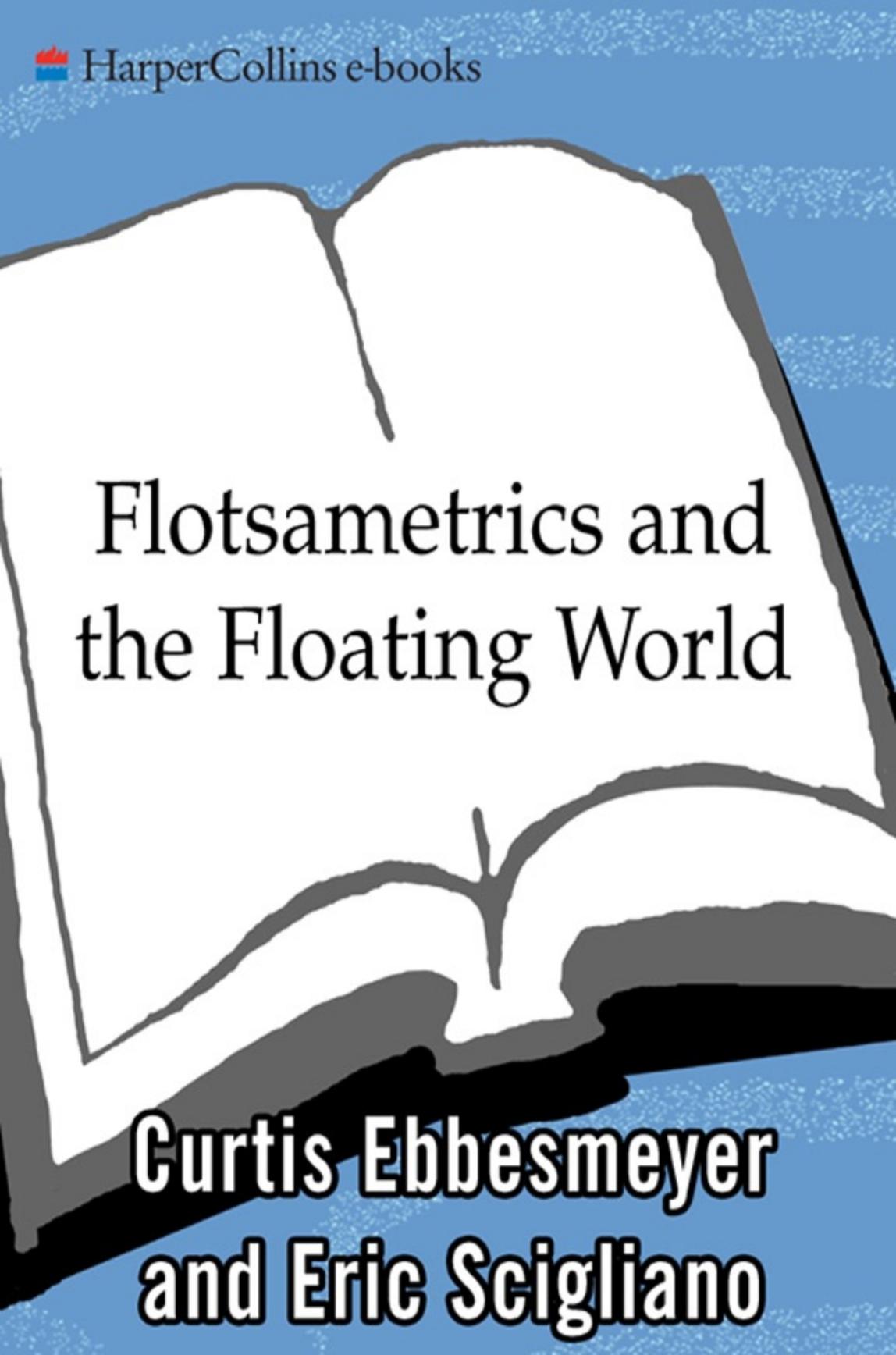




HarperCollins e-books



Flotsametrics and
the Floating World

**Curtis Ebbesmeyer
and Eric Scigliano**

How One Man's Obsession WITH
Runaway Sneakers AND *Rubber Ducks*
Revolutionized Ocean Science

 HarperCollins e-books

Flotsametrics



and the
Floating
World

CURTIS EBBESMEYER AND
ERIC SCIGLIANO



To Susie, who made this journey possible.



