Chesapeake Quarterly

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Keeping Swimmers Safe

contents

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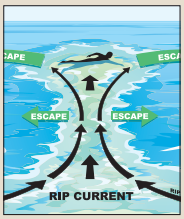

Chesapeake Quarterly

August 2009

Chesapeake Quarterly explores scientific, environmental, and cultural issues relevant to the Chesapeake Bay and its watershed.

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Cover photo: *Rescue boards in hand, rookie lifeguards hit the beach at Ocean City, Maryland. Their final training exercise includes using these surfer-style boards, often the fastest way to reach a swimmer caught in a rip current.* PHOTOGRAPH BY MICHAEL W. FINCHAM. ***Opposite page:*** *A strong swimmer, Pat Norris relaxes with her boyfriend next to the ocean where she nearly drowned.* PHOTOGRAPH COURTESY OF MICHAEL W. FINCHAM.

Riding the

This was before the war that would change everything. When Pat Norris went to the beach with her boyfriend, Bill Fincham, both were in their mid-twenties. She was tall, somewhat gawky (at least in the photos) with a big smile and a crown of curly light brown hair that flared out like a halo around her head in a style that was popular in the 1930s. He was slim, well dressed, with dark hair slicked back, a mustache, a sporty-looking car. A dude of sorts. The beach was Nags Head, North Carolina, on the Outer Banks.

That morning Pat dove through the breakers and headed out with confidence. Swimming was one of her great loves and she was good at it. Back in Washington, DC, she would take the streetcar downtown to the old YWCA where several times a week she swam laps.

Bill hung back on the front porch of the hotel that morning, perhaps out of laziness, perhaps out of hesitation. He was probably not a strong swimmer — no one in later years could remember him swimming — and possibly did not want to embarrass himself in front of this Catholic girl who had finally come away with him for a trip. That's my guess. That hesitation helped save his girlfriend's life.

Norris was a strong swimmer, but she was no match for the rip current that caught her up and carried her seaward. Not much was known in those days about rip currents like the ones that broke out that morning along the Outer Banks — except this one was much stronger than a strong swimmer.

Struggling against the surge, feeling her exhaustion growing and her panic rising, Norris hesitated, then rolled over

Rip...and Living to Tell a Tale

and began floating on her back. She also waved and yelled for help, but nobody on the beach could see her over the incoming swells, nobody could hear her over the sound of breaking surf.

It was her boyfriend up on the hotel porch, probably smoking a cigarette, who spotted her floating and waving in the distance. Details of the rescue are sketchy, but it involved four men recruited from the beach and possibly a small boat. By the time they reached her she had been floating for 45 minutes.

The story has passed down several generations now, and it always raises odd questions when I think of it. The boyfriend got his girlfriend to marry him and Pat Norris became Pat Fincham. Together they raised seven children, and one of them is the author of these articles on rip currents. What did she think about, I wonder, floating on her back, staring at the heavens? Was she afraid to die? Did her faith keep her calm? Did she think about children? What if she had drowned that morning? Now that she's gone, these are questions without answers. Yet every time I hear the story I am caught up in such musings like a weak swimmer swept away in a strong rip.

I also think about the tough choices my mother made when she realized she was caught in a rip current. For the last decade the conventional wisdom has said you should not swim towards the beach: you'll exhaust yourself against the current, your stroke will grow weaker, you'll probably panic, you could easily drown. The standard advice: swim parallel to the shore until you move out of the rip channel and then head for shore. If you can't get out of the rip current — if it is too wide, if you are too weak — then try floating and waiting.

My mother, though a strong swimmer, took the second option, floating and waiting calmly, and by following her instincts she may have unknowingly avoided other problems. Rip currents, depending on the setup of the local sandbars, can sometimes flow at odd angles away from the beach. A rip can angle southwards, for example, and by swimming southwards you stay in the current longer. Along some beaches, rip currents can curl back towards the shore. Swim or float? Even with what we know now, it's still a tricky choice.

We do know a lot more about waves and rip currents these days, thanks to a tradition of sea swell and wave forecasting that began during World War II in preparation for terrible, bloody beach invasions in places like French North Africa, Iwo Jima, and Normandy. Rip current research has not been around as long as wave research, but it is in high gear now, with projects in progress at more than a dozen American universities, much of it funded by Sea Grant programs around the country. One focus of that research is prediction, creating rip current forecasts as accurate as the weather forecasts we listen to before we leave for the beach. Forecasts that could save lives.

That research tradition has done much to educate us about how to look at a beach full of breaking waves, but our best protection still remains the lifeguards sitting on their towers, trained to read the waves for signs that rip currents are running strong enough to carry swimmers out to sea.

I thought again of this family story when I interviewed Butch Arbin, the captain of the Ocean City Beach Patrol. He's a 37-year veteran of the Beach Patrol, still passionate about his summer job, and he was telling me why so many lifeguards come back to the job year after year. When you save somebody's life, he explains, you touch a whole family. You find out how that somebody is a daughter, a sister, a niece, an aunt, a wife, a mother, a grandmother. "So when you save somebody, you've impacted a whole lot of people," he says. "Saving a life is significant." Like tossing a pebble into a pond where the ripples go on forever.

— *Michael W. Fincham*

It's D-Day minus 1, and Ben Davis begins his morning with a 5:45 am workout. Two days earlier it was an 800 meter run, 30 kettleball swings, and 30 pull-ups, five rounds of each. Today it's ten snatches with maximum weight. He's doing Crossfit training, a popular regimen promoted for "forging elite fitness," especially for first responders.

Fitness matters for Davis. He's a first responder, a crew chief for the lifeguards watching the south end of the 10-mile sand beach at Ocean City, Maryland. A four-year veteran of the Coast Guard and a nine-year veteran of the Ocean City Beach Patrol, Davis has brown, sun-streaked hair and a solid build he has to keep in shape. At 31 years old, he's got to be ready to run fast on wet sand, swim hard through heavy swells, and haul drowning bodies off the bottom of the ocean.

By 10:00 am 92 pairs of eyeballs are reading the ocean, looking for rips.

Fitness comes easier for Billy DePaola. He's a wiry, curly-haired first timer, fresh from college and four years of lacrosse and soccer. For DePaola, D-Day minus 1 begins with lifeguard drills on the beach. He carries injured swimmers out of the breaking waves. He practices sprinting, diving, and swimming out through the swells, first with his small red buoy, then with a landline, and finally with a long, yellow rescue surfboard.

