What do we want with this vast worthless area . . . this region of savages and wild beasts, of deserts of shifting sands and whirlwinds of dust, of cactus and prairie dogs? To what use could we ever hope to put these great deserts, or those endless mountain ranges, impenetrable and covered to their very base with eternal snow?

Daniel Webster, U.S. Statesman

PUNTA DE LOS REYES

High, granite headlands reaching into low clouds; long fingers of rock and hidden reefs pushing into the ocean, dots of jagged islands lying offshore; winds, currents, and turbulent surf that can drive a ship into innumerable obstacles and certain disaster — Point Reyes presents all these problems for mariners. It is also the windiest point on the West Coast and the foggiest light station site in the United States. Its history is as stormy as its setting.

Viewed in our human speck of time, Point Reyes seems everlasting, a land of somber solitude. However, until the last ten million of its 80 million years of geologic existence, this chunk of land would have been unrecognizable to us. The granite that forms the Farallon Islands, Bodega Head, and the Point Reyes headlands was once a part of the Sierra Nevada near Southern California, but it has been transformed several times from ocean floor to dry land and jolted 563 kilometres (350 miles) northward in a series of violent thrusts. At Point Reyes, two edges of the earth's crust meet in the notorious San Andreas fault, line of the catastrophic 1906 earthquake. Movement along the San Andreas, though, also created beautiful Tomales Bay, the placid Olema Valley that is the route for Highway 1, and the Bolinas Lagoon.

For the moment, Point Reyes juts boldly into the Pacific, but the unique shape of the peninsula makes it vulnerable to the eroding ocean on three sides. The land between the headlands and Inverness Ridge may still be sinking. If so, the waters of Drake's

Summer fog

Coastal fog forms at Point Reyes when warm, moist air, borne in from the vast expanses of the Pacific, meets the cold coastal waters off Northern California. Here the warm current that flows southward along the west edge of the continent veers out to sea, and colder waters from the ocean's depths well up to take its place. When the warm Pacific air meets these cold waters, its moisture condenses into a cloud of droplety fog.

Estero and the Great Beach will one day meet, and the magnificent headlands will be reduced to a tiny fleck of offshore granite like the Farallons.

If the valleys, bays, and hills of Point Reyes are recent features of the landscape, then historically speaking, settlement of this wilderness by human beings began yesterday. For hundreds of years, this was the land of the peaceful Coast Miwoks. These Indians did not navigate the ocean, or even plant crops or keep livestock. They simply lived in harmony with their surroundings, harvesting the abundance provided — fish from the waters, clams from the sand, edible plants and berries that thrived on the foggy hillsides and in the valleys, and deer and small game that roamed across the landscape.

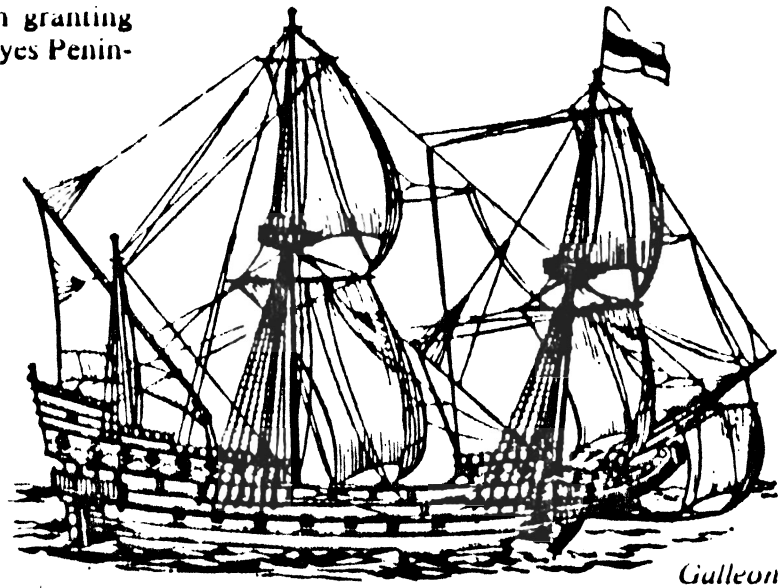
Into this peaceful wilderness sailed a daring English adventurer, Francis Drake, who had been attacking Spanish ships and ports along the west coast of South America. Heading homeward, Drake found a safe, calm harbor on the California coast near here, where he could make the *Golden Hinde* seaworthy for the long passage across the Pacific. In 1579 the ship entered "a faire and good Baye" where Drake and his crew remained from June 17 to July 23, "During all which time, notwithstanding it was in the height of Summer, and so neere the Sunne, yet were wee continually visited with like nipping colds as we had felt before ... neither could we at any time, in whole fourteene dayes together, find the aire so cleare as to be able to take the height of Sunne or starre." Four hundred years later, those words still describe a typical summer day on the central California coast!