*Surely the sea
is the most beautiful face in our universe.*

— MARY OLIVER, “THE WAVES”

Contents

Epigraph iv

Preface: A New World x

1. Chasing Water 1

♦ *The shoe drops and a quest begins.* ♦ *Growing up near the sea but not on it.* ♦ *Chocolate and ducklings, Flotsam and Jetsam.* ♦ *An educational detour.* ♦ *Dance class and lifelong love.* ♦ *Escaping the draft and working for Big Oil.* ♦ *Hearing the oceanographic call.* ♦ *A boost from John D. Rockefeller.* ♦ *A mentor with a holistic approach to the sea.* ♦ *An aquatic snark hunt.* ♦ *Deadheads and Trident subs.* ♦ *Eulerian and Lagrangian viewpoints.* ♦ *Water bodies as granular and dynamic.* ♦ *Dabob Bay as oceanic microcosm.*

2. Oil and Icebergs 18

♦ *Jim Ingraham creates the Ocean Surface Current Simulator.* ♦ *The UW gang fans out.* ♦ *Mobil Oil's first oceanographer.* ♦ *Conspiring to make Big Oil prepare for big waves.* ♦ *Cliff Barnes's war with icebergs and U-boats.* ♦ *Riders on the icy sea.* ♦ *Life on ice islands.* ♦ *North Sea perils.* ♦ *Goodbye, Dallas; hello, Seattle.* ♦ *Knocking on doors.* ♦ *Sewage grease balls and a devil's staircase.*

♦ Akira Okubo, master of swarm mathematics. ♦ Daredevil drift reading on the Strait of Juan de Fuca. ♦ Chasing snarks with the Russians. ♦ An ocean full of eddies.

3. Messages in Bottles 45

♦ My father's many illnesses. ♦ Our family is reunited in Seattle. ♦ Oil bust and near bankruptcy. ♦ Chasing the Gulf Stream's frontal eddies. ♦ The frustrations of environmental consulting. ♦ Low-tech drift sticks on Port Ludlow. ♦ The Vikings release the first ocean drifters and find new harbors. ♦ Yasuyori's wave-borne verse. ♦ The science of determinate drifters and the mystique of message bottles. ♦ Edgar Allan Poe, oceanographic seer. ♦ Guinness rules the waves. ♦ The czar's bottle. ♦ Gospel bombs and bottled salvation. ♦ I dedicate myself to drifters.

4. Eureka, a Sneaker! 70

♦ The Great Sneaker Spill. ♦ Shippers stonewall, but Nike shares its secrets. ♦ The joy of beachcombing. ♦ OSCURS predicts the sneakers' path. ♦ Another spill: beavers, frogs, turtles, and ducks. ♦ Ducky mania. ♦ OSCURS aces another blind test. ♦ The tub toys round the Aleut Gyre. ♦ Pacific Pathways comes to Sitka. ♦ Oceanic wheels within wheels. ♦ An epic freedom drifter. ♦ Hockey gloves outrace sneakers. ♦ Wind and waves sort left from right. ♦ Why nature is two-sided.

5. Coffins, Castaways, and Cadavers 94

♦ Four right feet. ♦ The float-away corpse. ♦ Ignoring the oil-spill omens. ♦ Dad's passing and the Beachcombers' Alert. ♦ Isis, Osiris, Moses, and Genghis. ♦ Freedom floaters and the Loop Current. ♦ Nelson Eddy strikes. Freedom's price. ♦ Floaters and sinkers. ♦ Follow the shark. ♦ The mystery of Barnacle Bill. ♦ The dead don't stay down. ♦ I lose my sea legs.