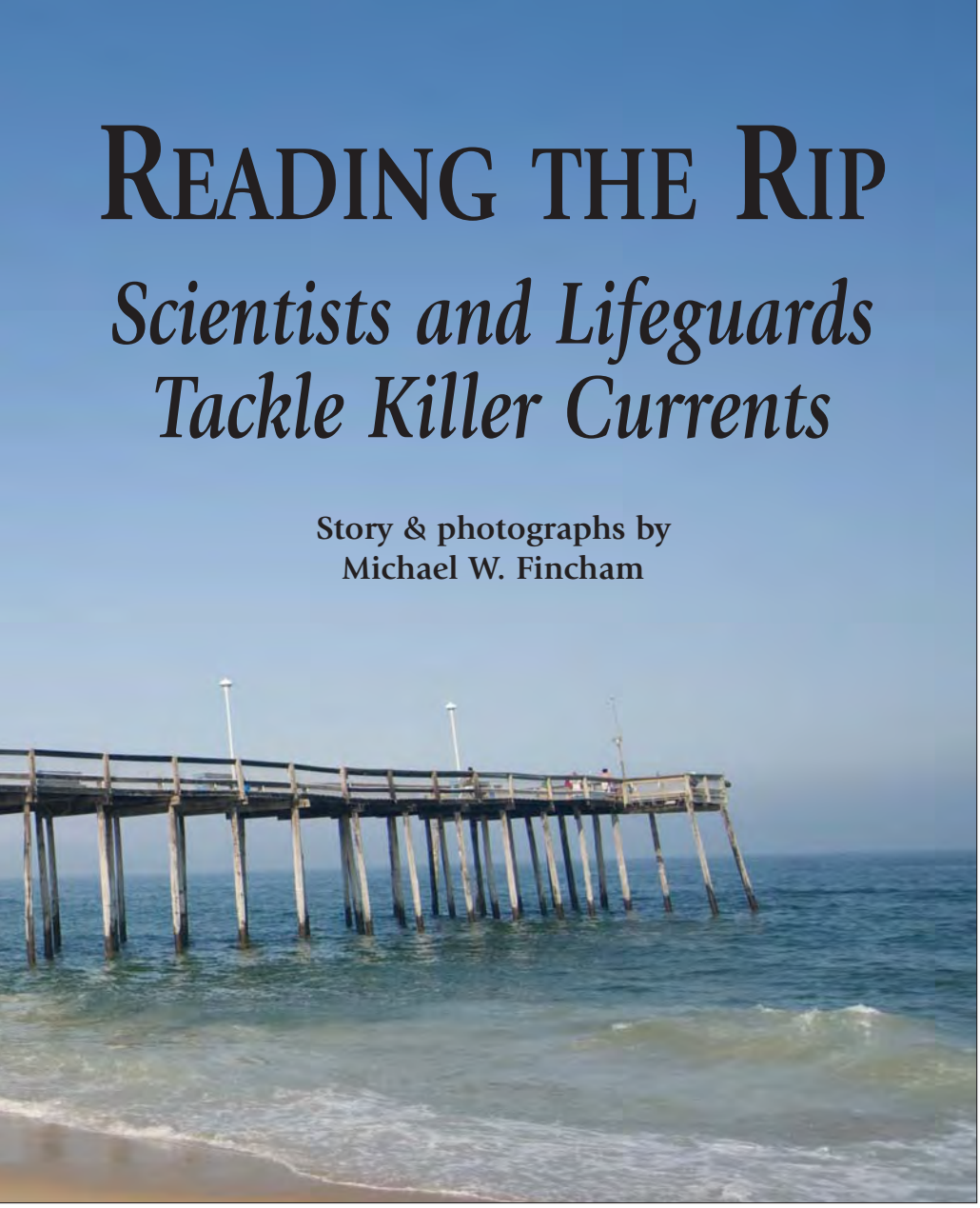
It's final exam day for DePaola and 33 other rookies working with the Ocean City Beach Patrol. For them, the beach drills are more fun than work, letting them race from one drill station to the next, then plunge into the surf, compete in teams, pull out practice victims, and celebrate with wisecracks and fist bumps. If they pass, they graduate, go off probation, and get a pay raise.

It feels like any last practice before any big game, but it's also like a war game of sorts. At each station sergeants and lieutenants are giving orders. Wherever they go veterans are walking around, arms folded, yelling "Keep your eyes on the ocean." Tomorrow is the start of the

Reading the Rip

Scientists and Lifeguards Tackle Killer Currents

Story & photographs by Michael W. Fincham



three-day July 4th weekend, D-Day for the Beach Patrol. This holiday always brings a massive invasion of beachgoers down to one of the East Coast's busiest beaches. That means tens of thousands of people will be plunging into the waves, many of them with weak swimming skills, and most with little understanding of what can happen when those waves slide back out to sea.

Beachgoers worry about sharks and lightning, but lifeguards worry about rip currents. Along most American beaches, they are the big killers. On any shore with breaking waves, channels of seaward-flowing water can suddenly open up and sweep swimmers and waders out past the breakers into deeper waters well beyond the beach. For most victims, swimming back against the current proves futile, leaving them exhausted and swept further out to sea. Most drownings on American beaches are rip current drownings. And ninety percent of the rescues by lifeguards at Ocean City are rip current rescues.

"Rotate! Watch your rotation," barks a sandy-haired man who's watching the beach action from beside a white jeep. Butch Arbin, captain of the Beach Patrol and a 37-year veteran, set up these final maneuvers and he wants them done right — all of them. "Station leaders," he yells through a loudspeaker, "Keep your people moving."

He wants all his guards, both veterans and rookies, ready for D-Day. He remembers what happened this time last year.

On the beach at Ocean City, Maryland lifeguards like Ben Davis *learn to read the waves and whistle swimmers and waders away from rip currents. Davis is crew chief down at the south end of the beach where the wooden city pier creates frequent rips by steering longshore currents out to sea.*

TONY DALRYMPLE AND VARJOLA NELKO thought they would never find a hotel in Ocean City. This was the fall of 2006 and the two scientists weren't looking for a room. What they wanted was a roof with a view. There they would set up four video cameras that would take pictures of the beach every day of the year. All the hotel managers hesitated. They had to check with ownership and ownership was often a corporation located in another town that saw little to gain from letting two scientists loose on a rooftop. It took dozens of phone calls and treks to 15 hotels before the manager of one hotel, the Grand Stowaway Hotel, said yes. What was the argument that worked? The cameras, the scientists said, could help save lives.

What would save lives, said Dalrymple, would be an accurate forecast for dangerous rip currents. Tony Dalrymple is lean, laconic, and white-haired, a coastal engineer at Johns Hopkins University who's published widely on wave dynamics and their effects on coastal structures like beaches, breakwaters, jetties, and dericks. He's been consulted on tsunamis in Thailand, hurricanes in New Orleans, and giant surfing waves in Hawaii. He's also kept up a long-standing interest in a less-famous subject: rip currents. When a new grad student, Varjola Nelko, arrived from Albania and Turkey in search of a Ph.D. topic, he gave her a tough one. They would work up a new way of predicting when rip currents are likely to show up.

How could they sharpen rip current forecasts using cameras? By capturing actual photos of rip currents as they formed. Then by correlating those rips in the photos with weather data about wind

and waves, the natural forces that drive these killer currents. That, at least, was the approach he wanted to try.

Observation, analysis, and predictive modeling, that's a classic progression, but it's not the way scientists usually forecast rip currents. Ever since the late 1980s scientists have focused on rip current rescues, not on actual rip currents observed in action. With their cameras, Dalrymple and Nelko were trying to change the ground rules of the forecasting game.

