### Title

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# What Makes a Natural Harbor?

## *Naturalizing Port Development along the Gulf of Kutch, Western India*

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The Mundra Port on the northern Gulf of Kutch in western India is one of India's largest port projects today. Advocates of the megaport present it not simply as a vehicle of trade but as an engine that orchestrates extraction, production, and consumption across India and the Indian Ocean.[1] Such are the political and economic ambitions embodied by this megaport. They depend on dramatically transforming the coastal landscape around the region of Mundra. Building the megaport has involved constructing concrete harbors for container ships (fig. 1); creating fortified enclaves that cut off people's access to the sea; constructing warehouses for commodities like grains, automobiles, and fertilizers; installing tanks and subterranean pipes that channel liquified petroleum gas (see figs. 2a–b); erecting coal terminals that fuel neighboring power plants; and building high-speed railways and highways to connect the coast to big cities and inland forest frontiers. Such efforts to transform the coast into a high-technology logistical hub have made the Mundra Port a model for port-building across the Indian coastline.[2]

But how did the Gulf of Kutch come to be the site of this logistical marvel? During the initial years of the megaport's development, the idea of the coastal region being a natural harbor was mobilized repeatedly to legitimize construction of the port. Supporters and builders of the megaport argued that natural features unique to Mundra's coast and the northern Gulf of Kutch made it ideal for building the megaport. Mundra offered "natural depth"[3] and "a clear deep-water approach with a natural deep draft at any state of the tide,"[4] the Gulf of Kutch acted as a "natural shelter" for the port,[5] and land masses acted as "natural barriers"[6] protecting the port from oceanic currents. Port proponents, policy briefs, and newspaper reports celebrated the natural advantages offered by the Gulf of Kutch in this way. Soon the idea of Mundra and the Gulf of Kutch as being a natural harbor became a taken-for-granted, naturalized truth, naturalizing megaport development along the Gulf of Kutch.

Using this port-sponsored narrative of the coast as a natural harbor as my starting point, I take a longer historical perspective to ask how official maritime projects in the Gulf of Kutch have mobilized nature. I do not dismiss the pervasive narrative of Mundra being a natural harbor. I do not take it at face value, either. Rather, I follow the logic of representing the coast as a natural harbor to its end by tracing the shifting ways in which nature has been enrolled into official projects of maritime development along the Gulf of Kutch from 1860s to the 1990s.

In examining how past and present maritime interests represent the coast, I follow historical geographers and anthropologists who analyze official texts, plans, and blueprints as historically specific understandings of landscapes.[7] These maritime ways of seeing across historical moments reveal the shifts in how the coast is imaginatively conceptualized and materially reconfigured. I also use the methods of humanistic scholarship that analyzes the


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Figure 1. A container ship docked along the harbor at Mundra, August 2012. Courtesy of Shivani Shedde.

genre of natural-history writings as cultural artefacts.[8] While natural-history writings are accounts of the ecological features and processes that make up a landscape, they are also windows into people's conceptions of nature. They are windows into how historically specific human authors seek to stabilize understandings of how the nonhuman world operates. They are a window into how human beings understand nature, whether they are seeking to control it, conserve it, or radically transform it.[9]

The Gulf of Kutch in Gujarat has a long history of maritime trade with places like East Africa and the Persian Gulf. Indeed, popular histories never fail to mention that a navigator native to Kutch brought Vasco da Gama from Malindi in Kenya to the Indian shores.[10] Port proponents and advocates often argue that the Mundra Port is resurrecting the region's glorious entrepreneurial maritime past. As the Mundra Port aspires to compete with established ports in the Indian Ocean like Singapore and Dubai, port proponents project it as a vehicle to India's rise through the region's expansive historical networks in the Indian Ocean.[11]

How did nature on the coast enable this glorious maritime past? Although the region features prominently in Indian Ocean historiography,[12] the coastal ecological features mediating these oceanic flows remain understudied. We know a lot about how the monsoons—as a system of winds blowing alternately from ocean and land—shaped seasonal patterns and directions of sail, thereby influencing a rich maritime history.[13] But how did nature on the coast inform, or thwart, the landing of oceanic goods and people? Maritime historians highlight how the region's seafaring populace mobilized the intricate network of creeks that constituted the region's long coastline to produce a global history of the Indian Ocean.[14] In this article, I attend to the nature of these creeks as they feature within official maritime records from the 1860s to the 1990s. I especially attend to these records' accounts of the ecological processes that made and unmade these creeks. I show that for the longest time, freshwater flows produced these creeks and made them navigable, contributing significantly to the region's maritime character.

Figure 2a. An oil tanker inside the multicommodity megaport, August 2012. Courtesy of Shivani Shedde.


Figure 2b. A yard filled with small machine parts inside the multicommodity megaport, August 2012. Courtesy of Shivani Shedde.

In what follows, I show how waters emerging not from the ocean but from interior terrestrial spaces were central to official maritime projects in the Gulf of Kutch until the 1950s. If harbors were natural, they owed their nature to freshwater flows that created creeks, rivers, and river mouths. Creeks and rivers served as navigable channels. The force of fast-moving fresh water created river mouths that served as structures of anchorage, harboring seagoing vessels. During the early postcolonial period, the inward-looking political priorities of a new nation-state emerging from colonial rule led to the diversion of fresh water to agri-

culture, and the emphasis on fresh water as a source of maritime potential gave way to an emphasis on the tide. A review of administrative records from the late 1800s to the 1990s—gazetteers, interdepartmental and intertier correspondence between government officials, and harbor development plans and surveys—shows that by 1959, rivers and freshwater flows in the Gulf of Kutch were no longer perceived and projected as arteries of oceanic exchange. Maritime records first document the vitality of fresh water to the formation of creeks, showing how fresh water interacted with seawater to expand these creeks. Later these records show the centrality of the tide or seawater in making the same creeks, gradually erasing the idea that creeks owed their creation to fresh water at all. Creeks are represented as entities constituted singularly by the tide until they are deemed entirely irrelevant to massive modern port-building in the 1990s. The political and infrastructural shift from fresh water to the tide naturalized the erasure of freshwater flows on the coast.

The objective of this article is not just to argue that no harbor is natural; what makes a natural harbor is, indeed, always shaped by those who seek to use it, when they seek to use it, and how they seek to use it. Following the shifting ways in which nature on the coast is represented within official maritime perspectives certainly reveals the fundamental point that would be the logical conclusion of a political ecology scholarship: dominant conceptions of what makes a natural harbor are informed by historically specific, politically charged ways of seeing the landscape. But beyond pointing to the inescapability of the construction of the natural,[15] unpacking how nature is officially mobilized along the coast for port development shows that the production of the coast as a natural harbor suitable for high-technology containerized shipping rests on the erasure of fresh water. It rests on a particular moment of rupture in the late 1950s when maritime ways of seeing turn toward the tide. This moment set the stage for transforming the very meaning of the coast from a place where fresh water and seawater meet, producing a rich and lively socioecology, to a space that is made singularly by the sea.

The erasure of fresh water from official maritime ways of seeing turned the northern Gulf of Kutch into an ideal site for megaport development in two specific ways. First, the erasure of the idea that fresh water flows into the coast and drains into the sea promotes the imagination of the coast as an arid wasteland. It feeds age-old narratives of improvement wherein dead spaces depopulated of humans and other species must be transformed into productive hubs of international trade. The idea of the coast as arid wasteland legitimizes enclosing swaths of coastal land to build container yards, warehouses, and coal terminals. The resultant no-go zones cut off ordinary coastal dwellers' access to the sea, as figure 3 shows.

Figure 3. Sheep outside the walls of the megaport, 2017. Photograph by the author.

