

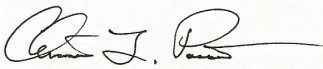
October 28, 2013

Dear all,

Thank you so much for taking the time to read this. I really value your feedback. The following is the first chapter of my forthcoming book, *Between Land and Sea: Narragansett Bay and the Transformation of the New England Coast*. This is an environmental history of Narragansett Bay (Rhode Island) from first European settlement in 1636 and ending in 1849, with the final dissolution of the Blackstone Canal Company, which completely reengineered the upper reaches of the estuary's watershed. My goal is to write littoral spaces—coasts and estuaries or what I see as the watery borderlands of early modern cultural contact and exchange—into Atlantic history. I show that at the nexus of land and sea, or the confluence of sweetwater and seawater, there existed a whole host of political, cultural, and legal ambiguities shaped by the tensions between what the English saw as improvable land, or spaces capable of progress, and an eternal, unchanging sea. As settlers modified these conceptually and ecologically complex environments to meet their needs, they changed what had been a broad coastal margin into a more clearly defined edge or “coastline.” And this, I argue, made the coast less resilient, or less capable of absorbing the blows of human initiative and natural variation. My book, therefore, makes a case for rethinking the definition of progress so that it includes space for impermanence. As much of the globe faces water shortages while sea levels continue to rise, an examination of past relationships between freshwater and saltwater, land and sea, and of the spaces precariously perched between them may help us rethink the notion of “progress” in ways that account for instability, uncertainty, and continuous change.

I know this is long, but I'd love to hear your thoughts on how it could be improved. Again, thank you!

Best,



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Chapter 1

CLAMS, DAMS, AND THE DESICCATION OF SEVENTEENTH-CENTURY
NEW ENGLAND

In July 1636 the coastal trader John Gallop weighed anchor from a harbor in eastern Connecticut and steered his bark of twenty tons southwest toward Long Island. Sailing before what was likely a fickle, northerly wind across the placid waters of the Sound, Gallop, traveling with a man and two boys, was forced to abandon his intended destination when the wind shifted. Changing course, he sailed east into the open ocean toward Manisses or Block Island, a pear-shaped splotch of land fourteen miles east of Montauk and thirteen miles south of the Narragansett Country. About two miles north of the island they came upon a small boat, which Gallop recognized to be that of fellow coaster, John Oldham. To his count, fourteen Indians were on deck, and several others paddled a nearby canoe toward shore. Upon hailing Oldham, Gallop and his crew received no reply.¹ A simple day trip to Long Island, Gallop soon discovered, would grow quite complicated in the coastal waters south of Narragansett Bay.

That such a bizarre scene was unfolding on a vessel owned by Oldham, whose lack of scruples had earned him wide notoriety, seemed not altogether impossible. A troublemaker through and through, Oldham had flirted with impropriety since the day he landed on American soil. Not long after arriving in Plymouth in 1623, Oldham, according

¹ John Winthrop, *Winthrop's Journal: History of New England, 1630-1649*, vol. 1, ed. James Kendall Hosmer (New York: Charles Scribner's Sons, 1908), 183.

to Plymouth Colony Governor, William Bradford, “grew very perverse and showed a spirit of great malignancy.” Later accused of religious subversion, Oldham responded with impertinence, hurling invective at his accusers and even drawing a knife on Captain Myles Standish.² Banished from Plymouth, Oldham fled to Massachusetts Bay, settling first in Nantasket, then Cape Ann, and finally Watertown, where he continued to indulge his penchant for mayhem. In July 1632, noted Massachusetts Bay Governor, John Winthrop, he fired his musket loaded with pistol bullets and shot “three men, two into their bodies, and one into his hands.”³ Fortunately, he had been at such a distance that he inflicted only superficial wounds. A month later, however, Oldham burned down his own house at Watertown “by making a fire in it when it had no chimney.”⁴ So quick-tempered was Oldham that his contemporary Thomas Morton called him “a mad Jack in his mood.”⁵ Unflinching in the face of risk or confrontation and increasingly unwelcome ashore, Mad Jack soon became the most experienced and savvy coaster in New England.

Despite his unsavory reputation—or perhaps because of it—Massachusetts Bay sought Oldham’s extensive knowledge of the New England coast when they asked him to retrieve a hefty ransom on the colony’s behalf. Four years earlier in 1632 Indians (likely Western Niantic) killed the English traders John Stone and Walter Norton, and the Pequots of eastern Connecticut were blamed. A Pequot delegation presented magistrates in Boston with two bushels of wampum and a bundle of sticks representing the number of

² William Bradford, *Of Plymouth Plantation, 1620-1647*, ed. Samuel Eliot Morrison (New York: Knopf, 1952), 151, 157.

³ Winthrop, *Winthrop’s Journal*, 1: 83 n. 1, 83.

⁴ *Ibid.*, 90.

⁵ Thomas Morton, *The New English Canaan*, ed. Charles Francis Adams, Jr. (Amsterdam, 1637; Boston: The Prince Society, printed by John Wilson and Son, 1883), 40.

beaver and otter with which they would compensate the English for the deaths.⁶ They sought peace with the English and also requested help establishing concord with the Narragansett, who bordered them to the east. The English, in turn, demanded the Indians responsible for killing Stone and Norton, a promise not to interfere with English settlement in Connecticut, and 400 fathoms of wampum and the pelts of 40 beaver and 30 otter.⁷ This final demand was oppressive. The pelts could be readily acquired, but 400 fathoms of wampum—2,400 feet, or nearly a half-mile comprising roughly 120,000 hand-carved shell beads, which promised to take ten skilled artisans almost a year to produce—was truly onerous.⁸ And it was the irascible Oldham's job to collect it.

That Oldham was nowhere in sight while a band of Indians, "armed with guns, pikes, and swords," unfurled his vessel's canvases signaled to Gallop that something was dreadfully wrong. By John Winthrop's account, Gallop responded swiftly by showering the Indians with "duck shot."⁹ He then drove the stem of his bark into the aft quarter of Oldham's pinnace, nearly capsizing it. So frightened were the Indians that "six of them leaped overboard and were drown." Gallop then pulled away and his crew positioned their anchor so that when they rammed the pinnace a second time, the anchor pierced its bow, the two vessels thereby "sticking fast." At close range Gallop's crew blasted the vessel with shot and then "raked her fore and aft," whereupon four or five more Indians

⁶ Winthrop, *Winthrop's Journal*, 1: 140.

⁷ Bradford, *Of Plymouth Plantation*, 291.

⁸ A fathom is six feet. So 400 fathoms equals 2,400 feet. There were roughly 300 wampum beads per fathom, which amounted to a total of 144,000 individual beads. A single person could produce between 36 and 48 white wampum per day. Purple wampum took twice as long. See Paul A. Robinson, "The Wampum Trade in 17th-Century Narragansett Country," in *What a Difference a Bay Makes* (Providence, R.I.: Rhode Island Historical Society, 1993), 27.

⁹ Winthrop, *Winthrop's Journal*, 1: 184.

leapt into the sea and drowned. Finally, Gallop stood off a third time, then sailed alongside and boarded. They bound one Indian and threw him in the bark's hold. They bound another and threw him into the ocean. They deigned to apprehend two Indians who had locked themselves with their swords in a small room belowdecks. While removing the sails and various provisions from the vessel, Gallop and his crew found, under a seine net, John Oldham's naked body, "his head cleft to the brains, and his hand and legs cut as if they [the Indians] had been cutting them off, and yet warm." They attempted to tow the battered boat toward the mainland (with the Indians still hiding inside), but facing nightfall and building winds, they set it adrift. Before casting off the line, they dragged Mad Jack's mangled corpse to the gunwales and "put him into the sea."¹⁰



Figure 1: Map of southern New England.

¹⁰ Ibid.

For the first generation of settlers, danger lurked at the ocean's edge. Although estuaries were the natural sites of settlement, their entrances and passages were often difficult to discern. From the deck of a ship, important headlands blended into what appeared to be a seamless timberline, making it all too easy to lose one's way. Dotted with rocks and shoals and frequently harboring disease, coasts were known to kill with caprice.¹¹ But among early explorers and traders, it was the specter of Indian attack that instilled truly penetrating fear. While surveying Cape Cod Bay for the first time, a group of Pilgrim scouts only narrowly escaped a barrage of Indian arrows on the beach early one morning.¹² When trader Henry Spelman sailed up the Potomac in 1623 he was so quickly surrounded by Indian canoes that he and his men managed to fire only one shot before they were killed and one boy, Henry Fleet, was taken captive.¹³ Similar accounts haunted English sailors up and down the coast of America. Invariably, anxiety was met with suspicion, and violence was met with retribution. Disorienting and uncontrolled, the coast played host to decades of struggle.

The assassination of the tribute collector, accordingly, led to calamity. First the English attacked Pequots on Block Island and then Saybrook. The Pequots responded by attacking English towns in Connecticut. This chain of reprisals culminated in May 1637 when the English, with Narragansetts, Mohegans, and Niantics surrounded and massacred the Pequots at Mystic, almost annihilating the tribe in the process. The bloody

¹¹ Lauren Benton, *A Search for Sovereignty: Law and Geography in European Empires, 1400-1900* (New York: Cambridge University Press, 45-49).

¹² [Edward Winslow], [*Mourt's Relation*.:] *The Journal of the Pilgrims at Plymouth in New England, in 1620*, ed. George B. Cheever (London, 1622; reprint, New York: John Wiley, 1848), 45.

¹³ James Rice, *Nature & History in the Potomac Country: From Hunter-Gatherers to the Age of Jefferson* (Baltimore: Johns Hopkins University Press, 2009), 89.

abandon with which the English slaughtered the Pequots left even their Indian allies appalled.¹⁴ The ferocious manner in which they engaged their foes did much to establish English dominance across southern New England during the seventeenth century. But Oldham's murder and the chaos that followed also underscored the ways the English, and Massachusetts Bay in particular, had begun to exact tribute, often at usurious levels, which, fomented rancor among indebted tribes and their allies.

For Native Americans, wampum, before Europeans adopted its use, was, according to seventeenth-century observer Daniel Gookin, used to "pay tribute, redeem captives, satisfy for murders and other Wrongs, [and] purchase peace with their potent neighbors, as occasion requires."¹⁵ It was also used to confer high social status. William Bradford noted that only "sachems and special persons ... wore a little of it for ornament."¹⁶ Wampum was essentially valued for its ability to generate social order and hierarchy. But as Europeans vied to become the arbiters of that order, they imbued these shell beads with their own value systems. Reflecting New England's growing radiance in the economic firmament of an expanding Atlantic world, William Wood observed of the Narragansetts, "The northern, eastern, and western Indians fetch all their coin from these

¹⁴ Mark G. Soulsby, "Native American Trade and Exchange Systems in Southern New England" (Ledyard, Conn.: Mashantucket Pequot Tribal Council, 1994), 50.

¹⁵ Daniel Gookin, *Historical collections of the Indians in New England. Of their several nations, numbers, customs, manners, religion and government, before the English planted there. Also a true and faithful account of the present state and condition of the praying Indians ... Together with a brief mention of the instruments and means, that God hath been pleased to use for their civilizing and conversion ... Also suggesting some expedients for their further civilizing and propagating the Christian faith among them.* (1674; Boston: Apollo Press by Belknap & Hall, 1792), 12.

¹⁶ Bradford, *Of Plymouth Plantation*, 203.

southern mintmasters.”¹⁷ Wampum had become money, and this developing market mentalité had far-reaching social and ecological repercussions.

As shell beads circulated inland they transformed the fur trade. More and more pelts were drawn to the coast.¹⁸ By the end of the 1620s a veritable “wampum revolution” had invigorated the Dutch West India Company fur trade along the Hudson River.¹⁹ Highly durable and easily portable, wampum soon spurred trade across southern New England and eventually across the entire Northeast.²⁰ Mounting demand for wampum, in turn, changed Native American patterns of subsistence, as more of them shifted their efforts toward wampum production.²¹ Such efforts sent waves well beyond American shores, as wampum spurred a wider economic exchange between the North American “periphery” and European “core.” Furs and other commodities purchased with shell beads were exchanged for European supplies and metropolitan credit.²²

¹⁷ William Wood, *New England's Prospect: A True, Lively, and Experimentall description of that part of America, commonly called New England: discovering the state of that Countrie, both as it stands to our new-come English Planters; and to the old Native Inhabitants*, ed. Alden T. Vaughan (London, 1634; reprint, Amherst: University of Massachusetts Press, 1977), 81.