HISTORY'S MOST FAMOUS D-DAY WAS the large beach invasion that happened 65 years ago this summer. On June 6, 1944, more than 150,000 American, British, and Canadian troops waded ashore through a three-foot surf, launching the Normandy Invasion that began the liberation of Europe and helped end World War II. One little-known key to the success of that long-ago assault was a top-secret technique, newly invented, that helped forecast the waves and surf that would be hitting the target beaches that day. On one of the bloodiest days of the war, that forecast helped save lives.

That technique, created by an Austrian named Walter Munk and a Norwegian named Harald Sverdrup, is no longer secret. Its basic claims about wind-created waves form the conceptual starting points for contemporary wave forecasting — and now for rip current forecasting. A wave, they said, starts with a wind somewhere in the world scraping along a stretch of ocean. They called that expanse of wind-stroked water a "fetch," and they theorized that the size and speed and direction of a wave depends on how long and wide the fetch is, how long the wind blows across it, and how strong the wind is. Six decades after the Normandy Invasion, any surfer can now go to websites like Surfline.com or WaveWatch.com and find an up-to-date forecast for the wave and surf conditions they'll probably see that day when they wade out with their boards from their local beach.

At Ocean City the beach patrol gets its wind and wave forecasts from the National Weather Service, specifically from the Wakefield, Virginia office where forecasters work up predictions using data from offshore buoys and output from the powerful numerical models that form the heart of contemporary wave forecasting. Since the buoys and the models don't always match, the forecasters turn to other statistical tools and, finally, to their own judgments. "It's not just: 'Here's the model, it's saying this.' And we just go with it," says John Billet, science operations officer at the Center. "We make adjustments." The final forecast is always made by people.

The field work was simple in concept: put video cameras on a high rooftop and then photograph the beach and surf zone where rip currents form.

Standing on the shore at Ocean City, lifeguard captain Butch Arbin can now find out what kind of swells are heading towards him, even if they're all the way from a "fetch" near Europe or Africa. Like most lifeguards, Arbin watches these wind and wave forecasts closely, but warily. What he really needs for his D-Day weekend is a way to turn those reliable wave forecasts into useable rip current forecasts.

IN THE 1980S, A METEOROLOGIST in Miami began asking medical examiners and beach patrols for reports about drowning deaths and rip current rescues along the beaches of southeast Florida. Jim Lushine, a forecaster with the National Weather Service, collected these reports and then looked for correlations between rip current rescues and weather conditions. What combinations of wind and wave conditions matched up with high rescue days, with moderate rescue days, with low rescue days? When lifeguards told him to focus on wind events, he pulled ten years of wind records for Miami Beach and found a robust correlation between strong onshore winds and high numbers of rip current rescues. Ebbing tides also correlated strongly. Focusing on winds and tides, he built the country's first system for forecasting rip current dangers. The Miami office began issuing daily warnings about high risk, moderate risk, and low risk days.

Long-distance ocean swells, surprisingly, got little play in his early predictive model for rip currents, apparently for geographic reasons. Long-running swells that crossed the ocean from Africa or Europe and headed towards Florida were largely blocked by the shallow waters of the Bahama Islands. Surfers who track big swells call this effect the island shadow. Later scientists who adapted the Lushine scale to other beaches gave greater numerical weight to wave heights and to long-period swells originating in distant locations. The game of mixing and matching weather factors with rip rescues was on.

And the game continues today. To work up a rip current prediction for Ocean City, John Billet and the other forecasters at the Wakefield Center use a later version of the system Lushine pioneered in Florida. They call their tool MALURCS, short for the Mid-Atlantic Lushine Rip Current Scale, and in their version of Lushine's scale ocean swells — their size, timing, and direction — are hugely important. "They are definitely the biggest input," says Billet. There are, after all, no nearby islands standing between Ocean City and the other side of the Atlantic.

The Wakefield forecasters are also using another tool: the eyeballs of Ocean City lifeguards. As Ben Davis, the veteran lifeguard, takes his place atop his chair tower, he scans the ocean in front of him, looking for signs of rip currents down near the Ocean City pier and inlet. Up the beach at 120th Street, Billy DePaola, the rookie, does the same. By 10:00 am more than 90 pairs of eyeballs are reading the ocean, looking for rips. Sergeants in charge of each section report their reads back to Beach Patrol headquarters, and the dispatcher on duty faxes them to the

Eyes in the skies, these cameras watch the beach *from the rooftop at the Grand Stowaway Hotel at 21st street in Ocean City. They send their photographs over the internet to desktop computers at Johns Hopkins University, where Robert "Tony" Dalrymple and Varjola Nelko analyze the images for evidence of how dangerous rip currents form. To see what these cameras see, go to their website: http://www.ce.jhu.edu/oceancity/. Can you pick out the rip currents?*

National Weather Service. The rip current threat is forecast as low or moderate or high as calculated by lifeguards — not by a Lushine predictive scale. The fax goes out three times every day, and the last one includes another number: the day's total for rip current rescues.

These rip current reads and rescue stats will play a key role, not for today's forecasts or tomorrow's, but for next year's. In the off-season the Wakefield forecasters will verify their forecasts from the past year by comparing them against all these reports from the field. With this kind of groundtruthing, they can adjust their weighting values and sharpen their predictive power for the next year. It's a kind of off-season tune-up for their forecasting engine.

The result, in theory, should be rip current forecasts that grow more precise year by year. The official forecasts, in practice, seem to be more helpful for occasional beachgoers as more media outlets every year carry the forecasts. If you're headed for the beach you can turn on the radio or go online and get the weather forecast. If you're going in the water, you can also get the rip current forecast. If it says "moderate risk" of rip currents, you might want to stay on the beach. If it says "high risk," you might want to stay home.

For now the official forecasts are largely ignored by Captain Burch Arbin and his lifeguards. When it comes to rip currents, they'd rather trust the readings they make themselves, watching the waves from chair towers eight feet above the beach.