6. The Admiral of the Floating World 118

♦ Far-flung flotsam in the Mediterranean catch basin. ♦ Awakening to Columbus. ♦ How sea beans conquered the sea. ♦ The first flotsamologist. ♦ The Azores dumping ground. ♦ Messengers from "Cathay." ♦ Invasion of the Finnmen. ♦ Reading the waters, not the maps. ♦ Phantom islands. ♦ Cross Creek's floating archipelago. ♦ Columbus's message in a barrel.

7. Borne on a Black Current 138

- ♦ *Ancient volcanic emigrants.* ♦ *The mighty Kuroshio sweeps them away.*
- ♦ *Asian infusions in America.* ♦ *Castaways from the hermit shogunate.* ♦ *Ranald MacDonald's bold mission to Japan.* ♦ *Wrecked junks at Malarrimo.* ♦ *The American Coastal Pathway.*

8. The Great Conveyor 152

- ♦ *Ban beans, brick beads, and buoyant urns.* ♦ *One mystery leads to another.*
- ♦ *The forgotten gyres, rediscovered and renamed.* ♦ *Amos Wood follows the fishing floats.* ♦ *Buzzy's board rounds the gyre.* ♦ *Tracking water by standing still.*
- ♦ *Orbital periods.* ♦ *Handoffs between gyres.* ♦ *Wheels within watery wheels.*
- ♦ *The global conveyor belt.*

9. Ashes to Ashes, Life from the Sea 171

- ♦ *Akira and Keiko, apart but inseparable.* ♦ *A young planet covered in floating rock.* ♦ *Pumice as primordial incubator.* ♦ *Akira and I broach our new theory of life's beginnings.* ♦ *Akira's end.* ♦ *A farewell feast.* ♦ *We flush Keiko out to sea.* ♦ *My parents join Akira and Keiko in the Turtle Gyre.*

10. Junk Beach and Garbage Patch 186

- ♦ *Growing official and corporate indifference to marine environmental threats.*
- ♦ *Deaf ears and cold shoulders.* ♦ *Frustration and early retirement.* ♦ *How a garbage patch forms: Hadley cells and reverse hurricanes.* ♦ *Huxley and Mann on Rubber Beach.* ♦ *St. Paul's suffering fur seals.* ♦ *Collector beaches.* ♦ *Hawaiian convergence.* ♦ *How the islanders used the currents.* ♦ *We reach Junk Beach.*
- ♦ *Cleanups, pileups, and an unending washup.* ♦ *Charlie Moore's war on marine dumping.* ♦ *Turtle beach and plastic sea.*

II. The Synthetic Sea 208

- ♦ *Plastic, born in mimicry.* ♦ *Pool balls and piano keys: seeking an ivory substitute.* ♦ *Plastic-packed albatrosses.* ♦ *Molecular mimicry.* ♦ *Endocrine disruptors and feminization.* ♦ *Nurdles sponge up greasy pollutants.*
- ♦ *Petroleum, plastic, lead, and mercury: which is worse?* ♦ *Rat poison canisters at the Fun Fair.*

12. The Music of the Gyres 222

- ♦ *The gyre orbits add up.* ♦ *Oceanic octaves, a global harmonic series.*
- ♦ *Melting the Arctic and speeding the gyres.* ♦ *Farewell, fundamental tone.* ♦ *Finding hope.*

Appendix A: Urban Legends of the Sea 229

The cold truth about Theophrastus's bottles, Queen Elizabeth's uncorker, the Octavius's drift, the Sydney's globe-circling lifebelt, Daisy Alexander's \$6 million bottle, and Clyde Pangborn's missing wheel.