¹⁸ William B. Weeden, “Indian Money as a Factor in New England Civilization,” in *Institutions and Economics*, vol. 2, ed. Herbert B. Adams, Johns Hopkins University Studies in Historical and Political Science (Baltimore: Johns Hopkins University, 1884), 395. “Wampum,” Weeden observed, “was the magnet which drew the beaver out of the interior forests.”

¹⁹ Neal Salisbury, *Manitou and Providence: Indians, Europeans, and the Making of New England, 1500-1643* (1982; reprint, New York: Oxford University Press, 1984), 147-152.

²⁰ William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983), 95. Cronon explained that “wampum was ideally suited to become the medium for a wider, more commercial exchange.”

²¹ Van Cleaf Bachman, *Peltries or Plantations: The Economic Policies of the Dutch West India Company in New Netherland, 1623-1639* (Baltimore: The Johns Hopkins University Press, 1969), 21-22, 93; Allen W. Trelease, *Indian Affairs in Colonial New York: The Seventeenth Century* (Ithaca, N.Y.: Cornell University Press, 1960; reprint Lincoln, Nebr.: University of Nebraska Press, 1997), 49.

²² Lynn Ceci, “Native Wampum as a Peripheral Resource in the Seventeenth-Century World-System,” in *The Pequots in Southern New England: The Fall and Rise of an American Indian Nation*, eds. Laurence M. Hauptman and James D. Wherry (Norman, Okla.: University of Oklahoma Press, 1990), 48-63.

Although Native Americans and Europeans held very different understandings about the purposes of payment—the former believing it was the beginning of a relationship and the latter believing it was the end—their common conviction that wampum was worth something was rooted in their mutual need for a means of economic and social exchange. A persistent emphasis on wampum’s economic role, however, has reinforced a narrative that Europeans sullied wampum by supplanting spiritual traditions with capitalism. The transformation of wampum into currency certainly led to bouts of discord and even outright violence between natives and settlers, but its ability to circulate unimpeded across cultures also reveals a meeting of minds: mounting contention over money presumes that both sides treasured it. That shared sense of value grew not only from economic necessity, but also from commonly held beliefs and the confidence it created.²³ In wampum, Europeans and Indians spun webs of meaning around a medium of exchange by placing mutual importance on the watery origins of the shells from which it was made.

The value relationship that developed in connection to wampum illuminates similarities between the ways Europeans and Native Americans understood land, sea, and nature in general. For both groups, wampum held value because it was mined from the edges of an “unknowable” sea, a space that embraced all the mystery of the divine. But wampum also nourished the European desire to subjugate the land. It was precisely this dual nature of shells and the mollusks that made them—at once “mysterious” and

²³ François Simiand, “La Monnaie, Réalité Sociale,” *Annales Sociologiques* D, fasc. 1 (1934): 58. Bronislaw Malinowski, “The Primitive Economics of the Trobriand Islanders,” *Economic Journal* 31, no. 121 (March 1921): 15, showed that economics were inextricably tied to “social, customary, legal and magico-religious” traditions. See also Pierre Vilar, *A History of Gold and Money, 1450-1920* (Barcelona: Ediciones Ariel, 1969; trans., New York: New Left Books, 1976), 24, which provides a summary of the historiography of money and includes a discussion of Simiand’s work.

“intelligible,” “hidden and manifest, placid and aggressive, flabby and vigorous”—explained the philosopher Gaston Bachelard, that has long drawn people to cherish them.²⁴ Fueling the beaver trade, wampum drained swamps and ponds and altered forest composition. Like axes, scythes, and ox-driven plows, wampum’s value, in this sense, lay in its ability to alter landscapes. For Iroquois and Algonquin tribes, mythic stories concerning wampum often celebrated its ability to effect terrestrial transformations. The value of wampum, therefore, lay partially in its watery origins and partially in its fantastic powers of “improvement.” Ultimately, the value of wampum embraced mutually held beliefs about the wealth of water while assimilating, however reluctantly, European ideas of terrestrial change.

By fueling a fur trade that systematically extirpated beaver, wampum mined from Narragansett Bay and its neighboring coasts, fundamentally reconfigured the broader ecology of the region. Born of the estuarine exchange between freshwater and saltwater, these whelks and quahogs in their cut and polished forms forged economic, spiritual, material continuities between the ocean and the continental interior, continuities that would have dramatic and enduring consequences. As the wampum trade dismantled the Northeast’s vast network of beaver dams, the amount of time a single water molecule remained in the system, dropped significantly. During storms, rivers ran faster, and during droughts the earth grew dryer. This altered, among other factors, the distribution of plants, the biogeochemistry of rivers, and the rate of sedimentation, which in turn affected river fauna, including fish and fowl. In short, wampum initiated the process of transforming a coastal margin into an edge. These changes began and then radiated

²⁴ Gaston Bachelard, *The Poetics of Space: The Classic Look at How We Experience Intimate Places*, trans. Maria Jolas (Beacon Press: Boston, 1994), 106, 112.

upstream from the place where wampum was made, which in time fundamentally reconfigured the northeastern landscape. During the first half of the seventeenth century small ripples of environmental change blew across Narragansett Bay and soon developed into waves. For Mad Jack Oldham, the tribute collector bludgeoned to death with a hatchet to the head just a few miles south of the Bay's mouth, wampum evinced these connections between ideas, ecology, and culture in ways that were all too real.

Narragansett Bay in Time

Just over a century before, during the spring of 1524, the Italian explorer Giovanni da Verrazano sailed cautiously toward a hitherto uncharted harbor, its mouth marked by a narrow strip of an island to the north and a low-lying bluff dominated by what he described as a “rock of freestone, formed by nature” to the south. Hired by the French Crown, Verrazano had been at sea for nearly three months, having left the island of Madeira in January and making landfall in “a new country, which had never before been seen by any one,” near Cape Fear, North Carolina, in March.²⁵ Unable to find a suitable harbor to the south, Verrazano and his crew of fifty men, turned north and continued along the coast, making several stops, until just east of Long Island Sound they reached a “very excellent harbor” in early May. Before entering the harbor's mouth, Verrazano was approached by about twenty small boats “full of people ... uttering many cries of astonishment.” Despite some hesitation, they eventually approached his vessel

²⁵ Giovanni Da Verrazano [to King François I, 8 July 1524], *Sailors Narratives of Voyages Along the New England Coast, 1524-1624*, ed. George Parker Winship (New York: Burt Franklin: 1905), 4.

and several boarded, including “two kings more beautiful in form and stature than can possibly be described.”²⁶

Verrazano marveled at their appearance. He described their jewelry as like that of Egypt and Syria. He praised their ornamented deerskins and the “rich lynx skins upon their arms.” Many wore their black hair, he observed, in braids and other intricate knots. They were, he avowed, “the finest looking tribe, and the handsomest in their costumes, that we have found in our voyage.”²⁷ After anchoring in open water for some time, the warm welcome Verrazano had received from the local people combined with deteriorating weather encouraged him to enter the harbor at the mouth of Narragansett Bay that he called “Refugio” and the English later named Newport.

The master was impressed by his surroundings. Rich mudflats and lush marsh grass covered the harbor’s south side. Sounding north, he and his men found deep water and a muddy bottom capable of holding an anchor fast in a gale. This refuge and its surroundings were so inviting that Verrazano and his men spent fifteen days exploring the area. Stretching twelve miles north from the coast, Narragansett Bay, he estimated was “twenty leagues in circumference.” Near the bay’s southern end Verrazano observed “very pleasant hills” from which flowed “many streams of clear water ... to the sea.” Farther north, he described five small islands “of great fertility and beauty, covered with large and lofty trees.” So protected was this bay that, “Among these islands,” he wrote, “any fleet, however large, might ride safely, without fear of tempests or other dangers.”²⁸

²⁶ Ibid., 14.

²⁷ Ibid., 14-15.

²⁸ Ibid., 20.

The country surrounding Narragansett Bay was similarly striking. Traveling into the interior upwards of eighteen miles, Verrazano “found the country as pleasant as is possible to conceive, adapted to cultivation of every kind, whether of corn, wine or oil.” He and his men saw vast plains “entirely free from trees or other hindrances” for “twenty five or thirty leagues in extent,” suggesting the region had been heavily managed by its native inhabitants. The forests, he observed, were filled with oaks and cypresses (among others he did not recognize) and “might all be traversed by an army ever so numerous.” That a large army could pass through this type of wild wood further suggests that Native Americans had cleared the undergrowth, likely by burning, and that the trees were enormous, creating a dense canopy whose shade prevented new growth from clogging the forest floor. Thomas Morton, a seventeenth-century observer of southern New England (but mostly in Massachusetts) explained that the Indian custom of “firing” the land, had made it park-like and “very beautifull and commodious.”²⁹ One of his contemporaries, Edward Winslow, noted that in the forests surrounding Narragansett Bay there was enough space between trees that “a man may well ride a horse amongst them.”³⁰ In the gaps between these impressive stands, Verrazano saw numerous plum, apple, and filbert trees and animals, including, among others, stags, deer, and lynxes “in great numbers.” These, he noted, the indigenous people hunted with snares as well as bows and arrows, which were “wrought with great beauty,” the arrow heads carefully carved from “emery, jasper, hard marble, and other sharp stones.” Also made of stone were their axe heads, which the Indians used to fell trees used for making canoes. These were constructed of

²⁹ Morton, *The New English Canaan*, 173.

³⁰ [Edward Winslow], [*Mourt's Relation*:] *The Journal of the Pilgrims at Plymouth in New England*, in 1620, ed. George B. Cheever (London, 1622; reprint, New York: John Wiley, 1848), 70.

single logs hollowed out to “contain ten or twelve persons,” which using short, wide oars they rowed “by force of the arms alone, with perfect security, and as nimbly as they choose.”³¹

Narragansett Bay and its surroundings, as Verrazano’s observations suggest, supported a large and mobile human population. Canoes certainly provided important means of transportation on and around the Bay. The Indians there frequently moved entire villages as well. They lived, Verrazano noted, in round dwellings “about ten or twelve paces in circumference” that were capable of housing twenty-five to thirty people. Made of split logs and thatched with hay “nicely put on,” their wigwams were used only temporarily, for they moved seasonally to take advantage of local resources. In addition to hunting and fishing, Verrazano noted, they subsisted by growing beans, which they “carefully cultivated.” That the impermanence of their dwellings and, as Verrazano believed, their lack of building skill, caused them to live in such simple shelters was a cause of lament for the explorer. Upon the beaches of Narragansett Bay, he observed, were scattered the raw materials to build “stately edifices.” In its entirety, the shore, he attested, “abounds in shining stones, crystals, and alabaster.”³²

³¹ Verrazano, [to King François I, 8 July 1524], 18.

³² Ibid., 19.

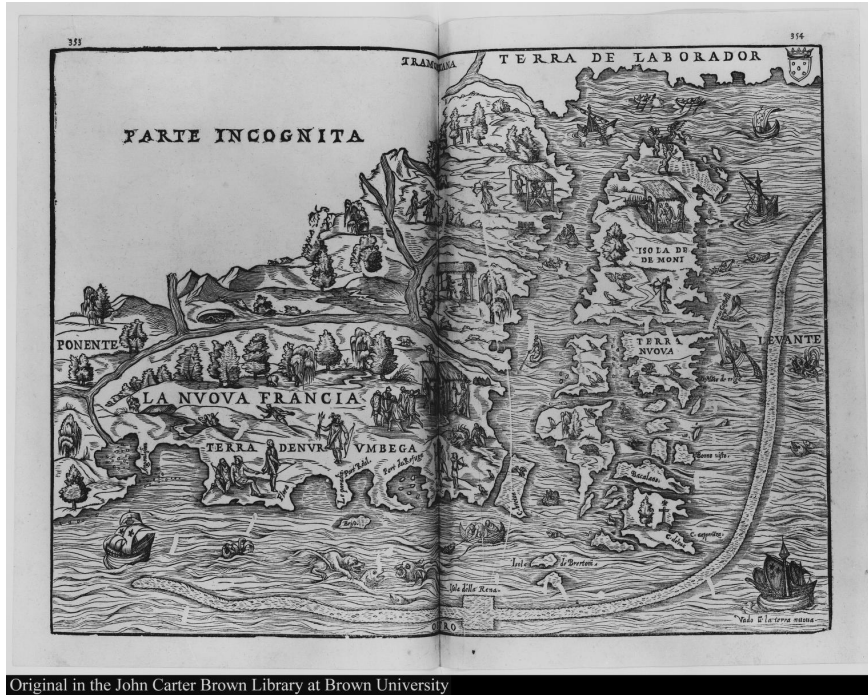


Figure 2: *La Nuova Francia* (Venice: Giunti, 1606) by Giovanni Battista Ramusio (1485-1557) and based on the cartography of Giovanni da Verrazano (1485-1528).