WHEN TONY DALRYMPLE AND VARJOLA

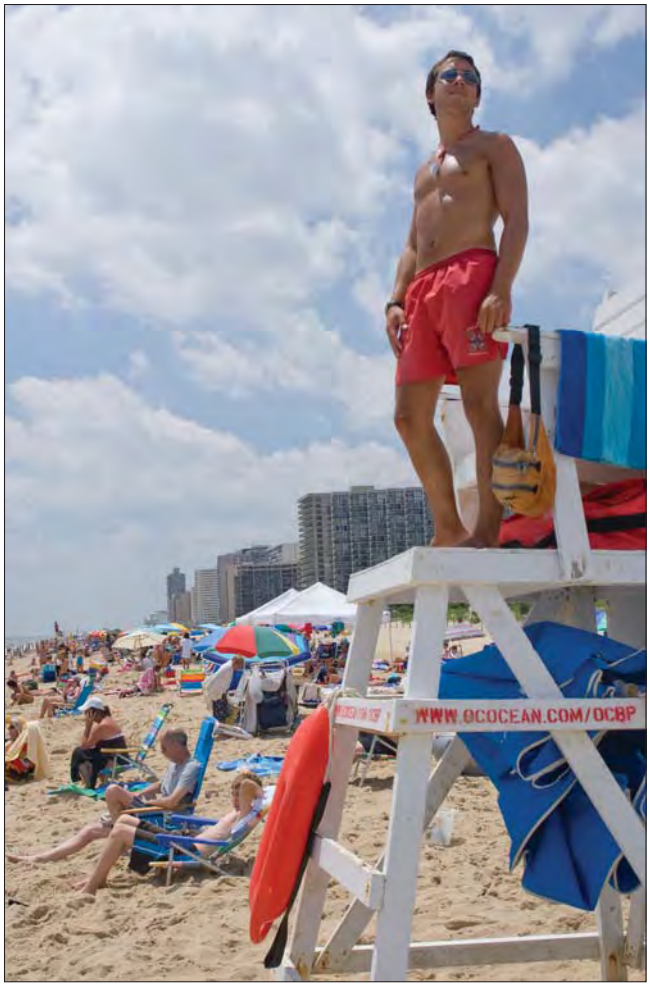
Nelko finally found an Ocean City rooftop for their cameras, they began reading the ocean from 14 stories above the boardwalk.

Their high-angle perch in the sky lets them test a radically different approach to rip current forecasting. Instead of collecting records of rip current rescues — as Lushine and his followers have been doing for two decades — they're collecting visual records of the rip currents themselves.

Their field work was simple in concept: put video cameras on a high rooftop and then photograph the beach and surf zone where rip currents form. The cameras take photographs at 3 frames a second for 10 minutes, then average them together and shoot them straight to Dalrymple and Nelko. From the rooftop cameras to a hotel computer to the internet to a desktop computer, the beach pictures fly from Ocean City to two university offices in Baltimore. Much like lifeguards sitting on their beach chairs, the scientists can sit in their office, without sunglasses or sunblock, and try reading the waves for rip currents.

From behind a desk strewn with books and assorted spiral-bound reports, Dalrymple swivels his chair and pulls up to a large-screen computer against the wall. He taps the keyboard. Here in this long office lined with bookshelves, with a guitar case sitting on the floor, with a window looking out onto the green, quiet campus of Johns Hopkins University, we are suddenly back in Ocean City. We're looking down on a beach busy with sunbathers sprawled on blankets and sitting under umbrellas. Perhaps they're having a good time. Beyond is the surf zone: shallow water, then lines of breaking waves, then deeper, dangerous waters. Only a few waders are actually in the water. Perhaps they know what they're doing. One wishes them well. It's a godlike view from up here in the sky.

A couple more taps and Dalrymple brings up another image, a freeze-frame that averages together 10 minutes of pic-



Two ways to read the rips: from on high, from on the beach. *Scientists Tony Dalrymple (above) and Varjola Nelko (opposite page) work at Johns Hopkins University using high-angle images from their rooftop cameras. With funding from Maryland Sea Grant, they are analyzing how rip currents form and are devising a formula for accurately forecasting their arrival. A lifeguard (right) works from a tower chair along the Ocean City beach using his training and experience to spot rip currents and rescue swimmers from their clutches.*

tures. Think of a double exposure multiplied 1800 times. The image is slightly blurry like an X-ray, and like a doctor advising a patient, Dalrymple begins diagnosing the big picture. "All the breaking is occurring right here," he says, pointing to a smudged line that compresses together hundreds of surf breaks. Waves break in shallow waters, and that smudged line of breaks tells him that's where the sandbars are.

"Then the water gets deeper again," he says, pointing to a dark strip of water trapped in a trough between the sandbar and the shore, water that has to run out to sea again somewhere. "Probably a low spot right there," he says, his finger on a dark gap in the breaker line. "Not necessarily a rip current there, but it's more likely to be there than anywhere else."

None of those tiny humans wading down there in the surf can hear Dalrymple's diagnosis of danger delivered from an office in Baltimore. "A well-trained lifeguard would know that there are likely rips there," says Dalrymple, "but it is really obvious from here." One hopes a lifeguard is alert. The view from the 14th floor may be godlike, but it's the vision of a distant, powerless deity.

Accurate forecasts may save lives in some future summers — that's the hope at least — but there's a whiff of scientific hubris around any project trying to predict natural forces as sporadic as rip currents. Following on the success of wave forecasting, however, scientists at more than a dozen universities are now working with wave-basin studies, current meters, pressure gauges, and time-lapse photography, all in hopes of tracking rip current behavior. Much of that field and lab data are then fed into numerical models.

With their cameras and freeze-frame X-rays, Dalrymple and Nelko are among the first to directly observe rip currents in action. By turning their observations into usable data, they are working around the drawback found in all the earlier forecasts. The Lushine predictive scales all focused not on rip currents but on rescues. Rescue totals can go up and down for reasons that have nothing to do with rip currents. Rescues can rise when sunny days or holidays bring out large crowds, and they can fall when cloudy skies keep people away. When nobody's at the beach, rip currents are still there, churning in the surf.

And Dalrymple's cameras are still there watching, capturing rips on cloudy days and all through the cold and windy off-season days when nobody's on the beach but a few walkers, bird watchers, and fishermen casting lines into the boiling surf.

Why try for a new way to forecast rip currents? Because Dalrymple and Nelko tested the forecasting tool now in use and came up with a failing grade. They took MALURCS, the Mid-Atlantic Lushine Rip Current Scale used by the National Weather Service, and they asked it a simple test question: How many of the actual rip currents they caught on camera could be predicted by the Lushine scale? Their answer: For every 100 actual rip currents, MALURCS predicted only 40, well below a passing grade in most schools. A

Ocean City is a long way from home *for Varjola Nelko. A native of Albania, Nelko moved to Istanbul, Turkey where she studied engineering at Bogazici University along the shores of the Bosporus, the famous strait leading south from the Black Sea. In 2004 she arrived in Baltimore to start graduate studies with Tony Dalrymple, a widely published professor of coastal engineering at Johns Hopkins University. Awarded a Maryland Sea Grant Fellowship, Nelko is close to completing her Ph.D. dissertation based on their research on the rip currents of Ocean City.*

score of 40 may be better than nothing, perhaps, but it means the forecasts now used for the Mid-Atlantic region are probably failing to predict 60 percent of the rip currents along the Ocean City shore.

IT'S NOT GODLIKE, BUT THE VIEW

from his 8-foot lifeguard tower is high enough for Ben Davis to easily spot a flash rip and quickly whistle at a small boy who's being tugged gently seawards. The boy looks up, then wades slowly sideways out of the rip channel. That doesn't count as a rescue stat, but it's probably a lifeguard's most common catch, spotting a risk before it becomes a rescue event.

He drops the whistle and swivels his head slowly from north to south, surveying his kingdom, the slice of beach that stretches from the long wooden town pier down to the rockpile jetty at the south end of Ocean City. As crew chief, he has dominion here. With several hundred people under the watch of his crew, he has to catch more than 40 percent of the rips.

Like a lot of lifeguards, Davis is also an on-site oceanographer, reading the waves and the wind so he can make his own instant forecast of rip current dangers. Watching swells roll past the end of the pier, he notes their direction, estimates their heights, and counts off the seconds between swells.