Appendix B: A Million Drifting Messages 233

Appendix C: The Oceanic Gyres 235

Average orbital periods, dimensions, and orbital speeds of the eleven main oceanic gyres.

Appendix D: Ocean Memory 236

Appendix E: Harmonics of the Gyres 238

Gyres and other orbiting currents classified by tone—length of orbital period—from longest to shortest.

Acknowledgments 240

Illustration Credits 242

Glossary 243

Further Reading 247

Index 267

About the Authors

Credits

Cover

Copyright

About the Publisher

Preface: A New World

Dave Barry, who often harkens back to his salad days as a reporter covering sewage treatment, isn't the only journalist to recall that unglamorous beat fondly. Call it perverse, but I found the subject fascinating. That was partly because the stakes seemed so high out here: Seattle and the towns around it dump their effluent into Puget Sound, a spectacularly beautiful, fruitful, and fragile body of water. But it was also because I and others covering the subject had Curt Ebbesmeyer to talk to. Ebbesmeyer was the go-to guy on the Sound's mysterious ways, the oceanographer who could explain how its waters moved and how things dumped into them did or didn't get flushed out to the open sea. He was always ready to share what he knew, and to put it in terms that whoever was listening could understand.

Over the years, since we've both moved on from the sewage beat, I've often seen Ebbesmeyer quoted in the local and national papers or heard him answer a radio interviewer's questions. The topics have grown ever stranger: spilled shipping containers, "shoenamis" of sneakers, flotsam flocks of rubber (actually plastic) duckies, drifting corpses, even severed

feet. But however exotic these objects might be, they had one quality in common: They all floated on the sea, sometimes for astonishing distances, and in the process revealed oceanic processes as intricate and finely meshed as the workings of a clock or a living organism. Many speak of the sea as a living thing, but for most that's just a metaphor or vague intuition. For Curt Ebbesmeyer it's a concrete reality, to be studied in the same ways a physiologist deciphers the body's processes and a physician diagnoses its ills.

Just as a good doctor learns to read every clue, however unexpected, Ebbesmeyer finds telltale data where others see only trash—in the most literal sense. As he says, every piece of flotsam has a tale to tell—one small piece of the ocean's great story. And anyone who is willing to pay attention, who has the feet and eyes and curiosity to comb a beach, can join in unraveling that story.

I saw how infectious Ebbesmeyer's own curiosity can be—and how much inspirational and instructional effect it can have—at the Beachcombers' Fun Fair held each squally March in the amiably ramshackle resort town of Ocean Shores, Washington. Other scientists might dismiss the participants in such a homespun event as mere hobbyists; beachcombers do pursue their flotsam treasures as avidly as stamp or doll collectors. But Curt sees them as researchers in the rough, potential recruits to a worldwide army of flotsam finders and ocean monitors. The high point of each year's Fun Fair at Ocean Shores is the Dash for Trash, a scavenger hunt-cum-beach cleanup. Scores of trash dashers scatter along the sprawling sands of what tourism boosters bill as the “world's longest ocean drive,” fill up heavy black garbage bags, and throng around a folding table where Curt Ebbesmeyer waits.

One by one, they present their booty. He spreads it out and pores over it, patiently explaining each relic's meaning: This plastic tube is an oyster spacer bar, torn loose from a Japanese shellfish farm. This serrated black plastic cone is the cap of a hagfish trap, used to catch eel-like sea-bottom scavengers that are savored in East Asia. These chemical glow sticks are used to attract swordfish and halibut to hooked longlines (as in miles long). Good thing you retrieved this scrap of net before a plus tide dragged it back out to sea, where it might strangle a seal or seabird. Likewise this plastic

bag—it only takes one to choke any sea turtle that mistakes it for a jellyfish. And what on earth is *this*?