For Verrazano, his “Refugio” and its surroundings was a veritable Eden. The mainland and islands abounded with animals and towering trees. The rivers, abundant and running clear and cold, teemed with fish and fowl. And a shelter, comfortable enough to house two dozen people, could be built by simply gathering materials from the landscape. So ripe for the taking were the fruits of Narragansett Bay, that the Native Americans who cultivated beans, corn, and squash in its adjacent soils, who cleared and maintained broad upland meadows, and who in canoes frequently plied its coastal marshes and islands, its salt creeks and rivers, lived, at least in Verrazano’s estimation, in blissful ease.

That Narragansett Bay was the backdrop to what Verrazano suggested was his favorite New World stopover speaks to the richness of its surroundings. Roughly twenty-eight miles from the ocean to its northern end and eleven miles at its widest point, the

saline portion of Narragansett Bay covered 147 square miles with an average depth of about twenty-seven feet.³³ An estuary, or, by definition, a semi-enclosed body of water fed at once by the ocean and freshwater sources, Narragansett Bay comprised numerous islands, the largest of which were Aquidneck (later called Rhode Island) and Conanicut dominating the Bay's southern end, and four smaller islands in the Bay's center that Roger Williams later named Prudence, Patience, Hope and Hog. In its western, northern, and eastern reaches, the Bay was met by nine river basins, the largest of which were later called the Taunton, Blackstone, and Pawtuxet. Also important was the Wood-Pawcatuck River watershed that fed the marshes and salt ponds of the Narragansett and Pequot Country, what would become southwestern Rhode Island and eastern Connecticut. If one added this vast network of rivers to the tidewater, the Narragansett Bay watershed covered more than 2,000 square miles.³⁴

Moving water defined this coastal space. Twice per day, tidal water from the ocean flooded Narragansett Bay from the south, while each day roughly 260 million cubic feet of water rolled down its rivers into the upper estuary.³⁵ The flow of water was dramatic, particularly during the winter months when rainfall was high and strong winds accelerated the Bay's circulation. During these periods of high flow the bay's flushing time, or the amount of time it took to exchange all of its water, was only ten days. During

³³ Richard A. Chinman and Scott W. Nixon, "Depth-Area-Volume Relationships in Narragansett Bay," *University of Rhode Island Marine Technical Report* 87, no. 67 (1985).

³⁴ Jon C. Boothroyd and Peter V. August, "Geologic and Contemporary Landscapes of the Narragansett Bay Ecosystem," in *Science for Ecosystem-based Management: Narragansett Bay in the 21st Century*, eds. Alan Desbonnet and Barry A. Costa-Pierce (New York: Springer Science, 2008), 26. The total Narragansett Bay watershed including estuarine waters is 4,766.2 square kilometers or 1840.2 square miles. The Wood-Pawcatuck watershed is 300 square miles. Combined, they equal more than 2000 square miles.

³⁵ Michael E.Q. Pilson, "Narragansett Bay Amidst a Globally Changing Climate," in *Science for Ecosystem-based Management: Narragansett Bay in the 21st Century*, eds. Alan Desbonnet and Barry A. Costa-Pierce (New York: Springer Science, 2008), 39.

the summer, when freshwater input was low, the flushing time could reach thirty-five days.³⁶ Nevertheless, these high rates of exchange made the waters of the Bay clear, clean, and nutrient rich. And as a result, the Bay was teeming with life.

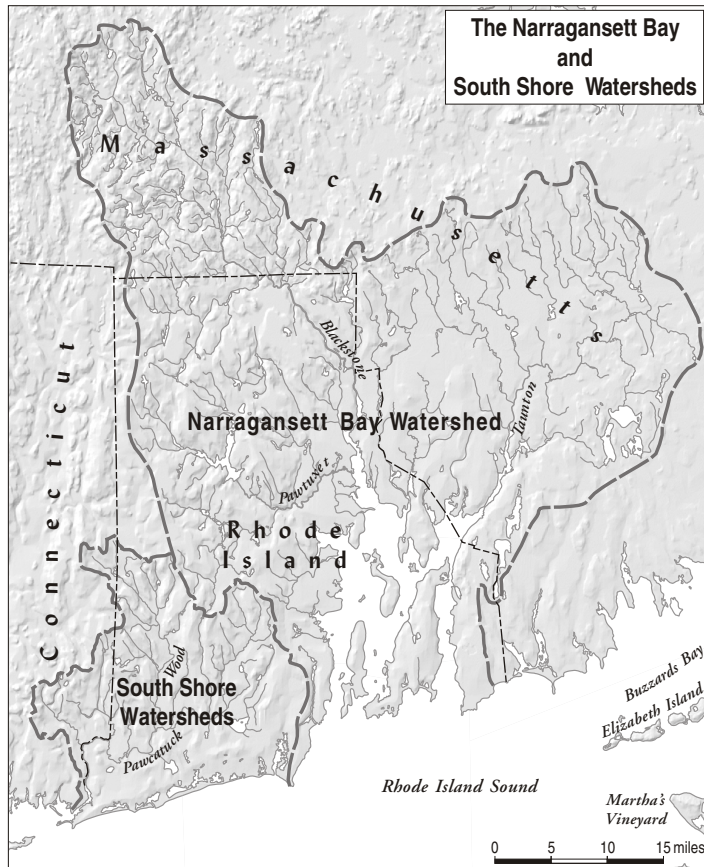


Figure 3: Map of the Narragansett Bay watershed.

With ready nutrients, plants burst from the Bay's shores, which in many ways mirrored those of other New England coastal areas. Wide swaths of eelgrass swayed among the sandy shallows, which, in 1634 William Wood noted of neighboring Massachusetts, provided habitat for a "great store of salt water eels." Using baskets baited with lobster, early settlers could catch a bushel of eels in a night, which were often

³⁶ Michael E.Q. Pilson, "On the Residence Time of Water in Narragansett Bay," *Estuaries* 8 (1984): 2-14.

cleaned and salted for winter. The rocks crawled with lobsters, “some,” Wood noted, “being twenty pound in weight.” So abundant and easily acquired were they that “their plenty makes them little esteemed and seldom eaten.” Only the Indians partook “when they [could] get no bass.”³⁷ Thomas Morton noted that he had seen Indians take 500 or 1,000 of them to “eate and save dried for store.”³⁸

There were enormous quantities of fish in Narragansett Bay. Wood, writing about nearby waters, noted that Sturgeon up to eighteen feet long plied coastal rivers and salmon were in “great plenty.” Fishermen frequently caught halibut “two yards long and one wide and a foot thick” as well as “Thornback and skates,” which were fed to the dogs. The most highly prized coastal fish was striped bass, which Wood described as “one of the best fishes in the country.” There were so many bass, “some be[ing] three and ... four foot long,” that, using a hook and line baited with lobster, Wood explained, “a man may catch a dozen or twenty of these in three hours.” Bass typically followed the bait. And in the spring, Wood observed, they chased runs of spawning alewife so thick that the rivers turned black with fish. These alewife, Wood explained, ran “in such multitudes as is almost incredible, pressing up in such shallow waters as will scarce permit them to swim.”³⁹ Thomas Morton marveled that so many bass pass through the salt creeks that one could walk across their backs “drishod.”⁴⁰ On the outgoing tides, the English blocked the creeks with seines to trap bass, catching “sometimes two and three thousand at a set.” When lobsters migrated inshore, the bass could be found in the rocks,

³⁷ Wood, *New England's Prospect*, 55-56.

³⁸ Morton, *The New English Canaan*, 226.

³⁹ Wood, *New England's Prospect*, 56.

⁴⁰ Morton, *The New English Canaan*, 222.

and when giant schools of mackerel pushed into the bays, again, the bass followed close behind.⁴¹ During the summer and fall, when the sun was high and the water was warm and algal and zooplankton growth in the Bay peaked, menhaden traveling in frothing schools spanning dozens of acres—schools so big that their smell drifted downwind for miles—were driven into the bay by bass, bluefish, and squeteague and harassed from above by screeching osprey, terns, and gulls, which were, in turn, molested by bald eagles. These oily, foot-long members of the shad family played a key role in the Bay’s food chain but they also served as invaluable seasonal custodians. Each one of these filter feeding fish sifted upwards of eight gallons of water per minute.⁴² Arriving by the tens of millions, these menhaden scoured the waters of Narragansett Bay, and as a result it was brilliantly clean.

But the true kidneys of the estuary were its shellfish. Prodigious beds of blue mussels held fast by tough bissell threads covered the intertidal zones, particularly in Rocky areas, such as the southern tip of Conanicut and the shores of Warwick Neck. Wood noted that “Muscles be in great plenty.” So numerous were they that mussels were “left only for the hogs.”⁴³ Across the bottom of the bay but particularly at the mouths of the tidal rivers, vast reefs of oysters, some covering hundreds of acres, had formed over the millennia, with young “seed” oysters propagating on the shells of others. The banks were so large that at spring tides, noted Wood, they were exposed to the open air. The individual animals were enormous as well. Wood observed that they typically took the

⁴¹ Wood, *New England’s Prospect*, 55.

⁴² H. Bruce Franklin, *The Most Important Fish in the Sea: Menhaden and America* (Washington D.C.: Shearwater, 2008), 27.

⁴³ Wood, *New England’s Prospect*, 56.

shape of a shoehorn and were upwards of a foot long. “The fish without the shell,” he noted, “is so big that it must admit of a division before you can well get it into your mouth.” The Bay’s vast mudflats were packed with soft-shell clams. Their numbers were so great, he explained, that “a man running over these clam banks will ... be made all wet by their spouting of water.” Sharing these same beds but also extending into deeper water were hard-shell clams or quahogs, “some as big as a penny white loaf.” Like mussels and their smaller, soft-shelled counterparts, the sheer abundance of quahogs left them largely ignored by settlers. They, Wood noted, “were great dainties amongst the natives and would be in good esteem amongst the English were it not for better fish.”⁴⁴ The siphoning action of so many millions of bivalves carpeting the Bay’s floor created clean water capable of supporting an extraordinarily productive ecosystem.

In terms of the broad sweep of time, the ecologically rich environment Wood and Morton observed was a relatively recent development. Following the end of the last ice age, roughly 10,000 years ago, the massive glaciers covering New England began to recede, causing sea levels to rise. What had been an enormous tundra-covered peninsula spanning more than 20,000 square miles and forming the southern flank of the Gulf of Maine was slowly submerged, becoming Georges Bank, the incredibly productive fishing grounds east of Cape Cod. As sea levels stabilized around 2,500 years ago, a prominent river valley to its west flooded with seawater and the area that now constitutes Narragansett Bay became “coastal.”⁴⁵

⁴⁴ Ibid., 57.

⁴⁵ David J. Bernstein, *Prehistoric Subsistence on the Southern New England Coast: The Record from Narragansett Bay* (New York: Harcourt Brace Jovanovich, 1993), 5. The following section follows Bernstein’s thorough survey of archaeological sources for the Northeast coastal region.