Reading the rip, like reading music, is a learned skill. The best sign of a rip, for Davis, is color, color that's different from the rest of the water. A rip current can be darker because the water is deeper where it flows through a channel. Or it can be lighter, especially with "flash rips," because they pick up sand from the bottom and carry it seaward. "It can be very deceptive," warns Davis. A rip current, ironically enough, can look like a safe patch of water. As a current surges out, it can knock down the surf break, creating calm-looking water that draws in timid waders who don't want to battle breaking waves.

Lifeguards up on their tower chairs are not gods, but they're not powerless either. When a rip opens up and it's too late to whistle people away, they have options, primarily speed, teamwork, and training. A guard signals the next tower, then hits the sand running. "You just head there," says Davis. Next comes in-the-water triage. "You start getting people out of the shallows. If they are already in over their heads, you tell them how to swim out." If they can't swim, then the guards go after them.

That could mean battling through the breakers with a rescue buoy to reach swimmers in panic. Or bounding into the breakers with a surfer-style rescue board, perhaps the fastest way to reach a failing swimmer. Or swimming out a lifeline so lifeguards on the beach can haul exhausted swimmers back through the surf.

Last year about this time, they had to use all their tools. As the annual July 4th invasion hit Ocean City beaches, a tropical storm began forming some 3,000 miles away, starting wave trains heading this way from the west hump of Africa. By July 7, the storm, now a hurricane called Bertha, was hanging well east and south of Bermuda — and still sending wave trains headed west. The storm never came near Ocean City, hanging out past Bermuda for nearly a week. But its long-period waves began coming ashore by July 9. For the next week, a week of mostly sunny days, rip channels were opening up all along the beach, and lifeguards were scrambling to pull out all their lifesaving gear. The Ocean City Beach Patrol, according to Captain Butch Arbin, set its all-time record. In one seven-day period, lifeguards rescued over 2,000 people from killer-size rip currents. While three people drowned along the New Jersey coast, nobody drowned on the beaches at Ocean City.

HUGE STORMS LIKE BERTHA, IT TURNS

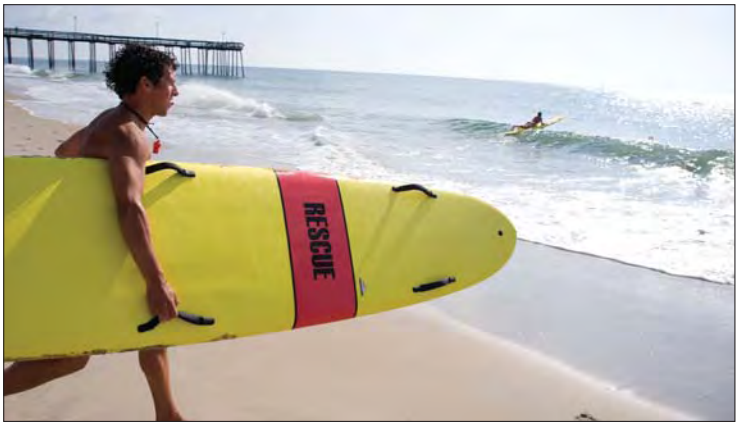
out, can play a surprising role in the dynamics of rip currents at Ocean City. With freeze-frame images from their cameras in the sky, Dalrymple and Nelko are able to watch how sandbars are born and track where they go to die. And it's the life cycles of sandbars that largely control the setup and spacing of rip current channels.

The world of rips, according to Dalrymple, begins with a flat beach and a big storm that tears sand off the shore and carries it seaward. The sand never gets very far because the outgoing water runs into other incoming waves and simply drops its load. And voila! New sandbars are born.

The beach is now "set up" to form rip channels. When backwashing seawater can no longer run out over the sandbar, on ebbing tides for example, it then goes looking for another exit. Wherever there's a notch in a sandbar or a low spot along the beach, backwashing water will begin wedging its way through. A notch becomes a channel, and a rip current runs through it, pulsing most strongly after the arrival of large wave sets.

In the weeks after the storm, those sandbars, as seen in their photos, start creeping shorewards, pushed back towards the beach by incoming waves. During the pushback, sandbars move at different rates, and new rip channels appear among them, flashing open in unexpected places. "The beach gets very wriggly," says Dalrymple. Barring another big storm, the sandbars will eventually reattach to the beach. The beach will flatten out again and stabilize. Rip currents will dwindle.

Creatures of winds and waves, rip currents are also, it's now clear, creatures of bathymetry. For scientists with their freeze-frames, reading the rips now means reading the bottom also: seeing the setup, charting the rip channels,



Final exams for rookie lifeguards *at Ocean City, directed by Captain Butch Arbin (top right), include working with lifelines (top left) for hauling swimmers out of rip currents and with rescue boards (middle left and right) for reaching swimmers fast. If they pass all their tests, rookies become certified Surf Rescue Technicians and receive a pay raise from $13.25 an hour to $14.42 an hour. The grand finale (bottom left) is graduation for the 34 rookies in the class of 2009. To kick off the ceremony, Arbin, a 37-year veteran, congratulates the first graduate of this year's class: his son Michael Arbin.*

tracking the slow, wriggly trek towards shore. For lifeguards without X-rays of the bottom, reading the rips just got more complicated. Now they need to keep a weather eye out for how rip channels can change during a storm cycle.

AT 5:30 BEN DAVIS STANDS UP on his chair, blows his whistle, and begins waving swimmers out of the water. And so do 91 other lifeguards along the 10-mile beach. It's closing time and Davis wraps up his American flag, climbs down, and begins packing up his gear.

For his last chore he tilts his tall chair tower over his back, all 300 pounds of it, and drags it thirty yards back through the soft sand and lays it on its side. It's pure grunt work and every guard does it every day.

The ocean empties, but the beach doesn't. And ten minutes later several swimmers begin wading back into the surf.

The work day ends just the way it began, *with Ben Davis hauling his 300-pound lifeguard chair across the beach. At day's end he lays the chair on its side. Tomorrow morning, he'll pick it up again and haul it back to the edge of the ocean where he'll climb aboard and begin watching the waves for rip currents.*

SO WHAT'S THE FORECAST FROM THE 14TH FLOOR?

When Dalrymple and Nelko built their new predictive system, they took their real-life rip currents as captured by their cameras and looked at each of the weather forces in play that day. In university research like this most of the grunt work falls to grad students like Nelko. First she plotted rip currents against wave heights, the best measure of how energy is hitting the beach. Then she did the same thing with wave period, which gives an estimate of speed. Then with wave direction. Then with wind speed and wind direction. That's an ocean of data she had to swim through.

When they tested their new system, they got a nice number. Their forecast predicted 72 out of 100 actual rip currents. Seventy-two percent is a big jump over 40 percent, the best the official forecasts could do with the same rips. That sounds like a passing grade in most schools, but it's not good enough at Hopkins, not yet. Nelko still has more data to wade through.

