his gravestone reads Whistler.

Another discrepancy involved Whistler's birthday, which was March 7, 1858 (according to the Carroll County Historical Society) or September 10, 1857 (according to the genealogy published in 1892) or September 17, 1857 (according to Greely and others on the expedition, who made a point of celebrating birthdays). Whatever the birth date, Whistler was 26 when he died.

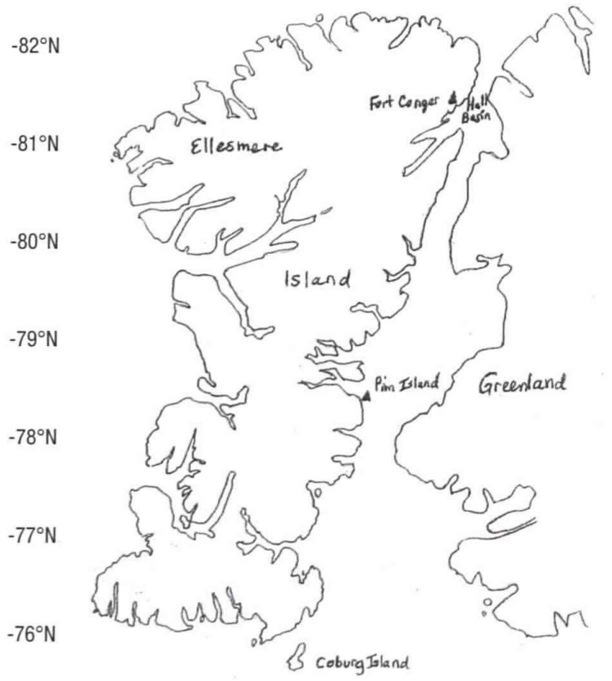
Fort Conger, 1881-1883

Although an expedition sounds like an impressive undertaking, Greely's consisted of only 25 men, including two he described as "Eskimo dog-drivers" who were natives of Greenland. These two men and the expedition doctor were the only men who had had previous experience in the Arctic.

Members of the Lady Franklin Bay Expedition. Whistler is standing, farthest left.

In July 1881, on a ship called the *Proteus*, Newfoundlanders transported Greely and his men from St. John's toward Discovery Harbor, located off Lady Franklin Bay in northeastern Ellesmere Island. In 1881, this section of Ellesmere Island was called Grinnell Land.

The bay, still called Lady Franklin Bay, was named after the widow of the famous British explorer Sir John Franklin, who had searched in vain for the Northwest Passage, disappeared in 1845 with his men and ships, and become the object of over 40 search parties, many financed by



(Author's sketch of Ellesmere Island and Greenland showing the locations of Fort Conger (81° 44'N x 64° 45'W) and Pim Island (78° 44'N x 74° 40'W).

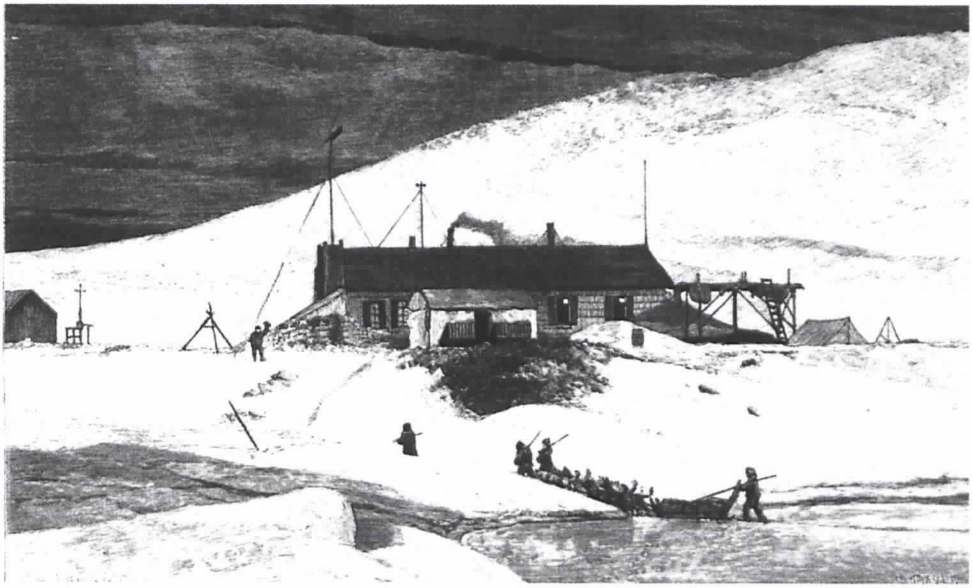
his widow. (Men on the Franklin expedition, too, had resorted to cannibalism.) The official name of the Greely expedition was "The Lady Franklin Bay Expedition."

After Greely and his men were set down at this remote spot in mid-August, they built their research station, including living quarters, with planks and timbers they had carried north. They completed the building near the end of the arctic summer, and Greely named the station Fort Conger after a U.S. senator who had supported their expedition. Now part of Canada's Quttinirpaaq National Park, Fort Conger is located more than 1,000 miles north of the Arctic Circle.

During their first year at Fort Conger, Greely and his men sledged to set up depots and to map several unexplored areas of Greenland and Ellesmere Island. The men also mined three tons of coal from the Watercourse seam, located nearby, to add to the 130 tons of coal they had brought north to heat their station. They set up numerous scientific instruments, including a magnetometer and a well equipped meteorological station. The IPY encouraged scientific research, not exploration for the purpose of staking national claims.

Despite the objectives of the IPY, Greely's men succeeded in 1882 at breaking the British record of farthest north. Three of his men, led by 2nd Lt. James B. Lockwood, left Fort Conger on April 3, made a round trip of almost 1,000 miles to reach 23.8' north, and returned to Fort Conger on June 1. Their record stood for only a short time, until Nansen's new record in 1896, but it interrupted almost 300 years of British records in the polar regions.

Lockwood's party was originally much larger than three, some of the men assisting only with transport, but at least four men left the expedition because of various physical complaints. One had a frostbitten toe, another complained of rheumatism, another had bladder trouble, and Whistler, who was among the four, was spitting blood. Despite the nature of their ailments, all four were young, the oldest being 30 in 1882, but during the trek each had hauled an average of 130 pounds and endured violent snow squalls in tempera-



Fort Conger, May 1883.

tures reaching –48° F.

Other parties that set out from Fort Conger discovered new lakes, rivers, mountains, fjords, and glaciers on Ellesmere Island. Whistler was traveling with Greely when their party discovered Lake Hazen, the largest high arctic lake in the world, named after the chief signal officer of the U.S. Army.

While Greely was busy naming lakes and glaciers and fjords, he named a mountain after Whistler. Still called Mount Whistler, it's in a chain that Greely called the Garfield Range—now called the British Empire Range. Its location is 82° 1' N, 74° 32' W, and it has an elevation of 8,202 feet.

During the spring and summer of 1882, Greely and his men unearthed various Eskimo artifacts, continued their recording of meteorological and other observations, hunted, and kept watch for a ship bringing provisions and mail from the United States. Although the group had meat, including musk oxen, and stores of food to last through the winter of 1882-83, they expected a relief ship to come to their aid.

When none appeared during the summer of 1882, Greely and his men settled in for the winter. It seems bizarre that the group actually kept several animals—including arctic foxes, musk calves, and snowy owls—as pets. Greely reports that the group killed over 150 skuas to feed to six owls that they raised and later released. The pets seem like a wild extravagance considering the pinched rations that awaited the men in 1884.

When the group celebrated Thanksgiving in 1882, Greely was grateful: "Exemption from death and disease, success in scientific and geographical work, together with the present possession of health and cheerfulness, may be mentioned as special mercies for which this command has reason to be devoutly thankful."

In the spring of 1883, Lockwood led another trek, to the western side of Ellesmere Island, setting a record for arctic farthest west. In 1883 as in 1882, the men waited for relief ships, but none appeared. Because of bureaucratic mismanagement and miscommunication, as well as heavy ice and gales, the relief ships that headed north in 1882 and 1883 failed to reach Fort Conger and also failed to leave all of their supplies at depots farther south, as they had been instructed.

Guttridge reports that three ships took 50,000 rations north but left only 1,000 (enough for 40 days' meals for 25 men) where they could be used. One of the ships that headed north in 1883 was the *Proteus*, the ship that had taken Greely and his men north two years earlier. It became icebound and sank, and the survival of the shipwrecked men took precedence over their mission to aid Greely and his men.

Privates Long and Whistler (right), May 1882, after a trip with a Hudson Bay sledge and snowshoes.

Heading South, 1883

Greely had no way of knowing what had happened to the relief missions. That August he decided to abandon Fort Conger and head south, his plan being to use the provisions that were supposed to have been left at depots he had designated as well as caches left by earlier explorers.

For about six weeks, the group traveled south in several small vessels. These included a steam-powered launch and a whaleboat that had been taken north in 1881 by the *Proteus* as well as a jolly boat (a small working boat) and an iceboat that had been left behind by British explorers.

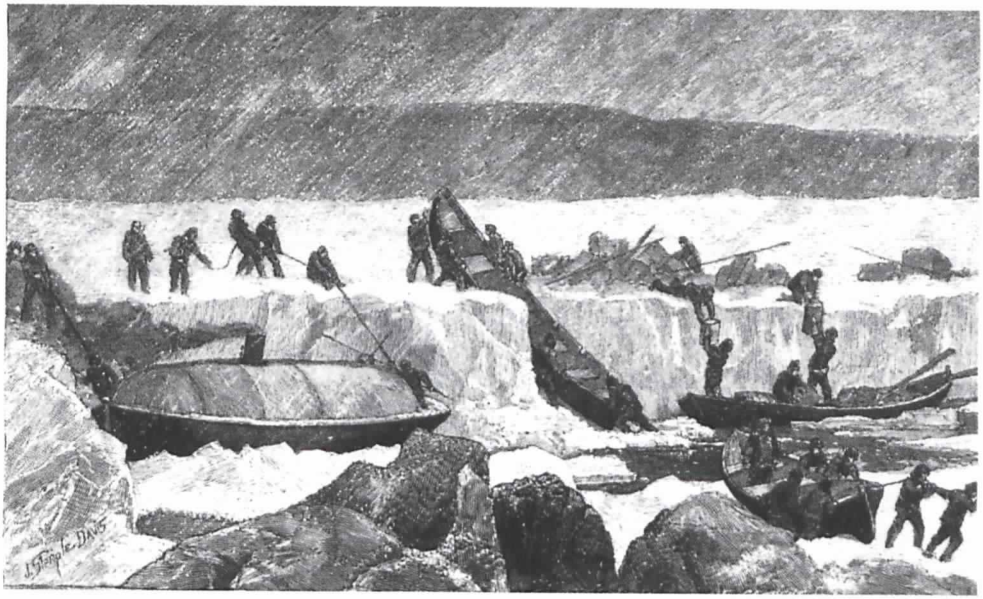
The men contended with winds and fog as well as icebergs, ice floes, and pack ice as they traveled south. When they reached Washington Irving Island, in Kane Basin, they had traveled for more than 300 miles, but they discovered that nothing had been left on the island since their own visit there in 1881, on their way north. At this point, the men hoped that they would find provisions at Littleton Island, about 50 miles south, close to Greenland.

Greely reports that the men were beset for 15 days on the trip south. For a while they were nipped—jammed by the ice—and for a while they even drifted north, losing ground. At times, the men had to abandon their boats for their sledges and, if the ice floes split or drifted apart, had to transfer themselves and their gear to the boats. At times, some of the men took shelter in a makeshift tent set up on an ice floe, while others took cover in their boats.

According to Guttridge, one man wrote in his diary that Greely was "toasting his chin" as he sat next to the boiler in the launch while his men struggled to survive out in the open. Guttridge quotes five of the men who had less than generous thoughts about Greely during the trip south, concluding that Greely had no idea "how lonely and unloved he had become." Even the one enlisted man whom Greely admired wrote in his diary, "Why will the United States government persist in sending a fool in command of Arctic expeditions?"

Guttridge claims that several of the men were close to mutiny. When Greely fell overboard during the trip south, Whistler was supposed to have said that he should have drowned, and another said, "The way things look, if C.O. has his way, we will wind up like Franklin."

By the end of September, when the men went ashore at a temporary camp, they had only two of their boats. Greely's orig-



A serious nip means plenty of work.

inal plan was to winter at this site, which he called Eskimo Point, but he changed his plans after two of the men trekked to Cape Sabine, on Pim Island, to search for provisions and messages. The men found a small cache that had been left by one of the relief ships when it attempted to reach Fort Conger, as well as a message that ice had kept one relief ship from reaching Fort Conger in 1882 and that the *Proteus* had sunk in July of 1883.

Greely interpreted the message—the statement "everything within the power of man will be done to rescue the brave men at Fort Conger from their perilous position"—as a promise by the men on the 1883 relief mission to return to Cape Sabine. Although his men were exhausted after their journey from Fort Conger, he asked them to pack up and head 20 miles north to Cape Sabine. It took 12 men in harness to haul each sledge over the ice, and it took them six days to move everything north.

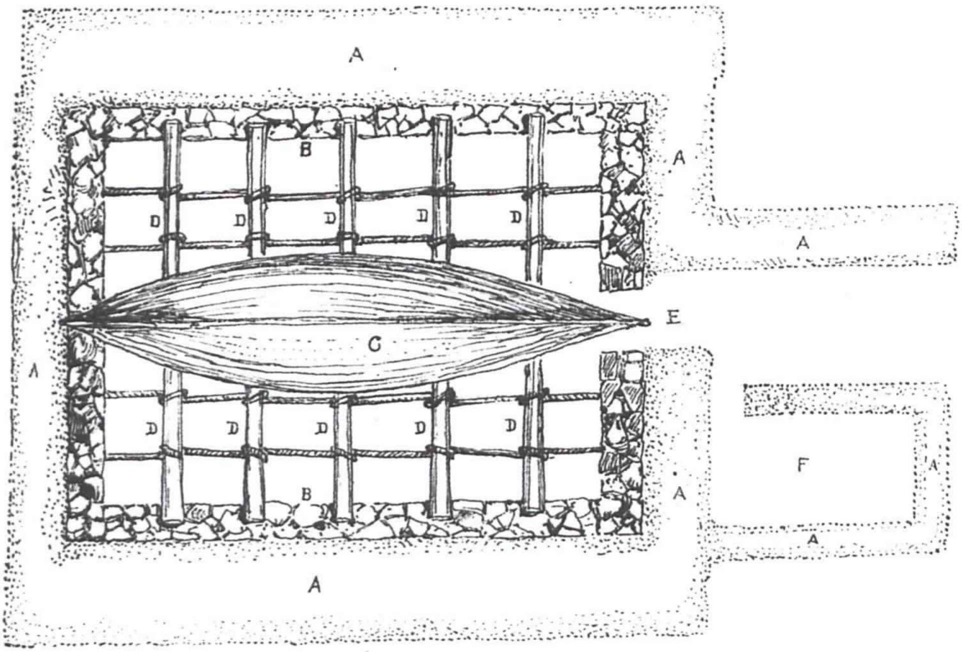
Cape Sabine, 1883-1884

At Cape Sabine, the men managed to construct a hut from their whaleboat, which served as the roof, and its oars, which became the rafters. The group collected supplies from the caches at Cape Sabine and attempted to reach another cache about 20 miles away. That trek ended in disaster when one of the men suffered frostbitten hands and legs. The injured man was rescued and survived, but the cache was left behind.