The high biological productivity of the estuary that formed provided a nutrient-rich environment for shellfish growth. Archeological studies of various sites along the coast of Narragansett Bay and particularly Greenwich Cove, on the Bay's western shore, showed that as the bay developed, Native Americans living in the area began to diversify their diets by including marine mollusks.⁴⁶ At about the same time southern New England also experienced one of the largest population expansions in prehistory.⁴⁷ It is difficult to know whether the exploitation of marine mollusks began in response to population growth or whether dietary diversification, which incorporated marine mollusks, actually caused it.⁴⁸ But the archeological record does show that southern New England's coastal Native Americans integrated shellfish into their lives in important ways as soon as natural environmental changes had made it available.⁴⁹

Such powerful draws were the clams, quahogs, and mussels of Narragansett Bay that they altered the ways Native Americans interacted with their environment and each other. Abundant and easily acquired, clams were harvested by coastal Indians year around.⁵⁰ William Wood noted of Indian women, who were the principal harvesters of shellfish, "In winter they are their husband's caterers, trudging to the clam banks for their

⁴⁶ In *Prehistoric Subsistence*, Bernstein showed that shellfish use began 2,700 years ago; Also see A. Leveillee and P.F. Thorbahn, "An Archaeological Assessment of the Sakonnet River," report 46-1 (Pawtucket, R.I.: Public Archaeology Laboratory, 1984). Leveillee and Thorbahn date quahog use along the Sakonnet River to 4,000 years ago, plus or minus 110 years. Wilbur Smith and Associates found similar results on Conanicut Island, with shells dating to 3850 years ago, plus or minus 120 years.

⁴⁷ D.R. Snow *The Archaeology of New England* (New York: Academic Press, 1980), 49-50.

⁴⁸ Bernstein, *Prehistoric Subsistence*, 57.

⁴⁹ *Ibid.*, 52.

⁵⁰ R.L. Greenspan, "Determination of Seasonality on *Mercenaria mercenaria* Shells from Archaeological Sites on Narragansett Bay, Rhode Island," The Rhode Island Sea Grant College Program Completion Report in *Archaeological Investigations at the Lambert Farm Site, Warwick, Rhode Island: An Integrated Program of Research and Education by the Public Archaeology Laboratory*, vol. 1, ed. J. Kerber (Pawtucket, R.I.: The Public Archaeology Laboratory, 1990), 184-193.

belly timber.” Only three or four days after having given birth, one “bare-footed mother ...,” carrying her child wrapped in beaver skin, “paddle[d] in the icy clam banks.”⁵¹ Although, as Verrazano observed, Indian bands moved periodically, they probably moved between coastal sites, rather than simply moving inland with the coming of winter.⁵² This coastal sedentism, which began somewhere between 4,700 and 2,500 years ago, led Native Americans to diversify their use of plants and animals.⁵³ And this placed new environmental pressures on the estuary. The archeological record shows a reduction in the size of shells during the period just prior to European arrival, which when combined with an increasingly diversified diet, suggests increased stress on coastal resources.⁵⁴ In other words, Native Americans continued to be mobile, but they increasingly concentrated their ecological footprints on discrete coastal locations. In small ways, this began the long process of transforming a coastal margin into a coastline. As Indians traveled less, their communities grew in size. And over time, they reached out to their neighbors to acquire things unavailable to them locally. As a result, trade networks formed that continued into the historic period.⁵⁵

The Narragansett Indians were key players in these burgeoning trade networks. Archeologists working in southern New England have uncovered, among numerous other

⁵¹ Wood, *New England's Prospect*, 114.

⁵² Bernstein, *Prehistoric Subsistence*, 149.

⁵³ D.R. Yesner, “Resource Diversity and Population Stability Among Hunter-Gatherers,” *Western Canadian Journal of Anthropology* 7, no. 2 (1977): 18-57.

⁵⁴ Bernstein, *Prehistoric Subsistence*, 81.

⁵⁵ Dena Dincauze, “A Capsule Prehistory of Southern New England,” in *The Pequots in Southern New England*, eds. Laurence Hauptman and James Wherry (Norman, Okla.: University of Oklahoma Press, 1990), 25-28.

items, copper beads from the Great Lakes region and flint from Ohio and New York.⁵⁶ One important prehistoric trade item among Rhode Island's Native Americans was stone pipes, cut from steatite, or soapstone, which was abundant in the area. Narragansett pipes were found in archeological sites across southern New England and as far west as Indiana.⁵⁷ Roger Williams noted the Narragansetts "sometimes ... make such great *pipes*, both of *wood* and *stone*, that they are two foot long, with men or beasts carved, so big or massie [*sic*], that a man may be hurt mortally by one of them."⁵⁸ William Wood observed that the Narragansetts were, among Native American tribes, "the most industrious, being the storehouse of all such kind of wild merchandise as is amongst them."⁵⁹

In the years following European settlement the most valuable of the Narragansetts' "wild merchandise" became tiny beads carefully hewn from the shells of marine mollusks. "They that live upon the Sea side," wrote Roger Williams, "generally make of it, and as many make as will," referring to the carefully crafted white and purple beads known to his neighbors, the Narragansett, as *wampompeage*, to the Dutch as *sewan*

⁵⁶ Charles Whilloughby, *Antiquities of the New England Indians* (Cambridge: Peabody Museum of American Archaeology and Ethnology, Harvard, 1935), 86-87, 92-112; James Tuck, "Regional Cultural Development, 3000 to 300 B.C.," in vol. 15 of *Handbook of North American Indians, Northeast*, ed. Bruce Trigger (Washington, D.C.: Smithsonian Institution, 1978), 28-43; James Fitting, "Regional Cultural Development, 300 B.C. to A.D. 1000," in vol. 15 of *Handbook of North American Indians, Northeast*, ed. Bruce Trigger (Washington, D.C.: Smithsonian Institution, 1978), 45.

⁵⁷ William Turnbaugh, "Post Contact Smoking Pipe Development: The Narragansett Example," in *Proceedings of the 1989 Smoking Pipe Conference, Selected Papers*, Research Record 22, ed. Charles Hayes III (Rochester: Research Division of the Rochester Museum and Science Center, 1992), 113-124.

⁵⁸ Roger Williams, *A Key Into the Language of America: Or, an Help to the Language of the Natives in that Part of America, called New-England* (London: Gregory Dextor, 1643), in vol. 1 of *The Complete Writings of Roger Williams*, ed. James Hammond Trumbull (New York: Russell & Russell, 1963), 72-73.

⁵⁹ Wood, *New England's Prospect*, 81.

or *zeewan*, and the English as *peage* or simply *wampum*. “The *Indians*,” Williams explained, “bring downe all their sorts of Furs, which they take in the Countrey, both to the *Indians* and to the *English* for this *Indian* Money: this Money the *English*, *French* and *Dutch*, trade to the *Indians*, six hundred miles in several parts (North and South from *New-England*) for their Furies, and whatsoever they stand in need of from them: as Corne, Venison, &c.”⁶⁰ Wampum, as Williams explained, had during the first third of the seventeenth century, catalyzed a dynamic network of long-distance trade between Native Americans and the various European powers that had settled in New England, New York, southern Canada, and beyond.

These shell beads, which in earlier centuries had been prized among Native Americans for their spiritual legacy of the sea’s powers, had during the early seventeenth century developed into a medium of exchange, and those tribes with ready access to the shells from which the beads were made grew powerful. “It [wampum] is made principally by the Narragansett black [Block] islanders and Long Island Indians,” wrote Daniel Gookin in 1674. “Upon the sandy flats and shores of those coasts the wilk shells are found.”⁶¹ William Wood observed that the Narragansett “are the most curious minters of their wampompeag and mowhacheis.”⁶² His use of the word “minters” suggests the Narragansetts were producing large amounts of wampum by the 1630s, that they largely controlled its production, and that it circulated widely as currency. Strong in numbers, the Narragansett held considerable influence among neighboring tribes, thereby establishing

⁶⁰ Roger Williams, *A Key Into the Language of America*, 173.

⁶¹ Daniel Gookin, *Historical Collections of the Indians in New England*, 12.

⁶² Wood, *New England’s Prospect*, 81.

a major stake in wampum production.⁶³ Although fewer in number and occupying a geographically smaller area west of the Narragansetts, the Pequot tribe, living along the Pawcatuck and Mystic rivers, maintained close trading partnership with the Mohegans and were likewise important wampum producers.⁶⁴ William Bradford observed, “Only it [wampum] was made and kept among the Narragansetts, and Pequots [Pequots], which grew rich and potent by it.”⁶⁵ With ready access to an increasingly valuable marine resource, both tribes grew powerful, trading finished wampum for furs and European goods.

The actual production of Wampum required considerable skill. Along the sandy shores of Narragansett Bay and Long Island Sound, Native Americans gathered the Northern Whelks, *Busycon canaliculatum* and *Busycon carica*, to produce white wampum from, observed Roger Williams, the “stem or stocke of the *Periwinkle*, which they call Meteaûhock, when all the shell is broken off.” Williams explained that these white beads, worth six to an English penny, were often strung into bracelets. Worth twice as much as the white, dark-colored beads—or as Williams explained, “black, inclining to blew”—were produced from the hard-shell clam, or quahog, *Mercenaria mercenaria*.⁶⁶ From the deep purple rim of the quahog’s inner shell known to clam biologists as the pallial sinus, a segment of shell was cut and smoothed into tiny cylinders one quarter-inch long and an eighth-inch in diameter. These were then carefully drilled into beads

⁶³ Salisbury, *Manitou and Providence*, 25-30. Salisbury estimated that there were between 37,000 and 38,000 Narragansett Indians.

⁶⁴ *Ibid.*, 147-148.

⁶⁵ William Bradford, *History of Plymouth Plantation, 1620-1647*, vol. 2 (Boston: Massachusetts Historical Society, 1912, 1940; reprint, New York: Russell & Russell, 1968), 43.

⁶⁶ Williams, *A Key Into the Language of America*, 173.

that the Narragansett called Suckáuhock, meaning black money, or, as William Wood attested, mowhacheis.⁶⁷ Using animal sinews or bark threads, Indian women assembled them by the thousands into strings, intricate belts, and other decorative garments. Some, Williams noted, strung wampum into necklaces and bracelets. Others wove their wampum beads into girdles several inches wide that were worn around their waists, shoulders, and breasts. “Yea the Princes,” he noted, “make rich Caps and Aprons (or small breeches) of these Beads thus curiously strung into many forms and figures: their blacke and white finely mixt together.”⁶⁸

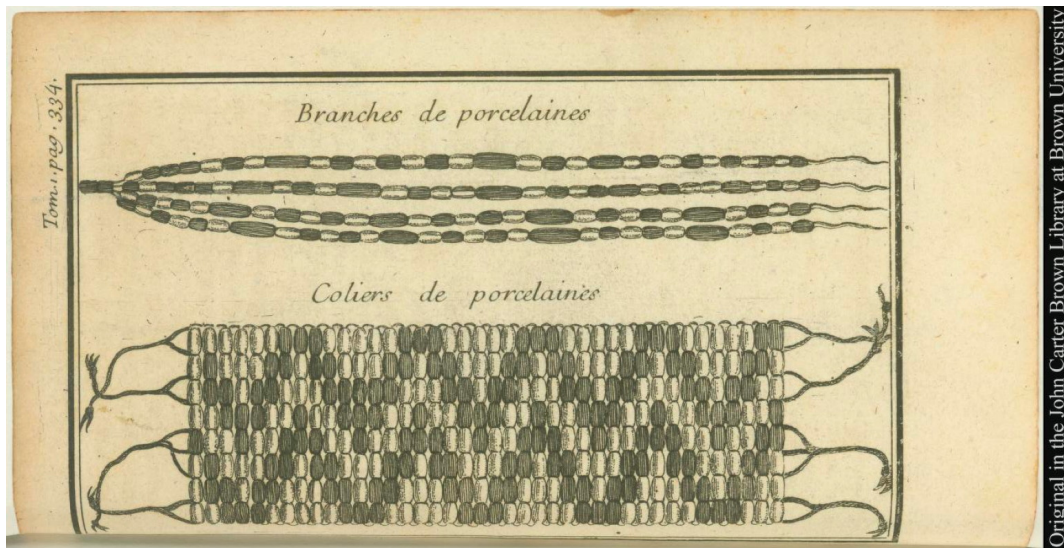


Figure 4: Two wampum belts. Published in Bacqueville de La Potherie, M. de *Histoire de l'Amerique Septentrionale* ... (Paris: Jean-Luc Nion and François Didot, 1722). Courtesy of the John Carter Brown Library at Brown University.