The scientists want to raise their POD, their Probability of Detection, and lower their FAR, their False Alarm Ratio. Their forecast unfortunately also predicted rip currents when there were none, a prospect that might keep people at home on perfectly safe beach days. "If people don't go to the beach," says Nelko "then you have a lot of merchants who are not selling saltwater taffy. It has economic consequences." If everybody stays home, then nobody's selling much of anything, not T-shirts or hot dogs or hotel rooms with a high-angle view of the ocean.

IT COULD HAVE BEEN AN EVENING

like this. The chair towers are down, the guards are gone, and the slanting sun is lighting the ocean with a brilliant, celestial blue. The two boys who went swimming that evening stayed down at the south end of the beach where their parents could watch them from the shore. From there the father was able to watch as the rip current carried both the boys, now shouting, out past the jetty. And the mother was able to watch as the father, now swimming, went out in the glowing sea to save his sons.

It was a passing boat that pulled the boys to safety. And it was an off-duty lifeguard who found the father's body. They call the work "search and recovery," and lifeguards practice this drill also. It was Butch Arbin, captain of the Beach Patrol, who sat on the beach with a sobbing mother holding a two-year-old, now fatherless baby.

"Our guards don't remember every person they've saved. I don't remember how many people I've rescued," he says. "I just don't remember." But they clearly remember the ones they couldn't save. Around the country, most rip current drownings happen much like this one at Ocean City. No lifeguards in their chairs. No cameras in the sky.

And here's where new forecasts could save lives, even when lifeguards can't. For the foreseeable future, lifeguards will probably remain their own rip current forecasters, relying on their well-earned skills at reading the waves in front of them.

But for the rest of us who may be driving to the beach or standing on the sand trying to read the waves, good forecasts count. We heard the weather forecast before we left the house and we trusted it enough to get in the car and head out.

It's here perhaps, on beaches empty of lifeguards, that good rip current forecasts would matter the most, helping us decide whether to go home, rest on the beach, or go for a plunge in the unpredictable waves.

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Outsmarting a Killer

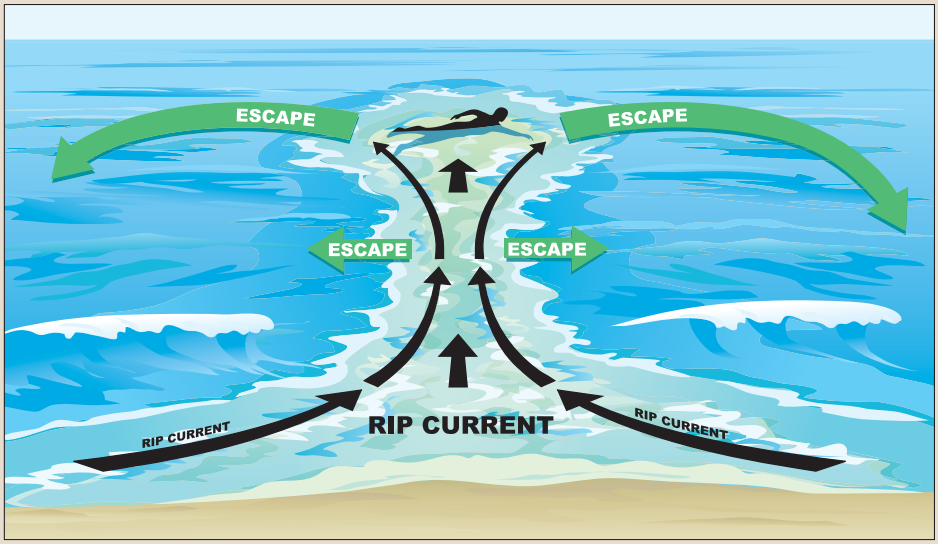
If you're swimming toward shore and the shore is moving away from you, you're probably caught in a rip current. You do have options — to swim out of the current or float with it — and both can work for you, but how well they'll work depends on what kind of swimmer you are and what kind of current you're in.

Rip currents are the offspring of incoming waves and the sandbars underneath them. When waves break over a sandbar, the backwash can be trapped in a trough, where it slides like a snake along the shore, looking for a break in the sandbars. When it finds one, it strikes straight out to sea, often with considerable speed, sometimes carrying swimmers and waders with it. According to a recent survey, rip currents on average kill more people per year than floods, tornadoes, lightning, or hurricanes. Sharks are more of a threat on television than on the beach where they average less than one kill per year.

Rips are more common when the waves are coming straight at the shore and sandbars are high enough to keep the backwash (sometimes called the undertow) from sliding straight back out under the incoming waves. They are more common during an ebbing tide when the trough water drops even further below the bars. During the slack of low tide, they may disappear altogether, leaving the sandbars, troughs, and channels exposed on the flats like a roadmap for tomorrow's rip current routes.

Not all wave trains come straight in. Many arrive at an angle to the beach, sometimes after traveling thousands of miles, and the result is a longshore current that flows down alongside the beach. Waves out of the northeast, for example, could set up currents flowing to the south. If you find yourself drifting well downshore from your beach blanket, you're probably caught in a longshore current.

As they cruise down the beach, these longshore flows can encounter nearshore sandbars and throw off eddies, small rips shooting off at odd angles. They can also throw off eddies if they bump into weak wave trains arriving out of the southeast. When a longshore current meets a jetty or a groin or a pier, it will swerve dramatically, creating a dangerous rip headed straight out to sea. Lifeguards call these "permanent rips," and they can be killers.



If you're caught in a rip, you have two options:

Plan A: Swim. Head for the side of the channel, swimming parallel to the beach or at an angle towards the beach. This is the most widely recommended advice. Swimming straight back against the current — with exhaustion as the likely outcome — is not a workable option.

Plan B: Float. Float and wait calmly for help. Eventually, somewhere beyond the breakers, the rips will slow down, spread out, and dissipate in the face of incoming sea swells, leaving you floating, perhaps not so far out from the beach. Some rips have been shown to curve back towards the beach.

Swim or float, which is your best option? To answer that you need to know yourself and you need to know your beach. Are you a strong swimmer with stamina? Can you float easily or tread water well (a trick that depends on body type as well as technique)? Are there lifeguards back there on the beach? If they're up there in the chairs, you can try floating and waiting for help. If the lifeguards are gone, and there's no one else around, you may need to swim. With both choices, calmness is key. Panic can be deadly.

— *M.W.F.*

Bilingual Rip Current Signs

To alert as many swimmers as possible about rip currents, Maryland Sea Grant has provided Ocean City with metal warning signs. Two years ago, the program presented 115 of these outdoor signs to the city and also sent 15 signs to the seashore at Assateague State Park. This summer, Maryland Sea Grant gave Ocean City 45 bilingual signs that carry warnings in both English and Spanish.

The outdoor signs form part of an ongoing nationwide campaign by the Sea Grant network, the National Oceanic and Atmospheric Administration, the U.S. Lifesaving Association, and others to educate swimmers about the deadly dangers of rip currents.

In Maryland, the Sea Grant effort began with calls from U.S. Lifesaving Association Member Tom Lott and from Chad Whitehead, a former Ocean City lifeguard who'd witnessed firsthand how rip currents can drag swimmers into danger.

To learn more, visit the web at: http://www.ripcurrents.noaa.gov/

Sea Change for Bay Beaches

Jack Greer

Darald Lofgren, recently turned 70, leans over and points to a shelf of tan-colored clay sticking out from the eroding banks of Mayo Beach. The air is humid. Perspiration dots his gray T-shirt. "Look at that," he says. "All these layers are getting exposed."

Small waves break against a few knuckles of clay that punch out of the crumbling bank, but otherwise it's all white sand here, stretching left and right, a prime stretch of swimmable beach right where the South River meets the Chesapeake. After all the creeks, rivers, and backwaters that have made the Bay so hospitable to human habitation, this strand feels more like ocean.

Looking at Lofgren, one can sense the layers. More than a half century ago, when he was 14 and sea level was lower, he worked a summer job here at Mayo Beach. Recently he found an old snow cone machine when he was going through a cluttered closet in one of the park buildings. When he looked at the scribbled list of sugary flavors, he recognized something. His own teenage handwriting. A layer, from long ago.

Now more layers are peeling away as the Bay chews into the shoreline. Sea level rise has eaten into this coastal plain for about 15,000 years, but recently it's been rising faster. And as water licks at the land it uncovers history. Lofgren has found Indian arrowheads here in the shorebreak, and parts of an old millstone. He feels pretty sure that there was a mill here, set by a tidal ditch, now overgrown, that carried water from a large inland pond to and from the Bay. "I told the County [Anne Arundel County] about the millstone," he says, "but so far there's been no interest."

There is a lot of history here at Mayo Beach, once owned by Commodore Isaac Mayo, naval hero of the War of 1812, and according to Lofgren, the man most responsible for locating the U.S. Naval Academy in Annapolis. In so many ways, Mayo Beach is only a shadow of what it once was.

Once Upon a Beach

Perched at the end of the Mayo Peninsula, Mayo Beach Park forms one of the white sand jewels that grace the Bay's Western Shore. Among them, to the north, there's Bay Ridge and Highland Beach. To the south, right next door, Triton Beach and Beverly Beach. And farther down the Bay, Chesapeake Beach. Each beach has its own story, its own rise and fall (see Once Were Bay Beaches, p. 16).

These small strips of sand, narrowed by eroding waters, once drew large crowds of city-dwellers from Washington, Baltimore, and beyond. Bay Ridge opened in 1880 and by 1895 the local newspaper estimated that 10,000 tourists attended the Fourth of July event there. According to Bay writer Lara Lutz, a large pavilion seated 1,600 diners at Bay Ridge, and the resort eventually covered over 380 landscaped acres.

In 1900, some fifty miles south, Chesapeake Beach opened in Calvert County. The Chesapeake Beach Railroad served the resort, and fliers proclaimed that the seashore was just an hour's train ride away from Washington, D.C. Tourists arrived to find a big wooden boardwalk, arcades, hotels, and a large roller coaster called the Great Derby.

For beaches on the Mayo peninsula, the heyday came a little later. Edgar Kalb opened Beverly Beach in 1925 and

***Bathers by the thousands** swarmed to beaches on the Mayo peninsula from the 1920s and 30s right through the 1960s — Mayo Beach, Triton Beach, and Beverly Beach (pictured here). Visiting them now usually requires a reservation.* PHOTOGRAPH COURTESY OF THE ENOCH PRATT FREE LIBRARY/ARCADIA PUBLISHING

bought neighboring Ford Beach (renamed Triton Beach) in 1942. In the late 1930s, Charles Trabing opened Mayo Beach to paying customers. By the 1950s, Mayo, Beverly, and Triton beaches were popular summer destinations. Cars crowded the road that led on and off the peninsula. Locals say they didn't even try to drive on summer weekends.

Some locals didn't complain. The crowds of city-dwellers brought summer work and much-needed dollars. Local boys worked as lifeguards, and one of those boys was Darald Lofgren.

At one time or another, including his student days at the University of Maryland, Lofgren lifeguarded at all three beaches. Now, decades later and after a long career in parks and recreation for Prince George's and Montgomery counties, he's returned to his home waters to serve as manager of Mayo Beach Park, owned by Anne Arundel County since 1976.

The beach is a far cry from the place he knew as a boy, and for eight years, he's watched some of that park slip away.

Losing Ground

The biggest change Lofgren noticed when he came back from serving in the Marines in the 1960s, was that the Bay had grown murkier. "You could just see that it looked different," he says.

It's not gotten better. This year the Chesapeake Bay Foundation released *Bad Water 2009: The Impact on Human Health in the Chesapeake Bay Region*, a report warning that bacterial levels appear to be rising in the Bay, perhaps linked to warming waters and a persistent overabundance of nutrients. Several life-threatening infections in boaters and bathers have raised serious concerns about the safety of swimming in parts of the Bay, especially after a heavy rainfall, according to the report (for a copy of *Bad Water 2009*, see www.cbf.org).

But the change that most worries Lofgren is quickening sea level rise. With every passing year, he's witnessed how the waves bite farther into the beach. He points to where fishermen could once hop from the shore onto the old stone jetties. Now he says they would have to wade out thirty feet or more to reach them.

Coming back to serve as manager of Mayo Beach *completes a circle for Darald Lofgren (left), who worked the Mayo beaches as a teenage boy. White sands made Mayo Beach a popular destination for decades, but now waves often break against eroding banks and shelves of clay (above). Lofgren has watched the peninsula change, and seen parts of the beach wash away.* PHOTOGRAPHS BY JACK GREER.

"There was a loop road that ran all around the property," he says, pointing toward an eroding shore and an expanding marsh filled with the common reed, Phragmites. "The road used to run outside that tree there, only a couple years ago." The tree now aims its roots toward the clouds. The rest of it lies in the Bay. There's no sign of the road.

At this rate, the place is going to melt away before his eyes.

Like much of the Bay's shoreline, Mayo Beach finds itself between a rock and a hard place. Its appeal lies in its open shoreline — according to Lofgren, the white sand there has always been natural. But if left as is, the beach will likely wash away. A plan by Anne Arundel County to erect large stone revetments and to place piles of rock offshore has raised concerns from environmentalists and drawn fire from local windsurfers worried about losing their launch site. It's a perfect storm of user conflicts. Environmentalists want to see a living shoreline that will preserve natural habitat. The windsurfers want access. And the County wants to keep its park from washing away.

Despite poor communication at the outset of the beach protection plan, the County agreed to meet with the windsurfers to hear their concerns. According to members of the Baltimore Area Boardsailing Association (BABA), the outcome appears to be an acceptable compromise. Contractors will widen the beach area available for launching sailboards and kayaks, and they'll angle a line of pilings to give them more sailing room.

Erik Michelsen, the local riverkeeper who's been fielding complaints, says it seems like a reasonable outcome. "The inescapable truth," he says, "is that the shoreline is migrating."