By the beginning of 1884, other IPY expeditions had ended or were about to end. A second U.S. station, at Point Barrow, Alaska, had been closed, and its expedition members had returned safely.

In his journal entry for February 11, Greely comments, "The spirits of the party, as a whole, continue very good, but Whisler is very much depressed; he said to-day that he did not believe we would ever reach Littleton Island. He is the first one who has ever made a remark of that kind."

At this point, Greely and his men were eating seal blubber, which had been used for lighting and fuel, not food, in the past. If the ice in Smith Sound had been solid, the men would have been able to sledge



Plan of the living quarters at Cape Sabine: A is exterior wall of snow, B is interior wall of stone, C is whaleboat serving as roof, D are oars serving as rafters, E is the entrance, and F is the cooking area.

east from Cape Sabine to Littleton Island, where a cache was supposed to have been left by one of the relief ships.

On March 13, Greely mentions another *if*: "If we were now the strong, active men of last autumn, we could cross Smith Sound...but we are a party of twenty-four starved men, of whom two cannot walk and a half dozen cannot haul a pound." One man had died at Cape Sabine in January, one had lost both hands and feet to frostbite, and Lockwood, who had led the trek farthest north, was in poor health.

Back in the United States, Greely's wife, Henrietta, was busy contacting congressmen and newspaper reporters to urge Congress to offer a bounty to the ship that returned the men to the United States. The rationale was that competition from whaling ships, which could detour to rescue the men, would speed up the mission of the U.S. Navy. In the spring of 1884, Congress approved a plan offering a reward of $25,000 to the ship that rescued Greely and his men.

With no knowledge of the plan, Greely wrote on March 25, "For the first time in five months a ray of outside light entered our wretched hut, and recalled home, and light, and warmth." Less than two weeks later, one of the Greenlanders, a skilled hunter, died of starvation. Five more men, including Lockwood and the second Greenlander, died in April. According to the expedition doctor, Whistler was "quite weak" in mid-April.

By May, the men at Cape Sabine had virtually no food. They were eating lichen, small shrimp-like crustaceans that they collected in a net, and sealskin from their clothing and sledge harnesses. Guttridge reports that one of the men attached a claw to the end of a stick to make a pole for collecting seaweed, and Whistler sewed bits of rubber and gunny-sack together to make gloves for the men who collected crustaceans.

In May, when everyone in the group

was slowly starving to death, Whistler was caught taking a pound of bacon from the group's stores. According to Greely's account, two others had opened a food locker, but Whistler, "pleading guilty to having been unable to resist the temptation to take the food, announced himself ready to pay any penalty." Whistler was excused, living long enough to die of starvation several weeks later.

In his journal entry for May 19, Greely describes Whistler and one of the sergeants as "quite broken down, and the whole party is in lower spirits than ever before." On May 22, Greely wrote, "The melting snow rains down such a quantity of water upon us that we are saturated to the skin and are in a wretched condition." On May 23, Whistler was unconscious, and he died around noon the next day.

There were four deaths in May, and in June there were seven. Alcoholism and scurvy might have hastened the first death, in January, which the expedition doctor attributed to "insufficient nutrition, which, of course, means starvation." Of the subsequent deaths, one was due to exhaustion, another to drowning, and the death of the expedition doctor was probably a suicide. One man, not Whistler, was shot for stealing repeatedly from the scarce food supplies. All of the others had starved to death.

After Whistler's death, Greely described him as "a man of fine physique, who had always labored his best to advance the interests of the expedition." Although Whistler died on May 24th, he was not buried until the 26th, according to Greely. The delay could have provided an opportunity to cannibals. The bodies of four men who died in June, supposedly "buried" in an ice crack, were never recovered, and it could be that they, too, were cannibalized.

Recovery and Controversy

The U.S. Navy, on the ships *Thetis* and *Bear* under the command of Winfield Scott Schley, arrived at Cape Sabine on June 22. After the seven survivors were rescued and the bodies of the dead were recovered, Schley made a special request. When the ships reached St. John's, Newfoundland, each body was to be placed in an iron casket, and each casket was to be hermetically sealed.

Schley reported in June that six of the bodies, including Whistler's, had been cut and the flesh removed. These men had died on April 12, May 19, May 23, May 24 (Whistler), June 1, and June 6. The four men whose bodies had been placed in an ice crack died on June 3, June 6 (two men), and June 12. Some of these men, as well as other men who died before the rescue, might have unknowingly eaten the remains of men who died before them.

Among the survivors were three men who had served as cooks, the amputee (who had suffered frostbite and received double rations at most meals), and an industrious "shrimper." Greely comments several times that these men were among the strongest, and some of the shrimper's collection dates were close to several dates of death—May 20, 23, 24, and 26 and June 1, 6, 8, and 9

Guttridge, too, comments on the "chief shrimper, trudging daily up past scarcely covered bodies on the cemetery ridge and down to the ice-scabbed cove, where he set his nets." By June 1884, Guttridge claims, "Greely lay all but helpless in his sleeping bag, comatose for hours....As far as Greely knew, his men were eating thongs, boot soles, scraps of moss." Greely mentions a sealskin stew and a "general shrimp stew" and a "general mess pot."

After the rescue and recovery—and after rumors of cannibalism began circulating—the Secretary of War (Robert Todd Lincoln), the Secretary of the Navy (William E. Chandler) and Schley conferred and reported that flesh had been removed from the six bodies for use as shrimp bait. Secretary Lincoln ordered that the caskets containing the men who had died on the expedition not be opened because of possible danger to public health and because the remains would not be recognizable. This was the explanation that Whistler's relatives received when they told a lieutenant in Delphi, Indiana, that they wanted to open the cast-iron casket before burial.

Near the end of *Three Years of Arctic Service*, Greely makes an oblique reference to cannibalism:

As to other matters which have engaged an undue share of public attention, while having no official knowledge of the facts in the case, yet the responsibility for all action in connection with such an expedition rightfully and properly rests on the commanding officer. In assuming that responsibility I know of no law, human or divine, which was broken at Sabine, and do not feel called on as an officer or as a man to dwell longer on such a painful topic.

The arctic explorer Vilhjalmur Stefansson, who wrote the introduction, offers an explanation that absolves the survivors of the Greely expedition of cannibalism. He claims that starving men who drink water and eat no food would live longer than men who drink water and eat fatless meat, such as flesh removed from a man who had died of starvation. He theorizes that the cannibals at Cape Sabine died prematurely of "protein-poisoning"; the survivors had been living on water, lichens, and crustaceans (which contain fat), not on human flesh.

Another finding, not quite as flattering to the survivors, has been reported by two Polish researchers, J. M. Weslawski and J. Legezynska, in their article "Chances for Arctic Survival: Greely's Expedition Revisited," published in the journal *Arctic* in 2002. These researchers lived at Pim Island from April to June 1998, the months corresponding with the three-month period when most of the men died at Cape Sabine. The researchers estimated the amount of food available to the men, based on accounts of hunting and fishing reported in the men's journals and diaries, and the amount required to prevent starvation. They also set up traps to collect the shrimp-like organisms that had been netted by Greely's men.

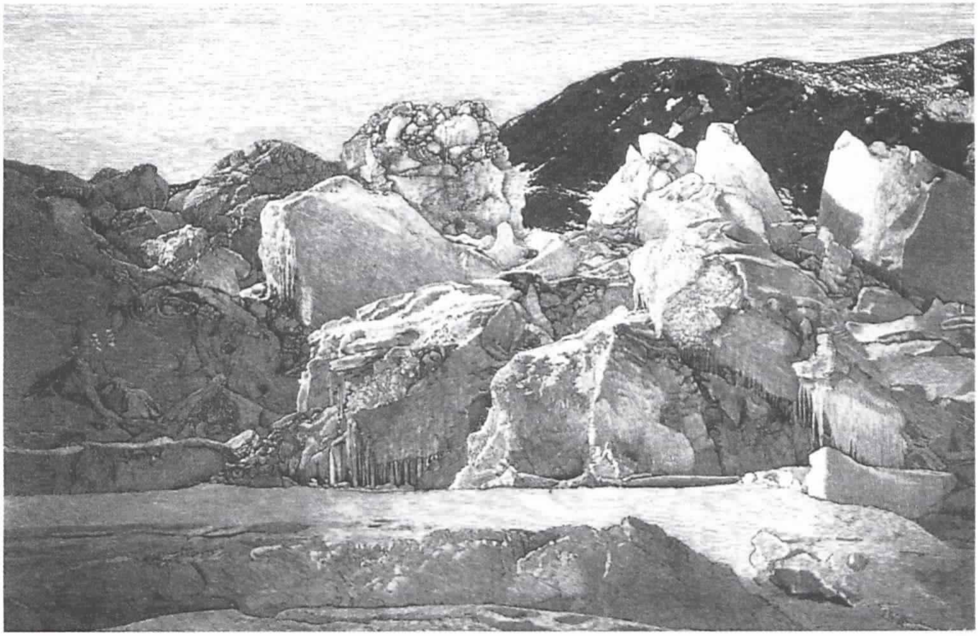
Weslawski and Legezynska conclude, "Even double the amount of crustaceans would not have provided enough energy for all the survivors. For this reason, it seems certain to us that the prolonged survival of some men was due to their engaging in cannibalism, the fact so desperately disregarded in the official documents." The researchers note that official reports of nineteenth-century arctic expeditions seldom mention cannibalism "since the fallen adventurers (even if deceased) were needed as national heroes, which was the case with the Franklin party. The same happened after Greely's return."

Weslawski and Legezynska suggest that individual differences in physique, health, and habits could have influenced survival—something mentioned by Jerry Kobalenko. Kobalenko, who was on Pim Island when Weslawski did his research there, suggests that slender people with a fast rate of metabolism (like Kobalenko and Whistler) probably need more food than heavy people who have a slow metabolism rate. "Sometimes even-steven is not fair," he says.

At the time of Lockwood's journey to farthest north, in April 1882, Greely noted that the average weight of the men was 176 pounds, ranging from Whistler's 156 pounds to the 203-pound weight of the heaviest man.

If relief provisions had reached Fort Conger in 1882 or 1883, or if sufficient supplies had been left at depots farther south, all of the men of the Greely expedition—with the possible exception of the alcoholic who died prematurely—might have survived. Considering that only three of the men had had any previous experience in the Arctic, their accomplishments up until their winter on Pim Island were extraordinary.

They had participated in the United



Ice foot and pressed up ice at Cape Murchison, Robeson Channel.

States' first cooperative effort in an international scientific research program; they had built what they thought was a permanent base in the high Arctic; they had established new records for farthest north and farthest west in the Canadian Arctic; and they had recorded and preserved voluminous meteorological and tidal data as well as reports on flora, fauna and auroral displays.

Of course, their expedition encountered enough reversals to lead Guttridge to write, "Before it was done, their story, and those of their would-be rescuers, would encompass starvation, mutiny, suicide, shipwreck, execution—and cannibalism."

Whistler's Role

Greely maintained, or attempted to maintain, military discipline throughout the expedition. As one of nine men with the rank of private, Whistler was on the next-to-the-bottom rung of the ladder. (The Greenlanders, though respected for their hunting skills, were definitely on the bottom rung.)

As a lowly private, Whistler was expected to follow orders, and from Greely's and Guttridge's accounts it appears that most of the time he did. There were several exceptions, including his attempt to steal a pound of bacon. Another time was when one of the Greenlanders left Fort Conger in an apparent suicide attempt. Whistler, "in his extreme zeal to be of assistance," according to Greely, *left the station without orders and was far too thinly clad for such exposure...[which] affected Private Whisler's mental faculties in much the same manner as was vividly described by [the American explorer Elisha Kent] Kane in the experiences of his party, when several men eventually perished. It was several hours after his return to the station before Whisler was entirely in his right mind.*

Todd describes Whistler as "physically one of the strongest of the men but definitely not one of the smartest," but he credits Whistler with keeping the expedition doctor from sabotaging Lockwood's attempt to reach farthest north. When the doctor attempted to take the best of the sledge dogs for his own use, Whistler drew his pistol to stop him, ensuring that Lockwood could use the dog for his record-setting journey.

Greely describes another incident when Whistler, the expedition doctor, and one of the Greenlanders, along with two dog teams, spent a night on a narrow ice foot in Robeson Channel. Whistler, of course, had no previous experience in the Arctic, but all of the others—men and dogs—knew the environment. On the ice foot, the group risked injury from rocks falling from the cliffs above and from icebergs pushed into their site by gale winds.

Whistler was a greenhorn in a cold climate. Greely reports, "Some alarm, which turned into amusement, arose from Whisler being attacked by a 'nightmare,' which caused him to believe that the ice-foot, with tent, was being carried into the straits, and to rush with fright from his sleeping-bag and the tent...."

From Greely's references to Whistler, which are few, it appears that Whistler was young and inexperienced but eager to serve. As a private, Whistler would have been equivalent to one of the Fids' general assistants, who did most of the scut work, often involving snowshoeing, sledging, or man-hauling under difficult conditions.

Information I received from Whistler relatives in Indiana included news about a local PBS program about William Whistler. From this I learned that Whistler's enlistment papers described him as a carpenter and farm boy. I also learned that Whistler kept a diary for the first two years of the expedition (which Guttridge, apparently, did not know about when he wrote *Ghosts of Cape Sabine*). Unfortunately, I could not obtain access to the diary, which belongs to a Whistler relative.

Return to Fort Conger and Cape Sabine

It goes without saying that travel in the twenty-first century is very different from travel in the 1880s. In 2006, on the Russian icebreaker *Kapitan Khlebnikov*, I traveled north with the tour company Quark Expeditions with hopes of visiting Pim Island.

Via ship, Zodiacs, and helicopters, we visited several sites in Lancaster Sound, including Beechey Island, where Franklin and his men wintered before disappearing in the Arctic. After crossing Melville Bay, we made several stops in Greenland, including Etah, which Peary and Cook used as a base when they attempted to reach the North Pole.

Not on the original itinerary was icebreaking travel farther north and a helicopter flight to Fort Conger. Although it was too windy for the helicopters to land, we had brief "flightseeing" trips over Greely's old base.

Greely's station had been dismantled in 1900 by Matthew Henson and several of the Inuit who worked for Peary. They used the wood to construct several small huts that were much better suited to the arctic environment. The remains of the huts, which Peary used as his base for three expeditions, are still there.

In the arctic summer, viewed from a helicopter, Fort Conger looked bleak, a blotchy mix of ice and bare soil. It was hard to imagine how it must have looked during the winters of 1881-82 and 1882-83, before global warming melted so much of the glacial ice and sea ice. But it took little imagination to see how remote and unforgiving the landscape was. As tourists, we were close geographically but far removed in time and experience from Greely and his men.

When the *Kapitan Khlebnikov* headed south, we had several stops on Ellesmere Island as well as several flyovers, via heli-

Aerial view of Fort Conger, September, 2006. (Photo by the author).

copter, including one at Pim Island. Like the weather at Fort Conger, winds at Pim Island kept us from landing, but we flew over Cape Sabine and tried to interpret what we saw. A geologist on board the KK told us that the island is mainly pink granite, but it looked nothing like polished granite. It looked cold, damp, rusty and muddy.

In 1924, Donald Baxter MacMillan, affixed a bronze plaque to a large rock on Pim Island to commemorate the role of the Greely expedition in the first International Polar Year. It reads, "To the memory of the dead—who here gave their lives to ensure the final and complete success of the first scientific cooperation of the United States with other nations."

From the air, it was difficult to see where Greely and his men had set up their refuge and where they had buried their dead, and there was no hope of seeing the plaque that MacMillan had installed. There was little snow on the ground, but there was ice in the water that I think was Rice Strait, which Greely named after his expedition photographer.

It had been easier, looking at Fort Conger, to imagine what it had been like to spend two years in the far north, but there were very few clues at Cape Sabine. Under different conditions—during the winter, with subzero temperatures, snow on the ground, darkness, and gale winds—there would have been no doubt about conditions at Cape Sabine in 1884. In the summer of 2006, we tourists were far removed from Greely and his men.

The Whistlers in Indiana

When I contacted the Carroll County Historical Society in Indiana, I was curious about the spelling of Whistler's name. The curator of the society's museum told me that Whistler, spelled with a *t*, is buried in the Whistler cemetery, which is located next to a small family church near the Whistler farm northeast of Delphi, Indiana. Another of Whistler's relatives (like me, descended from John Peter Snyder, 1729-1807) owns the family farm.

The Indiana relative I spoke with seemed to be more interested in William's older brother, Clarence (1856-1885) than in the arctic explorer. Clarence held the title of Graeco-Roman heavyweight Champion of the World after he defeated "Professor" William Miller in Melbourne, Australia, in 1885. According to the genealogy of John Peter Snyder, the Australians erected a statue in memory of Clarence Whistler in Melbourne—whereas William ended up in a family graveyard on a farm near the Wabash River.

The Indiana relative sent me correspondence about both Clarence and William Whistler. Several items appeared to have been transcribed from old newspaper clippings. The most interesting one, which put an end to my curiosity about William H. Whistler, was an article dated "August ??, 1884," with the headline "Carved and Eaten: The Body of Whistler Exhumed and Examined."

The transcript describes a postmortem examination by four physicians, attended by several Whistler relatives and two newspaper reporters. The opening paragraph is extremely long. About midway it reads:

The head and neck were unmutilated and at first glance the trunk appeared uninjured to within two inches below the navel. The arms were stripped of all flesh to the wrists. Parts of the mittens worn by the dead boy were still in their place, and the flesh was not at all decomposed, the marks of the knife being very distinct. The legs were stripped in the same way to the ankles, where the knife mark[s] showed as plainly as on the wrists....The third finger of the right hand had been hurt in a threshing machine years ago and this mark was the first one sought for and very easily found....The body was turned over upon the face, and from the base of the neck to the heels, it had been picked clean, not even the skin remaining. Between the bones could be plainly seen the marks of the knife....Every muscle except the intercostal muscles (between the ribs) from the whole body, except hands, feet, neck and face, had been removed as completely as if the operation had been performed by a skilled dissector....The features of the face were easily recognized by those who had been acquainted with the deceased. The short red beard and the dark auburn hair aided materially in the identification. The sides and back of the head had been well preserved by the stout fur hood.

After the physicians had finished their examination, the body was covered, with [the] exception of the face, and the female relatives permitted to look upon the wasted and emaciated countenance. Such exclamations as, 'Poor Willie, starved, frozen and abused!' and 'Poor, poor boy!' banished all the idle curiosity of the spectators and the purely business mien of physicians and reporters, and for a brief moment the little company stood awed and quiet in the presence of a great horror, and a greater grief. The little grave yard with its dozen or more graves grouped in the center, the bright sunshine, the breeze gently waving the tasseled corn, the woods near by, the little church and the group gathered 'neath a tree by its side, comprised a scene that no one present will ever forget.

The casket was closed, placed back in the grave, those present took their departure and the examination was over. ■

Errata: Marsteller, Phyllis. William H. Whistler, IPY 1882-1883. *Underwater Naturalist, Bulletin ofthe American Littoral Society* 28(4): 3-16, 2010.

Page 3, left-handcolumn,paragraph2, line 8 *shouldread*
genealogy *(History ofJohn Peter Snyder, His Wife Mary Cath. Elizabeth Stantz Snyder, and Their Descendants,* by AnnaB. Grove. Chambersburg,Pa.: 1892). Fromotheraccounts I have

Page 5, left-hand column, first line *should read*
two-volume report on the expedition *(Three Years ofArctic Service: An Account ofthe Lady Franklin Bay Expedition of1881-84 and the Attainment ofFarthest North.* New York: Scribner's, 1886) and have traveled to

Page 6, right-hand column, paragraph 2, line 11 *should read*
reach 83° 23.8' N, and

Page 7, left-hand column, line 13 *should read*
Whisler, it's in a chain that Greely called

Page 9, left-hand column, line 12 *should read*
Greely interpreted the message--including the

Page 12, left-hand column, paragraph 4, line 2 *should read*
Stefansson, who wrote the introduction *to* Alden Todd's account *(Abandoned: The Story of the Greely Arctic Expedition, 1881-1884.* Fairbanks: University of Alaska, 2001),

Page 12, right-hand column, paragraph 3, line 5 *should read*
Kobalenko *(The Horizontal Everest: Extreme Journeys on Ellesmere Island.* New York: Soho Press, 2002). Kobalenko, who was on Pim

Page 15, left-hand column, line10 *should read*
In 1924, Donald Baxter MacMillan, an American explorer,

Page 16, left-hand column, paragraph 3, line 7 *should read*
H. Whistler, was an article from the Delphi *Times* dated "August

Photo captions
Inside front cover: *Discovery Bay* shouldbe *Discovery Harbor* Page 10: last lineshouldread *and F is the commissary.*

THE MIGHTY OCEANS' CURRENTS

BY GEORGE MOFFATT

Sight unseen, ocean currents move massive amounts of water, influencing (one could almost say dictating) global weather and the ocean's biology. Here we cover the main currents: surface, deep, and upwelling, each with different causes and effects.

One of the most exciting sights to watch is the power and majesty of the ocean as its waves crash on the shoreline. Meanwhile, the most potent, valuable, and complex forces of an ocean – its currents – stream quietly and invisibly offshore.

Although rarely recognized or appreciated (except by fishermen and sailors), these currents are important to the Earth's ecology because they:

- Mix the nutrient-rich, oxygenated waters of colder regions, such as the Arctic and Antarctic, with less productive, less-nutrient-rich warmer waters, especially those along the Equator;
- Support *upwelling*, by which nutrient-rich, oxygenated cold water flows vertically up to the ocean's surface, replacing warmer, less productive water;
- Mix highly saline and low-saline waters to reduce extremes in salinity that could adversely affect marine life;
- Flush out inland seas, such as the Mediterranean Sea, by exchanging water with adjacent oceans;
- Moderate extreme atmospheric temperatures and weather conditions of certain continental areas by moving the heat in warmer water currents;
- Transport plankton and fish, carbon dioxide, and chemicals such as salts.

The author is a long time NJ coastal resident, teaches marine biology to grade schoolers, and spends almost every spare moment on a beach somewhere.

Three types of blue water currents

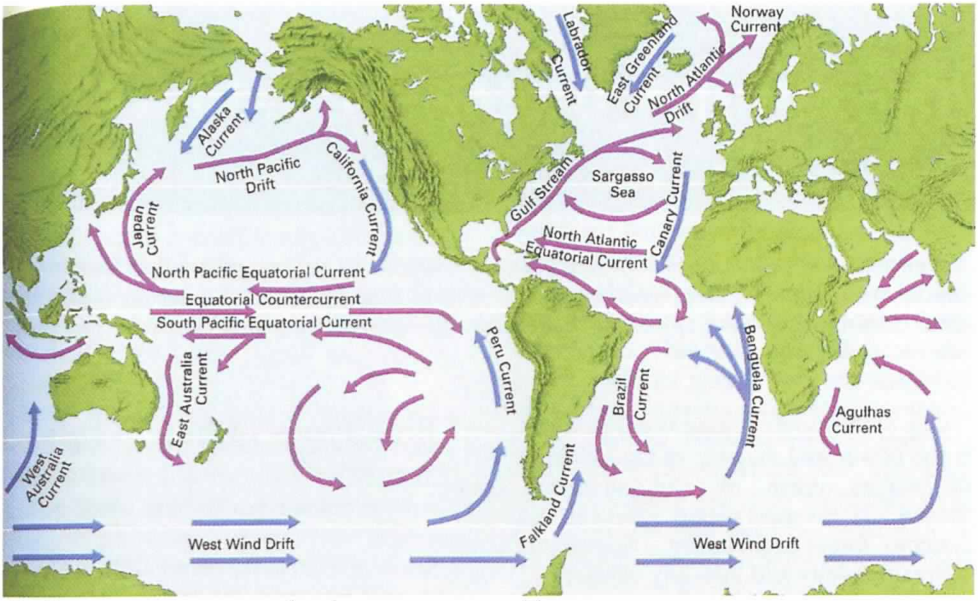
There are three types of blue water ocean currents:

- **Surface currents**, continuous currents created primarily by winds, which, in turn, are triggered by solar heating. Surface currents flow like rivers on or near the surface of an ocean, and are deflected by land masses;
- **Deep currents**, continuous currents created by differences in water density, salinity, and temperatures. They flow river-like very slowly along the floor of an ocean;
- **Turbidity currents**, temporary deep currents caused by underwater landslides.

Think of currents as "rivers" that distribute energy throughout the world. Surface currents generally distribute warm water, one form of energy, while colder deep currents distribute nutrients, another form of energy. Both impact marine and terrestrial life.

Studying ocean currents

Since the earliest days of sailing, people have been studying currents, along with the winds, to determine the best – and worst – ways to sail from one point to another. Surface currents were the most identifiable and the most important to sailors, who took advantage of them to reduce travel time. Oceanographers later



Surface currents are purple; deep currents are blue.

began studying the deeper currents, no small undertaking, since tracing them underwater initially was a next-to-impossible job. Modern day technologies, including electronic topography mapping, manned and unmanned submersibles, and underwater surveillance devices, are making great gains. With all this high-tech help, oceanographers still aren't above tracing currents by tracking wreckage from sunken ships, containers blown off modern freighters, and even a shipment of 60,000 Nike shoes that went overboard in the northeastern Pacific in May, 1990.

Today, scientists have a good understanding of the oceans' currents and their effects on ocean and coastal environments.

The driving forces of surface currents

Things at rest tend to stay at rest; things in motion tend to stay in motion, physicists tell us. Only an external force changes an existing state. Ocean waters behave the same way. Without an external force, they would just sit there, like the water in your bathtub. For surface currents, that force is the wind. For *deep* currents, that force is variations in temperature, density, and salinity.

Let's look at surface currents first. As you probably recall, winds are caused by two forces:

- Rotation of the Earth, and
- Uneven warming by the sun of the Earth's surface due to its rotation.

If winds over an ocean are steady, they can "grab" and move enormous amounts of surface water, and almost all of the oceans' surface currents are the result of the Earth's winds. Wind conditions vary by locales and over time, but most wind patterns are predictable, even temporary storm-driven winds. Surface currents account for about 10 percent of the oceans' total water volume and extend down about 400 meters.

Surface currents start as warm water currents that originate along the Equator and flow in a westerly direction. These currents are controlled by three factors:

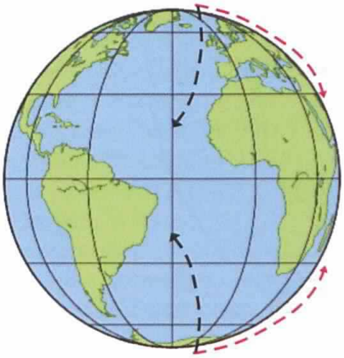
- **Wind belts**, four zones wrapping

around the Earth within which the winds initially move in the same general direction;

- **Earth's rotation**, which creates the Coriolis effect, the apparent deflection of the Earth's winds within the wind belts;
- **Continents**, whose shorelines deflect ocean currents.

The "Trades" and Coriolis 'deflections'

Four global wind belts, called *trade* and *westerly winds*, primarily determine the Earth's surface currents. Winds are created as air moves from a relatively high-pressure area to a low-pressure area. In the northern hemisphere, any air movement (wind) either north or southward appears to be deflected to the *right* of its path by the Coriolis effect. In the southern hemisphere, air moving north or southward appears to be deflected to the left of its path by the Coriolis force. *Appears* to be deflected? Right! The wind actually isn't being deflected as it moves north or southward from a point of high (H) pressure to low (L). Instead, the Earth's rotation eastward causes point L to move eastward as well, creating the appearance of the wind deflecting westward. Accordingly, airline pilots making long north-south trips take the Earth's rotation into account when plotting their flight paths.



Coriolis effect.

The higher the wind speed, the greater the apparent deflection, although the Coriolis effect is zero at the equator. The four wind belts are the:

- **Northeast trades** (0° to 30°N latitude) that flow southwesterly to the equator in the Atlantic, Pacific, and Indian Oceans;
- **Southeast trades** (0° to 30°S latitude) that flow northwesterly to the equator in all three oceans;
- **Northern westerlies** (30°N to 60°N latitude) that flow northeasterly from 60°N in all three oceans; and
- **Southern westerlies** (30°S to 60°S latitude) that flow southeasterly from 60°S, and push the Earth's largest ocean current, the West Wind Drift, completely around the southern hemisphere at the southern edge of all three oceans.

Trade and westerly winds are generally predictable and initially determine the surface currents' paths and directions. Localized winds due to storms are more variable, although their general direction is usually predictable.

If you find it difficult to associate the westerlies with winds blowing eastward, remember that westerlies refers to where the winds are coming *from*, not where they are going *to*. Thus, westerlies push surface currents eastward from the west and the easterlies push currents westward from the east. (The same reasoning defines local *off-shore* winds as from the land and *on-shore* winds as from the oceans.) And contrary to popular opinion, the Coriolis effect does not determine whether water draining from a sink should spin clockwise or counterclockwise in a particular hemisphere. The determining factors are the design of the sink and the direction of the water source. Don't believe it? Try a few experiments and see.

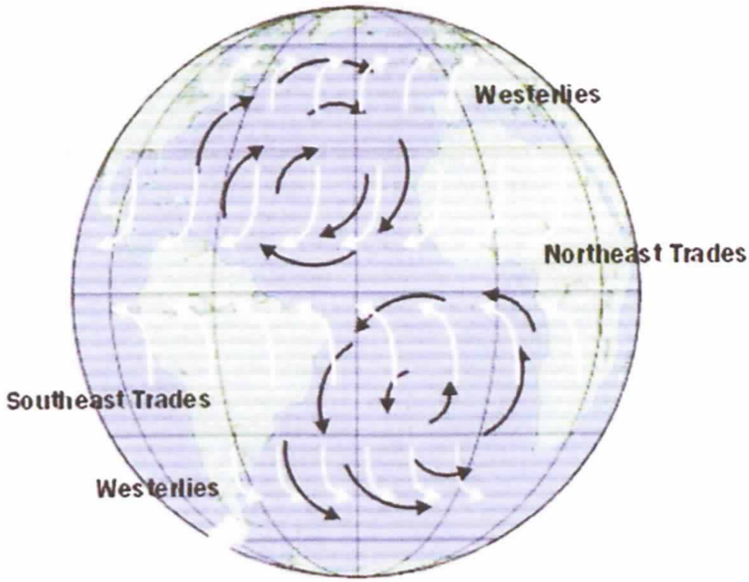
So much for the winds. Let's get back to surface currents.

Continental blocks and gyres

As the map of currents shows, surface currents initially flow westward until they become blocked by continental landmasses. Then they flow in a predictable direction either north or south toward either of the poles. As they near the poles, they mix with colder waters.

Continents block or deflect almost all ocean currents, except the West Wind Drift in the Southern Hemisphere. Two major warm-water currents, the Gulf Stream in the North Atlantic and the Japan Current in the North Pacific, would be driven westward by the winds except that the North American and Asian continents deflect them, respectively, to flow northeasterly — against the winds. Currents also tend to deflect and occasionally divide when approaching an opposing landmass. The westward Brazilian Current, for example, is deflected south by the South American landmass, while the Gulf Stream divides as it approaches Europe's landmass.

Currents in the North Pacific and North and South Atlantic follow paths like a billiard ball in a four-bank shot, bouncing off of the continents in a circular fashion. It is more complicated than that. The combination of winds, the Coriolis effect, gravity, a mechanical process called the Eckman transport, and the continents create huge circles of moving water that are higher in the center of the circle than at the edges. These circles are called *gyres*. A gyre's flow is clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. A gyre generally consists of four separately identifiable



currents based on the direction of flow: north, east, south, and west.

As a current begins to lose its speed, it becomes known as a *drift*. For example, in the map of the North Atlantic on pg. 18, the Gulf Stream loses speed and becomes the North Atlantic Drift.

The Gulf Stream (first charted by the American statesman and inventor Benjamin Franklin) is worth noting as an example of a surface current because of its size — it can move 100 million cubic meters of water per second. (In contrast, the Mississippi River, which drains 40 percent of the United States, moves just 15,400 cubic meters of water per second. The Gulf Stream also moves 25 times more water than all the rivers in the world. Often, scuba divers and fishermen as far north as New York City spot or catch tropical fish that have became involuntary hitchhikers in the Gulf Stream.

When currents change direction: El Niño

One particularly infamous current is El Niño, a warm surface current in the Pacific Ocean that causes havoc when it arrives along South America's west coast. El Niño means "little boy" in Spanish, a name given the phenomenon because its effects on weather usually peak around the Christmas season. In the Pacific Ocean, currents flow from east to west, but every two to seven years, the trade winds that normally push warm water away from the Western Pacific coastlines begin to weaken in mid-December. The weakened trades allow the current near the Pacific Equator to reverse direction and flow from west to east. When the warm water reaches South America's west coast, it is deflected south to where cold water usually is found.

When warmer El Niño surface water overrides the normally colder water along South America's west coast, havoc breaks loose. Massive fish kills occur when fish acclimated to a cold-water environment are trapped by El Niño's warm water. So massive are some of these kills that the rotting fish piled up on shore produce hydrogen sulfide, which blackens the hulls of ships and anything else in or near the water. Pacific coral reefs die from the temperature change and nesting birds are forced to move away from the warm waters. El Niño also affects weather patterns around the world. The temperature of the unexpectedly warmer Pacific water affects atmospheric pressure, which in turn shifts the subtropical jet stream, and thus weather patterns. In the early 1980s, parts of Africa and Australia both experienced severe droughts, which devastated crops, killed livestock, and caused much human suffering because of El Niño. At the same time, Ecuador, Peru and other South American areas experienced exceptionally heavy rains that flooded many communities, killing numerous people and causing enormous property damage. In effect, El Niño moves heat out of the tropics to other parts of Earth, which in turn affects local weather. Scientists can predict El Niño almost a year in advance, but they can't stop it.

The havoc caused by El Niño troubles many scientists and environmentalists who are also concerned by the problems of global warming. As the Earth's atmosphere becomes warmer due to increased emissions of carbon dioxide (CO_2) and other gases, the oceans will become warmer as well. This warming trend could alter ocean currents and cause serious climatic changes throughout the world. The result could be increased storms and rainfall in some areas and reduced rains and droughts elsewhere, local temperature increases in some areas and drops elsewhere, the dislocation or destruction of fish habitats, and the reduction and destruction of animal species as well. One small blessing — some scientists suspect that if El Niño causes increased winds in, for example, the middle Atlantic, the increased wind shear could reduce the number of hurricanes from forming in the region.

The Pacific also has another anomaly — the La Niña current. La Niña is characterized by unusually cold ocean temperatures in the Equatorial Pacific, compared to El Niño, which is characterized by unusually warm ocean temperatures in the Equatorial Pacific. La Niña, which means The Little Girl, sometimes is called El Viejo, anti-El Niño, or simply "a cold event" or "a cold episode".

In the U.S., winter temperatures are warmer than normal in the Southeast when La Niña occurs, and cooler than normal in the Northwest. Global climate changes caused by La Niña tend to be opposite those of El Niño. In the tropics, ocean temperature variations in La Niña also tend to be opposite those of El Niño.

Driving the oceans' deep currents

Deep ocean currents, well below ocean surface currents, are moved by the salinity and density differences of adjacent bodies of water. Originating in the deep polar waters of the Arctic and Antarctic, these deep currents move much, much more slowly than surface currents as they flow under warmer (or relatively less cold) surface waters on the way to the Equator.

Deep ocean currents are caused by the:

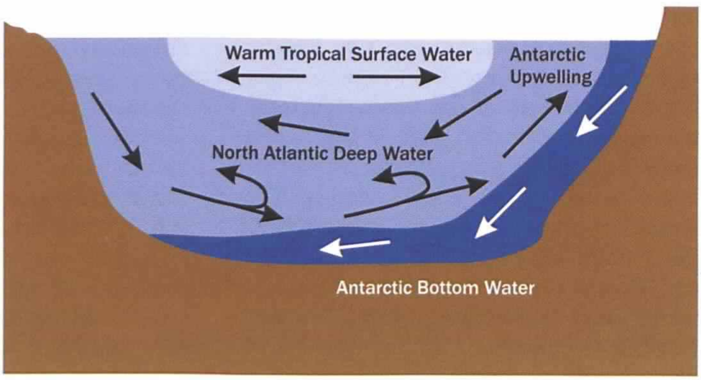
- Differences in water **salinity** between adjacent bodies of water,
- Differences in water **density** between adjacent bodies of water (due mostly to salinity differences), and
- **Gravity** that causes the colder and denser water to flow under the warmer, less-dense surface water.

Differences in water *density* are caused by three factors:

- **Temperature** — When a body of water becomes colder, primarily due to winds, water molecules move closer together, making a given volume of cold water heavier than a similar volume of warmer water.
- **Freezing** — Dissolved salts in a freezing body of water drop out, increasing the salt in the adjacent unfrozen water. These additional dissolved salts in the adjacent unfrozen water cause that water to become heavier.
- **Evaporation** — As surface water in warmer climates evaporates, it leaves its salts in the adjacent water. This heavier, salt-laden water drops to the bottom of the sea or ocean, creating heavier bottom water that acts similar to the much colder bottom waters of the Arctic or Antarctic.

Density is defined as the ratio of the mass of a substance to its volume, expressed as gram/cubic centimeter (g/cm^3).

- **Fresh water** has a density of 1 gram per cubic centimeter;
- **Ocean salt water** has a minimum density of 1.026 to 1.028 grams per cubic centimeter; and
- **Colder polar water**, of course, is even heavier.



Salinity, which affects density, is the number of grams of dissolved salt in one kilogram of ocean water (expressed as g/kg). In most oceans, the salinity (the number of grams of dissolved salt in one kilogram of water) is 3.6 to 3.7 percent, that is, 36 to 37 grams per 1,000 grams of ocean water — often expressed as parts per thousand (ppt) or 1,000 milligrams per liter. For the record:

- **Fresh water** contains less than 0.5 parts per thousand (ppt) of dissolved solids, usually salt;
- **Brackish water**, the mix of fresh and salt water in coastal wetlands, has a salinity that is greater than 0.5 ppt but less than 25 ppt;
- **Salty water** is 25 ppt or more; and
- **Oceans** average 35 to 37 ppt.

Ocean temperatures vary widely, depending upon the amount of direct, long or infrared wavelengths of sunlight the ocean locale absorbs. In tropical waters, where the high-angled rays (80° to 90°) directly strike the water, surface temperatures can reach 85° F (30°C).

The sun's rays hit the Earth at low angles at the Earth's two polar regions, which:

- Spreads a given column of radiation (energy or heat) over a wider surface area than in the tropics;
- Reduces the amount of absorbed radiation, in contrast to tropic or temperate waters; and
- Increases the amount of radiation deflected back into the atmosphere.

The reduced absorption of solar energy allows surface temperatures to drop below 28.5° F (-2° C), the point where salt water can freeze. As a result, the colder, saltier, and thus denser waters in polar regions sink to the ocean floor and then begin flowing toward the Equator under the relatively less-dense warmer surface water. This polar flow can continue for several thousand miles without the deep current mixing with the lighter, warmer water above it.

Deep currents account for about 90 percent of the ocean waters.

Two of the oceans' major deep currents

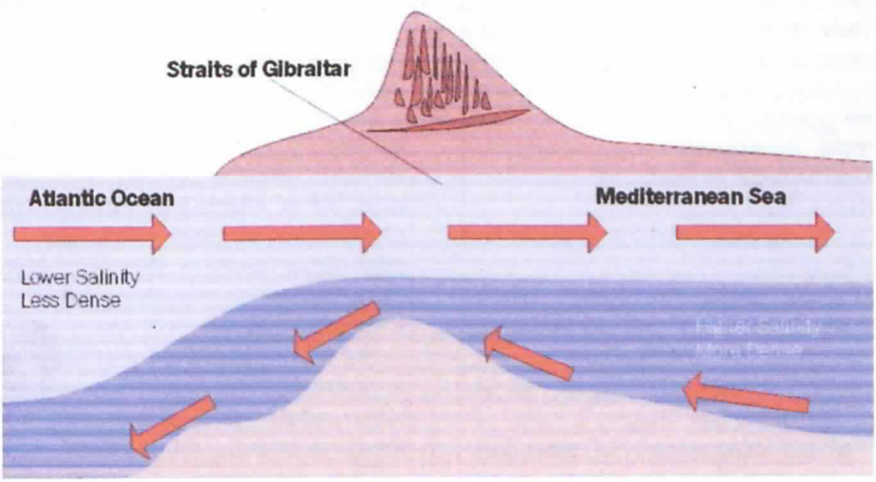
There are two major deep currents worth noting:

- Antarctic Bottom Water, and
- North Atlantic Deep Water.

The Antarctic has a very cold (28.5° F or -2°C), very salty (3.7+ percent) body of water (it isn't regarded as either a sea or an ocean) that makes it the coldest and densest salt water in the world. This water sinks to the ocean floor and then moves slowly north toward the Equator as the Antarctic Bottom Water. It slides under the warmer, less dense ocean waters until it reaches the northern latitude of about 40°N. It takes several hundred years for the Antarctic Bottom Water to make the trip.

The North Atlantic Deep Water begins in the cold, dense waters south of Greenland. It sinks to the ocean floor, and moves southward as a deep current under the northward surface current, the warm Gulf Stream. At the Equator, the deep current divides. One part heads north while the other part continues to the Antarctic, where it passes over the denser, colder Antarctic Bottom Water.

Another example of a deep current is the exchange of less dense, lower-saline



Atlantic Ocean waters with the denser, more highly saline Mediterranean Ocean waters in the summer months. During the summer, the Mediterranean waters become denser and saltier due to high evaporation and low rainfall. The resulting dense Mediterranean deep current flows west out along the floor of the Straits of Gibraltar and into the Atlantic, while the less dense Atlantic surface water flows eastward above it and into the Mediterranean. During World War II, these two currents allowed German submarines to sneak in and out of the Mediterranean undetected by not using their engines.

Upwelling from the deep

A form of deep current called *upwelling* occurs when the colder, deeper, and denser water moves sharply to the surface, replacing the warmer, less dense surface water. Upwellings transform a deep current into a surface current. Since the bottom currents are a huge "storage area" for nutrients, upwellings help re-nourish the upper waters by bringing these nutrients to the surface. An upwelling is called a *vertical current*.

The mixing of colder and warmer waters by upwellings is caused by:

- **Continents** that block the flow of deep ocean currents;
- **Winds** over deep water blowing the warmer surface water away, allowing the colder, oxygen- and nutrient-rich deep water to rise to the surface;
- **Waves** in shallow water becoming strong enough to mix cold and warm water;
- **Tides** in shallow water mixing cold and warm water;
- **Undersea projections**, such as sea mounts that force a cold current to the surface; and
- **Colliding currents**, causing one to surface over the other.

We've all experienced an upwelling. Have you even been swimming in the ocean one day, only to discover the water is much colder the next day? One explanation is that overnight, the winds shifted from on-shore, whereby it was pushing a warm surface current toward the shoreline, to offshore, whereby the warm surface water was pushed away from the shoreline. As the warm water was pushed away from the shoreline, the colder water underneath was allowed to surface – and give you a bone-chilling jolt.

The occasional turbidity current

The third type of ocean current is called a turbidity current. It occurs when a large mass of sediment on the continental shelf or the continental slope breaks loose and flows downward. The loosened sediment makes the water cloudy and denser, causing it to slide under the less dense water as a turbidity current. Unlike the continuously flowing surface and deep-water currents, turbidity currents are temporary events. Some scientists think that turbidity currents are responsible for scouring deep submarine canyons along the continental slope.

Turbidity currents should not be confused with waves, called tsunami, that are triggered by underwater earthquakes, volcanoes, and large mainland land slides. The shifting underwater sediment that creates turbidity currents releases far less energy than the disturbances that cause a tsunami.

Nor should blue water ocean currents be confused with coastal rip tides, longshore currents, or tidal currents in rivers and bays, all of which are associated with a combination of local winds, waves, and tidal action along a shoreline. None of these local phenomena have the energy of a turbidity current.

The fourth type of current, tide currents, are caused by the gravitational pull of the moon and sun, and the centrifugal force of the Earth spinning on its axis.

Thus, three types of currents: Surface

currents are driven by winds and the Earth's rotation. Deep water currents are created by difference in water temperature, salinity, and density. Surface currents are important because they act as engines to distribute heat thoughout the oceans and to moderate climates on adjacent landmasses. Historically, they were important to navigation in the days of sailing vessels. Deep water currents distribute nutrients from colder regions to warmer regions, and help moderate both ocean and land temperatures. Upwellings are phenomena that allow the colder, deeper water to mix with less dense, warmer surface waters. They are caused by winds, waves, tides, undersea projections, and colliding currents. Upwellings distribute nutrients to ocean surface areas, where they are consumed by both marine and plant life. Turbidity currents are temporary movements of water created by underwater landslides, underwater volcanoes, and plate tectonics. ■

TO FOLLOW THE WATER: EXPLORING THE OCEAN TO DISCOVER CLIMATE

By Dallas Murphy

Basic Books, New York.
256 p. Cloth.

To solve some mystery stories one recommendation is to cherchez la femme; to solve Watergate, Woodward and Bernstein followed the money. Now, Dallas Murphy adds: to discover climate, follow the water, in this case the ocean currents that move masses of water of various salinities and temperatures as they swirl and pulse along coasts, in oceanic basins, and around the poles. Here Murphy says, lie the answers to why climate changes.

Most of us know something about the sea: waves are caused mostly by wind – strong wind from the sea brings big waves; tides go up and down and can be predicted. These are things we can see, but no one can really "see" an ocean current. But they're out there and, boy, can they move water, and a moving ocean governs climate. Consider the Gulf Stream. Murphy calls it "the most studied, investigated, probed, measured, and pondered strip of saltwater on the globe." It flows out of the Gulf of Mexico and up the Atlantic coast at 3-5 miles an hour. "One billion cubic feet of seawater blow past Miami, Ft. Lauderdale, and Palm Beach every second." Ships going south along the coast stay inside or outside the Gulf Stream; coming north they get right in the middle and cut their fuel costs by almost 20%. Off Cape Hatteras it becomes the North Atlantic Current and bathes the British Isles and Scandinavia, while an eddy bends northwest and up some of Greenland's shores.

Ocean currents do this kind of work all over the world—rising, sinking and turning as they change temperature or bang into continents or undersea barriers. Antarctic bottom water takes hundreds of years to reach the Arctic. El Nino and La Nina take turns producing anchovetta off the Peruvian coast and dictating climate over much of the U.S.

The author's job here is to explain how oceanic systems work, and he does it well in large part because he believes in being on the scene, sometimes at sea on research vessels, sometimes hanging around labs listening to scientists. The book is part a history of the field of oceanography from Chaucer who taught navigation, through the powerhouse of the Woods Hole Oceanographic Institution to the present day research that includes deep sea drilling and Greenland ice cores a mile long as the climate and ocean people try to figure it all out. This is at once an entertaining and solid job by an engaged reporter/story teller. You will learn and enjoy.

THE TUNICATES ARE COMING

BY DANIEL WIECZOREK

Tunicates (Urochordata, Tunicata), more commonly known as sea squirts, can begin their lives at sea as tadpole-like swimming larvae or by asexual budding. Sexual reproduction allows for the organisms to spread to new locations while asexual budding allows them to establish large colonies. After only a brief period, the larvae settle and develop into sedentary sea squirts that we have observed clinging to various underwater structures. During growth, most species develop a thick, tough cellulose covering, called a *tunic*, which protects their soft bodies.

Adults of most tunicates species are hermaphroditic (each individual is both male and female). Some species are solitary, lacking tissue connections between individual squirts and reproducing only by sexual means and larval production, for example, sea grapes. Others are colonial, producing interconnected webs of communicating individuals by asexual budding in addition to sexual reproduction.

Tunicates are suspension feeders, meaning they use an incurrent siphon to draw in water from which to filter out food and an excurrent siphon to expel that same water. Small planktonic food particles and detritus drawn in with incurrent water are entangled in small, mucus-covered hairs called cilia, on a gill basket, then are passed along the cilia down the esophagus, and finally into the gut.

Two interesting facts about tunicates are, 1) they are the only animals able to create cellulose, a privilege usually reserved for plants, and 2) they are more closely related to birds, humans and fish than to some other invertebrates. Indeed, the tadpole larva has a rudimentary spine that disappears after metamorphosis into an adult tunicate.

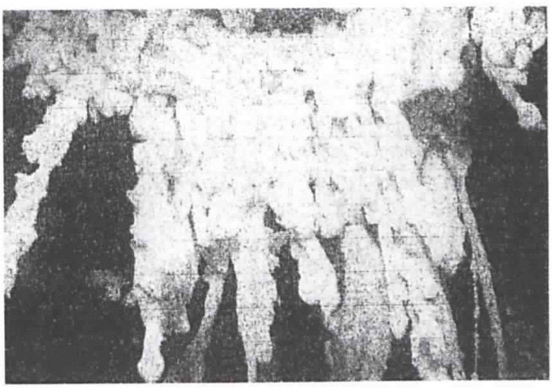
Although most tunicates are indigenous to a particular marine area, many tunicates are categorized as invasive species because they have very successfully invaded locations where they are not native. When a species is introduced into a new environment, often it is able to utilize habitat resources more efficiently than some native species. The result of this is the invader out-competes native species and forces them out of the area. Also, an invasive species may not have natural predators in an area that can control their population numbers. Some important examples are zebra mussels, nutria, and sea lamprey for fresh water and periwinkles, green crab and Asian shore crab in salt water. In the marine environment, introduction often occurs when larval invaders hitch a ride in ships' ballast water or when animals are imported intentionally for research, aquaculture, or the pet trade, then released, accidentally or intentionally, into a new habitat.

Two species of invasive colonial tunicates have become a threat to the coastal northeast, *Didemnum vexillum* and *Botrylloides violaceus*. Didemnum vexillum is the invader that spurred our research. Two additional invasive tunicates were encountered during our study, the *Botrylloides violaceus* and the solitary *Styela clava* (club tunicate).

Wieczorek is a marine biologist at the James J. Howard Laboratory (National Marine Fisheries Service). Some of his research calls upon his scuba diving skills.

Didemnum vexillum

Populations of *D. vexillum* were first observed on the northeast coast of the US in the late 1980s and on the west coast during the 1990s (Bullard et al., 2007). It currently ranges inshore from Eastport, Maine to Moriches Bay, NY, on the east coast and covers part of the rich fishing grounds offshore on Georges Bank. On the west coast, it extends from Humboldt Bay to Port San Luis, California, and into Washington. It is also found on several sites in southwestern British Columbia on, and adjacent to, oyster and mussel farms (Bullard et al., 2007). *Didemnum vexillum* may have been introduced from East Asia with the brood stock for shellfish aquaculture. *Didemnum vexillum* colonies occur in a variety of forms. Some are long, ropey or beard-like colonies that commonly hang from hard substrates such as docks, lines and ship hulls and some are low,

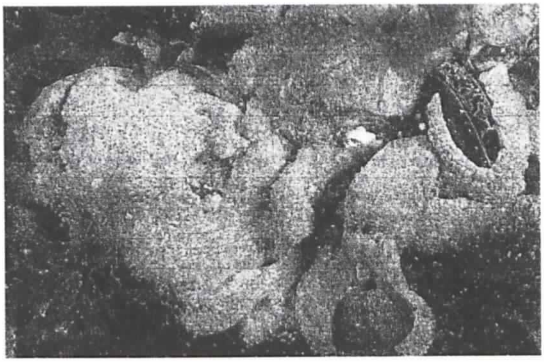


Didemnum vexillum
Photo source: USGS Woods Hole Science Center

undulating mats with short appendages that encrust and drape rocky substrates (Photo 1). Colony texture is sometimes soft, but often leathery. They range in color from yellow and orange to gray and brown. Individuals appear as densely-packed, tiny colored blobs embedded within the colony.

Botrylloides violaceus

Dense clusters of individual animals (zooids) form colonies. *Botrylloides violaceus* may have been introduced to the west coast from Asia, and then from the

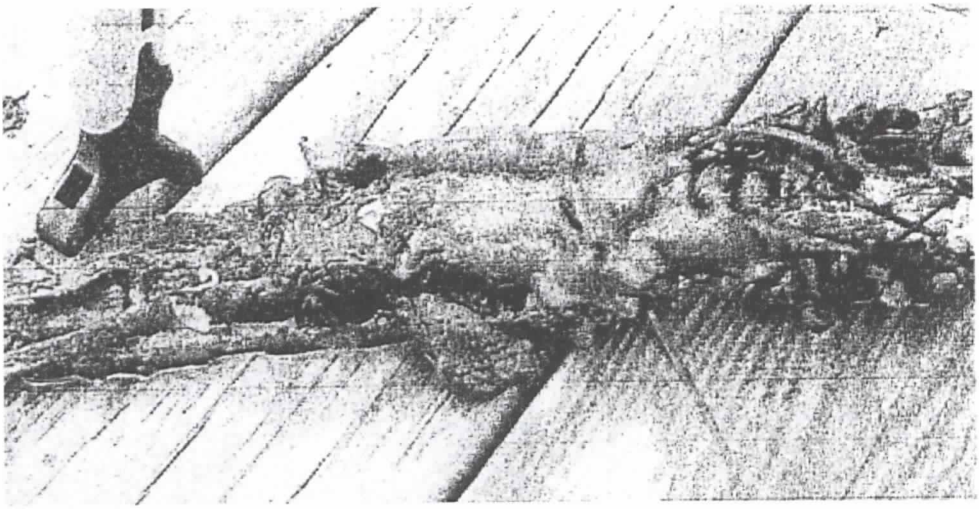


Botrylloides violaceus
Photo Source: P. Erickson, MIT Sea Grant College Program

Pacific to the Atlantic in the 1970s (McCarthy et al., 2007). It forms firm, rubbery encrustations, sometimes forming characteristic "lobes." *Botrylloides violaceus* exhibits a wide range of vibrant colors ranging from typically bright orange or red, to a dull purple or brown. Different color forms are sometimes found living side by side. As with *D. vexillum*, individual *B. violaceus* zooids appear as tiny colored blobs within the colony and depending on the location, can often be confused with Red Beard sponges due to the similarities in color and texture.

Styela clava

Styela clava was first recorded in British waters in 1954 in the Lynher River estuary, Plymouth (Carlisle, 1954). Native to Japan, it was first introduced to Europe and then to the US, most likely via ballast water. These solitary sea squirts



Styela clava
Photo source: J. Pederson, MIT Sea Grant College Program

have large, elongated, tapering bodies and a characteristic brown or yellow color with a rough and wrinkled surface. These characteristics give them a club-like appearance, hence their common name "club tunicate." Individual squirts can grow to be approximately six inches (15 cm) tall.

How do tunicates affect the marine ecosystem?

Invasive tunicates such as these can be a problem for indigenous fish, shellfish, and other marine life. Tunicates have the ability to overgrow almost anything in their path and are now dominant in many hard bottom communities in New England

Multiple color variations of B. violaceus growing together with a colony of Styela clava at Fire Island, NY.

waters. Encrusting tunicates may alter the habitat that is necessary for the survival, growth, and reproduction of important indigenous species. Tunicates can also cause fouling of boats, piers, aquaculture structures, hard bottom fish habitats, and numerous types of fishing gear.

Where have we found these tunicates?

In 2007, an inshore dive survey by NOAA National Marine Fisheries Service divers was conducted. The purpose was to observe and evaluate the presence of the invasive tunicate *Didemnum vexillum* that is beginning to dominate some subtidal and offshore habitats in New England. Our goal was to begin at the southernmost range (previously reported) of *D. vexillum* (Shinnecock, NY), and observe and evaluate any further spread, as well observe other potentially suitable habitats that could be colonized as the species spreads south along the coast. An unexpected discovery was the presence of the two other invasive tunicates not previously reported this far south, *Botrylloides violaceus* and *Styela clava*.

Dive sites were selected for location and structure as potential tunicate habitats. For sites not accessible from shore, we used our 18 ft Carolina Skiff and for those sites not safely reached by the small boat, our larger, 50 ft vessel the R/V NAUVOO was used. Dives were conducted using standard scuba equipment and all dives were documented using underwater video equipment. Any site where there were potential tunicate specimens found, samples were collected and returned to the lab for identification. Samples were taken by carefully peeling or scraping pieces of the colony from the substrate into plastic sample bags. Great care was taken to minimize any fragments from floating away to prevent unintentional spread.

Botrylloides violaceus being collected by divers

Prior to our investigation, the presence of *D. vexillum* had been confirmed from Maine to Connecticut, with a probable observation at Shinnecock Inlet, New York. Our 2007 survey demonstrated expansion of *Didemnum sp.* as far along the Long Island south shore as Moriches Inlet. Since the species is predicted to be adaptable to conditions as far south as North Carolina, this appearance represents continued advancement through the New York Bight. Research surveys by NOAA divers in 15 different areas from Shinnecock Inlet south to Delaware Bay have found two other invasive tunicates previously not reported from the area: *B. violaceus*, similar in physiology and habitat requirements to *Didemnum sp.* and *S.*

B. violaceus being collected by divers.

B. violaceus growing over Didemnum sp. At Shinnecock, NY.

clava, a solitary form known as the club tunicate. Our observations extended the range of *B. violaceus* south along the coast to Shark River, NJ and included sightings at Romer Shoals, the entrance to Lower New York Bay. The southern-most limit of *S. clava* was extended from Long Island Sound to the south shore of Long Island, NY. Our observations also showed that not only can *B. violaceus* and *D. vexillum* live in the same habitat, but *B. violaceus* has the ability to overgrow *D. vexillum*.

What is being done?

In close relation to the survey we conducted an outreach project with the goal of spreading the word about these invasive organisms beyond the scientific community and to encourage public involvement. We have made presentations to local dive clubs and are in the process of publishing information pamphlets. A display for a local aquarium is also in the works, as well as diving with recreational divers and offering them a chance to participate in the project. There are also other research projects being conducted at the NOAA, James J. Howard Marine Sciences Laboratory on Sandy Hook to develop a better understanding of what other species can utilize tunicates as a food source and what possible nutritional value they may have.

Acknowledgments

I would like to acknowledge some contributions that made this project possible. First off I would like to thank Andrew Draxler for his invaluable guidance throughout the project. Also Vince Guida for taking the time out of his busy schedule to share his knowledge of tunicates whenever I was in need. I would also like to thank our other divers Jeff Pessutti and Amanda Goeller who took time from their own projects to participate. And lastly Tom Cleary who was looking out for our safety on the surface while we were diving below.

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Locations Observed:

State	Location	Site	Didemnum	Botrylloides	Styela clava
NY	Shinnecock	Bridge and boat ramp	X	X	
NY	Moriches	inlet east jetty	X	X	
NY	Moriches	inlet west jetty	X	X	
NY	Fire Island Inlet	Coast Guard Base		X	X
NY	Jones Bay	Coast Guard Base		X	
NY	Fish Heaven	Off Long Island			
NY	Rockaway Pt	Jetty			
NY-NJ	Romer Shoal	Raritan Bay		X	
NY-NJ	West Bank	Raritan Bay			
NY-NJ	Old Orchard	Raritan Bay			
NJ	Sandy Hook	Coast Guard Base			
NJ	Sandy Hook Bay	Officers Row			
NJ	Atlantic Highlands Marina	Sandy Hook Bay			
NJ	Navesink River	Rocky Point to Swimming River			
NJ	Shrewsbury Rocks	Off Sandy Hook coast			
MA *	Woods Hole	floating dock	X		X
MA *	Sandwich	Dock	X	X	
MA *	Chatham	Dock	X	X	
RI *	Jamestown	floating dock	X	X	X
CT *	Avery Point	floating dock	X	X	X

*Table 1. Locations we observed during the survey. X represents tunicate species found at that site, * represents observations made from shore without diving.*

AMERICAN LITTORAL SOCIETY 49TH ANNUAL MEETING

MONTAUK, NEW YORK – OCTOBER 21-24, 2010

The 49th annual meeting of the Society will be held at Montauk, NY, near the eastern end of Long Island, starting Thursday evening, October 21, and ending around noon on Sunday, October 24. As usual, the long weekend is an excuse to get out into littoral territory to see nature in action; there will be evening programs, maybe an owl/star walk, and a brief business meeting and election.

Where: Headquarters will be at Montauk Manor - which includes lodging and meals starting Friday breakfast to Sunday breakfast.

What: The Montauk area is laced with nature trails, parks, beaches and dunes, all open to exploration and discovery. We'll see migrating birds, seals, tide pools, rock outcroppings and the famous Montauk Lighthouse. Trips will run from Friday a.m. through Sunday a.m. There will be a special dinner on Saturday evening. This year, for an additional fee, we're offering an optional striped bass fishing trip with our tagging director, Jeff Dement. Spaces on the boat are limited so we advise early registration to secure a spot. There will be a special dinner on Saturday evening.

Cost: See the coupon below for costs and sign-up. These prices are for double occupancy only, and are based on the price per adult.

Other Info: Dress is casual all weekend.....Field trips go rain or shine..... The Manor boasts a hot tub and indoor pool. No car? Take the LIRR to Montauk train station – the Manor will pick you up.

To Reserve Your Place:
Mail form and payment to American Littoral Society, 18 Hartshorne Dr., Suite 1, Highlands, NJ 07732.

Montauk Manor.

American Littoral Society 49th Annual Meeting – Registration Form

Name: ______________________

Address: ______________________

City: ______________ **State:** ________ **Zip:** ________

Phone: ______________________

Email: ______________________

No. of Persons 12 and older: __________ **No. of Children Under 12** ______

☐ **Plan A:** 3 nights at Montauk Manor, all meals--Friday am to Sunday am, guides:
$425 per adult, $160 per child under 12. Total: $__________

☐ **Plan B:** 2 nights at Montauk Manor, all meals--Friday am to Sunday am, guides:
$375 per adult, $160 per child under 12. Total: $__________

☐ **Plan C:** Commuter: Everything except rooms—meals Friday AM – Sunday AM, guides:
$200 per adult, $160 per child under 12. Total: $__________

☐ I am interested in the fishing trip

Confirmation, directions & details will be sent via email (if provided); otherwise, please enclosed a self-addressed stamped envelope with your registration.

WHERE DID MY FISH GO?: An overview of recent advances in fish tagging and tracking

BY JEFF DEMENT

The marking of fish for later identification and data collection, often termed, "mark-recapture studies," dates back to as early as the 17th Century. In *The Compleat Angler* in 1653, Izaak Walton described how private individuals tied ribbons to the tails of juvenile Atlantic salmon and in following years' spawning runs determined that Atlantic salmon return from the sea to the river of their birth.

According to a 1945 American Fisheries Society paper titled "How to Mark Fish," authors George Rounsefell and John Kask state, "The early tagging of fish was chiefly a hobby of wealthy owners of riparian rights, whose records are scattered and unsatisfactory, and that the first really successful demonstration of fish tagging was carried out in the year 1873 by Charles G. Atkins of the U.S. Fish Commission, on Atlantic Salmon in Bucksport, Maine." American Littoral Society members participate in a centuries old practice when they tag and release the fish that they catch.

The conservation practice initiated by New England lobstermen of tail notching egg bearing females (for easy identification as females at times of the year when they are not actively bearing eggs) and releasing them, is a form of mark-recapture biology, as is the branding of cattle by ranchers of the western rangelands. The banding of birds has revealed to science many of the mysteries of their extensive migrations and often remarkable life histories. A recent study that outfitted a Purple Martin captured in Pennsylvania with a "geo-locating data-logger backpack," revealed that this small bird traveled 5,000 miles to the Amazon rain forests of Brazil, in only 13 days, including 4 stopover days.

Many years ago, I instigated my own simple tagging experiment in my suburban backyard. Following the loss of an adjacent 40-acre woodland, due to suburban expansion, one spring morning I counted no fewer than 19 squirrels milling about my small fenced backyard. A relocation plan to a nearby oak-dominated county park, a short 1 1/2 miles away, was quickly adopted for this refugee rodent population, and I purchased a live-release cage trap for the task. After hearing suburban legends and tales of squirrels returning from many miles away after relocation, only to re-haunt attics or raid familiar bird feeders, I decided to "mark" my squirrels with an indelible white dot of paint on their rumps before release, to ensure that I could identify them if they did indeed manage to navigate their way back "home." For many months afterward, I scrutinized the rumps of any squirrel spotted in the vicinity; to no avail, none of the relocated squirrels was ever observed to have returned, although a couple of elderly graying neighborhood squirrels did on occasion cause me to sit up and take a second glance.

But, enough about banding birds and marking squirrels; now back to tagging fish.

Since the 1940's, large-scale fish tagging programs have been initiated worldwide in an effort to study the biology and ecology of fish populations. Cooperative tagging programs utilizing anglers at large soon after developed, such as the one presently being conducted by the

ALS member Greg O'Driscoll, Sewell, NJ, with a striped bass caught in the Delaware River, Spring of 2009. Note Society tag behind dorsal fin near his thumb. This is an example of a passive tag.

American Littoral Society and many others, in which fish are tagged by both scientists and volunteer fishermen offering the advantages of a broad geographical coverage of taggers, and the great number of fish that can be tagged each year. The Society's fish tagging program presently tags about 25,000 fish per year.

Conventional fish tagging studies have commonly been used to answer fisheries management questions and have played an essential role in our present understanding of fisheries ecology and population dynamics. Fish growth rates, age estimates, migration routes, mortality rates and habitat utilization are just some of the types of data afforded by conventional tagging programs to fisheries scientists.

The range of conventional fish tags includes: Peterson disc/button, Carlin wire, dart anchor, t-bar anchor, dorsal loop spaghetti or cinch, opercle clip, visual implant, and fin clipping.

The most recent and technologically centered practices and advances in fish tagging can be separated into two general categories, Active: where the tag possesses an internal power source and actively records and/or transmits data, and Passive: where the encoded tag must be in close proximity to a reader.

The latter type, PIT tags (passive integrated transponders), are electromagnetically charged microchips that can be read remotely with the use of a fixed or portable scanner. Scanners (frequency detecting antennas) are often set completely across small streams and in fish ladders, to detect fish movement past, much in the same way that the security posts at a department store operate. The tiny PIT tags are usually injected under the skin or into a fish's visceral cavity using a hypodermic needle and syringe, although in certain situations they may be gastrically applied (swallowed). Ship-based sonar, acting as an antenna, can also be used to track the movements and behavior of individual fish over short periods of time.

The use of PIT tag monitoring systems allows researchers to obtain data on the survival, growth, age, movement, and the timing of that movement for individual fish, without the need for recapture or repeated handling.

Archival or data storage tags are designed to periodically record data at predetermined time intervals; on the depth of the fish or stage of the tide (water pressure), ambient temperature, and light intensity. Some of these fish tags may also record information about the fish's internal body temperature or chemistry.

These capsule-like tags can be applied to the fish; internally, directly attached externally, or attached by a wire to an anchoring device. The data from these tags are downloaded when the tagged fish is recaptured and the tag is recovered and the data is interpreted by a reader.

Another variety of electronic tag, namely the pop-up satellite tag, has been essential in determining the movements of bluefin tuna. The tags approximate geolocations (Latitude, Longitude) of the fish based on the angle and intensity of the sunlight it receives and the timing of sunrise and sunset. It calculates its position much in the same way that mariners of the 17th century used sextants for navigation. It was through the use of this type of tag that fisheries scientists like Barbara Block of Stanford University were able to identify the Gulf of Mexico as the previously unknown spawning grounds of the Western Atlantic bluefin tuna population.

Pop-up archival satellite tags were developed in part to alleviate some of the problems associated with low tag-recovery rates of expensive data-logger type tags. These tags combine data storage tags with satellite transmitters and detach themselves from the fish at a predetermined time when sea water electrolysis severs the thin wire connecting the data-logger/ transmitter unit to the anchoring device of the tag (usually a dart-style anchor). The data-logger/ transmitter unit then floats free to the surface where it uploads its collected data back to data managers by satellite link.

Acoustic telemetry fish tags: each fish tag is a transmitter "pinger" that emits a unique frequency in a unique series of pulses. By listening with underwater microphones (hydrophones) for the transmitter's pulse signals, the location and depth of each fish can be determined. These tags must be surgically implanted in a fish's visceral cavity, with the fish usually being anesthetized for the procedure. The transmitters are coated to prevent the fish's immune system from rejecting the transmitter, and each unit possesses a battery life of approximately two years.

An individual hydrophone is able to detect a transmitting tag is generally 100-1000 meters, depending greatly on the frequency of the transducer and the power output of the tag. As fish with these tags swim near the receivers, the date, time and tag number are recorded. If the hydrophones are equipped with antennas, and the coverage range within the array is overlapping with other hydrophones, the data can be instantly uploaded to a central control station via radio transmission, providing real-time continuous data of fish movement within the study area. Conversely, conventional tagging studies commonly provide only discontinuous data; whereby data is obtained on an individual fish only at the points of initial and subsequent recapture with the activities of the fish in between those times unknown. Hydrophones are often placed at inlets, river mouths and fish passages to act as gate keepers recording individual passing fish.

Possibly the most extensive network of this type to date is the Pacific Ocean Shelf Tracking (POST) array. The goal of this project is to eventually provide complete hydrophone coverage to the area. The

An acoustic tag which will pulse signals to nearby hydrophones is surgically inserted into the muscle of a West Coast giant sea bass. This is an example of an active tag. Photo from PIER, Pfleger Institute of Environmental Research, Oceanside, CA (Pier.org)

West coast of the US was chosen over the East coast as the site for this extensive project due to its comparatively narrower continental shelf.

According to David Welch from the Kintama Research Corporation in British Columbia, Canada, "The POST system is like a fish "EZ -Pass" where the animals can go through and the receivers accurately record which individual fish it is." The POST system has predominately focused its tagging studies on the spawning runs of anadromous Pacific salmonids in Western rivers systems such as the Snake and Columbia.

This type of tracking system is extremely expensive, and requires continual and often equally expensive maintenance to operate effectively.

Passive acoustic fish monitoring systems are also gaining popularity to study fish, especially vocal species of fish such as the drums, croakers, and other vocal members of the family Sciaenidae. While researchers have known for years that some species of fish communicate vocally, I have often wondered if fish "sing" as birds do. Is there a "dawn chorus" of fish singing in our oceans and estuaries?

Chemical tags: through a new technique known as transgenerational isotope labeling, researchers introduce an artificial tag consisting of a stable isotope of barium, into the tissues of mature female fish just before spawning. That chemical tag is then passed to the female's offspring and becomes a chemical signature within the ear bones (otoliths) of the next generation of fish.

Simon Thorrold, a fish ecologist from the Woods Hole Oceanographic Institution, is now using this fish marking technique to track the dispersal of the larvae of coral reef fishes in the western Pacific Ocean.

The science and art of fish tagging and tracking has advanced a long way since the days of tying ribbons to the tails of salmon. New technologies and discoveries promise to increase our knowledge and insight into the secret underwater lives of fishes. ■

NFL BLUEFISH

BY JIM BALICKI

No, bluefish don't play football. And, this article has nothing to do with the National Football League. In the "Underwater Naturalist," the tagging returns are tabulated. Have you ever noticed the bluefish returns, especially the dates? Have you noticed how often the date the fish was tagged is close to the date it was recaptured? I sure have noticed this, and have come to the conclusion that many of our bluefish are NFL (Not For Long).