Wampum was undoubtedly a symbol of social prominence, but its value was rooted in its mythic meaning and otherworldly origins. For the Iroquois, much of wampum’s spiritual significance resided in its “orenda,” a supernatural force inherent in

⁶⁷ Roger Williams, *A Key Into the Language of America*, 175-176, 177-178; William Wood, *New England’s Prospect*, 81, 104, 111.

⁶⁸ Williams, *A Key Into the Language of America*, 175-176, 177-178.

shiny things that seemed to come from outside the natural world.⁶⁹ Among many Algonquian tribes, water, shells, wet rocks, and polished metals, among other reflective materials, held supernatural qualities because, it was believed, they provided a window into the soul.⁷⁰ One of the most important places that the Indians of southern New England came into direct contact with the spiritual world was along the ocean's edge. Their god Cautántouwit lived somewhere to the southwest, past the salt ponds of the Narragansett Country and beyond the ocean and summer breezes. "[T]o the *South-west*," wrote Williams, lay the souls of their Forefathers, and there "they goe themselves when they dye."⁷¹ According to Narragansett tradition, the dead were buried with earthly things they needed in the afterlife, which, for their journey over the seas, often included wampum drills and cutting tools as well as beads ceremonially placed on the body, which William Wood noted, were used "to purchase more immense prerogatives in their Paradise."⁷² In addition, the estuary from which wampum was plucked had been created by and was home to important deities. In addition to their "Sea-God," called Paumpágussit, Williams noted, the Narragansetts "have many strange Relations of one *Wétucks*, a man that wrought great *Miracles* amongst them, and *walking upon the waters*

⁶⁹ Barbara A. Mann, "The Fire at Onondaga: Wampum as Proto-Writing," *Akwesasne Notes* 1, no. 1, (Spring 1995): 43. Also see Christopher L. Miller and George R. Hamell, "A New Perspective on Indian-White Contact: Cultural Symbols and Colonial Trade," *Journal of American History* 73, no. 2, (1986): 315, 325.

⁷⁰ Christopher L. Miller and George R. Hamell, "A New Perspective on Indian-White Contact: Cultural Symbols and Colonial Trade," *Journal of American History*, 73, no. 2 (Sept. 1986): 316.

⁷¹ Roger Williams, *A Key Into the Language of America*, 24.

⁷² William Scranton Simmons, *Cauntantowwit's House: An Indian Burial Ground on the Island of Conanicut in Narragansett Bay* (Providence: Brown University Press, 1970), 46, 138; Wood, *New England's Prospect*, 111.

... with some kind of broken Resemblance to the *Sonne of God*.”⁷³ Of central importance to almost all southern New England coastal bands, Wétucks, Ezra Stiles noted during the eighteenth century, was also called Maushump by Long Island Indians and Maushop among the Wampanoag.⁷⁴

The Indians of Cape Cod and the surrounding islands developed a particularly vibrant estuary-centered creation story. According to one Wampanoag myth, the giant Maushop, the first to visit the coastal plains, carved the region’s vast network of salt lagoons as he wandered through the dunes and among the marshes while dragging his heavy foot.⁷⁵ Accordingly, he created the estuaries of southern New England and then, as other accounts attest, settled on Martha’s Vineyard, where he feasted on fish and whale meat. Maushop was particularly fond of enjoying his pipe, the smoke and ashes from which brought fog to Cape Cod and formed the island of Nantucket. Sand from his moccasins formed the Elizabeth Islands. When the English came, it is said that he disappeared below the waves, but before doing so, Maushop hurled his wife, Saconet, toward the mainland, where she landed and remained to collect tribute at the promontory marking the southeast corner of Narragansett Bay.⁷⁶ That an important deity like Wétucks or Maushop was known to have created some of southeastern New England’s most prominent coastal features and weather phenomena and that he retreated below the waves

⁷³ Williams, *A Key Into the Language of America*, 150, 24.

⁷⁴ Ezra Stiles, *Extracts from the Itineraries and Other Miscellanies of Ezra Stiles, D.D., LL.D., 1755-1794*, ed. Franklin B. Dexter (New Haven: Yale University Press, 1916), 157.

⁷⁵ Helen Manning, *Moshup’s Footsteps: The Wampanoag Nation Gay Head/ Aquinnah, The People of First Light*. (Aquinnah, Mass.: Blue Cloud Across the Moon Publishing Co., 2001), 22-25.

⁷⁶ William S. Simmons, *Spirit of the New England Tribes: Indian History and Folklore, 1620-1984* (Hanover, N.H.: University Press of New England, 1986), 172-234.

with the arrival of Europeans, suggests the sea was a spiritual sanctuary. That Maushop's wife was sent to collect tribute, likely wampum, at her seaside station at the mouth of Narragansett Bay suggests that estuarine shell beads were an important medium between the human world on land and spiritual world at sea.

Its watery origins imbued wampum with value for Europeans as well. For Williams, however, wampum, like precious metals, marked a departure from the path of righteousness. "The Sonnes of men having lost their Maker, the true and onely Treasure," he wrote, "dig downe to the bowels of the earth for gold sand silver; yea, to the botome of the Sea, for shells of fishes, to make up a Treasure, which can never truly inrich nor statisfie."⁷⁷ Only God, Williams attested, held true value, but having strayed from him, man burrowed deep into the earth for ores and below the sea for shells. Like gold and silver, wampum was plucked from the deep unknown and held significance because of it. If Williams was skeptical of wampum's cosmological value, he nevertheless saw beneath the waves of the Bay a touch of the divine. Of one particularly frightening incident, he wrote:

*Alone 'mongst Indians in Canoes,
Sometime o're-turned, I have been
Half inch from death, in Ocean deepe,
Gods wonders I have seen.*⁷⁸

The ocean, he conceded, held the mysteries of God. And when his canoe overturned God's "wonders" were revealed. Describing his trans-Atlantic crossing, William Wood noted that ships "seldom doth ... sink or overturn because it is kept by that careful hand

⁷⁷ Williams, *A Key Into the Language of America*, 178.

⁷⁸ *Ibid.*, 135.

of Providence by which it is rocked.”⁷⁹ For Williams and Wood alike, God operated among the waves.

The Lord spoke through the sea’s creatures as well, including shellfish. “How many thousands of Millions,” Williams asked, “of those under water, sea-Inhabitants ... preach to the sonnes of men on shore [?]” Williams referred to marine animals as “Christs little ones,” which after being “Devour’d,” will “rise as Hee.”⁸⁰ Blessed in the brackish waters of Narragansett Bay, these fruits of the estuary delivered to man the word of God and the body of Christ. The sea was a source of the divine and wampum benefitted from its glow for both Europeans and Native Americans. That its production required highly specialized skill and hours of labor and that the resultant beads were beautiful, durable, and easy to handle would have also led to a mutual appreciation of it. But along the coast of southern New England, where wampum was physically produced and then socially constructed, it was widely acknowledged that there was something special about its origins below the surface of the sea.

As wampum circulated deeper into the continental interior its watery origins continued to underpin its value. Inland mythic traditions surrounding wampum, however, began to emphasize a supernatural presence among rivers and lakes. In one myth, Hiawatha, while traveling to establish the Iroquois League, saw a flock of ducks take flight from a lake. Upon their departure, they left the lakebed dry and scattered with shells. Using them, Hiawatha assembled the belts that forged the bonds of the

⁷⁹ Wood, *New England's Prospect*, 70.

⁸⁰ Williams, *A Key Into the Language of America*, 142.

confederacy.⁸¹ With wampum's arrival the birds disappeared, the lake dried up, and a powerful political union was formed. This suggests that among some Native Americans, wampum's value was rooted in its ability to transform not only social interactions but the physical landscape as well. As it was traded farther inland, wampum's value reflected the power of improvement.

For other Native American groups, wampum's ability to transform the land honored important spiritual obligations. One Cree myth justified the slaughter of beaver by claiming the Great Spirit had, for some unnamed offense, banished them from dry land into the rivers where they became numerous and expanded their watery domain. The Great Spirit countenanced the beaver's destruction, and man, literally defending his turf, obliged.⁸² In both the Iroquois and Cree myths, the transformations are environmental, involving the reclamation of dry land. This suggests that some Native American groups were aware of the ways the beaver trade affected water resources. For the Iroquois, wampum desiccated lakes. For the Cree, the exchange of shell beads for furs validated a spiritual duty to drain the swamps and bogs created by a rodent that had fallen from grace.

Although there are still other myths attributed to the genesis of wampum, most show wampum moving from the spiritual world to that of human construction. Almost all of these stories involve some form of preternatural bird that sheds wampum or leaves it

⁸¹ Ibid., 64.

⁸² David Thompson, *Narrative, 1784-1812*, ed. Richard Glover (Toronto: The Champlain Society, 1962), 155. Cited in Calvin Martin, *Keepers of the Game: Indian –Animal Relationships and the Fur Trade* (Berkeley: University of California Press, 1978), 107-108; Susan M. Preston, introduction to “A Pair of Hero Stories,” in *Algonquian Spirit: Contemporary Translations of the Algonquian Literatures of North America*, ed. Brian Swann (Lincoln: University of Nebraska Press, 2005), 231. Within the Cree mythic tradition, Preston has shown that water often has “conjuring power” was often the “locus of species transformation, both literal and symbolic.”

as a gift in its wake, perhaps referencing its distant or supernatural origins or its great mobility. That the birds were either scared off or killed, leaving wampum behind for human use, perhaps acknowledges that wampum was inextricably tied to changes in animal populations. And that water was often central to wampum mythology suggests at some level either contemporary Indians saw changes to the rivers and surrounding landscape or that subsequent generations who retold those stories had witnessed those types of transformations. Over time, the value attributed to wampum in coastal areas based on shared belief in an eternal sea gave way to one that reflected wampum as a tool of improvement. Dug from the shores of Narragansett Bay and fashioned by the Indians who lived there, wampum, once ferried upstream by canoes and dragged inland on sleds, was re-evaluated by new groups of Indians and the European traders with whom they interacted. If wampum still held a touch of the divine, it came to reflect the power of human needs and aspirations. The long process of transforming the continental interior had begun. What had been a broad, soggy coastal margin began to dry into a line.

Draining the Land

Less than a year after the Dutch West India Company was established in 1621 one of its own, a trader named Jacques Elekens, kidnapped and held hostage a Sequin sachem. The lands of New Netherland were still largely unsettled and the Dutch commercial war with Spain in America provoked outright violence from the West India Company and its traders.⁸³ Not limiting physical aggression to his European competitors, Elekens embraced the mercenary nature of his mission with grim enthusiasm. Demanding

⁸³ Jaap Jacobs, *The Colony of New Netherland: A Dutch Settlement in Seventeenth-Century America* (Ithaca, N.Y.: Cornell University Press, 2009), 28.

a hefty ransom, Elekens threatened to cut off the sachem's head if his people did not deliver.

Although Elekens' countrymen had landed in the New World more than a decade earlier, New Netherland was still a crude outpost along the margins of the Atlantic world. Henry Hudson first landed in the area in 1609, exploring the island of Mannahatta and the impressive river that would later bear his name. In 1614 the New Netherland Company was granted a trade monopoly patent, but it wasn't until 1623 or 1624 that colonists began to people the area between the Delaware River and Narragansett Bay in earnest. To lay claim to the land, the Dutch spread out, a few settling near Saybrook Point, others at Burlington Island, a few at *Nooten Eylandt* near Manhattan, and several along the North River at Fort Orange, or Albany.⁸⁴ As early as 1625 the Dutch West India Company established a trading station at Quotenis, later named Dutch Island, at the southern end of Narragansett Bay as well as two others on the mainland.⁸⁵

The promise of colonial settlement in the New World captured the imagination of the Dutch at home. Following these developments closely, the historian, physician, and publisher Nicolaes van Wassenauer launched the first edition of the *Historisch Verhael* in 1622, an annual periodical dedicated to compiling the notable events of the year. Impressed by the extraordinary happenings abroad, van Wassenauer dedicated the entire second issue to descriptions of New Netherland.⁸⁶ His coverage continued until 1630,

⁸⁴ Ibid., 30.