Sir Francis Drake

Other Europeans also touched the coastline in the 16th century. Spanish galleons were sailing the strong Pacific winds to trade with the Philippines for silks, spices, and other luxuries. On their return trip, the ships headed northeastward to find the westerlies which carried them to their first landfall near Cape Mendocino, just north of Point Reyes. From there, however, the most dangerous part of the voyage began. Too often, valuable cargo was wrecked along the treacherous California coast. In 1564 King Philip II ordered the Spanish fleet to chart the coast and find a safe route and calm harbors. It was on such a trip in 1603 that Don Sebastian Vizcaino sighted an impressive peninsula and named it *Punta de los Reyes* ("Point of the Kings"), in honor of the Feast Day of the Three Holy Kings.

For the next 175 years, contact between Europeans and the native inhabitants remained infrequent. Then, in 1817, the Spanish established Mission San Rafael 27 miles from Point Reyes, and began their campaign to convert the Indians to Christianity, farming, and European behavior. After Mexico won independence from Spain, it secularized the missions, and the sites were turned over to the state. Diseases and irrevocable damage to Indian ways left the remaining native population small in number and ill-equipped to re-establish its culture. In 1834 Mexico began granting tracts of Marin County land to Mexican citizens, and by 1843 all of Point Reyes Peninsula was owned by grantees.



Galleon

A SHIPWRECK COAST

Protruding far beyond the rest of the coastline and often shrouded in heavy fog, Point Reyes has destroyed approximately 40 vessels in the nearly 400 years since European seamen first saw it. The first loss on record occurred in 1595.

Returning from the Philippines, Sebastian Cermeno anchored his *San Agustin* in what is now Drakes Bay while he charted the nearby coastline. With most of the crew ashore, a flash storm struck; the vessel pulled loose from its anchors and was dashed on the beach. Most of those left on board were lost, along with the cargo of porcelain, silk, and beeswax. The survivors set out for Mexico in a launch they had salvaged from the wreck and after one of history's most harrowing voyages eventually arrived safely.

That was the last Spanish galleon sent exploring; they used smaller, non-commercial ships from then on. In the early 1800's an occasional "Boston" ship would smuggle goods to Mexican settlers around San Francisco Bay, and a few American whalers sailed through the Golden Gate to rest their crews and repair their ships. But contact between the two cultures was infrequent until 1821, when Mexico proclaimed its independence from Spain and began to encourage trade.

The second recorded shipwreck occurred in 1841. A French trader, Jose Yves Limantour, set sail for San Francisco under the Mexican flag, with his ship, the *Ayacucho*, loaded with luxury items from France. In Monterey he fired his Mexican captain and headed northward. Unfortunately, acting as his own navigator, he missed San Francisco Bay and stranded his ship in Drakes Bay on the spit that bears his name. Most of the cargo was later salvaged and brought to San Francisco.

The crush of hopefuls seeking gold in 1849 brought a sudden demand for food, shelter, clothing, and amenities. Merchant seamen saw fortunes to be made, and San Francisco was soon the busiest port in the West. Local shipbuilders turned out schooners and sloops at a furious rate; fleet clipper ships carried easterners on the 18,000-mile trip around Cape Horn to San Francisco. The traffic of incoming and outgoing ships through the Golden Gate became awesome.

Isolated and rugged, Point Reyes remained relatively unaffected by the Gold Rush, but it gained fame as a deadly, jutting snag that threatened every ship approaching the Golden Gate. When California gained statehood in 1850, the dangers of its rocky,

From the earliest history the wary mariner, skirting the coast of California to the west of Drakes Bay, has known and shunned a certain bold headland, shrouded for the most part in fog, but in clear weather revealed to him in all the awfullness of its rocks and precipices, and perpetually churning waters. Punta de los Reyes . . . God help the hapless mariner who drifts upon it!

San Francisco Chronicle, 1887

The WARRIOR QUEEN

"Warrior Queen" came ashore on the beach about three miles north of the point. She was bound from Auckland, New Zealand, to San Francisco, in ballast. The sky had been so overcast with fog that they had not been able to take any observations for ten days, and the "dead reckoning" showed them to be many miles at sea. Suddenly they found themselves in the breakers going ashore on a sand beach. They immediately cast anchor and held the vessel from going hard ashore, although she was driven far upon the beach subsequently. The men embarked in three boats and put to sea rather than try to effect a landing in the surf, and reached San Francisco safely the next day.

Munro-Fraser

1874 July 19 — During the night the English ship Warrior Queen went ashore in a thick fog on the Beach on the North side of Point Reyes near Clellands Ranch (no Lives Lost).

1874 July 20 — Mr. Lincoln 2nd Assistant Left the Station for the purpose of visiting the wrecked ship & not returning at night he is supposed to be drowned.

1874 July 23rd — No tidings from Mr. Lincoln. Notified the Inspector of the Death of the 2nd Assistant on the 19th of July.

Principal Keeper's Log

"This," says the driver, "is the place where in 1874 the Warrior Queen was wrecked. A noble ship she was, bound from Auckland, New Zealand, to San Francisco, and lost in one of our heavy fogs. There she lay one morning, high and dry on the sands, with all sails set. You could walk out to her without wetting your feet. The prettiest sight I ever saw and a nine days' wonder to a quiet community like this."

A main feature of the little garden in front of the last ranch house is the figure head of the lost Warrior Queen, rising ghostlike from the ground, and still proud and mournful as when she bent above the heaving wave.

San Francisco Chronicle
1887

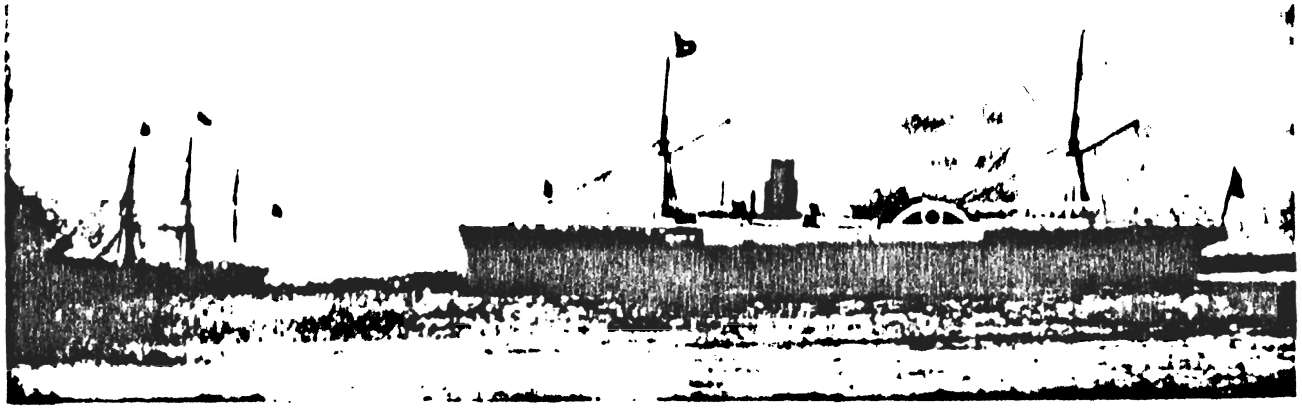
fogbound coast began to arouse official concern. Four years later, after the founding of the U.S. Lighthouse Service, Congress appropriated $25,000 for a lighthouse on the notorious *Punta de los Reyes.*

Construction was scheduled to start in 1855, but the plans were thwarted. The owners of the land "demanded a most exhorbitant sum for what was intrinsically worthless." During the seventeen-year legal battle over the purchase of the land, the annual report of the Lighthouse Board complained each year about this high price and the "delay for want of approved titles."

Meanwhile at least seven more ships went aground. One, the clipper ship *Sea Nymph,* had been enveloped in fog for ten days and was sailing blind. Confused by the similar appearance of Tomales Head and the Golden Gate, the captain believed he was entering San Francisco Bay, and crashed onto Point Reyes Beach with all sails set. As spectators watched, the lifeboat capsized in the breakers. One of the local ranchers proved himself a hero as he lassoed the people struggling in the surf and pulled them to safety.

Two years later, in 1863, the Russian steam corvette *Novick* ran ashore while sailing to San Francisco for a courtesy visit. Unfortunately, the captain had been using an English nautical chart labeled as including "corrections to 1865," which showed a lighthouse already built on the Point Reyes headlands. The light was not actually installed until seven years after the wreck.

Finally, in 1868, the Lighthouse Board initiated condemnation proceedings. That seemed to be the push the owners needed, and they agreed to sell 120 acres, access to Drakes Bay, and rights to firewood, water, and a granite quarry — all for $6,000. However, acquiring the land was only the first challenge.



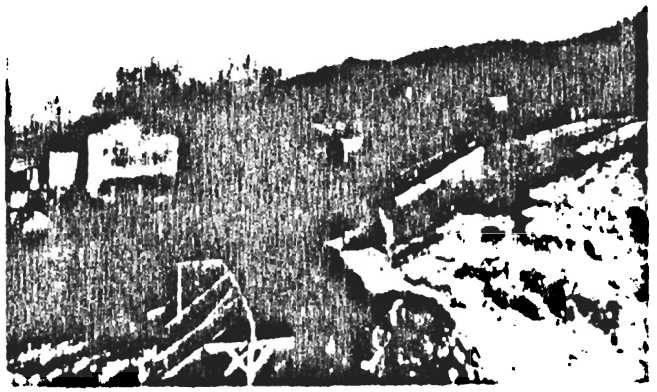
Steamer in San Francisco Bay, 1867

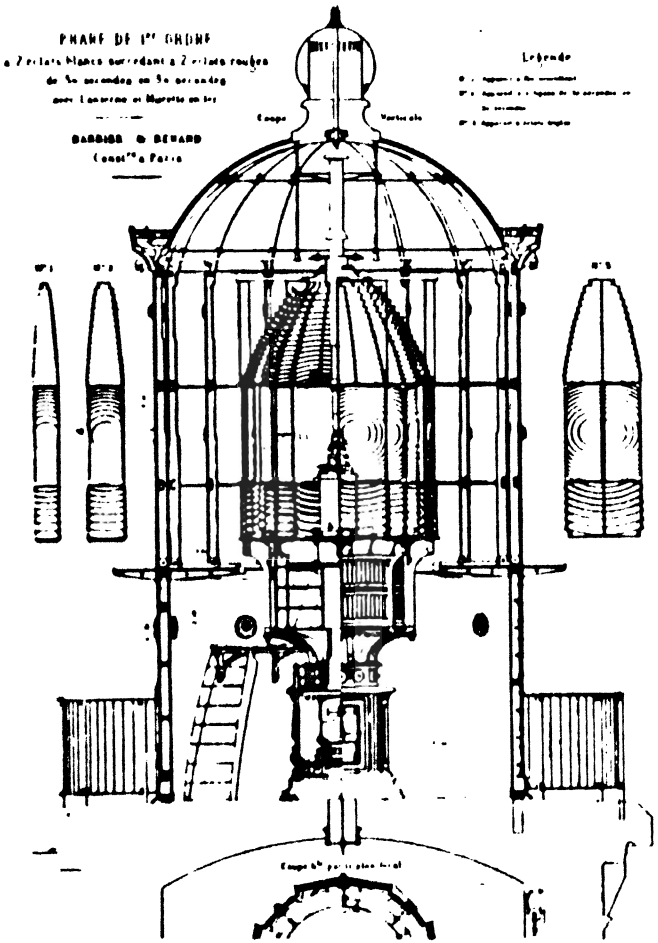
ERECTING THE LIGHT

The Lighthouse Service's structures were chosen especially for Bay Area terrain and weather. Taller, more elegant towers were inappropriate, and low-powered beams inadequate to pierce the fog. Western towers are usually short and substantial, with lights which are powerful first-order or second-order lenses.

Engineers had already learned the hard way about Bay Area "high fog," which may cover only the tops of hills and headlands. The lesson came at Point Bonita, southernmost point in Marin County and the last major obstacle for ships entering the Golden Gate from the north. The sites for its lighthouse and the one for Point Reyes had been selected at the same time, but the delay in proceedings at Point Reyes allowed Point Bonita the honor of being Marin's first lighthouse. In 1855, its original tower was placed on top of the 91 metre (300-foot) cliff, a site which seemed logical at the time. But all too often high fog obscured the light, and 22 years later the shortened tower was moved down the cliff. The engineers did not repeat their mistake at Point Reyes. A road from Drakes Beach to the top of the cliffs and a tramway down the headlands to the tower site were begun in January, 1870, and finished in April — both difficult and expensive jobs, requiring considerable blasting. Although placing the tower halfway down the 183 metre (600-foot), sheer, rocky headland made construction immeasurably more difficult, the Point Reyes light was situated properly. A site for the fog signal was blasted lower on the cliff, removing massive, overhanging rocks and leaving a vertical wall 30 metres (100 feet) high. The stairway to the light consisted of nearly 600 steps, with another 338 to the fog signal below. Beside the stair ran the coal chute and a small flatcar.

The same machinist who had built the tower for Cape Mendocino contracted to build a similar forged iron tower for Point Reyes and install the lens apparatus in it. In September, 1870, the tower and lens were shipped to Drakes Bay and hauled up the cliffs by oxcart. It took six weeks to get the parts down to the precarious site, assembled, and bolted to the rock. The light first shone on December 1, 1870 — eighteen years after Congress had appropriated the money for it.





French plan for a 1st Order Lens

FRENCH JEWELS

A light station must be readily identifiable from the water, and for this reason many beams flashed in a coded pattern. To create this effect, the lens at Point Reyes was mounted on wheel-like bearings and revolved by a clockwork mechanism. The revolution took two minutes, so the 24 separate panels in the lens caused the light to appear to flash every five seconds. The mounting was driven by the slow descent of a 79-kilogram (175-pound) weight which the keeper had to hoist 5.3 metres (17 feet) by hand every 2 hours and 20 minutes to wind the mechanism. Because of the gears, the job was not physically difficult, merely tedious.

Using only the weak light from four wicks that burned a highly refined lard oil, the wondrous lens could cast a beam 24 nautical miles out to sea. This 2.7-metric ton (3-ton) lens is beautiful in its intricate and extraordinary craftsmanship. It was cast in 1867 by the Paris firm of Barbier and Fenestre after the design of August Jean Fresnel. The basis for such beauty does not lie in artistic principles, but in the revolutionary deductions of this 19th century French physicist who became commissioner of lighthouses in France. He eliminated mirrors as reflectors and obtained circular polarization using a complex pattern of lenses. In the Point Reyes lens, light is focused through 24 panels, each an intricate assembly of hand-cut and polished crystal prisms and bull's-eyes — over a thousand pieces of glass in all — mounted in a brass framework.

Fresnel classified his lenses by order. The largest, or first order, like that at Point Reyes, was approximately 2.4 metres (7'10") high and 1.9 metres (6'1") in diameter, and the smallest, or sixth order, was approximately 1.4 meters (1'5") high and 0.3 metre (1') in diameter. To the genius of Fresnel we owe both the effectiveness and the beauty of Point Reyes' "French jewels."

In 1871 the fog signal was installed below the light, but its history of problems began just one year later when the building burned to the ground. Steam-powered, the signal had operated only one season after the rains filled the cistern at the top of the cliff. No sooner was it rebuilt than a drought stopped it again in 1873 because the cistern had run dry. During a five-week period a contractor hauled over 20,000 gallons of water trying to keep the station functioning. The watershed was then considerably enlarged, guaranteeing the operation of the fog signal with as little as 8" of rainfall a year. But the challenge of lowering the required 140 pounds of coal per working hour continued.

Over the years, the type and location of the signal was changed several times in an attempt to make it more effective. In 1880 the Lighthouse Inspector reported, "Great complaint has been made, and now is made, of the inefficiency of the signal at this place, which at times cannot be heard a mile distant . . . . Point Reyes is one of the most important points on the coast, and the needs of navigation require that its fog-signal should be in efficiency second to none." Hoping to increase the effectiveness of the signal, the Lighthouse Service removed the original signal in 1880, substituting steam-driven sirens (also fueled by coal), then, in 1890, replaced those with larger steam whistles.

As a record for the light station the fog horns later included a timing device which noted every hour of the day the horns were on. This record was the keepers' protection in the event they were ever accused of not having the signal operating when needed. Now Point Reyes seemed equipped to change its history of shipwrecks and disaster.

1875 November 18 — In letting Coal down today the belaying pin bent. The truck or hand car went with violent speed down the track broke through the end of the shed and sleeping room and also doing serious damage to the car.

Principal Keeper's Log



Steam whistle fog signal and coal chute, Eadweard Muybridge, 1873
(Bancroft Library)

1885 September 21 — Fog Fog and nothing but fog

had no mail since 9th visit. Getting short of Provisions.

1892 December 25 — Christmas Day Fog Watch Man all day.

1893 January 1 — Happy New Year to all. Cleaned Lens Mod. N.W. wind clear and pleasant.

Principal Keeper's Logs

Oh, what is the bane of a lightkeeper's life,
That causes him worry and struggles and strife,
That makes him use cuss words and beat up
his wife,
It's Brasswork.

Principal Keeper's Log

The Point Reyes Light Station is considered by this office to be the most undesirable one in the district . . . . No keepers ever volunteer to transfer to Point Reyes, and almost without exception the keepers on the station are the ones who have entered the service there. This office has great difficulty in getting keepers to accept appointment to this station, and still greater difficulty in keeping them in the service after they have reported there.

Superintendent of Lighthouses
San Francisco, 1926

MEN OF THE LIGHTHOUSE

The Lighthouse Service set high standards for keepers. The Lighthouse Board reported in 1894: "The discipline of the service is somewhat rigid, and has been from the beginning ... Now the class of men from whom keepers are selected is so good that the punishment of dismissal is infrequently inflicted. But it follows swiftly in two cases. A keeper found intoxicated is not only summarily dismissed from the service, but he is instantly ejected from the station; and a keeper who allows his light to go out is dismissed without regard to his record of previous good conduct. The Board holds that it is the duty of every light-keeper to stand by his light as long as the lighthouse stands. For him to desert it when it is in danger is as cowardly as for a soldier to leave his guns on the advance of an enemy ...."

But it was hard to uphold such standards at Point Reyes. Duty there seemed designed to test the ability of human beings to survive. Furious winds battered shelter and senses. Fog silently blotted out the rest of the world for days and weeks at a time. Life consisted mostly of routine maintenance jobs, and the pay was poor — $1,000 a year for principal keepers and as low as $500 for assistants. The isolation may have inspired meditation and study as the Lighthouse Board romantically believed, but in the early years at Point Reyes, the everpresent loneliness and monotony were oppressive.

The fog signal blared about one-third of the time. It is small wonder that a reporter for the *San Francisco Chronicle* wrote in 1887, "The sirens had been in operation for 176 consecutive hours and the jaded attendants looked as if they had been on a protracted spree."

Even the descent from the sleeping quarters to the lighthouse could be a terror. In 1887 another visitor wrote, "...this beacon is reached by an exposed stairway of seven hundred and fifty steps. When the storms are at their worst spray dashes up two hundred feet, ... and the poorly paid servants of a prosperous but ungrateful republic stand erect at the risk of their lives when going from their post of duty. Their only safety is in crawling on hands and knees up and down those seven hundred and fifty steps." Along most of the way there was a guard rail to keep the men from being blown directly into the ocean. The wooden stairs were constantly repaired and replaced, and the current concrete set of 300 steps and additional ramps were poured in the early 1960's.

The Principal Keeper's Log for the early years records mostly weather conditions, storm damage, visitors, and maintenance — the eternal polishing of glass and brass and the whitewashing of buildings. More fascinating are its glimpses of the human beings who were confined there.

For months in 1875-76 Principal Keeper Wadsworth contended with his unruly assistants. Third Assistant Parker regularly neglected to show up for watches, left his post in dense fog, "went to Olema and took the government horse with him and returned to the station drunk and unable to perform his duty that night." Parker left, but Wadsworth's troubles did not end. "1st Assistant Rowe is a grumbling nuisence ... He is all the time finding fault with someone at the station and never satisfied." Wadsworth left orders to repair the road, but Rowe refused to work. Another day records, "1st Assistant Rowe shamefully abused me by calling me vile names, saying he would never stop until he or I was removed from this station." Both were removed. The beleaguered Wadsworth was relieved by a new principal keeper, who then discharged Rowe.

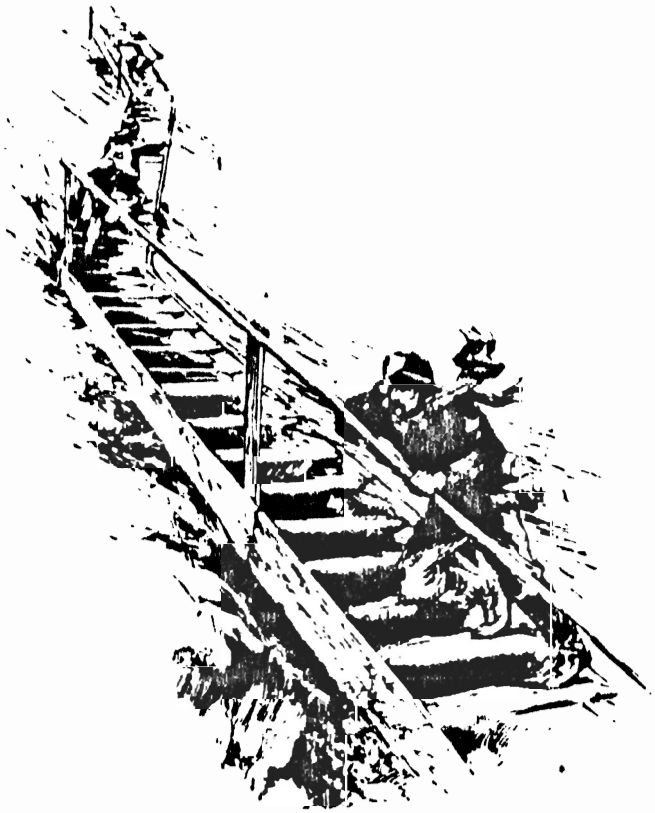
The incidents did not stop, however. Other keepers also recorded work refusals, abusive language, and abrupt resignations. Given the working conditions, it seems inevitable that in 1889 an assistant "went crazy and was handed over to the constable in Olema."

A keeper's heroism did not necessarily stop with his standing by his light until the end. Once, in winds of 80 mph, a fishing boat smashed onto the rocks below the lighthouse. The three survivors clutched the rocks for 13 horrifying hours. Finally, Keeper Fred Kreth was able to lower himself partway down by rope and pull them up to safety one by one.

Slowly, equipment, accommodations, and conditions improved. In 1880 the light station acquired telegraph communication with San Francisco. By 1888 there was a complex of buildings — keepers' cottages, a blacksmith shop, barn, storehouse, lime house, coal house, and a signal building. In that year also, the lamps were switched

O Solitude where are the charms that
Sages have seen in thy face.
Better dwell in the midst of alarms
than reign in this terrible place.
Society Friendship and Love Divinely
bestowed upon man
O had I the wings of a Dove
How soon would I taste you again.

E.G. Chamberlin, Principal Keeper
Principal Keeper's Log, 1885



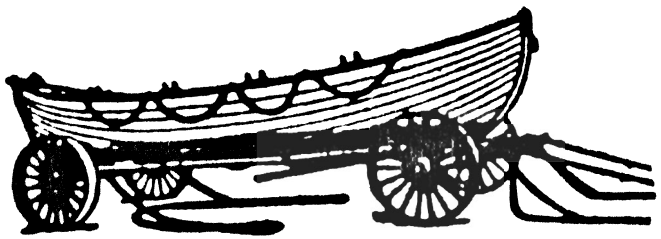
from lard oil to mineral oil. The mule and horse-drawn carts quickly chewed into the roadway, as they annually carried everything from food and water, to 200,000 pounds of coal and 760 gallons of refined lard oil. Later, trucks faced the same impassable conditions. Roads of wooden planks were constructed to control the deep mud and fences were erected to help curb shifting sands.

By the turn of the century, frequent tourists and guests visited the light station and helped considerably to enliven the days of the keepers. Gradually the telegraph, telephone, radio, automobile and electricity (brought to the station in 1939) improved the quality of keepers' lives and allowed them closer contact with society.

Despite the presence of a light on Point Reyes and some heroic keepers to man it, ships continued to run aground and lives were lost. There were nearly forty shipwrecks during the first 65 years of the lighthouse's operation. The first shipwreck occurred just three years after the fog signal was installed.

But for the time, all had been done that could be done to prevent accidents. The government then began systematically trying to save the lives of those who managed to survive the persistent wrecks. The Lifesaving Service, created in 1860, built a lifesaving station on Point Reyes Beach in 1888. A flagpole flew coded flags to distressed ships, and a bell in the front yard warned vessels in foggy weather. Personnel walked the Great Beach to the north and south in four-hour shifts, and the station's crew held dangerous weekly drills in rescue boats. The chaotic Point Reyes surf even made victims of the rescuers. Four members of those lifesaving teams have their graves in a stand of eucalyptus trees near Point Reyes Beach where they died.

Operations of the Lifesaving Service eventually shifted to the relative calm of Drakes Bay, where it built an auxiliary boathouse in 1912. After the Coast Guard took over the duties of the Service in 1915, a better station was built north of Chimney Rock, and in 1927 the Point Reyes Beach site was abandoned. By the end of World War II, advances in technology — improving both navigation and rescue — had made such lifesaving stations obsolete, and no more crews plunged into the wild surf.



At the lighthouse, wicks and lard gave way to incandescent oil vapor about 1877, and to electricity in 1939. Eventually a 1,000-watt light produced a one million-candlepower beam, visible up to 24 nautical miles, and a small electric motor was used to rotate the lens apparatus instead of the original clockwork mechanism. In 1949 a radio beacon was installed, and in 1975 the lens itself was retired in favor of the automated light on the roof of the building below the first site. However, the original lens and its rotation mechanism are still in operating order. Combined with a Coleman-type lantern, they can be used in the unlikely case that both commercial power and the emergency generator fail.

The fog signal, too, has seen change. In 1915 the steam-driven signals were replaced

by a two-tone diaphone signal which makes the familiar drawn-out sound we associate with fog horns. During the NPS tours in 1966, eleven of the twenty-seven tours had to be cancelled because the ear-deadening foghorn was in operation. This signal was later replaced by the current electronic diaphone foghorn. Each of the three navigational aids — rotating light beacon, electronic foghorn, and radio beacon — emits a coded signal unique to Point Reyes.

The Coast Guard took over the Lighthouse Service in 1939 and, nationwide, this altered the character of the light stations. Younger military attendants rotated often, so some of the former feeling for the stations was inevitably lost.

Automated in 1975, Point Reyes became a ghost station. Attendants were no longer necessary. In 1977 the historic buildings were transferred to the National Park Service.

Today, the spectacular beauty of the natural setting draws people to Point Reyes. Many species of birds rest on the cliffs, and plant life provides a rich palette of texture and color. Sea mammals can be seen at the water's edge; in fact, the headlands afford one of the best places on the West Coast to observe the California gray whale migrations. But at the heart of most visits is the allure of the light station itself, a silent monument to centuries of seamen who risked their lives in these waters and to the long-suffering keepers who stood by in loneliness to warn and save them.





THE LENS

First order Fresnel lens
- Outside circumference 6 metres (19′7″)
- Inside diameter 1.8 metres (6′)
- Inside height 2.6 metres (8′6″)

Weight — 2722 kilograms (6,000 pounds)

1032 pieces of hand-ground crystal
- Each bull's-eye 279 millemetres high, 222 millemetres wide (11″ x 8¾″)
- Height from base of tower to focal plane — 7 metres (23′)

Revolved once every two minutes
- 24 flash panels
- Flash pattern — 1 second flash in every five seconds

Effective visibility of beam — 24 nautical miles
- Height of focal plane above sea level — 90.2 metres (296′)
- Beam intensity — 1,350,000 candlepower
- Arc of illumination — 285°

THE STEPS

307 steps, with an additional 6[illegible] metres (217′) of ramps

Top of cliff — 183 metres (600′) above sea level

THE POINT REYES LIGHT

Established 1870

THE TOWER

Forged iron plate — 16 sides

12.2 metres (40′ high)

THE WEIGHT

[illegible] kilograms ([illegible] pounds)

Maximum running time [illegible]

TEXT BY PAT HALL — EDITING BY PAT KOLLINGS
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