How did I come to this conclusion? By using a computer (an Excel Spreadsheet) to analyze 403 bluefish recaptures from July, 1992 until October, 2005. There was also one "sport" data point from 1988 that was included. Using the data from the "Tagging Returns" in the "Underwater Naturalist," the tagging date was entered in one Excel column. The recapture date was entered in the next column, and then a third column was used to subtract the first date from the second date. Excel calculated the difference between the two respective dates for each of the 404 entries. For example, a bluefish was tagged on 6/3/05 and recaptured on 8/24/05. Excel calculated that the difference between these two dates is 82 days. In a second example, a bluefish was tagged on 8/25/03 and recaptured on 10/1/03. Excel calculated that the difference between these two dates is 37 days.

Another Excel column was used to record whether the bluefish was recaptured in the same season as it was tagged. In the two examples above, the recapture was clearly in the "same" season. But let's take another example. Tagged on 7/17/04 and recaptured on 5/2/05. The difference between these two dates is 289 days, not a full year. But winter occurred between the two dates, so this recapture would be considered to have happened in the "next" season. Yes, there was winter. The fish was tagged off Block Island, RI, and recaptured in Raritan Bay, NJ.

The author is an active fish tagger for the Society and, like others, curious about what fish do and why.

Table 1.

Recaptured in Which Season	No.	Percent
Same	321	79.46%
Next	78	19.31%
Second	4	0.99%
Third	0	0.00%
Fourth	1	0.25%
Total	404	100.00%

Now for the results for all 404 recaptures. See Table 1.

Next, let's analyze the "same season" recaptures since they are about 80% of the total recaptures. To do this, we make a table that show how many recaptures occurred in each 10-day time interval. That is, how many recaptures occurred 0-to-10 days after tagging, 11-to-20 days, 21-to-30 days, and so on. See Table 2. Before showing the data in Table 2 in a column chart, we need to convert the range of days in the left column to a single number, the average days. That is, 0-to-10 averages to 5, 11-to-20 averages to 15, 21-to-30 averages to 25, and so on. The data in Table 2 is shown in a column chart in Fig. 2. Statisticians call this type of column chart a histogram.

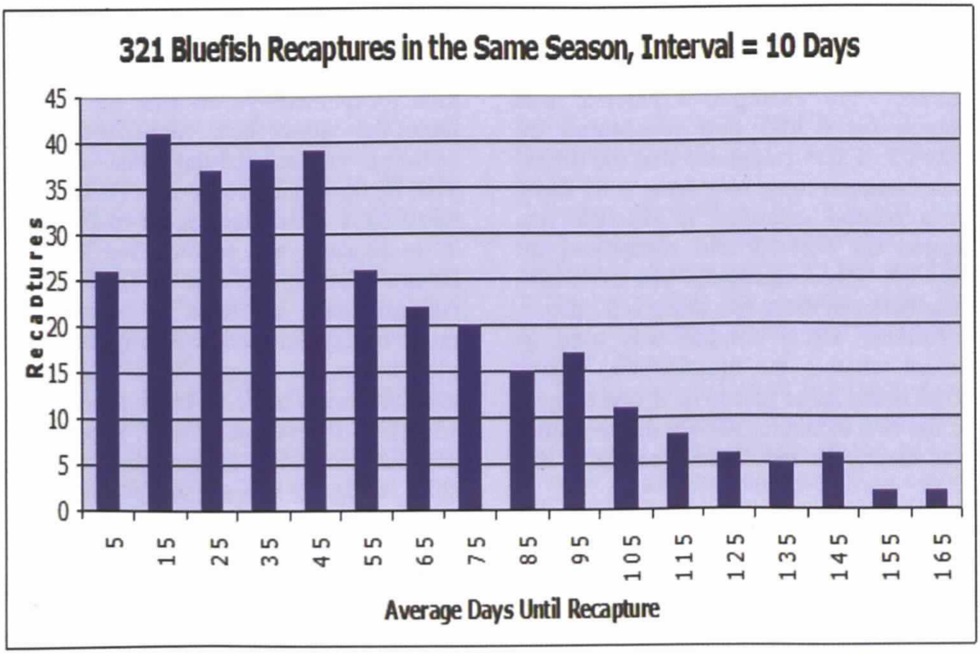
In Fig. 2, note how the recaptures markedly decline after about 50 days.

Why? The answer is speculation. When a bluefish is swimming with a bright yellow tag behind its dorsal fin, perhaps one of its school-mates bite off the tag? And, the more time that goes by, the more likely that this bite-off happens? But there could be an entirely different answer. Perhaps there are many schools of bluefish far offshore, and randomly a few schools come inshore to feed. Then they return to their offshore area, perhaps to never to come inshore again? Do bluefish view going inshore as "combat duty" where they find fishermen using a variety of lures and bait? After 50, or so, days of "combat," do the survivors start to leave? A radio-transmitting tag might shed some light on where the bluefish go.

Table 2. Same-Season Recaptures

Days Until Recapture	Number of Recaptures	*	Average Days Until Recapture	Number of Recaptures
0-10	26	*	5	26
11-20	41	*	15	41
21-30	37	*	25	37
31-40	38	*	35	38
41-50	39	*	45	39
51-60	26	*	55	26
61-70	22	*	65	22
71-80	20	*	75	20
81-90	15	*	85	15
91-100	17	*	95	17
101-110	11	*	105	11
111-120	8	*	115	8
121-130	6	*	125	6
131-140	5	*	135	5
141-150	6	*	145	6
151-160	2	*	155	2
161-170	2	*	165	2
Total	**321**	*	**Total**	**321**

Figure 2



Field Notes

Underwater Naturalist is an equal-opportunity journal. Some articles that you read here have been assigned, but most arrive without warning. Beginning with Volume 1, Number 1 in 1962, we have encouraged members to send us brief, informal notes of observation they have made. Many of us keep logs or field diaries (fishermen are famous for keeping notes, weather, tides, and, of course, relative fishing success). If something strikes you as a worthy occurrence to share with others, let us know. In other words, these "Field Note" pages are wide open for business.

AVIAN MISDEMEANORS

BY JOSEPH DUTTON

Benjamin Franklin was said to have disagreed with the choice of the bald eagle as America's symbol partly because of its practice of stealing fish from other birds. Some sea birds make a living the same way. Recently, I caught some in the act.

A mid-winter business trip took me to Florida, yet another opportunity to pack a small spinning rod, a reel of six-pound test line, an assortment of jigs, spoons, and popping and swimming plugs, binoculars, face mask, and bird book in case I could pry out a few hours to cast for speckled trout or snook or look for some real snowbirds. This visit was in and around Stuart on the Atlantic coast about 75 miles north of Miami. I didn't catch any fish but was treated instead to a series of encounters between birds that swim for their food and their cousins who freeload. All these observations were along the northern causeway that connects Hutchinson Island and Jensen Beach, across the mile-wide Indian River. It was two days of sunny, 70 degree weather.

The swimmers were common loons, red-breasted mergansers, and double-crested cormorants. The freeloaders were laughing gulls and Bonaparte gulls. Then, simply because they were there, I also recorded notes on other avian fishermen.

Common Loon/Bonaparte Gull – A loon swam into shore from a hundred yards off and began snorkeling parallel to the shoreline in three feet of water. Mostly it swam rapidly with its head underwater sweeping back and forth, sometimes diving and staying underwater from a few seconds to nearly half a minute. Soon, a single Bonaparte gull settled down near the loon (with larceny in mind) and trailed it for 50 yards or so, sometimes anticipating correctly where the loon would pop back on the surface. There was no sign that the gull scored any food by its actions, and it soon moved off for more promising fare or, at least, a better fisherman.

Dutton is a retired school teacher who dabbles in real estate and claims to have fished most of the freshwater streams of Pennsylvania, his home state.

Mergansers/Laughing Gulls -- Four mergansers snorkeled along close to shore pretty much side by side, possibly herding small baitfish. Then all four would dive at once, chase something, and surface in a ring as if they had corralled fish. At this

Red breasted Merganser

point, a pair of laughing gulls arrived, landed among the mergansers, dipped their bills in the water, tipped their bills back, and swallowed. It was impossible to see if they were eating and if so, what.

Cormorant – One cormorant swam along the edge of the causeway, poking its bill in one crevasse after another, then surfacing to swallow something eel-like. It had no freeloaders with it, but its boisterous surfacing did scare off half a dozen ruddy turnstones that had been picking invertebrates from the rocks.

Pelican/Laughing Gull – A pelican did one of its clumsy but effective dives into the water and came up with something worth swallowing, whereupon a laughing gull landed nearby and picked up some scraps. Later, I looked for but didn't see pelicans napping on docks with laughing gulls sitting on their heads.

Then there were the bird/man interactions:

Cormorant/Fisherman – They use live shrimp for bait down here, edible sized beauties. A guy fishing near me, had a bite, struck hard, and yanked an empty hook from a surfacing and satisfied cormorant. I had the distinct impression that the angler and the bird knew each other. I told the guy I was a tourist (maybe my wingtip oxfords gave me away). He said "I'm a red neck; I live down there across from the bait store." We talked while he fished, fed the cormorant, and drank off the last of three 16 ounce cans of Budweiser, picked up his empties, and left, telling me again that he lived just up the road across from the bait store. It was around 8:00 a.m.

Pelicans/Fishermen – There were two boat launching ramps on the causeway, each staffed by half a dozen pelicans, bobbing in the water just off the ramps, waiting for fishermen to get rid of bait before hauling their boats ashore or to pick up scraps from the fish cleaning tables. Available gleanings set off terrible squabbles among the birds. No politeness here; may the biggest, fastest pelican win.

Great Egret/Cast Netter – A cast netter was walking the water's edge looking for mullet when a great egret flew in and joined the hunt, about 10 paces to the rear.

With all this inter-, intra-, and opposite-species activity going on, it made me wonder if these birds ever just went off and hunted on their own, or whether this was simply normal, off-season, non-breeding, winter-vacation, no-need-to-defend-territory behavior.

It was a good place for other birds. On a sandbar nearby there were laughing and ring billed gulls, an oystercatcher, skittish little blue heron, Louisiana (now tri-colored) heron, snowy egret, great blue heron, black bellied plover, yellowlegs, and a peep; and, overhead: fish crows, turkey vultures, and boat-tailed grackles…and then, an osprey flew overhead with not a fish-stealing eagle in sight. But all in all, up and down the causeway, there was a whole lot of protein exchange going on. ■

HUNGRY SHAD DON'T READ

BY STEPHEN SAUTNER

While fly fishing on the East Branch of the Delaware River on a pleasant May afternoon, I noticed a large fish feeding on fry in a quiet backwater along the bank. At first, I ignored the feeding fish, focusing instead on a trout some 30 feet away rising to a hatch of mayflies. But when the fry scattered just off my rod tip followed by a loud SLURP, I decided to try to catch whatever it was gorging just a few feet from where I stood. In the Upper Delaware the list of large pisciverous fish is fairly long, ranging from the anadromous striped bass, which seem to range farther and farther up river each year, to the non-native smallmouth bass, rainbow and brown trout. Other predators include fallfish, various sunfishes, walleye and even muskellunge, to name a few.

I had just switched from a dry fly to a small streamer, when the fish came up again – this time allowing a full view. To my surprise, it was an American shad of about three pounds. Shad runs on the Delaware are legendary, but the fish are not thought to feed until they are done spawning, and even then, they eat aquatic insects as they drop back to saltwater. It was only mid-May: the river temperatures hovered in the high 50s, so it was unlikely the fish had already spawned (most shad don't spawn until the river reaches 60 degrees). While at sea, American shad feed mostly on plankton, not fish – unlike its cousin, the hickory shad, which often can be seen chasing bait fish to the surface in estuaries. I never caught the shad, but for the next half hour I continued to watch it patrol the backwater, chasing the dimpling fry to the surface and slurping them down in its scoop-like mouth. Clearly this particular shad hadn't read the literature.

Sautner is this journal's fishing editor.

American Shad

WATCHING LOONS ON THE GULF OF MEXICO

BY GEORGE THATCHER

Common Loon, winter plumage

Watching loons on a sunny, but cold, winter afternoon on the Gulf of Mexico is a pleasant occupation.

Within easy view is a pair of goose-size common loons, floating in tandem, diving from time to time in water about 12 feet deep. Unusual at this season, the sea is glassy calm.

A sporting game among observers is guessing where the birds will resurface after a dive. One rarely guesses correctly, because of a major factor, the varying length of time loons choose to remain submerged.

Henry David Thoreau was continually fooled by loons at Walden Pond, finding the birds surfacing in unexpected places, then calling out to him..

Open-water birds, loons are among the oldest extant creatures on earth, having first appeared in the Paleocene Epoch in the Tertiary Period, perhaps 50 million years ago.

Floating, loons are agile and powerful swimmers, their dives lasting for a minute or so. Seldom do they come ashore in our region. On land, we read, the birds are awkward and have difficulty taking off in flight.

This afternoon the pair swims together on the surface, their heads held regally aloft, their long bills horizontal. From time to time, one dives, the other remaining afloat. In the area, there are other diving birds — a cormorant and some nondescript diving ducks, but the loons command out attention.

Winter residents along our shore, loons arrive here in December, departing in March for the continent's northern reaches, where their likeness appears on Canadian half-dollars, amiably called "loonies."

Tiring after a while of watching the aquatic loons, we turn our attention to the clouds, semingly stationary above the barrier island, floating prettily in a peaceful blue sky. The scene calls to mind the words of a fine, old hymn, "Thy clouds….are fountains of goodness and love…" ■

The author is a veteran beach walker and serves as the eyes and ears of the Society on the Mississippi Gulf Coast.

THE OSPREYS OF JAMAICA BAY

BY DON RIEPE

The osprey, a fish-eating raptor, and some other top line predators were decimated in the 1950's and 1960's by the prevalence of DDT in the environment. Rachel Carson's book "Silent Spring" highlighted the issue and in 1972 DDT was banned from use in the U.S. By the 1980's osprey populations started to rebound until today, they are once again common nesting birds on Long Island and in other parts of their original range.

To my knowledge there were no breeding ospreys in NYC for most of last century. The first record was at a nesting platform in Jamaica Bay I helped put up for the National Park Service in 1985. Since then, osprey populations have grown exponentially in Jamaica Bay, and currently there are 17 nesting pairs.

For the past 18 years, the American Littoral Society has been providing nest platforms and monitoring ospreys by examining and banding fledgling birds. Each winter and early spring, osprey platforms are checked and repaired if necessary; new ones are built and erected at protected marsh sites around the bay. All new nest sites are being placed at least three miles from JFK Airport runways as ospreys and other birds routinely cross runways to get to foraging sites around the perimeter of the bay. The main food for the ospreys appears to be menhaden or "mossbunker," an oily fish that plankton feed at or near the surface. Ospreys are now nesting in Staten Island and other boroughs of NYC as well. They are welcome to stay...and proliferate.

Book Reviews

PARKS DIRECTORY OF THE UNITED STATES, 5TH EDITION

Darrin L Smith and Kay Gill, Editors

www.omnigraphics.com, Detroit, MI
1100 p. Cloth.

Anything over 1000 pages can be called a tome, but that term connotes heavy reading. This is a big book because it is so complete, but it's not work to delve into it. Consider its contents, a listing of just about all federal and state parks in the U.S. and Canada, forests and grasslands, battlefields, seashores, trails, scenic highways and byways, and refuges, with maps, directions, brief descriptions, schedules. You name it, it's there. Or you can use it to contact individual parks for more detail.

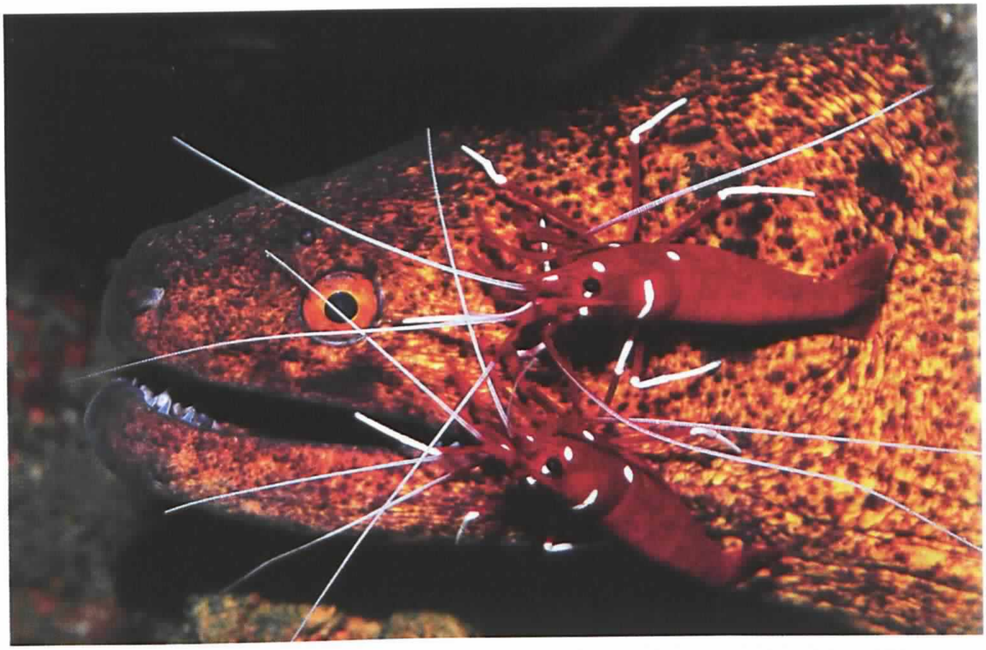
It covers these open spaces, large and small. For contrasts, look on page 96 for example. At the top of the page is Women's Rights National Historical Park, in Seneca Falls, NY, 7.4 acres commemorating the beginning of the women's struggle for equal rights. The next entry is Wrangell-Saint Elias National Park and Preserve, Copper Center, Alaska, just up the road from Valdez and a day's drive from Anchorage. It's 8,000,000 acres of park and 5,000,000 acres of preserve, the biggest unit of the National Park System, It holds the continent's largest assemblage of glaciers and of mountains over 16,000 feet (mostly unnamed and unclimbed), including 18,008-foot Mount St. Elias, second only to Denali in the U.S. The following activities are suggested: camping, hiking, horseback riding, boating, rafting, kayaking, fishing, hunting, wildlife viewing, and cross country skiing. Bring your own boots.

OCEANIC WILDERNESS

By Roger Steene

Firefly Books, Buffalo, NY
339 p. Cloth.

This is a great big book of magnificent underwater photographs, almost all close-ups of an amazing collection of colorful coral reef fishes. It's a good bet that even the seasoned diver/traveler has seen only a fraction of what is shown here, and even then the fish moved too fast, the water



wasn't clear, or in some cases you didn't even realize what you were looking at was alive. There are, for example, mantels of clams that look other worldly, gobies sharing their burrows, eels that change color and sex as they mature, and crabs whose markings make the artistry of a wood duck's face look like childish scribble.

Along with the photographs are excellent captions that cover habitat and behavior, locale, and special conditions if important. Most of Steene's work is from the Pacific but he travels afar; there is much to wonder at and enjoy.

And it is a big book, 11-13 inches, of rich, thick paper, weighing in at about eight pounds. But for all its beauty, listen to the uncomplicated equipment: "The photos in this book were taken with 100 ASA film, using 14, 20, 28-80, 105, and 70-185 mm lenses. All were shot with a single top mount flash except the occasional wide angle. The 70-185 mm has a 2X wet diopter attachment for close-ups and is the lens I use most. The microscopic pics. were taken on an optical bench with tungsten film." Then Steene adds: "I invite readers to make contact with information on behaviour, observations discoveries or nomenclature updates of marine life: Roger Steene, Box 188, Cairns 4870, Australia." Why not drop him a line about that nudibranch you saw in Fiji or just to say thanks.

TRACKING TRASH: FLOTSAM, JETSAM, AND THE SCIENCE OF OCEAN MOTION

By Loree Griffin Burns

Houghton Mifflin, New York. 56 p. Cloth.

There's a sign on the wall of the Society's office that reads "The ocean is so big it will never be polluted." It's supposed to be funny. But gravity insists that everything above sea level must try to head downhill – mountains, water, silt, dead fish, cigarette butts, water bottles, and many other signs of advancing civilizations. When it gets to the sea, it joins the flotsam and jetsam and the rest of the family of solids, solubles, disposables, and unmentionables that make up man's contribution to the oceanic mix. Some is critical to the ocean's health – minerals, nutrients and trace elements that are part of life's cycle. Some can do real harm, but some spills of floatables have added helpful knowledge to our understanding of ocean currents and a call to action to treat flotsam as a serious ocean pollution issue.

On May 27, 1990, the cargo ship Hansa Carrier lost 21 cargo containers from its decks during a Pacific storm. Five of the containers were full of 40,000 pairs of Nike sneakers which then burst from their confines and proceeded to journey generally east northeast to western Canadian landfalls near Vancouver Island. Two years later, a second cargo ship in the Pacific lost cardboard boxes of bathtub toys – yellow ducks, red beavers, green frogs, and blue turtles, 28,800 in all – which favored landings in Alaska.

From these two spills and the general knowledge of floating stuff came a renewed interest in the ultimate destination of floatables in the ocean and their impacts on marine life. Among the damage: pelagic birds feeding on plastic bits, seabirds and marine mammals entangled in nets and monofilament fishing line, turtles eating balloons, and a rash of other lethal and sub-lethal impacts from the tons of non-biodegradables added to the ocean each day. Some collects in great oceanic gyres like the one in the north Pacific near Hawaii. Some has favorite onshore destinations: the beach of Padre Island, Texas, is the final resting place for a daily wash-up of plastic buckets, oil containers, plastic bags, lumber, and other spillage, much of it from oil rigs and fishing and crew boats in the Gulf of Mexico.

This little book (for ages 10 and up) is a fine mixture of science, gee whiz, and common sense with good illustrations, suggestions for further reading, and recommendations for action. Among its points: join a beach clean up session (go to the Ocean Conservancy website to find a cleanup near you), but, more important, get after industry and the public to eliminate the epidemic of over-packaging.

And, don't throw your sneakers in the ocean.

ATLANTIC COAST BEACHES: A GUIDE TO RIPPLES, DUNES, AND OTHER NATURAL FEATURES OF THE SEASHORE

By William J. Neal, Orrin H. Pilkey, and Joseph T. Kelley

Mountain Press, Box 2399, Missoula, MT 59806. 229 p. Paper.

Ocean beaches were made for walking. Let us count the ways: summertime in shorts and bare feet from the beach chair into the water, down the beach to fish, against a chin-freezing winter wind, looking for boys/girls, looking for seashells, letting the dog chase gulls. Followed by dozens more. And then there are all those unexplained markings in the sand: holes, mounds, ripple marks, wrack lines, dips, gullies, shelves, color bands, dimples, and domes. Just how do these things happen? What can we learn about them and from them?

The authors have done a thoroughly readable job of describing and illustrating hundreds of the marks that most beach walkers have seen but often misidentified, the marks made in the sand by plants and animals, tides, currents, waves, and wind. They write, they explain, and they have collected excellent photographs. A glance through one of the book's sections will open your eyes to dozens of marks you have seen and wondered about. For examples:

>>> Those "nail holes" that you see on low tide beaches are most often not worm or crab holes; they are formed by air escaping up through beach sand as the tide drops.

>>> Those little domes you find on the beach ("blisters") are formed by air cavities that will result in nail holes when the air escapes.

Ghost Crab Hole

>>> Different beach colors are different minerals: quartz, feldspar, and shell parts are usually white; heavy metals and minerals (tourmaline, magnetite, ilmenite) are dark. Water and winds sort them.

>>> Beach profiles reflect weather conditions and seasons: steep beaches and sharp berms are usually the result of big winter waves; gentle summer surf makes gentle beaches.

There are whole sections on how beaches form; what jetties, groins, and seawalls do to beaches; what invertebrates populate beaches and the marks they make (ghost crabs, ant lions, worms). Dunes get their due, and there is a concise 14-page first chapter on the geology of the Atlantic shore. The writers are serious scientists taking some time off from academic strictures to be both accurate and informal.

Tuck this book in your backpack next time you hit the beach or take a school group down to the water's edge. It will make for a better hike, interesting learning, and probably more than a few I didn't know that's.

SUV Owners Seek Advice

As you might expect, readers have filled up the mailbox with questions about what to do with their SUVs as prices at the pump soar. Readers seem to realize that while oil and thus gasoline prices rise and fall, the unstoppable trend is up. Here are selected questions and our answers:

Q: We have a 550 horsepower Chrysler Sierra 5x5 Prairie Ripper, a nine-passenger SUV with tinted floor mats and seven digital electronic cup holders. We can't afford to drive it any more, and it's worthless on the used car market. Any suggestions on how to put it to good use?

A: It just so happens your Prairie Ripper is perfect for storing winter root crops – rutabagas, turnips, parsnips, potatoes. Here's how: Cut off the top of the Ripper at the seat back level but leave the windows intact, bury it up to the top of the windows and fill the inside with alternate layers of vegetables and dry sand. Paint the word "veggies" on the Ripper top, use it to cover up the cargo, and dig in for a season of eating pleasure.

Q: We own an almost brand new Ford SUV, a K-2 Glacier Blaster with nine brushed platinum cup holders, powered with 700 pounds/feet of expensive diesel-fueled torque. My significant hubby uses it to commute 170 miles each day, round trip. Needless to say, we're looking for a smaller car, but the dealer won't take the Blaster as a trade in, so I guess we're stuck. Got any ideas?

A: Actually, you're in luck. The Glacier Blaster has an extra-big 110 gallon fuel tank. Fill 'er up with diesel, bury the Blaster in the back yard, mark the spot with a stake, and figure that your initial investment of $305.50 worth of diesel will double every five years. If you don't want to wait that long, turn the Blaster into a chum pot. Fill it with a mixture of cat food, canned corn, and crushed mussels, crack open the outside air vents, sink it in 10 feet of water, and start cranking in winter flounder.

Q: We have matching His and Her Desert Camo Hummers. The price of gas doesn't bother us, but people laugh at us in our Hummers at traffic lights. Last week, a guy yelled at me, "Hey stupid, still driving that gas guzzling piece of junk?" Fact is, I don't feel stupid…I feel manly.

A: What's your question? This is not the place just to blow off steam. Give us a question. (And, please tell us how many cup holders your Hummers have.)

Q: How can I find out how much my used SUV is worth?

A: Good right-to-the-point question. Here's a simple answer: Find the price of scrap steel on the commodities market (now about $340 a ton); multiply that number by the weight of your SUV in tons, generally about 3. It comes out to around $1000. It works out that a used SUV is worth about the same price as 22 SUV tanks full of gasoline.

Q: I have a 2006 true black Chevvy Suburban (Eddie Bauer Edition) with twin 5.2-liter turbocharged inline sixes. It has eight semi-retractable cup holders, but it gets low single-digit miles per gallon. How can I put this vehicle to good use?

A: Don't panic – because of its high road clearance the Suburban makes an excellent fish smoker. Load yours up with about two metric tons of mackerel, leave the window on the driver's side open halfway, dig a really big hole and bury it up to the roof. Reach in through the open window and torch the Eddie Bauer upholstery which puts off imitation hardwood smoke. The result is hard to describe.

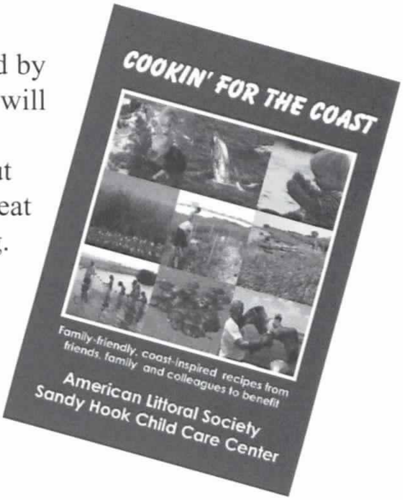
Q: Just a year ago, me and the missus bought a pair of Cadillac Esplanades. Hers is faux baby blue with beige hubcaps; mine's forest green. Each one has V-6 cup holders. We are thinking of trading in the Caddies and downsizing to Beemer convertibles. How much do you think we can get for the trade ins?

A: You may have a tough time getting anything for your SUVs even if they are Caddies, so why not have some fun with them? Enter both SUVs in a Demolition Derby and fix it so you and the little woman end up going at each other in the finals, one on one. It's a win/win: you get rid of your aggressions and your SUVs.

Coming Next Issue: Two questions:

(1) Is organic natural gas worth the added cost? (2) What's a chimera and why can't we all?

COOKIN' FOR THE COAST COOKBOOK FUNDRAISER



Cookin' for the Coast features nearly 100 recipes submitted by fellow members, colleagues, friends, and family. Proceeds will support the work of the American Littoral Society and the Sandy Hook Child Care Center, our non-profit neighbor out on Sandy Hook. *Cookin' for the Coast* features not only great seafood fare, but also recipes of all types for castual dining. These are great for holiday gifts and stocking stuffers. Supplies are limited so order your copies now.

Price per book: $20 plus $2.50 for shipping.

Pay online using Paypal at www.littoralsociety.org or

Mail form and payment to: *American Littoral Society, 18 Hartshorne Drive, Ste. 1, Highlands, NJ 07732*

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