⁸⁵ Samuel Greene Arnold, *History of the State of Rhode Island and Providence Plantations*, vol. 1 (New York: D. Appleton & Co., 1859), 155n. 1.

⁸⁶ J. Franklin Jameson, introduction to *Historisch Verhael*, in *Narratives of New Netherland: 1609-1664*, ed. J. Franklin Jameson (New York: Charles Scribner's Sons, 1909), 63-64.

providing vivid reports as relayed to him from his correspondents, many of whom traveled deep into New Netherland's interior in search of furs.

For van Wassenauer, the number of correspondents multiplied after Elekens seized the sachem, for that act played a pivotal role in energizing the fur industry. In exchange for the sachem, Elekens was paid a ransom of 140 fathoms of zeewan, or wampum, which Van Wassenauer characterized as "small beads they manufacture themselves, and which they prize as jewels."⁸⁷ With hundreds of feet of valuable shell beads in their possession, Elekens and Dutch authorities parlayed their ill-gotten winnings into the fur trade along the Hudson River, which Van Wassenauer explained, was the most important trade route to points north.⁸⁸ Prized by Native American hunters and so easily stored and transported, wampum turned a largely localized, small-scale trade in furs into a region-wide mad dash for pelts. The removal of so many beavers and the subsequent disintegration of their dams fundamentally changed the way water rolled down hill.

⁸⁷ Nicolaes Van Wassenauer, *Historisch Verhael*, in *Narratives of New Netherland: 1609-1664*, ed. J. Franklin Jameson (New York: Charles Scribner's Sons, 1909), 86.

⁸⁸ Salisbury, *Manitou and Providence*, 148-149.

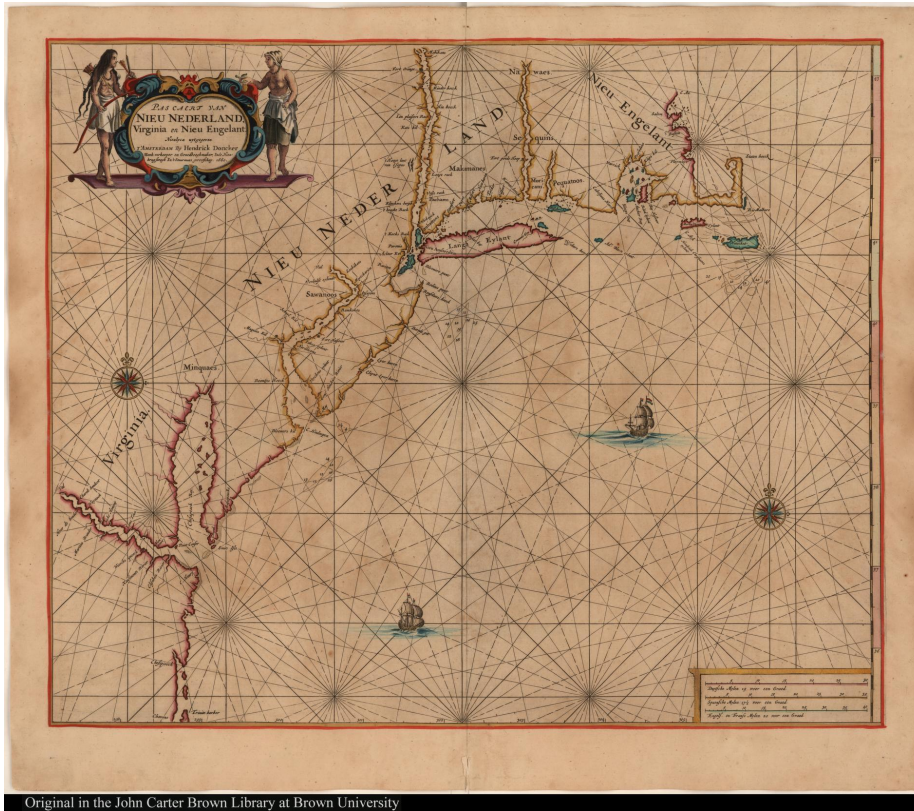


Figure 5: *Pascaert van Nieu Nederland, Virginie en Nieu Engeland*, Amsterdam: Hendrick Doncker, 1660. The seventeenth-century lands of New Netherland and New England. This may be the first mention of the town of Providence on a printed map. Courtesy of the John Carter Brown Library at Brown University.

Early Dutch West India Company correspondents described a watery world north of New Amsterdam. Fifty leagues above Manhattan, Van Wassenauer carefully noted, was “very swampy, [with] great quantities of water running to the river, overflowing the adjoining country.” So wet was the terrain that Dutch settlers at Fort Nassau, later Albany, “frequently lay under water” and as a result the site was abandoned.⁸⁹ One prominent New Netherland landowner, Adriaen van der Donck, a careful observer of nature who spent considerable time exploring the countryside during the 1640s, noted, “The rivers have their origin in sprouts which flow from valleys, and in springs which

⁸⁹ Van Wassenauer, *Historisch Verhael*, 68.

connected form beautiful streams.” He also saw “numerous small streams and sprouts throughout the country, serving as arteries or veins to the body, running in almost every direction, and affording an abundance of pure living water.” Still other streams, he wrote, “rise in bushy woods, through which the summer sun never shines, which are much trodden by wild beasts, and wherein the decayed leaves and rotting vegetation falls.”⁹⁰

This flooded landscape shaped a rich riparian ecology. Van Wassenauer described vast wetlands that included “all sorts of fowls, such as cranes, bitterns, swans, geese, ducks, widgeons, [and] wild geese.” And this soggy landscape extended deep into the forests, which echoed with their calls. “Birds fill also the woods,” he wrote, “so that men can scarcely go through them for the whistling, the noise, and the chattering.” Teeming with other riparian fauna, the forest floors, he explained, crawled with small tortoises and the “most wonderful . . . dreadful frogs, in size about a span, which croak with a ringing noise in the evening.” Dotted with bogs, ponds, and vernal pools, the land to the north was so wet that Van Wassenauer remarked it was “surprising that storks have not been found there, since it is a marshy country.”⁹¹

The Dutch in New Netherland expanded their wampum-for-fur trade into this watery interior, while keeping a watchful eye on the English neighbors to the east, who remained largely ignorant of the incredibly lucrative and quickly developing trade. Perhaps realizing that the English would eventually catch on, in 1627 Isaack de Rasieres, the Secretary of New Netherland, traveled to Plymouth Colony to talk with William Bradford. According to Bradford, Rasieres sold him wampum worth fifty English pounds

⁹⁰ Adriaen van der Donck, *A Description of New Netherlands*, ed. Thomas F. O'Donnell (1655; reprint, Syracuse, N.Y.: Syracuse University Press, 1968), 15-16.

⁹¹ *Ibid.*, 71-72.

so that Bradford might trade it for furs with the Indians in the English-controlled Kennebec region.⁹² According to Rasieres, he sold them the wampum “because the seeking after sewan by them is prejudicial to us, inasmuch as they would, by so doing, discover the trade in furs; which if they were to find out, it would be a great trouble for us to maintain.”⁹³ Rasieres’ generosity was motivated by his interest in keeping the English out of New Netherland’s trading hinterland, the eastern end of which was Narragansett Bay. But Rasieres’s attempt to distract the English ultimately drew them squarely into the trade. “[T]hat which turned most to their [Plymouth’s] profite,” wrote Bradford, “in time, was an entrance into the trade of Wampampeake.”⁹⁴

Narragansett Bay played host to this imperial power struggle, for where wampum was readily available, pelt traders set up shop. While the Dutch West India Company maintained its trading stations on the Bay, Plymouth established trading posts in 1632 at Sowamset on eastern Narragansett Bay and Aptucxet, at the northern tip of Buzzards Bay. In 1636 Roger Williams established a permanent settlement in northern Narragansett Bay at Providence. Soon after, Richard Smith, in the words of Roger Williams, “broke the ice at his great charge and hazard, and put up in the thickets of the barbarians, the first English house amongst them.”⁹⁵ Smith built a trading depot at Wickford on the western shore of Narragansett Bay along the coastal overland route

⁹² Bradford, *History of Plymouth Plantation*, 42-44.

⁹³ Isaack de Rasieres to Samuel Blommaert, 1628, *Narratives of New Netherland: 1609-1664*, ed. J. Franklin Jameson (New York: Charles Scribner’s Sons, 1909), 110.

⁹⁴ Bradford, *History of Plymouth Plantation*, 42-43.

⁹⁵ Roger Williams, “Testimony of Roger Williams relative to the first settlement of the Narragansett Country by Richard Smith, July 21, 1679,” in *The Letters of Roger Williams*, vol. 6 of *The Complete Writings of Roger Williams* ed. John Russell Bartlett (New York: Russell & Russell, 1963), 399.

between Boston, Connecticut, and New Amsterdam, and was for several years accompanied by Roger Williams, who did the same.⁹⁶ By 1638 increasing numbers of settlers had moved into the Connecticut River valley and the first wave of settlers near Boston had begun trading furs. As coastal beaver were decimated, traders looked farther inland. In 1636 William Pynchon settled Springfield at the junction of the Connecticut River and the overland Connecticut Path in south-central Massachusetts. There, he established trading relations with Agawam and Woronoco Indians, which commenced a lucrative trade in pelts that he continued into the early 1670s.⁹⁷

As wampum was traded deep into the continental interior, increasing numbers of beaver were pulled from the Northeast ecosystem. Whereas only ten years earlier the coasts had served as the fur-trading frontier, by 1630 wampum was traded up the Concord and Connecticut Rivers. By 1640 the traders had pushed as far as Springfield, Massachusetts, and far into the interior along the Blackstone and Merrimac Rivers.⁹⁸ Although the full extent of the beaver hunt is unknown, scattered records indicate that vast numbers were killed and that beaver populations began to decline. Between 1652 and 1657 Thomas Pynchon alone shipped to England 8,992 beaver skins, weighing 13,139 pounds. But in the following sixteen years between 1658 and 1674 he exported only 6,480 beaver pelts, weighing roughly 9,000 pounds, suggesting that due to declining numbers they were much more difficult to acquire and the beavers that remained were

⁹⁶ Francis X. Moloney, *The Fur Trade in New England, 1620-1676* (Cambridge: Harvard University Press, 1931), 43; Also see Howard Millar Chapin, *The Trading Post of Roger Williams With Those of John Wilcox and Richard Smith* (Providence, R.I.: E.L. Freeman Co., 1933).

⁹⁷ Stephen Innes, *Labor in a New Land: Economy and Society in Seventeenth-Century Springfield* (Princeton, N.J.: Princeton University Press, 1983), 30-33.

⁹⁸ Moloney, *The Fur Trade in New England*, 110-112.

smaller in size.⁹⁹ Combining Pynchon's efforts with those of countless others, this mass extraction of beavers caused dramatic changes to the ways water moved across the land.

Prior to European entry into the fur trade, the beaver, *Castor canadensis*, had shaped the Northeast landscape. Beaver engineering was so extensive that Roger Williams characterized them as "beasts of wonder" that could "draw of great pieces of trees with his teeth, with which and sticks and earth I have often seen, faire streames and rivers dammm'd and stopt up by them."¹⁰⁰ Echoing Williams' seventeenth-century observations, modern scientists have shown that beavers fundamentally altered river morphology. Beavers built dams, which created ponds, in the center of which they constructed lodges of mud and wood. And those beaver ponds, when maintained, often lasted for decades. As a result, the dam- and lodge-building activities of *C. canadensis* established vast wetlands, which retained sediment and organic matter. The wetlands shaped the ways organic matter decomposed and nutrients were cycled through forest systems. The retention of water by beaver dams also affected the chemical composition and amount of water transported downstream. The activities of beavers shaped the species composition and diversity of plants and animals of the forests in which they lived as well.¹⁰¹ Water-loving plants and the insects and animals that ate and made their homes among them were abundant. The biological rhythms of the entire forest were inextricably tied to the seasonal cycles of rain, ice, and intermittent drought. Ultimately, the beaver is

⁹⁹ Sylvester Judd, "The Fur Trade on the Connecticut River in the Seventeenth Century," in *The New England Historical and Genealogical Register*, vol. 11, Samuel G. Drake, ed. (Boston: C. Benjamin Richardson, 1857), 218-219.