Ebbesmeyer habitually hunches forward, leaning yet farther in to catch questions from children. His is the posture of a man who's spent much time poring over spread charts and rubble-strewn beaches—or of a bear craning to snuff up a treat. He is a large man, tall and no longer lean, with a shock of white hair that's congenitally tousled and incongruously boyish. His beard covers a receding chin and jowl, and though it's cropped short it lends a Santa Claus quality, an impression abetted by his wide grin and twinkling, bespectacled eyes. He dresses in classic Seattle casual: khaki pants, comfortable shoes, a lightweight parka over loose-fitting plain sweaters, just the threads for a walk on a Northwest beach. He's often mistaken for a prof, though he's worked in the wider world since taking his PhD, feeling more at home on bouncing boats and in the rough-and-tumble of the oil derricks than amid the intrigues of academe. Indeed, academia may be one of the few places Curt Ebbesmeyer does not feel at home.

He listens patiently when others talk; his curiosity ranges far, and people, like flotsam, often have unexpected stories to tell. When he speaks, he emphasizes big points by pausing wide-eyed, brow arched as though shocked at his own impertinence, soliciting assent or disputation before he continues. He exclaims, "Cool!" at good news and interesting ideas and shakes hands in the raised-arm, power-to-the-people clench of the sixties. Somehow, these do not seem like anachronisms or affectations in a sixty-five-year-old man. They're just further signs of his enthusiasm and affability.

Ebbesmeyer's voice is gentle, a gravelly low tenor. It is not a conventional speaker's voice, but he captivates the audiences he addresses, and he addresses many. Though he would blush at such terms, to a far-flung community of beachcombers, ocean watchers, and amateur "flotsamologists," he is a guru and oracle—the man who taught them to read flotsam and love the ocean more deeply. He insists he learns from them.

At the beachcombers' fair, I spoke to a cheerful young man named André Hart and his wife and mother. For them, beachcombing was more than a sideline or diversion; it was a lifeline. In 1993 Hart suffered a severe

head injury, courtesy of a drunk driver, and fell into a long coma. For years after he awakened, his mother, Priscilla Hart, explained, “he didn’t find anything he could enjoy or get involved in. Then we took him beachcombing. Now he does it all the time. He gets up at four in the morning so he can go scour the beaches. His life just revolves around this, and around *him*.” She nodded toward Ebbesmeyer, who was judging trash. “At first, all we did was look for garbage. Then Dr. Ebbesmeyer enlightened us. We started seeing more there.” Now they talk of selling their house, buying a camper, and following the storms and flotsam year-round.

We writers have taken as much in our way from Curt Ebbesmeyer’s work as the Harts have. Many have built articles or books on the perambulations of the sneakers and bath toys. Some have appropriated his ideas or incorporated them without knowing where they came from; so familiar has the great “garbage patch” in the North Pacific become that no one seems to remember that it was Curt who coined the term. But what they’ve had to share is just—the clichés are irresistibly apt here—the tip of the iceberg and the surface of the sea. His most exciting and original work has remained buried in scholarly journals or the files that fill his basement. So widely have Curt’s thoughts and research ranged that assembling them in a coherent narrative proved daunting even for him—“like drinking from a fire hose,” as he likes to say. It’s been a pleasure and a privilege to assist, and to journey with, Curt through the floating world.

Eric Scigliano
Seattle, July 31, 2008

I. Chasing Water

I was a penniless, uneducated man.

A piece of driftwood.

—ABRAHAM LINCOLN

In the wee hours of May 27, 1990, midway between Seoul and Seattle, the freighter *Hansa Carrier* met a sudden storm and, as freighters often do, lost some of the cargo lashed high atop her deck. Twenty-one steel containers, each forty feet long, tore loose and plunged into the North Pacific. Five of those containers held high-priced Nike sports shoes bound for the basketball courts and city streets of America. One sank to the sea floor. Four broke open, spilling 61,820 shoes into the sea—and into the vast stream of flotsam, containing everything from sex toys to computer monitors, that is released each year by up to ten thousand overturned shipping containers.