When I met Jay Amin,[16] a finance executive employed by the Mundra Port, during the conference "Logistics: Propellers of the Indian Economy in the Twenty-First Century," I asked him why the megaport builders chose to build the port in Kutch. He painted a picture of the region as underutilized. In a quick elevator pitch of what made Mundra ideal for port development, he said the reason was "the availability of land, no farmland, so it minimized the displacement of people, and it was not smack in the middle of a major city with huge populations." The owner of the conglomerate building the Mundra Port similarly argued that Mundra was sterile and uninhabitable. In a 2014 television interview, he asserted that all land acquired was "unsurveyed land and submerged land. . . . Anyone who knows Kutch and understands Kutch won't argue. It is completely a desert. There was nothing!"[17]

Apart from promoting the coast as arid wasteland, the disappearance of fresh water from official maritime ways of seeing naturalizes megaport building in another way: by presenting the coast as a zone made singularly by the tide. Indeed, today, among both protestors and proponents, Mundra is known for its five-kilometer tide that makes coastal land, where tidal waters periodically submerge and recede from five kilometers of land. On the one hand, port developers argue that the long tide must be harnessed to unlock the region's maritime potential by using an otherwise degraded swampland in continuum with the arid wasteland. On the other hand, conservationists argue that the same tide produces a fragile creek-filled ecology of India's second-largest mangroves, currently being destroyed by megaport development that has blocked all the creeks. In these representations the Gulf of Kutch emerges as a largely fragile ecology of fish, turtles, and charismatic camels (fig. 4). At the most, it is in continuum with nomadic agropastoralists whose lives are adapted to the arid landscape that exists almost awkwardly with these tidal mangrove forests.

By seeing the coast largely in relationship with the tide, the ocean, the sea, and the marine sphere, conservationists overlook the fact that freshwater flows emerging from the terrestrial sphere are also essential to replenishing the mangroves and interlinked human and nonhuman lives. Obscuring the idea that fresh water flows into the sea ironically undercuts the conservationists' agenda. Acknowledging the history and possibility of fresh water on the coast also acknowledges the possibilities of human and human coastal life that may extend well beyond mangroves, fish, and marine life.

What's lost in the din between the port's proponents and opponents is the historical presence and recognition of a lively ecology where merchants, farmers, fish, fresh water, seawater, and lighthouses coalesce. What's lost in this prominent battle between conservation and economic megadevelopment is not simply the river and the official recognition of the river that flows into the sea, but the historical presence of an official ecology where maritime commerce and coastal conservation were not antithetical agendas but instead were part and parcel of the same ideological and administrative project. Consider this map from Salim Ali's *Birds of Kutch*, commissioned by the princely state in 1945 (fig. 5).

Zooming into Mundra, the map shows the freshwater stream Bhukhi running into watery spaces before it enters the Gulf of Kutch. In the same watery space Bhukhi meets a port designated as the Mundra Bander and a lighthouse. The acknowledgment of fresh

Figure 4. Camels swimming in the mangrove ecologies of Kutch, 2020. Photography courtesy of Shanna Baker, "Where Camels Take to the Sea," *Hakai Magazine*, https://hakaimagazine.com/features/where-camels-take-to-the-sea/.

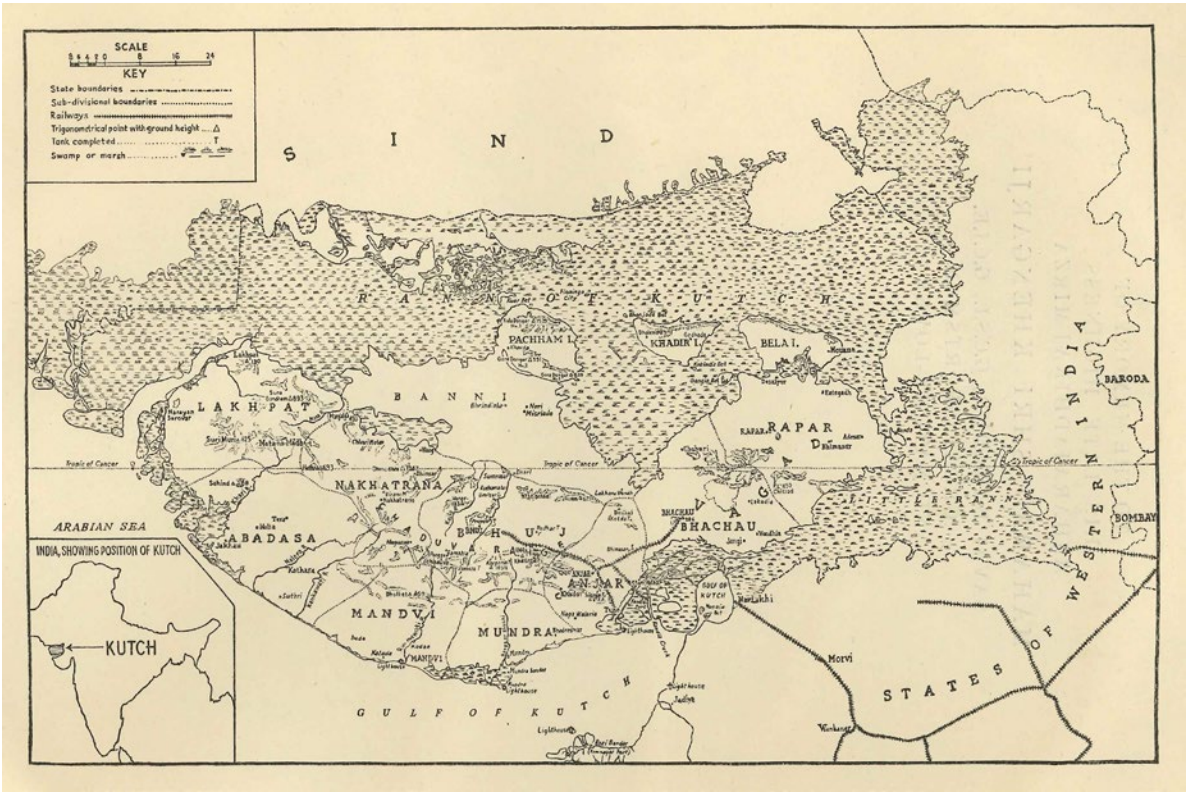


Figure 5. Map of Kutch from Salim Ali's *Birds of Kutch*, 1945. Map from inside cover, © Oxford University Press, printed with permission. Image courtesy of Yale Ornithology Library, New Haven, CT.

water on the coast enabled such a prevailing imagination where maritime ways of being were enmeshed in a diverse socioecology rather than abstracted from it. Within this officially sanctioned ecology, pigeons are perched on custom outposts, stealing grain from sacks. Laughing gulls swooping in from Travancore on the south Indian coast move along the seacoast, creeks, ports, salt pans, and freshwater ponds and fields.[18] In the pages that follow, I trace how the erasure of fresh water from official maritime ways of seeing creates the conditions for the erasure of such an imagination—one that is at once expansive and thoroughly enmeshed in the intricate networks of creeks of the coast.

The presence of fresh water on coastlines and in the service of port-building and maritime trade isn't unique to Kutch. The presence and presentation of navigable freshwater creeks may have been true of other coastal sites with smaller harbors on the western Indian coast. Malabari traders used small oared boats to escape up many narrow rivers connected to the sea and circumvent the Portuguese, whose large ships would never navigate those waters in the 1500s.[19] The dense networks of rivers flowing into the Bay of Bengal still serve as transportation channels today, and siltation and choking in these waterways remains a chronic source of anxiety for port management in the twenty-first century.[20] The transformation of the Panama Canal into a global shipping hub rests fundamentally on creating freshwater reserves and radically transforming not just the coast or the sea but also terrestrial agrarian environments from where this fresh water is diverted.[21] Unlike the Panama Canal, in the Gulf of Kutch, fresh water's presence coincided with a relatively conservative, small-scale port development period. Although Kutch maintained its relative autonomy as a princely state, it also entered into a relationship of suzerainty with the British in 1819.[22] This peculiar political status arguably shaped the modest but innovative interventions on its coastline. In the mid-nineteenth century, when documentation about the region became available in records of the Bombay Presidency, the objective was to make the coast work for the port, but without radical intervention. Within these ways of seeing, its navigability was of interest and was to be maintained, but only in relation to the imperial port of Bombay, then aggressively expanding. In stark juxtaposition to current-day imaginations of the Gulf of Kutch, this political-economic alignment allowed for the flourishing of a particular kind of imaginary of the

coast that is as open-ended and expansive as it is ecologically embedded in the coast.