¹⁰⁰ Williams, *A Key Into the Language of America*, 127.

¹⁰¹ Robert J. Naiman, Jerry M. Melillo and John E. Hobbie, "Ecosystem Alteration of Boreal Forest Streams by Beaver (*Castor canadensis*)," *Ecology* 67, no. 5 (October 1986): 1254-1269.

what ecologists call a keystone species, one that was ecologically integral to the healthy function of forest and riparian ecosystems.¹⁰² But as the hunt for beavers escalated, the forests and rivers—the entire ecosystem—began to change.

The broad geographic range and sheer numbers of beaver in North America made their effects on the waters profound. Before European arrival in North America, beavers inhabited all of Canada and the territory that now includes most of the continental United States, barring the border regions with Mexico. Although the exact numbers of beaver is unknown, in 1929 Ernest Thompson Seton, compiling figures from numerous beaver surveys, estimated that before European contact there were between 60 and 400 million beavers colonizing the rivers of North America, a calculation that numerous scientists have subsequently used for their own estimates.¹⁰³ Before Europeans began targeting beaver, almost all lower-order streams—small rivers, brooks, and creeks—and almost every lake or pond in New York, New England, and southern Canada was occupied by beavers.¹⁰⁴ If these estimates are accurate, one can assume that during the seventeenth century beavers were as plentiful as the gray squirrel is today.

¹⁰² Robert T. Paine, "A Note on Trophic Complexity and Community Stability," *The American Naturalist* 103, no. 929 (1969): 91–93.

¹⁰³ Ernest Thompson Seton, *Lives of Game Animals: An Account of those Land Animals in America, north of the Mexican Border, Which Are Considered "Game," either because they have held the Attention of Sportsmen, or received the Protection of Law*, vol. 4, *Rodents, Etc.* (Garden City, N.Y.: Doubleday, Doran & Co., 1929), 447–448.

¹⁰⁴ R. Rudemann and W.J. Schoonmaker, "Beaver Dams as Geological Agents," *Science* 88 (1938): 523–525.



Figure 6: “Beaver Den and Beaver” in Johann Friedrich Schröter, comp., *Allgemeine Geschichte de Länder und Völker von America. Zweiter Theil. Nebst einer Vorrede Siegmund Jacob Baumgartens* (Halle: Johann Justinus Gebauer, 1752). Courtesy of the John Carter Brown Library at Brown University.

The abundance of beavers was incredible. Recounting the fur trade’s history, eighteenth-century explorer of southern Canada, David Thompson, explained:

Every River where current was moderate and sufficiently deep, the banks at the water edge were occupied by their houses. To every small Lake, and all the Ponds they builded Dams, and enlarged and deepened them to the height of the dams. Even to ground occasionally overflowed, by heavy rains, they also made dams, and made them permanent Ponds, and as they heightened the dams [they] increased ... [the] extent and added to the depth of water;

Thus all the low lands were in possession of the Beaver, and all the hollows of the higher grounds.¹⁰⁵

The ubiquitous beaver, Thompson noted, shaped a watery landscape in which every river, stream, and creek was dammed, creating broad ponds and marshes that covered lowlands for miles. In a letter to the Congregational minister Jeremy Belknap of New Hampshire, Joseph Peirce, explained that God “has a farther design in this little animal ... which stops the water from pursuing its natural course, and makes it spread over a tract of land from five to five hundred acres in extent.” Marveling at a beaver dam’s ability to transform the landscape, Pierce explained, “[A]ll trees, bushes and shrubs are killed. In a course of time, the leaves, bark, rotten wood and other manure, which is washed down, by the rains, from the adjacent high lands, to a great extent, spread over this pond, and subside to the bottom, making it smooth and level.”¹⁰⁶ As Pierce observed, beavers and their dams built a watery world.

Weighing up to fifty-five pounds, beavers, like humans, engineered the landscape extensively. Using powerful incisors that grow throughout their lives and sharpen themselves continuously during the process of chewing bark and wood, beavers typically target medium-sized trees located along the bottoms of small river valleys that will fall toward the riverbed. Once a tree is felled and divided into more manageable pieces, it is either floated to the dam site via canals constructed by the beaver or dragged overland. Trees are integral to beaver dams, which can range from two to twenty feet high and can stretch over a hundred feet in length. The logs are piled at the dam site and the spaces

¹⁰⁵ Thompson, *David Thompson’s Narrative*, 198. Also see Calvin Martin, *Keepers of the Game*, 106.

¹⁰⁶ Jeremy Belknap, *The History of New Hampshire*, vol. 3 (Boston: Belknap and Young, 1792), 160.

between them clogged with mud and other debris. When the dam is complete a pond develops.¹⁰⁷

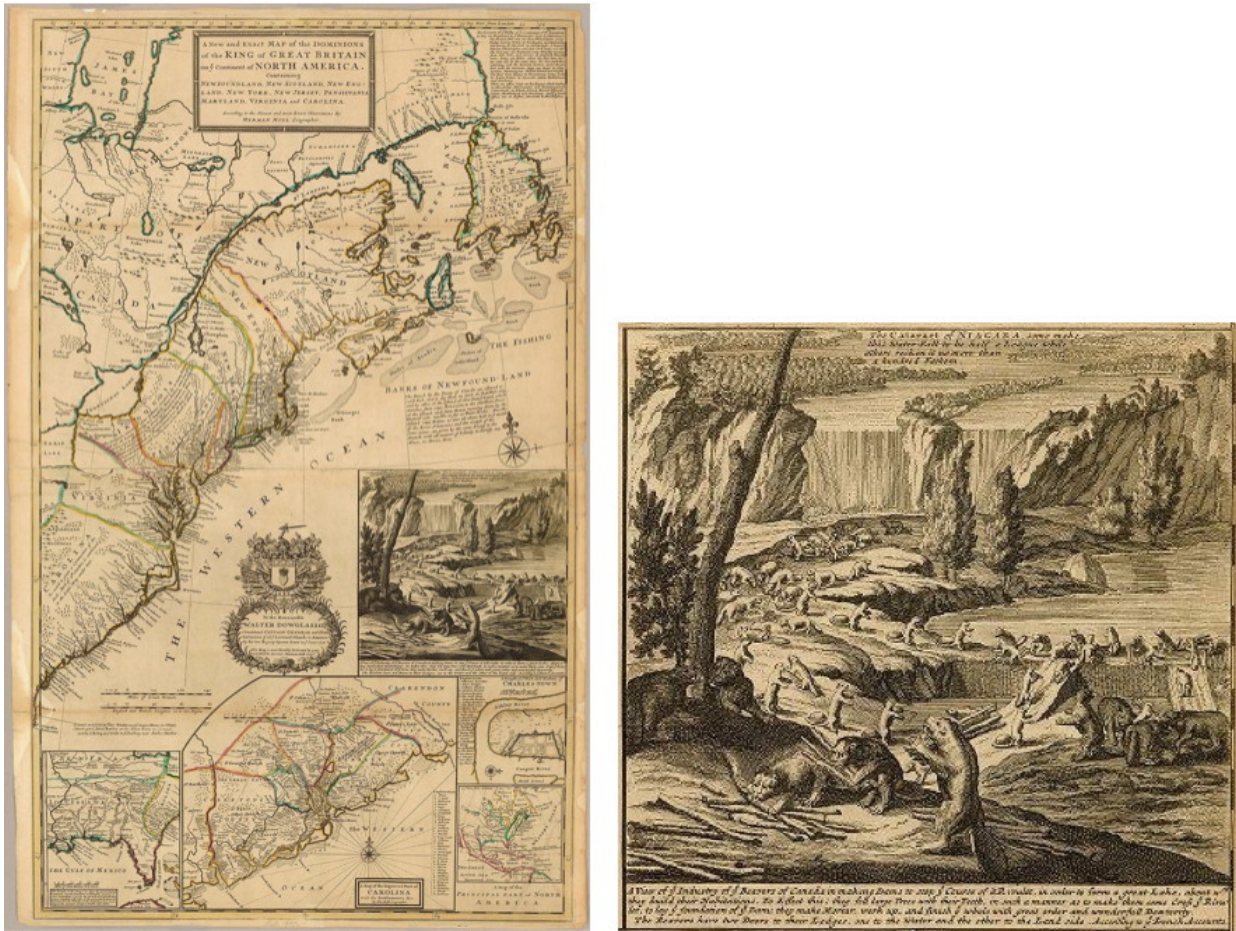


Figure 7: *A New and Exact Map of the Dominions of the King of Great Britain on ye Continent of North America ...*, London: Herman Moll, 1715. The inset image (shown at right) depicts beavers at work near Niagara Falls. Courtesy of the John Carter Brown Library at Brown University.

Quick to multiply, beaver families populated North America in staggering numbers and built millions of ponds in the process. A typical beaver family comprised between four and eight members, which lived together in one pond.¹⁰⁸ And most beaver families constructed between two and five ponds. As such, the minimum number of pre-

¹⁰⁷ Ronald L. Ives, "The Beaver-Meadow Complex," *Journal of Geomorphology* 5, no. 3 (October 1942): 194-197.

¹⁰⁸ M. Novak, "Beaver," in *Wild Furbearer Management and Conservation in North America*, eds. M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch (Toronto: Ontario Ministry of Natural Resources, 1987), 282-312.

European beaver ponds was between 15 and 100 million, with a maximum range of between 37.5 and 250 million ponds.¹⁰⁹ Observing these numbers—whether at the more conservative or more aggressive end of the estimates—one can conclude that before Europeans began hunting beavers in earnest, the Northeast region of America was decidedly wet.

But as beavers were removed from the landscape, patterns of water flow and impoundment changed. In 1624 Van Wassenauer noted of Indian traders who had travelled “far from the interior,” that they “declare there is considerable water everywhere and that the upper country is marshy,” which suggests that near the coast where beavers had already been removed, conditions were drier.¹¹⁰ By the 1640s Adriaen van der Donck observed that “beavers keep in deep swamps, at the waters and morasses, where no settlements are.”¹¹¹ By mid-century beavers had been reduced to the far reaches of New Netherland and that the watery environment that beavers created was far removed from Dutch settlements. On the coast, remarked van der Donck, the terrain was pleasantly dry. “It is a great convenience and ease to the citizens of New Netherlands,” he wrote, “that the country is not subject to great floods and inundations, for near the sea, or where the water ebbs and rises, there are no extraordinary floods.”¹¹² Along the coast where beaver were first removed, van der Donck’s observations suggest, rivers flowed obediently within their banks. In fact, a lot of beavers had been removed: between 1624 and 1626,

¹⁰⁹ David R. Butler and George P. Malanson, “The Geomorphic Influences of Beaver Dams and Failures of Beaver Dams,” *Geomorphology* 71 (2005): 55-56.

¹¹⁰ Van Wassenauer, *Historisch Verhael*, 70.

¹¹¹ Van der Donck, *A Description of New Netherlands*, 114.

¹¹² *Ibid.*, 16.

during the initial years of Dutch settlement, they shipped 16,553 of them.¹¹³ And those numbers skyrocketed. Between the 1641 and 1650 van der Donck estimated that “about eighty thousand beavers have been killed annually, during my residence.”¹¹⁴ So sure of these numbers was van der Donck that he was careful to note he had “frequently eaten beaver flesh, and have raised and kept their young.” In addition, he avowed, “I have also handled and exchanged many thousands of skins.”¹¹⁵

As tens of thousands of beaver were killed, their dams were destroyed, which drained the land. The second half of Peirce’s letter to Belknap explained the effects of beaver hunting. “[T]he water is drained off, and the whole tract, which was the bottom of a pond, is covered with wild grass, which grows as high as a man’s shoulders, and very thick.” He continued:

These meadows doubtless serve to feed great numbers of moose and deer, and are of still greater use to new settlers, who find a mowing field already cleared to their hands; and though the hay is not equally as good as English, yet it not only keeps their cattle alive, but in tolerable order; and without these natural meadows, many settlements could not possibly have been made, at the time they were made.¹¹⁶

Although Peirce’s observations were made a century after the fur trade’s heyday, the stages of dam-to-meadow succession in newly settled areas likely followed the same general patterns. After the beaver were hunted, their dams deteriorated, and what had been vast ponds became dry meadows, which attracted settlement. Adrien van der Donck observed during the mid-seventeenth century similar patterns. “Near

¹¹³ Van Wassenaer, *Historisch Verhael*, 83.