One year later, in early June 1991, I stopped by my parents' house in Seattle, as I did every week or so, for lunch and the latest news. My mother, who loved serving as my personal clipping service, had extracted a wire story from the local paper. It reported a strange phenomenon: Hundreds of Nike sneakers, brand-new save for some seaweed and barnacles, were washing up along the Pacific coasts of British Columbia, Washington, and, especially, Oregon, Nike's home state. A lively market had developed; beach

dwellers held swap meets to assemble matching pairs of the remarkably wearable shoes, laundered and bleached to remove the sea's traces. The details as to how they'd gotten there were sketchy, verging on nonexistent, and that piqued my mother's curiosity. "Isn't this the sort of thing you study?" she asked, assuming as ever that her son the oceanographer knew everything about the sea. "I'll look into it," I said.

I started looking and never stopped. Seventeen years and many thousands of shoes, bath toys, hockey gloves, human corpses, ancient treasures, and other floating objects later, I'm still looking.

Objects like these have been falling into the sea and washing up on the shores since the dawn of navigation—for billions of years, if you count driftwood, volcanic pumice, and all the other natural materials that float upon the waves. Ordinarily, flotsam is soon lost to human memory—though not, as we shall see, to the ocean's memory. The Great Sneaker Spill would have proved one more curiosity in the annals of beachcombing if my mother hadn't asked her question, and if I hadn't been ready to see the research doors that it opened.

It's only now that I can see how my entire life—from my first childhood encounters with the sea to decades of mainstream research into currents, tides, drifting pollutants, and the curious mobile water bodies called slabs—had prepared me for the puzzle posed by this spill. These thousands of lost sneakers composed a giant scientific experiment on a silver platter, fully if unwittingly funded by Nike—a serendipitous window into the ocean's deepest secrets. They were also the grain around which a worldwide network of beachcombing field volunteers has formed, zealously scouting out and recording telltale washups from Norway to New Zealand.

These high-seas drifters offer a new way of looking at the seas, their movements, and, as we shall see, their music. Call it "flotsametrics." It's led me to a world of beauty, order, and peril I could not have imagined even after decades as a working oceanographer—the floating world.

I did not grow up beside the sea; we lived across the San Rafael Mountains in the hot and dusty San Fernando Valley. My mother and father were



Budding oceanographer Curt Ebbesmeyer, age four, learns about seaweed from his parents at Zuma Beach, California.

raised in Chicago and never saw the ocean until the war brought them to California in 1941. But we were close enough to the water to pine for it—and to escape to the beach whenever we had a free day. Perhaps being so near and yet cut off from the sea made me crave it all the more.

As far back as I can remember, I was fascinated with water and its movements. As soon as I could get my hands on a garden hose, I stuck it in the ground and watched the soil bubble up and wash away around it, like sand on a beach. I would make a pond out of my red Radio Flyer wagon, filling it with water and setting toys and beer bottles floating across it. In elementary school I wrote a story about Paul Bunyan but recast him as a giant of the ocean rather than the woods, striding from sea to sea in his seven-league boots.

My father was a chocolate salesman. Perhaps this followed from his mother's career back in Chicago—making bootleg whiskey, a trade she learned growing up on an Iowa farm and then used to see her children

through the Depression after her husband died as the result of an industrial accident. Dad's stock-in-trade was a fine German chocolate brand named Merckens. Twice a month he drove up the coast from Los Angeles to San Francisco teaching small candy shops along the way how to dip conventional American chocolates in melted Merckens. He was a natural at such performances—tall and mirthful, with hair turned a distinguished premature white by all the ether he'd been administered as a teenager during operations on a badly broken ankle. He was a born starter-upper, always organizing projects when he got home—a go-kart for us, new trees for the yard, a block wall around our entire half-acre lot.

Dad's sales trips usually lasted a week, and after each he brought home presents for my brother Scott and me. One Easter, when I was about ten years old, he brought two yellow ducklings. With characteristic whimsy, he named them Flotsam and Jetsam, names that would stay with me for the rest of my life. No one could have guessed how prophetic that gift would prove to be.