Such an official understanding of the Kutch coast continued from the late nineteenth century into the late 1950s. Such continuities across widely accepted conventions of periodization are cautionary reminders against painting a broad stroke regarding how colonial port projects transformed the Indian coastline. Regional variations during the late nineteenth century similarly remind us that not all anthropogenic environmental devastation and vulnerability of coastal regions can be attributed to accelerated coastal development and imperial trade during that period. As this article will proceed to show, even if Bombay was the subject of radical technological intervention for harbor development in the late 1800s, the Gulf of Kutch was where the same maritime engineers delegated harbor-making largely to nature. They encouraged vegetation to enhance freshwater flows. When the idea of the seafront was materializing in Bombay,[23] and the sea was being produced as an enemy to land,[24] the Gulf of Kutch remained an intricate network of creeks and bays, sheltered from the open sea. If harbor development rested on producing strong boundaries between land and sea in parts of nineteenth-century Bombay, in the Gulf of Kutch it rested on managing the connections between land and sea, rather than radically altering them.

Local coastal dwellers complicate the idea of the coast as an arid landscape through their stewardship and use.[25] They challenge the idea of the coast as just a tidal space, and they relate to freshwater flows amid its growing absence. These are topics I take up elsewhere.[26] This article is invested in official maritime ways of seeing. Only a longer history of official maritime ways of seeing can reveal how freshwater streams were a crucial artery of maritime trade, the sector that dominates how the coast is seen and valued today. What can only be revealed by analyzing official state-led perspectives is the historical production of the ideological divide between conservation of creeks and maritime promise. Interrogating maritime ways of seeing on their own terms highlights how conservation of freshwater and coastal creeks was not an alternative narrative to port development, emerging from protest and resistance to the maritime agenda. Rather, coastal conservation and maritime promise were part of the same ideological project on this part of the Indian coastline.

In the following sections, I focus on three historical moments to highlight how freshwater flows and creeks feature in the official maritime ways of seeing from the 1870s to the early 1990s. How do freshwater flows and creeks feature in navigation manuals, gazetteers, and harbor development reports in the late nineteenth century? How do they feature in the early 1950s, once Kutch becomes integrated into the new nation-state reeling from the effects of colonialism? Within these narratives, how do these freshwater flows and creeks interact with plants, oceanic winds, sand, and the tide? Finally, how do creeks figure in the megaport's imagination as it arrives on the Kutch coast? How do they feature within hydraulic and mathematical studies simulating coastal dynamics for the Mundra Port? The following sections address these questions.

The Mundra Port is spread over six thousand hectares across fourteen villages in the administrative block of Mundra and ten villages in the administrative block of Mandvi.[27] The first three sections focus on how maritime ways of seeing represented the Gulf of Kutch with Mandvi at its center, moving toward Mundra in the final section. Located not more than twenty-six miles from the town of Mundra, Mandvi was the principal port of entry during the late 1880s.[28] This principality arguably subjected it to more documentation than other harbors along the northern Gulf of Kutch. Mundra is overshadowed by Mandvi and receives scarce attention in these official records. I begin the next section by explaining the ways this absence of Mundra within official records—as well as what happens at Mandvi—holds significant implications for Mundra and the northern Gulf of Kutch.

## Remaking the Port in the Late Nineteenth Century

A focus on Mandvi with attention to the broader network of creeks within which it is enmeshed exemplifies the basic point that freshwater flows were essential to maritime ways of seeing in the region until the early 1950s. But Mandvi's principality, I suggest, had direct material and representational effects on other harbors along the Kutch coast. If its role as the revenue-earning port for the princely state made its freshwater flows subject to harnessing, engineering, and channeling, such representational and infrastructural scrutiny on Mandvi allowed freshwater flows in neighboring areas like Mundra to emerge, disappear, and reappear.

Assessed through their navigability and in relation to each other, Mundra's freshwater flows remained within the realm of possibility and potential. A freshwater flow at Mandvi, in contrast, was subjected to a more determined assessment and intervention. During the late nineteenth century, two freshwater flows or

streams emptying into Mandvi and Mundra were both called Bhukhi. *Bhukhi* literally means "hungry." Both the streams were described as hungry for water and choked with silt. Bhukhi at Mundra remained a "channel" that was "difficult and passable only at high tide . . . filled with silt so that vessels of more than 200 tonnes burden could not come near the land place."[29] It was compared to "a deep open creek, 7 miles west of Mundra"[30] called Navinal, which literally means "new creek," suggesting the possibility of putting this stream to use in the future. Whereas official maritime ways of seeing let Mundra's Bhukhi emerge, die, and reemerge, fed by seasonal tides and occasional rains, it sought to stave off Mandvi's Bhukhi's thirst for water, as I will proceed to show. And yet, proposed interventions in Mandvi's Bhukhi during the late nineteenth century were only subordinate to Glasgow and Bombay. Scottish engineer Thomas Ormiston, who subjected Glasgow to radical river engineering and transformed Bombay through steam dredgers, cranes, and other state-of-the-art technologies,[31] delegated the work of harbor-making at Mandvi largely to nature: that is, the nature of flowing fresh water and ecological processes that enhanced these freshwater flows.[32]

In the late nineteenth century, Bombay was emerging as an imperial hub of commerce, and cotton was becoming an important export commodity from the coastal alluvium along the northern Gulf of Kutch.[33] During this time, the *India Directory for Guidance of Commanders of Steamers and Sailing Vessels* presented the Gulf of Kutch as a complex ecology of creeks, islands, and tides that captivated European merchants interested in obtaining cotton from the southern Gulf of Kutch.[34] The *Directory* asserted that if the Gulf of Kutch had any maritime advantages, it was the "creeks that discharged a considerable body of freshwater" during the rains.[35] Against contemporary megaport development at the Mundra Port, where channels between land and sea are actively chiseled, maintained, and made permanent through concrete and other materials, the *Directory* presented rain-fed freshwater-filled creeks as channels for sailing vessels. It depicted how these freshwater-filled creeks interacted with the tide to expand the navigability of the creeks, which funneled differently sized vessels. It painted Mandvi's maritime capacity in particularly poor light, with its anchorage less "serviceable" than it "formerly" was.[36] Thomas Ormiston, chief engineer of the Bombay Port Trust and consulting engineer for harbor improvement at Mandvi, and Jagannath Sadasiwjee, chief engineer of the princely state of Kutch, entered this landscape of seasonal, gushing, rain-fed creeks known for its ambivalent maritime capacity when they recommended improvements to the Mandvi harbor in 1876, only a year after steamships began to regularly call into Mandvi.

What distinguishes a "river" from a freshwater-filled "creek" is the subject of an entire article that can certainly be taken up elsewhere. Both rivers and creeks emerge as channels evaluated for their navigability within official maritime ways of seeing in the late nineteenth century and the early 1950s. But when a channel becomes an object of technological intervention, it is a river. Conventions established by the dictionary suggest that a "creek" is a natural stream of water—an inlet, channel, or sheltered waterway that is normally smaller and narrower than a "river," from which it may branch out.[37] Although *nadi* conventionally translates into "river," my coastal-dwelling interlocutors use it to describe any freshwater flow that drains into the sea, however seasonal, erratic, narrow, or wide. I would argue that the fact that the word *nadi* is used for both "creeks" and "rivers" is not simply an empirical detail. Rather, it suggests an understanding of freshwater flows that assumes, rather than denies, fluctuation, seasonality, and changing routes and volumes. Within official ways of seeing, what seems to separate the river from a freshwater creek is the degree of engineering and investment applied to the waterway in question. So, for example, the navigational manuals describe freshwater flows around Mandvi as creeks, or sometimes "freshets" when they carry little water.[38] However, a freshwater stream flowing into the sea that becomes subject to harbor improvement plans is called a river.

"The mouth of the river Bookee forms the harbor of Mandvee," wrote the engineers Ormiston and Sadasiwjee in 1876.[39] At Mandvi, the freshwater stream Bhukhi was granted the status of a river, becoming subject to a harbor improvement plan. As a river, the freshwater stream ended in a mouth. This mouth formed the harbor, and it sheltered and anchored seagoing vessels. Within this harbor improvement plan, the force of the river Bhukhi scooped out sediment from the coast to create a cavernous indentation or mouth that served as a harbor. "The scouring effects" of the river Bhukhi's flooding created the Mandvi harbor, the engineers wrote.[40] Within coastal design and engineering, "scouring" is the removal of particles by a fluid's hydrodynamic potential or the force exerted by a fluid's mechanical motion.[41]A technical word for "erosion," scours today are associated with compromising the integrity of an

engineered structure through the velocity of water that creates wounds or craters in the earth.[42] But in 1876, these very erosive effects of the river made it invaluable for harbor-making on the Gulf of Kutch. Whereas earth movers, dredgers, and machines may be used to create such crevices and depressions in land, late nineteenth-century maritime ways of seeing painted the fast-moving potential of fresh water as essential to carving out a harbor at Mandvi. The Bhukhi river was productive precisely because it scooped out the mouth before the sea to anchor seagoing vessels.

The engineers wrote that rain-fed "floods" produced the Mandvi harbor.[43] They argued that the river's flooding—that is, the accelerated flow and volume of fresh water caused by heavy rainfall—was essential to the harbor's maintenance and operation. Rain-fed floods from the Bhukhi river lent form and substance to the mouth that became the Mandvi harbor. The Mandvi harbor demanded a high-intensity rainfall that produced torrential floods. The dependence of Mandvi's harbor on heavy downpours is further highlighted by the fact that the engineers paint meager rainfall as a strong deterrent to harbor formation. Lighter showers, they argue, are much worse than their absolute dearth: the slow accretion and deposition of silt at the mouth resulting from the trickling waters of a feeble shower counters the scouring effects of a torrential downpour.[44]

Within colonial maritime ways of seeing—across the harbor development plan and the navigation guides—monsoons were as much of a disruption to creating a navigable landscape as they were an asset. As oceanic winds sweeping in from the Arabian Sea, these southwesterly monsoons carried a vast amount of evaporated water that condensed and burst as rainfall, indispensable to producing navigable creeks, mouths, and harbors.[45] But the same winds that rushed into land from the ocean carried sand that choked existing creeks. They created sand bars that obstructed access to the coast from the sea. Sand blown from the ocean onto the coast through strong gusts of monsoon winds filled the mouth with particulate matter, counteracting the capacity of lashing fresh waters to carve out a harbor at Mandvi.[46]

The engineers proposed building a breakwater at Mandvi to offset the detrimental effects of the monsoons while harnessing their capacity to create a harbor. At its simplest, a breakwater is a permanent structure constructed on the coast to protect against a range of naturally occurring phenomena: tides, currents, waves, and storm surges.[47] While I was standing next to a large, hard, rocklike structure by the sea within the Mundra Port, a young port engineer told me that where we stood was a breakwater. Breakwaters, he told me, defended the port from drifting and settling sediments when turbulent layers of water washed against its shores. Some ports along the Gujarat coastline have natural breakwaters, islands that break waves from crashing into land. In the twenty-first century, architects—especially those in the global North—are experimenting with the idea of "living breakwaters," where oysters and other natural elements are enlisted to defend coastal cities against the rising sea.[48] Inside the Mundra Port, however, standing with the young engineer, I saw that the breakwaters had been built from dredged soils and concrete, only to be intermittently rebuilt as they are eroded at length by the tide. The engineers on the Gulf of Kutch in the nineteenth century saw the breakwater as a structure that protected the river's capacity to produce a harbor from being throttled by windswept oceanic sand.

Such infrastructural interventions proposed for Mandvi's coast were only in addition to enlisting nature to make the harbor. The engineers saw the breakwater as something that supplemented terrestrial ecological processes in making and maintaining the harbor. They thus acknowledged the role of terrestrial ecology in generating freshwater flows and consequently creating the harbor. They represented the health of the forests as vital to the health of the river and therefore vital to Mandvi's maritime promises.[49] They connected the volume of rainfall to the density of plant life, issues today considered epistemologically disconnected from—and practically and politically oppositional to—the maritime sector. The engineers speculated that the diminished rainfall and the resultant deterioration of the harbor could be attributed to neglect of forest conservation: "The harbor at present is about half tide level and is said to be worse than it used to be, which is supposed to be due to the floods being lighter of late years than formerly; this is of course due to diminished rainfall, which again may be owing to the non-conservation of the forests."[50] In the twenty-first century maritime interests are pitted against ecological conservation on the Gulf of Kutch. Within late nineteenth-century maritime ways of seeing, ecological conservation and harbor maintenance were not separate projects. Harbor development officially relied on ecological conservation for its functioning. Even as Bombay and Glasgow were subject to massive technological interventions by Thomas Ormiston, the recommendations he proposed for the Gulf of Kutch were far more modest, seeking to conserve ecological

relationships between trees, rivers, fresh water, and the sea, rather than work independently of them.

Such regional variations in port-building remind us that a wider orchestration of political calculations and relationships lets certain coasts be while intervening in others. Such orchestration allows for the emergence of particular patches of the coastline to be port environments where the lines between land and sea are blurry and others where the divisions are more sharply delineated. As such, the coast is a social space, much like the pristine, primary, or secondary forest.[51] When it appears relatively removed from human intervention, this very removal is underpinned by a wider political ecology of ports in which the coast is enmeshed.

**Training the River in Early Independent India**

In the 1950s, the transport sector documents of the Indian government continued to see river mouths and creeks as potential harbors and channels. Their interest in conserving rivers and creeks lay at the intersection of conservative trade policies and an official understanding of Kutch as an underdeveloped state with landward geographical barriers, whose small maritime livelihoods needed welfare.

If the imperial imagination subordinated the development of rivers and creeks in Kutch to Bombay, the newly independent Indian government saw little need to maximize economic value and intensively exhaust these creeks and river mouths, and instead sought to maintain them to support small-scale maritime livelihoods. On the twenty-first-century Kutch coastline, much like late nineteenth-century Bombay, the idea that trade will follow once infrastructures are built is a powerful perspective backed by government policies. Mundra Port's growing expansion from port development into agribusiness and coal mining in places like central India and Australia suggests that maritime infrastructures are envisioned not merely as transit zones of trade but as engines activating and producing trade. For a central government transport official in 1952, however, the rationale that maritime trade would follow once maritime infrastructures were built was considered absurd: "There are no doubt a number of creeks and river mouths where Harbours could be constructed but what for is the question,"[52] wrote the transport official, in what was ostensibly the first comprehensive survey of minor ports after India's independence and the integration of former princely states.[53] If the transport officer's general rule was that ports were to be supported only if trade demanded it, he made an exception for the Gulf of Kutch. He asserted that landward geographical barriers—like three mountain ranges blocking the development of railways and communication routes via land—made historically established maritime commerce with places like East Africa, the Persian Gulf, and Pakistan essential to the region. Prioritizing the well-being of small-scale maritime livelihoods, including boat-building and seafaring, undergirded the presence of creeks and rivers in which these maritime activities were based.

The continuing significance of freshwater flows as a source of maritime potential for the Gulf of Kutch within early postcolonial maritime ways of seeing is made evident in the fact that Mandvi is the only harbor in India to receive a detailed and diagrammatic plan for its improvement in this first official survey of all minor ports on the Indian coastline (fig. 6). The desire to improve the river in the early postcolonial period was propelled by the new priorities of a new inward-looking nation-state, which diverted the river for agricultural development: "It appears that in the past, the river was able to scour and maintain sufficient depth. . . . With construction of irrigation dams and reservoirs, the flow in the river downstream is so scanty that it has no capacity. Siltation at the bar and the creep of sand into the inner bar has therefore increased."[54] Terrestrial developmental issues competed with seaward-looking priorities, and the river was at the heart of this competition.

Maritime engineers in the late nineteenth century strove to allow the freshwater floods to do the job of creating the harbor, by offsetting the detrimental effects of the oceanic sands. In the 1950s, they sought to actively engineer the river—renamed from Bhukhi to Rukmavati—to generate and maintain the harbor.[55] It was not only that the river could not be relied upon to reach the sea because it was increasingly diverted to feed upstream dams and reservoirs. Rather, within these maritime ways of seeing, a flooding river damaged the very channels and mouths it created. The floods were destroying the mouth and the pathways the floods themselves created. They scoured—or wounded— their banks well before they reached the mouth, and they created mounds of sediment on the mouth even as they hollowed out the earth to carve out the mouth: "Scouring during each flood discharge and the scoured material deposited into the river mouth basin form islands and shallow mounds making navigation difficult and dangerous."[56] If the late 1800s official maritime narratives praised the flood, the 1952 transport official reveals a growing ambivalence toward the floods and the river's

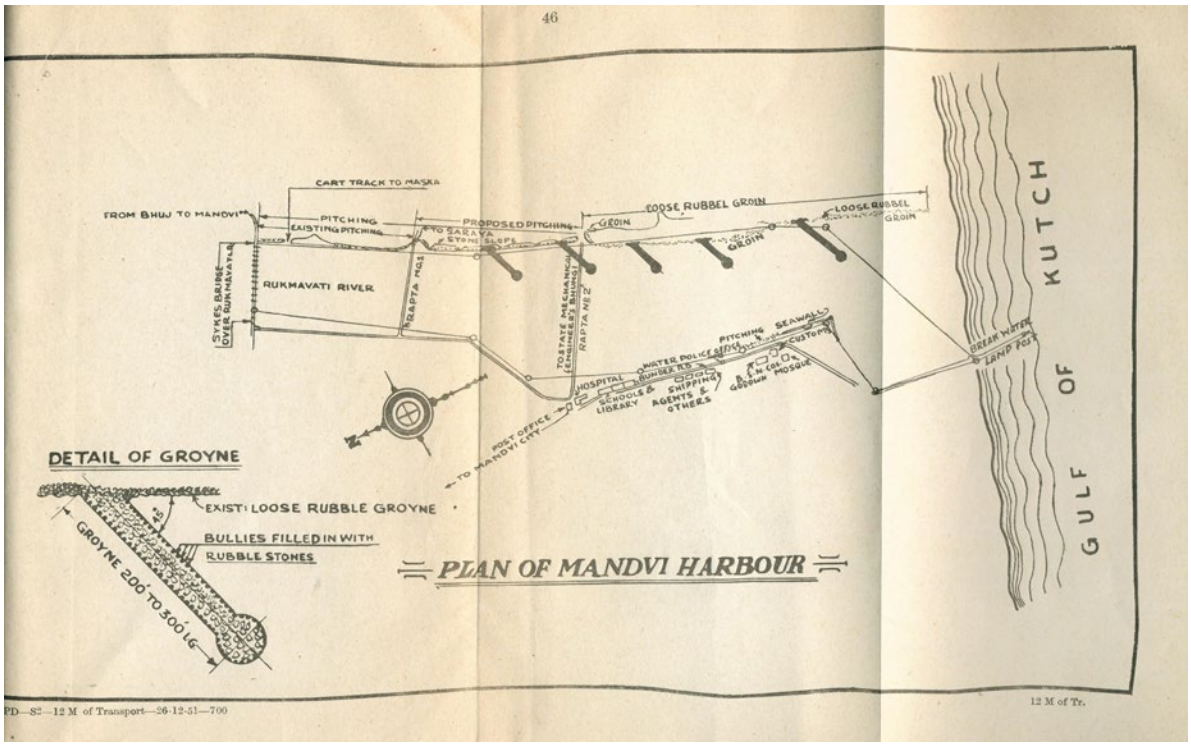


Figure 6. Plan of Mandvi Harbor. *Report on the Survey of Minor Ports in India* by S. Nanjundiah, 1952.

capacity to produce a harbor. Late nineteenth-century maritime ways of seeing represented sand-bearing oceanic winds as the primary agent of coastal siltation. The 1952 transport official saw the river as being equally responsible for the growing material deposition along the coast through gradual accretion caused by its trickling waters as well as mounds and islands caused by its dramatic floods.[57]

To train the river was to prevent its flows from eroding its banks by disciplining the direction of its flow toward the harbor after dredging the material deposits caused by oceanic and riverine action. The persistent centrality of fresh water in defining Mandvi's maritime potential is highlighted by the fact that all other recommendations for Mandvi's harbor, such as extending the breakwater, were secondary to river training: that is, protecting the riverbank and thrusting the directional flow of water by constructing hard structures called "groynes" in the river bed at an angle to support and orient the flow of water toward the existing harbor, as figure 6 shows, and filling the spaces between the groynes with boulders.

Rather than creating shipping channels by excavating the seabed, the dredger recommended by the postcolonial transport official targeted material deposits in the river itself, not the sea. The continued salience of the river in the early postcolonial maritime ways of seeing is further highlighted by the fact that the princely state owned a dredger specifically for the river, and it was named Rukmavati after the river itself.

River training was thus a response to the river's volatility—its tendency to migrate, bite into land, breach its borders, and dissipate its own hydrodynamic potential by branching out in all directions. As the transport official argues, "The river which has become feebler cannot be relied upon for its scouring and maintain a channel wide and deep for the country craft unless flow is trained into other narrow limits, instead of dissipating on a wide sand bar."[58]

One could argue that this very training—protecting the riverbank and targeting the riverbed—distinguishes a river from a creek. Per Dilip Da Cunha, channeling freshwater flows and undercutting their impulse to meander and dissipate arguably "invents" the river. It substantiates the river through material interventions in concert with plans, maps, and discussions that subject it to such material intervention.[59] Against the idea of freshwater flows as a force of nature with little regard for boundaries, beds, or banks, training freshwater flows arguably produces the river, its bed, and its bank.

### Postcolonial Turn toward the Tide in 1957

The 1876 plans proposed protecting the river's mouth from oceanic sands via the breakwater. The 1952 port

proposals built on this infrastructural focus on the river as an agent of maritime action by advocating river training through groyne construction and river channel dredging. Acting on the growing skepticism toward the river's potential to offer adequate depth, the 1957 plans proposed departing from the river toward harnessing the tide as an agent for maritime action.

The 1952 official worried that harbors were threatened by agrarian interests diverting the river from its flows into the sea. The 1957 proposals authored by the government of Bombay's principal port officer and engineer—who was thus a representative of the port sector—did not oppose these agrarian interests. He wholeheartedly supported the river's diversion toward agriculture: "Irrigation needs militated against the conservation of the port. . . . The irrigation requirement cannot be sacrificed for an off-chance of scouring effect."[60]

The 1957 port officer proceeded to suggest that the harbor's dependence on the river's hydrodynamic potential be replaced by directing attention to the tide, basing the production of a "navigable approach channel"[61] on the maintenance, conservation, and deployment of the "tidal prism."[62] Tidal prism is the volume of water exchanged during mean high water and mean low water of the spring tide (when the tidal length is at its highest in any month). The proposed interventions aimed at enhancing the "scouring" effects of the tide to create depth[63] by "training" the tide, not the river, to make and maintain depth in lieu of "the heavy recurring costs of dredging."[64]

Early postcolonial port officials continued to mobilize terrestrial ecology for harbor maintenance, but with a difference.[65] The 1870s and the 1950s proposals both saw plants as essential to maintaining the coast's harboring capacity. Engineers in the 1870s saw forests as essential to generating rainfall, in turn producing accelerated volumes of freshwater-filled navigable channels and freshwater-chiseled river mouths. Early postcolonial ways of seeing envisioned trees not as agents of freshwater flows but as windscreens blocking the "littoral drift" carrying sands. The littoral drift entails the swashing of waves that carries materials up the coast, and the backwash carries the materials down at an angle. Such upward and angular downward wave action moves and settles the sand along the coast.[66]

Natural-history accounts of the Gulf of Kutch highlight how the southwesterly monsoons transported sands onto the coast to create sand dunes.[67] Monsoons bring rain clouds when the air on land heats up and rises, and they are typically associated with wetter periods. Along the coast of Kutch, they were also carriers of sand.[68] The early postcolonial period cast vegetation as essential windbreakers halting oceanic sands from filling up the coast, reducing its depth and resultant capacity to harbor. Plants within these postcolonial maritime ways of seeing were what landscape architect Kate Orff would today call elements of living breakwaters—natural creatures defending the harbor from the damaging effects of the sea.[69]

In summary, the task of harbor formation was delegated to the force generated by the mechanical movement of tidal waters. Plants were no longer cast as agents of freshwater-filled navigable creeks; rather, they were seen as windscreens that stabilized the active, mobile oceanic sand dunes. Such processes interacted with irrigation and agrarian priorities of the newly formed nation-state to shape harbor making. The official relevance of rivers in the life of harbors fell to the wayside, slowly obscuring the idea that fresh water created creeks and harbors.

### Coastal Conservation and Maritime Promise

Several scholars argue that a shift from impermanent toward permanent, concrete infrastructures intensifies environmental damages like waterlogging,[70] floods,[71] and the rising sea.[72] A similar critique is found in the writings of the 1959 Kutchi author of *Kutch brahad bhugol* (*Geographical and Physical Features of Kutch*). The author writes that his father was the latest of three generations born in Zanzibar. In this book, he paints a nostalgic picture of the Gulf of Kutch. He bemoans the loss of life-giving creeks, painting creeks as the protagonists that anchored ships, protecting them from storms and surges. He also offers solutions for what can be done to revive these creeks. While I proceed to detail this local native critique, my objective here is not to trace the effects of the forward march toward infrastructural permanence. Instead, I aim to highlight how the official presence of creeks and freshwater flows on the coast aligns with a period of coastal governance where maritime commerce and ecological conservation were also aligned. Such alignment allowed for the flourishing of an imagination where the maritime is embedded in the coast as a living, breathing, regenerative entity, rather than being abstracted from it. It allows for a particular subject position of the coastal dweller who speaks for animals, farms, and plants without compromising his oceanic heritage.

The Kutchi author, writing when sand accumulation is plaguing the Kutch coast, invading people's

homes, clogging creeks, and blocking the coast's capacity to handle ships, critiques the breakwater built in the late 1800s. He questions the practical effects and the political grounds of its construction. The Scottish engineer Ormiston's obituary eulogizes his breakwater design by saying it created the Mandvi harbor: he "designed the Albert Edward breakwater . . . to form the harbor for the town of Mandvi," as if to imply that no harbor had existed before Ormiston's interventions.[73] The Kutchi author suggests the opposite. He writes that the northern Gulf of Kutch was previously blessed with creeks (*naal*) that harbored boats, creeks that were a boon during storms and surges.[74] The rivers' velocity ensured that water was always present in these creeks, he wrote, making them sites of port settlement. High tide expanded these creeks with seawater's additional velocity. Such long, wide, deep creeks were few and far between in all of India, he wrote. If a breakwater was built to keep sand from drifting into the creeks and silting them, it activated the sand accumulation problem, the writer argued. The early postcolonial harbor plans concede that the breakwater merely redirected sand accumulation onto another part of the coast, leading Mandvi to acquire "unsavoury fame for its sand dunes."[75] The 1959 Kutchi author, however, does more than bemoan the sand problem in Mandvi; he asserts that the breakwater produced it. The breakwater constructed during the princely state suzerainty pushed the sand into creeks. It clogged these creeks and rendered them useless for seagoing vessels.[76]

Notwithstanding the possible limits to his account, what rings true here is the ecological, indigenous, and political sentiment: the salience of fresh water in shaping maritime orientations, freshwater creeks interacting with tidal action to become vital arteries of maritime trade, and the attribution of blame to colonially influenced breakwaters. The Kutchi author was skeptical of "colonial solutions that suggested spending lakhs of rupees."[77] He suggests that such difficult interventions for harbor conservation be avoided altogether and be replaced by plantations: mangroves in creeks, palms on sand dunes, and salty and sweet plants growing along the coast in the intermingling of fresh water and seawater.[78] Such plants, the Kutchi author suggests, would protect creeks by preventing sand from drifting into them; they would enhance rainfall, contributing to replenishing these freshwater creeks and hence their navigability; *and* they would serve as wonderful fodder for livestock, yielding delicious butter for humans.[79]

In the Kutchi author's account of the Kutch coast, freshwater flows on the coast were both sources of abundant fresh water (*meetha paani*) and agents of navigability. Abundant fresh water in and around the gulf, he said, encouraged urban settlement. The Kutchi author's account suggests that apart from the capacity of a river flood to generate a harbor, the emergence of the Mandvi port was also stimulated by the river as a source of potable water. The author's portrayal of the entwinements between freshwater, seawater, and navigable channels on the Kutch coast as productive and nourishing is reminiscent of Karl Appuhn's analysis of Renaissance Venetian ideas about nature. "An ideal balance of silt laden fresh water and tide-borne salt water" in the lagoon profoundly shaped Venetian ideas about the "unusual environment" in which they lived "well in advance of the conquest of the terraferma in the early fifteenth century."[80] For the Venetians, the "ideal environment" was "ultimately transitory, fragile, and contingent on the ability of its human inhabitants to protect and preserve it. The development of a favorable natural order happened as a result of providence, but its preservation in that providential state depended almost entirely on properly directed human effort."[81] Similarly, if the Kutch coast was naturally blessed with creeks, its conservation depended on human endeavor, the Kutchi author implied.

Notice the subject position of the author: he claims an expansive seafaring lineage connecting him to East Africa, and he writes intimately and passionately about agroecological lives. Creeks were at once assessed for their navigability and their life-giving, nourishing qualities, feeding plants, animals, and humans—showing us how maritime promise and agroecological futures were not separate projects. I want to emphasize that harbor conservation and environmental conservation going together was not an alternative narrative or an alternative to official ideas of development. Rather, it cut across official and popular discourse and continued well into the postcolonial state across tiers of the government.

Much like the Kutchi author, port officials across government levels in the 1950s and 1960s emphasized the necessity of maintaining creeks through mangrove plantations. By 1956 fresh water vanishes as something that makes creeks within maritime ways of seeing, but creeks continue to feature as navigable channels to be maintained by conserving certain ecological processes. In the first all-India survey of minor ports, only Kutch's ports were advised to retain control over conservancy of creeks, prevent water diversion from such creeks, and

prevent the cutting of mangroves along creeks and backwaters, because mangroves offer natural protection from sand erosion and therefore prevent creeks from silting.[82]

A similar sentiment is echoed beyond the national government across tiers of the port sector—from the state, to the district, to the block, and then to the local level—revealing a preoccupation with protecting the coast and its creeks. In a 1952 letter, the district port officer writes to block port officials to instruct a battery of local port workers—sailors of wooden sailing vessels (*khalasis*), lighthouse keepers, and customs inspectors (all increasingly outmoded occupations in the time of containerized shipping)—to prevent the destruction of oyster beds and interlinked creeks by guarding the coast against the excavation of stones.[83]

In the subsequent correspondence over the decade, mangroves became a site of negotiation between the port department and revenue department officials.[84] Whereas the port department highlighted the significance of creeks in conserving ports, thereby restricting access to port premises, the revenue department asked the port department to relax its mangrove conservation policies under prevailing conditions of scarcity. In 1960, the principal port officer writes how mangrove bushes growing on creek banks within the port limits are being cut or removed without necessary permissions from port authorities. He says, "The growth and proper preservation of mangrove bushes on the banks of the creeks and channels and sea-coast is very essential since it holds the soil on the banks thereof and prevents it from being washed into the creeks in the rains etc." He then draws attention to section 30 of the Indian Ports Act of 1908, according to which no one can remove "rocks, stones or any other protection from the banks or shore of the ports" without the port conservator's permission.[85] The principal port officer depicts rocks and stones as protective of creeks, and he proceeds to deem their removal to be a breach of law—not of coastal conservation laws, but of the Indian Ports Act of 1908.

Such correspondence suggests that if the port sector today is accused of destroying coastal creeks and interlinked mangroves in Kutch, at least until the 1960s that same sector was seriously invested in conserving creeks and mangroves, drawing explicit linkages between mangrove conservation, creek maintenance, and port maintenance. The duties of the maritime office included coastal environmental protection, and it was not unusual for the maritime sector to take an active interest in executing and administering the protection of coastal creeks.

Reviewing such maritime ways of seeing across tiers of governance also reveals that the river exists within the port sector documents and maps from the late 1950s only as a boundary or landmark delineating the limits of the port area. Creeks were previously presented as waterways shaped by freshwater flows, typically after a good rain, and widened and deepened with tidal flows; but by the end of the 1950s, when large public-sector oil companies began to solicit the port authorities about the Kutch coast's capacity to handle petroleum, Kutch's ports were firmly presented as being situated on tidal creeks hosting tidal ports.

### Abstracting the Port from the Coast in the 1990s

This section analyzes how creeks feature in the Mundra Port project's imagination as it begins to firmly lodge itself on the coast. Mundra Port's builders planned to locate the port on the creek Navinal, mentioned early in the essay as a creek recorded within colonial gazetteers as a deep, open, wide channel, in contrast with Mundra's silt-choked Bhukhi.[86] The builders commissioned a study analyzing Navinal's relationship to two neighboring creeks.[87] The study analyzed how the tide would affect water dynamics in these creeks. It also simulated how Navinal creek's closure would affect the Mundra Port.[88] Focusing on creeks whose mouths previously served as key maritime sites, the study found that these creeks were connected to each other through seawater circulating between them during the ebbing tide. It ultimately concluded that their closure would not affect the proposed megaport, causing only local siltation.[89]

The analytical study's *undertaking* exemplifies how the makers of Mundra Port recognized and took as their starting point the existence of creeks. The creeks' mouths, their cross-sections, and their lengths were units of observation. The analytical study's *methodology* reveals a conceptual emphasis on the tide—rather than on fresh water—as an agent producing hydrodynamic action in the creeks. Creeks were framed as singularly tidal, assessed through tidal waters' circulation.

But they were no longer evaluated for their capacity to harbor seagoing vessels. Rather, they were cast as potential agents of obstructive siltation. No longer viewed through the lens of navigability, they were cast as possible agents of disturbance, viewed through the lens of tranquility. For example, the plan sought to draw out the connections between the tide, waves, and inlets or smaller creeks that connected the gulf to the open sea.[90] It found that "nonuniform" currents within these inlets created long, sharp waves during the ebbing tide.

These waves contributed to perturbances at the port.[91] If monsoons were earlier cast as vital to producing navigable creeks, from Mundra Port's perspective they were only a source of problematic waves: seas, swells, and high tidal current-induced perturbations.[92] The rivers' velocity, freshwater flows, and the volume of the water in creeks were no longer subjects of discussion, determining the port's capacity to harbor.[93]

The gulf's thirty-kilometer-wide mouth became the unit of analysis, cast as an entity that provided depth. Large protrusions on either end of the gulf were seen as windbreaks and structures that protected the coast from the monsoons.[94] The maritime focus on creeks lessened as infrastructural interventions were proposed to attenuate perturbances caused by the creeks. These interventions included permanent piers built one kilometer offshore and breakwaters constructed with reinforced cement to durably dissipate local waves. [95]

**Conclusion**

The official discourse of port proponents has been that the Gulf of Kutch is a natural harbor, whereas opponents have long argued that the Mundra Port has blocked all the creeks.[96] This article has interrogated these polarizing claims. I have shown that creeks, far from being antithetical to maritime practice, were in fact essential to making and maintaining maritime harbors. To take the dominant port-circulated discourse of Kutch being a natural harbor seriously, the article has examined the natural features that historically made a harbor in the northern Gulf of Kutch. An analysis of maritime records from the 1850s to the early 1950s reveals that fresh water was essential to making and unmaking official maritime harbors. If harbors anchoring Indian Ocean flows were indeed natural, they owed their nature to formations such as creeks, rivers, and mouths created by fresh water. Within the official port records, fresh water emerging from the terrestrial sphere interacted with seawater propelled by the tide. Such interaction between fresh water and seawater expanded the creeks' navigability and the coast's capacity to channel and anchor seagoing vessels. This salience of fresh water in accounts of the making of maritime harbors made it subject to assessment, measurement, and enhancement through a variety of state-led interventions. The emphasis of maritime officials from the 1800s to the 1950s was first to maintain and protect fresh water flowing into the gulf and then to actively discipline and channel these flows. Such material and discursive interventions on particular freshwater-filled creeks, I suggest, also consolidates their status as rivers within official maritime ways of seeing. Caught up in political priorities diverting fresh water to agriculture, an emphasis on freshwater flows gives way to an emphasis on the tide in the shaping and reshaping of creeks and harbors, naturalizing the erasure of fresh water on the coast and creating the conditions for building the megaport. Unlike colonial port cities of South Asia, however, the Gulf of Kutch remained a creek-filled space until these creeks became irrelevant to the making of harbors in the 1990s.

The presence of freshwater flows and the ecological processes that shape them in official representations of the Kutch coast has significant material consequences. Kutch is considered a wasteland—incapable of supporting life—precisely because dominant ways of seeing deemphasize the possibility of freshwater streams making and remaking the Kutch coast. It is this image of the Kutch coast as unyielding that legitimized its acquisition and transformation into a megaport project. Ironically, what was lost in the clamor raised by the opposition to the port is the nature of creeks themselves: the fact that fresh water made the creeks, rather than tidal action only. Such opposition perpetuates the image of the Kutch coast as being a space overdetermined by marine and tidal action. In so doing, it visually and epistemologically erases the material conditions for life that emerge in the interactions between fresh water and seawater. Erasing possibilities of diversity produced in the interactions between fresh water and seawater that extends beyond marine life is not simply a question of ecological diversity for diversity's sake. Rather, it erases the potential for resilience that comes from such diversity. Such erasure of possible ecological diversity perpetuates coastal fragility, and materializes imaginations of the coast as a landscape on the brink of climate collapse.

Today, competing perspectives pit fragile mangrove forests against oceanic commerce. But history shows that this binary is an illusion and that coastal governance was designed to maintain essential connections between maritime commerce and coastal conservation. It is only with the development of the massive port that these connections become binaries.[97] As the Indian state avows its commitment to economic growth by becoming a leading player in international trade, policy makers and technocrats present new, upcoming, and modernizing ports around the Indian coastline as agents of India's progress into the twenty-first century. However, the historical ecology of the Gulf of

Kutch offers a radically different future, one where maritime worlds are embedded in lively coastal ecologies, not abstracted from them. It invites us to consider what futures remain possible as megaports expand their domain of influence across India and the Indian Ocean.

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1. See the Adani Enterprises home page, https://www.adanienterprises.com (accessed December 1, 2023).

2. See "India's Largest Commercial Port," Adani Ports and Logistics, https://www.adaniports.com/ports-and-terminals/mundra-port (accessed December 1, 2023).

3. Manoj, "Charting a Success Story."

4. *The Hindu*, "A Benchmark in the Volume of Trade Handled."

5. "Mundra Port," Adani Ports and Logistics, https://www.adaniports.com/Home/Ports-and-Terminals/Mundra-Port (accessed December 1, 2023).

6. *The Hindu*, "A Benchmark in the Volume of Trade Handled."

7. Braun, *The Intemperate Rainforest*; Sivaramakrishnan, *Modern Forests*.

8. Raffles, *In Amazonia*; Tsing, *The Mushroom at the End of the World*.

9. My sources include harbor development plans (1870s and 1950s), gazetteers and navigation manuals (1860s to 1880s), government of India survey reports on ports from the 1950s, and analytical studies commissioned by the Mundra Port (1990s). Such technical reports are supplemented by administrative correspondence between the revenue and the port department across tiers of the government. These documents collating official maritime ways of seeing are supplemented with an account by an indigenous Kutchi author writing in the 1950s, and my own observations from fieldwork during 2014–18.

10. Vashi, "Kutchi Sailor."

11. I draw on fieldwork observations of global conferences where Kutch's maritime history was mobilized to attract twenty-first century investments in ports. These include "Leveraging on Make in India and Sagar Mala for Infrastructure Development and Capacity Enhancement," December 2016, Gujarat Maritime Board, government of Gujarat; and "Vibrant Gujarat Summit 2017: Connecting India to the World," January 10–13, 2017, government of Gujarat. Both events took place at the Mahatma Mandir Convention Center in Gandhinagar, Gujarat.

12. Goswami, *Globalization before Its Time*.

13. Chaudhuri, *Trade and Civilisation in the Indian Ocean*.

14. Alpers and Goswami, *Transregional Trade and Traders*.

15. Skaria, "Cathecting the Natural."

16. Pseudonym.

17. *NDTV*, "No Crony Capitalism."

18. Ali, *Birds of Kutch*, 26–28.

19. See Pearson, *Coastal Western India*, 30.

20. Cons, "Delta Temporalities," 322.

21. Carse, "Nature as Infrastructure."

22. Simpson, *Muslim Society*.

23. Ghosh, *The Great Derangement*, 37.

24. Mathur and Da Cunha, *Soak*.

25. Anusha, "Challenging State Representations from Coastal Environments in the Gulf of Kutch."

26. Anusha, *The Living Coast*.

27. Palnitkar, *Rapid Environment Statement*.

28. Simpson, *Muslim Society*, 113.

29. Campbell, *Gazetteer of the Bombay Presidency*, 173.

30. Campbell, *Gazetteer of the Bombay Presidency*, 173.

31. Hazareesingh, "Interconnected Synchronicities."

32. See Sarah Besky and Alex Blanchette on conceptualizing nonhuman natures as entities that are put to work, enlisted and enrolled into labor regimes. Besky and Blanchett, "Introduction: The Fragility of Work," 1–10.

33. Campbell, *Gazetteer of the Bombay Presidency*, 242.

34. Taylor, *India Directory*, 341.

35. Taylor, *India Directory*, 298.

36. Taylor, *India Directory*, 298.

37. *Merriam Webster*, s.v. "creek," https://www.merriam-webster.com/dictionary/creek (accessed December 4, 2023).

38. Taylor, *The West Coast of Hindustan Indian Pilot*, 203.

39. Oza, *A Report on the Harbour Works*, 4.

40. Oza, *A Report on the Harbour Works*, 4.

41. Melling, *Hydrodynamic and Geotechnical Controls*.

42. "Scour," British Geological Survey, https://www.bgs.ac.uk/geology-projects/hazard-and-resilience-modelling/scour/#:~:text=The%20removal%20of%20sediment%20or,%3B%20Highways%20Agency%2C%202006.

43. "Scour," British Geological Survey, https://www.bgs.ac.uk/geology-projects/hazard-and-resilience-modelling/scour/#:~:text=The%20removal%20of%20sediment%20or,%3B%20Highways%20Agency%2C%202006.

44. "Scour," British Geological Survey, https://www.bgs.ac.uk/geology-projects/hazard-and-resilience-modelling/scour/#:~:text=The%20removal%20of%20sediment%20or,%3B%20Highways%20Agency%2C%202006.

45. Taylor, *India Directory*, 298.

46. Oza, *A Report on the Harbour Works*, 4.

47. *Britannica*, s.v. "breakwater," https://www.britannica.com/technology/breakwater (accessed October 20, 2023).

48. Klinenberg, "The Seas Are Rising. Could Oysters Help?"

49. Oza, *A Report on the Harbour Works*, 4.

50. Oza, *A Report on the Harbour Works*, 4.

51. Hecht, Morrison, and Padoch, *The Social Lives of Forests*.

52. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 4.

53. The Indian Constitution of 1950 divided India's ports into minor ports and major ports, whose status was defined by the jurisdiction they fell under. Major ports fell under the jurisdiction of the central government, and minor ports fell under the jurisdiction of state governments. See Aiyer, "The Benefits of Port Liberalization," 5.

54. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 39.

55. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 19.

56. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 39–40.

57. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 39.

58. Nanjundiah, *Report on the Survey of Minor Ports in India*, I, 39.

59. Da Cunha, *The Invention of Rivers*.

60. Oza, *A Report on the Harbour Works*, 9.

61. Oza, *A Report on the Harbour Works*, 14.

62. Oza, *A Report on the Harbour Works*, 14.

63. Oza, *A Report on the Harbour Works*, 14.

64. Oza, *A Report on the Harbour Works*, 14.

65. Oza, *A Report on the Harbour Works*, 17.

66. Seymour, "Longshore Sediment Transport."

67. Ali, *Birds of Kutch*, iv–v.

68. A National Science Foundation–funded study has found a similar phenomenon occurring in central China. Stronger monsoons contribute to active dune formations in China's deserts. When the southwesterly monsoons peak, central China experiences both heavy summer rainfall and strong upward airflow that leads the winds to transport sand and create sand dunes. See "Ancient China's Sand Dunes Reveal Unexpected Dryness during Heavy Monsoon Rains," National Science Foundation, News release, October 6, 2009, https://www.nsf.gov/news/news_summ.jsp?cntn_id=115713.

69. Klinenberg, "The Seas are Rising. Could Oysters Help?"

70. Dewan, *Misreading the Bengal Delta*.

71. D'Souza, *Drowned and Dammed*.

72. Mathur and Da Cunha, *Soak*.

73. "Obituary. Thomas Ormiston," 413.

74. Bhadala, *Kutch brahad bhugol*, 74.

75. Oza, *A Report on the Harbour Works*, 10.

76. Bhadala, *Kutch brahad bhugol*, 74.

77. Bhadala, *Kutch brahad bhugol*, 247.

78. Bhadala, *Kutch brahad bhugol*, 247.

79. Bhadala, *Kutch brahad bhugol*, 248.

80. Appuhn, *A Forest on the Sea*, 274.

81. Appuhn, *A Forest on the Sea*, 276.

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