¹¹⁴ Van der Donck, *A Description of New Netherlands*, 111.

¹¹⁵ Ibid.

¹¹⁶ Belknap, *The History of New Hampshire*, 3: 160-161.

the rivers and water sides there are large extensive plains ...,” he noted, “which are very convenient for plantations, villages and towns.” And these meadows, he noted, appeared deep within the forests as well. “We also find meadow grounds far inland,” he explained, “which are all fresh and make good hayland.”¹¹⁷ As early as 1634, the Englishman Thomas Morton observed that among the “great conflux of waters as are there gathered” in the northern reaches of the Iroquois country, there were “many fruitfull and pleasant pastures all about it.”¹¹⁸ That these meadows were formed near waterways and particularly in patches within the heavily wooded interior suggests that a generation of hunting beaver had begun to transform the land. As Peirce observed, once those meadows were settled, they were frequently mowed, the natural grasses sapping nutrients and moisture from the soil. Grass growth slowed and settlers responded by planting European hays, which further changed the soil’s nutrient composition. With nowhere else to go, water that had once inched lazily across the country, coursed swiftly into narrow riverbeds.

Surging rivers and streams caused sedimentation, and in some places on a massive scale. When beaver dams were removed, stored sediment and nutrients were released into faster-moving fluvial systems, which changed downstream water quality. When one dam breaks, faster-moving water can damage those downstream.¹¹⁹ And sediment loss can be so extensive when a beaver dam breaks, it can kill riverbed plants and smother fish eggs.¹²⁰ In the Mohawk country the reverend Megapolensis observed in

¹¹⁷ Van der Donck, *A Description of New Netherlands*, 18.

¹¹⁸ Morton, *The New English Canaan*, 240.

¹¹⁹ R.A. Marston, “River Entrenchment in Small Mountain Valleys of the Western USA: Influence of Beaver, Grazing and Clearcut Logging,” *Revue de Geographie de Lyons* 69 (1994): 11.

1644, “The soil is very good, but the worst of it is, that by the melting of the snow, or heavy rains, the river readily overflows and covers that low land.”¹²¹ That rivers consistently overflowed their banks suggests that as the marshy buffers surrounding beaver ponds were removed, rivers had begun to run faster and more violently during periods of high runoff. It is possible, too, that the rich lowland soil Megapolensis observed, was sediment that had been moved there from farther upstream. Similarly, van der Donck observed of these lowlands that “Sometimes the water may wash out a little in places, but the land is manured by the sediment left by the water.” It is impossible to know whether dam destruction was the precise cause of that sedimentation, but for these Dutch observers it was noticeable and even remarkable. When combined with their accounts of capricious rivers, it suggests a system reeling from the effects of widespread dam removal. “Those floods do not stand long,” van der Donck wrote of the wild fluctuations in water level, “as they rise quick, they also again fall off in two or three days.”¹²² Although sediment transport volume is highly dependent on sediment size and hill slope, all indications are that sedimentation increased—and in some cases quite dramatically—when beaver were removed from the landscape.¹²³

Ever the ecological keystone, beavers shaped not only the movement of water, but also the surrounding geology and patterns of forest succession. Any disruption to this

¹²⁰ R.S. Rupp, “Beaver-trout Relationships in the Headwaters of the Sunkhaze Stream, Maine,” *American Fisheries Society Transactions* 84 (1955): 75-85. J.D. Stock and I.J. Schlosser, “Short-Term Effects of a Catastrophic Beaver Dam Collapse on a Stream Fish Community,” *Environmental Biology of Fishes* 31 (1991): 123-129.

¹²¹ Johannes Megapolensis, Jr., “A Short Account of the Mohawk Indians,” in *Narratives of New Netherland: 1609-1664*, ed. J. Franklin Jameson (New York: Charles Scribner’s Sons, 1909), 171.

¹²² Van der Donck, *A Description of New Netherlands*, 17.

¹²³ David R. Butler and George P. Malanson, “The Geomorphic Influences of Beaver Dams and Failures of Beaver Dams,” *Geomorphology* 71 (2005): 55-56.

carefully balanced system—namely, killing beaver—lowered the water table, changed the floral and faunal composition of the surrounding forest, and altered the course of water and the speed at which it moved. If the introduction of wampum to the fur trade sparked a “wampum revolution,” then one must also acknowledge the ecological revolution that followed.¹²⁴

Changes to inland rivers impacted the coastal estuaries into which their waters flowed, and in a relatively small watershed like that of Narragansett Bay where hunting pressure on beaver was particularly strong, the effects on sedimentation were dramatic. Drawing on earlier work that calculated a 673-square-kilometer watershed retained 3.2 million cubic meters of sediment behind beaver dams, estuarine ecologists calculated that in Narragansett Bay, which was seven times larger, beaver dams would have retained 22 million cubic meters of sediment.¹²⁵ If those dams were removed, a full 10 centimeters, or nearly four inches, of sediment could have theoretically covered the entire bottom of Narragansett Bay.¹²⁶ At the very least such a volume of mud and sand would have surely fouled Bay waters. But it is important to note that beavers were not removed all at once, and that sediment would have become trapped in beaver ponds downstream.

Nevertheless, with less time to steep in numerous beaver ponds, river water flowing into Narragansett Bay at higher rates deposited dissolved nitrogen, phosphorus, and a cocktail

¹²⁴ Salisbury, *Manitou and Providence*, 147-152.

¹²⁵ Nixon based his calculations on Robert J. Naiman, Jerry M. Melillo and John E. Hobbie, “Ecosystem Alteration of a Boreal Forest Stream by Beaver (*Castor canadensis*),” *Ecology* 67 (1986): 1254-1269.

¹²⁶ Scott W. Nixon, “Prehistoric Nutrient Inputs and Productivity in Narragansett Bay,” *Estuaries* 2, no. 2 (June 1997): 253-261.

of organic compounds that spurred the growth of chlorophyll-producing algae, the foundation of the food chain.¹²⁷ This nutrient-rich water released by the destruction of beaver dams, experts believe, caused the “primary production” of chlorophyll to more than double on Narragansett Bay.¹²⁸ It is possible that in some sheltered inlets this caused harmful algal blooms that consumed oxygen and choked Bay creatures. But it is also likely that the introduction of organic matter caused dramatic increases in microscopic plant and animal life in the estuary.¹²⁹

Beaver dam removal made Narragansett Bay more productive. Although estuarine ecologists admit that the variables affecting coastal plant and animal growth are legion, they nevertheless believe that the introduction of nutrients can increase marine fauna.¹³⁰ Ecologists have demonstrated that there is a “strong correlation” between elevated chlorophyll and “the reported landings of finfish and shellfish.”¹³¹ In short, the doubling

¹²⁷ J.E. Ridley and J.A. Steel, “Ecological Aspects of River Impoundments,” in *River Ecology*, ed. B.A. Whitton (Berkeley, Calif.: University of California Press, 1975): 565-587; R.M. Baxter, “Environmental Effects of Dams and Impoundments,” *Annual Review of Ecology and Systematics* 8 (1977): 255-283. See also J. C. Varekamp, “The Historic Fur Trade and Climate Change,” *Eos* 87, no. 52 (December 26, 2006): 593, 596-597.

¹²⁸ *Ibid.*, 258.

¹²⁹ Charles S. Hopkins, Jr. and Joseph J. Vallino, “The Relationships Among Man’s Activities in Watersheds and Estuaries: A Model of Runoff Effects on Patterns of Estuarine Community Metabolism,” *Estuaries* 18, no. 4 (December 1995): 598-621.

¹³⁰ F. Gross, “An Experiment in Marine Fish Cultivation: Introduction,” *Proceedings of the Royal Society of Edinburgh* 63B (1947): 1-2. In 1947 F. Gross experimented with fertilizing Loch Craiglin in Scotland with the hope of increasing British food production during World War II. As Gross and his associates had hoped, dumping inorganic fertilizer into the loch at regular intervals produced more fish. See also F. Thurow, “Estimation of Total Fish Biomass in the Baltic Sea During the 20th Century,” *ICES Journal of Marine Sciences* 54 (1997): 444-461. An examination of twentieth-century Baltic fish stocks revealed increases after 1950, which author F. Thurow attributed to eutrophication. Also see J.D.H. Cushing, *Marine Ecology and Fisheries* (Cambridge: Cambridge University Press, 1975). Cushing outlined the mechanics of what he called a nutrient-induced “agricultural model,” of fish production.

¹³¹ Scott W. Nixon, “Quantifying the Relationship Between Nitrogen Input and the Productivity of Marine Ecosystems,” *Proceedings of Advanced Marine Technology Conference*, eds., M. Takahashi, K. Nakata, and T.R. Parsons (Tokyo, 1992): 57-83; Scott W. Nixon, “Nutrient Dynamics, Primary Production and Fishery Yields of Lagoons,” *Oceanologica Acta* 4 (1982): 357-381; S. Nixon and B. Buckley, “A

of nutrients flowing into the estuary likely increased fish productivity. It is conceivable that the prodigious fish runs and sprawling clam banks observed by settlers like William Wood, Roger Williams, and Thomas Morton, among others, were to some extent accentuated by human action. In this case, for a brief time humans made things better for themselves before they made them worse.¹³²

Although the amounts of freshwater that flowed into Narragansett Bay before beaver dams were removed is unknown, it is highly likely that more freshwater flooded the bay after those beavers were killed and their dams deteriorated. As a result, more nutrients entered the Bay and the flushing time decreased, changing the chemical composition of Bay waters, particularly those in the estuary's brackish arms where shellfish proliferated. Conceivably, the shells mined from Narragansett Bay and later transformed into beads changed the very environment from which they had come. The imposition of Native American and European cultures onto a simple estuarine resource—the shells of whelks and quahogs—ultimately, following a tortuous route, reshaped the environment of that resource itself. The value attributed to that prized wampum for its timeless, trackless, and even divine estuarine origins came to reflect the powers of “improvement” that it provoked as it fueled the relentless search for furs farther and farther into the continental interior. As beavers were “gleaned away,” as William

Strikingly Rich Zone”—Nutrient Enrichment and Secondary Production in Coastal Marine Ecosystems,” *Estuaries* 25 (2002): 782-796.

¹³² See Charles C. Mann, *New Revelations of the Americas Before Columbus* (New York: Alfred A. Knopf, 2008). Mann posits that the extraordinary abundance witnessed by European observers could have been human-induced. Disease and human-induced land clearance could have altered environmental conditions in ways that caused population explosions. Noting that many experts contest this thesis, he cites the example of the passenger pigeon, explaining that some scientists believe that changing ecological conditions caused “outbreak populations,” pp. 315-318. Similarly, Mann, referencing the work of William S. Preston, explained that as coastal California Indian populations crashed due to disease, clams and mussels grew larger and their populations “exploded,” p. 321.

Hubbard, a contemporary, observed, and water drained off the land, the eternal sea felt the impact.¹³³ Even before human and animal populations around Narragansett Bay began to grow in earnest and large-scale forest clearing ensued, a handful of fur traders and the Indians with whom they developed shared notions of value initiated the systematic destruction of the beaver. This changed not only Narragansett Bay but the entire region as well. Southern New England's soggy coastal margin had begun to harden into an edge. Within a generation, the Northeast became a dryer place and one less likely to contain European settlers on its shores.

¹³³ William Hubbard, *The History of the Indian Wars in New England From the First Settlement to the Termination of the War with King Philip, in 1677*, ed. Samuel G. Drake (London: Roger L'Estrange, 1677; reprint, Roxbury, Mass.: Printed for W. Elliot Woodward, 1865), 31.