Of Time and Tide

Lofgren ambles back to the house that serves as his headquarters, an old dwelling encased in later additions. On the floor of a closet lie pieces of millstone he found. Another closet is actually a tight winding

Continued on p. 16

A New Day on the Bay

Jack Greer

Jack Greer

All smiles, reunion organizer *Preston Johnson directs out-of-town guests toward Mayo Beach. For Johnson and the large Copeland clan, this area is new territory, a great place to gather, swim, and fry up some fresh-caught fish.*

On a bright morning in mid-July, Preston Johnson stands at the turnoff for Honeysuckle Road, where signage is scarce, except for the uninviting "Dead End." Crape myrtle blossoms nod with wind in a nearby yard, and sunshine bounces between puffy gray-and-white clouds. Johnson has taped a white banner to his red SUV, and he's drawn arrows pointing right down that dead-end road.

One car after another pulls up and stops. Johnson's dark reflection melts away as windows roll down and smiling faces beam out. "Hey, Preston," they say. Or, "Hey, family."

One young woman brakes in front of him, cuts her eyes, and says with a taunting smile, "Hi, Little Preston."

Johnson, over six feet, with big hands and broad shoulders, smiles back. "Welcome," he grins. "You found it."

He waves her down the road, and her shiny Honda sedan follows the others toward the dead end that is Mayo Beach.

The wind blows out of the south and brings an Atlantic breeze barreling up the Bay. Crisp waves fold onto white sand. In the distance a sailboat works its way out of the West River. Here it feels all open air and sunshine. It feels like beach.

Today this thin stretch of sand and the grassy park behind it are the site of the Copeland family reunion. For the casual visitor the official signs guarding the park look off-putting, warning "By Permit Only." But for those who have rented the park for the day, it's a welcoming place.

The Copeland family would not always have been welcome here.

Before the late 1960s, it was not just the sand that was white on many of the Bay's commercial beaches. African Americans were not allowed, nor were Jews. It was a longstanding practice. In the late 1800s, the owners of the beach at Bay Ridge turned away the son of famous orator Frederick Douglass because of his race. A determined man like his father, Charles Douglass walked a little farther south and bought a piece of property from an African American farmer. The shoreline there became Highland Beach — a beach enjoyed by African Americans for decades, including such famous lights as Langston Hughes and Alex Haley.

Highland Beach, south of Annapolis, *was a summer resort for African Americans during the era of segregation. Charles Douglass (inset photo), son of abolitionist Frederick Douglass, founded Highland Beach.* PHOTOGRAPHS COURTESY OF THE HIGHLAND BEACH HISTORICAL COMMISSION/ RAYMOND LANGSTON/ARCADIA PUBLISHING.

Especially below the Mason-Dixon line, beaches, like so many other public spaces, were separate, even if not equal.

In 1964, the U.S. Congress passed the historic Civil Rights Act, the law that made it illegal to exclude patrons on the basis of race, creed, or color. Some beach owners vowed to close rather than integrate.

One era of the Bay beaches came to an end. But on this sunny Saturday in July, the news is anything but sad to Preston Johnson.

"I don't know much about this area," Johnson admits. "We drove up from North Carolina." He says that every year the large Copeland clan picks a different place to stage their reunion.

Preston says he and his extended family are loving their stay in Chesapeake Country. "Last night we went fishing out of that place near here… Chesapeake Beach. And we caught a cooler full of fish. Mostly spot. We've got them all cleaned up and today we're having a fish fry."

Another car pulls up. Another smiling face. More family. The Copeland clan. Once through the opened gate, people climb out, stretch their legs, reach for the blue-and-gray sky.

It's going to be a beautiful day.

For more about the history of Highland Beach, visit the town's web site at http://highlandbeachmd.org/.

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Bay Beaches, *continued from p. 14*

staircase, a throwback to old-time architecture.

From his office he can look out over the Bay and remember the past.

The Bay resorts that reigned at the turn of the 20th century lasted only a short time. The train line that delivered tourists to Bay Ridge closed in 1904. The big hotel there burned in 1915. Chesapeake Beach lost the impressive Belvedere Hotel to fire in 1923, and it was not rebuilt. In 1935 the last train left the Chesapeake Beach station bound for Washington.

Change had come to the Bay beaches. A layer of history peeled away.

In 1952, the new Preston Lane Bridge spanned the Chesapeake near Annapolis, and city dwellers extended their drives a bit farther beyond the sea-nettle-plagued Bay to reach the Atlantic. In 1968 Maryland outlawed slot machines, and the gambling pavilions that lined the Bay beaches went silent.

As the 1960s came to a close, civil rights also came to the region, changing the complexion of the Bay's beaches (see A New Day on the Bay, p. 15).

The landscape changed as well. Property surrounding the beaches began to sprout new houses, often as part of a beach owner's larger business plan. Faster automobiles and better roads meant more commuters could work in or near the big cities and still drive home to be by the Bay. More accessible air travel and growing affluence meant that many vacationers could go to the beach in Florida, the Caribbean, or Hawaii.

The Bay's shoreline entered a new era of mixed blessings. It gained big houses, countless cars, cell phones, and jet skis. It lost its clear waters, its underwater grasses, its sprawling oyster bars, and so much of its sandy shoreline. Washed beneath the tides of time are the old beaches where big city tourists once flocked to escape the heat, and where a local boy might make a buck, mixing up snow cones or lifeguarding for all those sunburned city folk.

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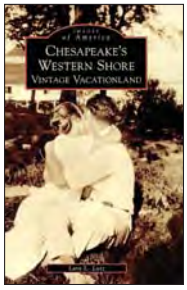
Jack Greer

White sands along the Mayo peninsula *shrink between relentless waves and spreading stands of common reed. Even this thin ribbon of beach draws a woman and her dog on a warm summer day.*

Once Were Bay Beaches



Grand hotels, dedicated railway lines, wide boardwalks, and a stream of big city tourists. For most of us, stories of the Bay's beach resorts have slipped into the past, a lost part of the region's history. Bay writer Lara Lutz has rescued those stories in a new book, *Chesapeake's Western Shore: Vintage Vacationland.* A pictorial tour, the book is part of the Images of America series produced by Arcadia Publishing.

In her introduction, Lutz traces the region's development from Bayside farming and fishing communities to inland cities built by the industrial age. Eventually those city dwellers, sweltering in summer heat, looked back toward the Bay for relief and for a quick get-away. She writes that some of these vacation spots were modest enclaves along quiet coves but that others sported large entertainment venues that drew thousands.

She also describes restrictions that banned minority races and religions, and how those minorities found their own places to enjoy Bayside fishing, picnicking, and swimming — places like Highland Beach near Annapolis and the Captain Salem Avery house in Shady Side.

Chesapeake's Western Shore gives an inside look at private resort communities that sprang up on rivers like the Magothy and the Severn, and at commercial beaches like Bay Ridge that looked straight out on the Bay. Those more accustomed to Ocean City and the Atlantic beaches will find an interesting portrait of shores on a smaller scale and intriguing pictures of the past.

Chesapeake's Western Shore: Vintage Vacationland by Lara Lutz, Arcadia Publishing, Charleston, SC, 2009, 128 pp, is available at bookstores and on the web.

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