Even Dad's chocolate trade seems in retrospect to have forecast the path I would take. The Western world's first chocolate salesman was Christopher Columbus, who brought Europe its first cacao beans when he returned from America. And it was flotsam that led Columbus to America in the first place.

As I grew up, I returned again and again to the water. I took up surfing and scuba, in effect making my body a tool for flotation experiments. The sea was such a presence in my life that I took it for granted; I did not imagine it could be a subject for formal study when the time came to start college.

Choosing a school was no problem; San Fernando Valley State College (now California State University at Northridge) was nearby and cost just \$25 a semester. But I had no inkling what I wanted to study there; I felt then, as I've often felt since, like Abraham Lincoln's "piece of driftwood." Mom and Dad couldn't offer much help; they'd never been to college. But I was pretty good at math and science and liked doing projects, so when I visited campus I stopped by the Engineering Department. It was just start-

ing out and eager for good students who could help it win accreditation. The staff persuaded me to take an aptitude test. I got the top score, and they begged me to enroll, which sounded appealing at the time.

I completed my degree in mechanical engineering, but belatedly realized I had no real enthusiasm for it. I did, however, discover one lasting passion at Valley State. In those days, high schools and colleges still required physical education, and I struggled to fit PE credits into my schedule. By my junior year I was working forty hours a week at the phone company while carrying seventeen units of physics, chemistry, and engineering; any PE class I could take would have to start early, and I would have to wear a suit and tie so I could dash off to work afterward. I found a 7:00 AM dance class. Fair enough—my parents had made me take dance classes during high school, and I'd gotten catcalls when I ducked out of track practice early and the coach hollered, "Curt is leaving for his dance class!"

I showed up in my suit for my first college dance class and discovered about three guys and thirty girls had also enrolled. My eyes went straight to one of the women, and I still remember what she wore: white high heels, a pink sleeveless shift and matching sweater—Jackie Kennedy—style—with



It all started at dance class. Young sweethearts Curt and Susie arrive at his fraternity house.

her hair teased into a fashionable beehive. When it came time to select partners, I walked straight over to Susie and asked for the first dance. It was love at first sight, the greatest “Aha!” moment of my life. We danced together through the whole class, and afterward I asked if I could walk her to her next class—quickly, because I had to get to work. From then on we were inseparable. In April 1965, shortly before I graduated, we got married. Soon afterward, Susie introduced me to her great passion, the ballet. In the forty-three years since, we must have attended a hundred performances. I’ve come to see how the movements of the ocean are a sort of ballet, the drift of flotsam choreographed to the music of the currents.

June 1965 was not an auspicious time to lose a student deferment. Three months earlier the first Marines had gone ashore in Vietnam; by the end of that year 180,000 American soldiers, sailors, and airmen would be serving there. And there was a very good chance I would soon join them.

But that was not the most pressing thought on my mind as I finished college. Before I could worry about whether or not I would go to war, I needed to find a job. And for the first (but far from the last) time, fate in the form of petroleum intervened in my life. It’s surprising, and a little shocking, to think how much of my life has been intertwined with oil—the best and worst of substances, which powers ships, produces plastic, fouls the ocean, and enriches and ravages human life like nothing else. Oil has greased the tracks of my life’s progress and marked each milestone in my understanding of the floating world.

As graduation approached, I happened to spot a notice on a bulletin board at the Business Department announcing that Standard Oil of New York (later Mobil Oil) would be interviewing on campus. When I showed up, I discovered that only the company’s Advertising Department was represented. But the interviewer recommended me to someone who might have something more up my line: Bill Clauser, chief of oil production in Standard/Mobil’s Bakersfield District.

Clauser was an old-style Southern gentleman with a well-developed sense of Southern hospitality. My interview with him was an unusual one: