

MAKAHIKI KAI

festival of the sea

'78

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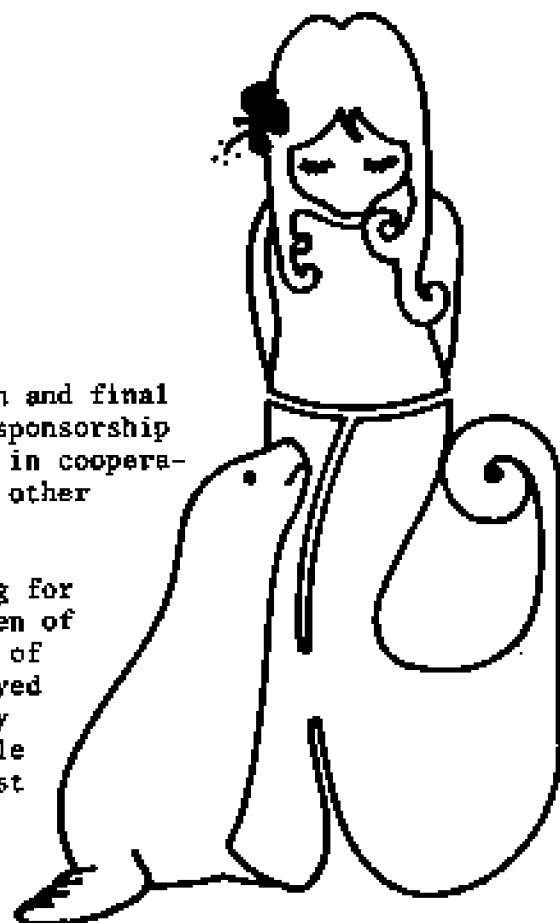
TEACHERS' GUIDE

WORKING PAPER NO. 30

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MAKAHIKI KAI '78 is the fifth and final year of the series of festivals of the sea under the sponsorship of the University of Hawaii Sea Grant College Program in cooperation with the Marine Affairs Coordinator's Office and other governmental agencies.

The concern of the State Legislature in providing for equal educational opportunities for all of the children of Hawaii was demonstrated by the generous appropriation of funds to enable Makahiki Kai '76 and '77 to be displayed on the neighbor islands. The '76 bicentennial display was mounted on the Navy's experimental semi-submersible ship, *Kaimalino*, and shown as a floating exhibit. Last year's exhibit was displayed on Kauai, Maui, Lanai, Molokai, and Hilo and Kona, Hawaii and not on Oahu, except for a limited display at the Ala Moana Shopping Center.



A project of the University of Hawaii Sea Grant College Program

For the Hawaiian Bicentennial, Makahiki Kai '78 will focus on the historical re-creation of Lahaina, Maui and the whales which provide a link between the past and the present. Once slaughtered by whalers from New England who used Lahaina as a base for taking on water and food, the whales today annually migrate to Hawaii and enjoy the protection of federal regulations.

The exhibits on marine mammals are designed so that it will be possible for schools to set them up in their own library or other resource room. Although this is the last year for the designing of new exhibits, it will be possible for teachers and schools to use whatever is available in their own schools.

It is hoped that teachers can use this guide to enrich the experiences of their students before and after their trip to the Neal Blaisdell Exhibition Hall. Teachers especially are invited to write in any comments or suggestions they may have. Write to:

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Lahaina

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Activities

This section can be easily integrated with the study of Hawaiiana. The following list suggests some of the subject areas that can be pursued by students.

1. Captain Cook's discovery of the islands.

What would a map of the Pacific look like before Captain Cook's three voyages? What was he searching for when he discovered Hawaii? How was he received in Hawaii? Why?

2. The kapu system--its effects before and after Kamehameha's renouncement in 1819.

What was the religious climate at the time of the arrival of the missionaries in 1820? What part did the kapu system play in the daily lives of the Hawaiians? Do you recognize any effects of the kapu system in our society today?

3. Life of the missionaries.

Why did they come to Hawaii? Describe their long journey to the islands. What part did they play in the education, government, and general life of the people, including Hawaiians and whalers? What do you think Hawaii would be like if the missionaries had not arrived when they did?

4. Life in Lahaina during the height of the whaling era.

Describe the town: shops, marketplace, fort, roads, etc. Who lived there? How would the population and place differ from other areas of Hawaii with the exception of Honolulu? Describe how the Hawaiians adopted the foreigner's influence in their lives such as the way they dressed. For example, ladies fancied silk and satin muumuu and men proudly wore malos with sailor peajackets.

Suggested Excursions

1. Bishop Museum
2. Mission House - restored home of the early missionaries

LAHAINA - 1853

Welcome to Lahaina! It is October 1853 and Lahaina is a beehive of activity! Each spring and fall, her calm and safe roadstead serves as a major port for provisioning whaleships before they head out to sea again in search of their "treasures"--whale oil and whalebone.

The crews from the whaleships, numbering from 1,200-1,500 men, are roaming the single main street and byways of Lahaina in search of recreation which to many stands for alcohol and women. Grogshops and brothels are prospering from satisfying the thirst and cravings of the lusty seamen. Debauchery and street brawls are frequent for the philosophy of "no God west of the Horn" sets the tone of life in this port.

The captains of the ships are making heavy cash payments for provisions and supplies, much to the happiness of the merchants. The influx of ships has brought an unprecedented business boom and prosperity to this town. The chief source of income for the people of this island comes from provisioning the whaleships with water, beef, hogs, goats, fowls, vegetables (Irish potatoes which were introduced in 1840 and flourished on the Kula lowlands, sweet potatoes, pumpkins, and cabbage), fruits (bananas, melons, oranges), salt, rope, fishhooks, sextants, hardware, wood, and other necessities. The demand for firewood is so great that the forests are stripped and causing erosion problems. Some sailors are rolling huge casks of water across the main street. They have come straight up from the landing to the water pump which is worked steadily night and day when the whaleships are in port.

The demand for fresh vegetables and fruits and meat have stimulated a growth of diversified agriculture. All the food supplies come from the country and are brought on the dusty, muddy, and unpaved roads. Despite opposition from residents, cattle is driven through the main street of town then to the port where they are slaughtered as they are needed.

Commercially, the good seems to balance the evils brought here by the whaling fleet. However, the missionaries, who are not commercial but religious minded, do not see it this way. While their main concern is to bring enlightenment to the Hawaiians, they are devoting much of their time and effort not only in attempting to control the behavior of the sailors but to recruit them into Christianity through the temperance society, the establishment of a Seamen's Chapel, and sheer determination. Considering circumstances, it is amazing that they are making progress in their work against worldly obstacles.

The islands are united as one kingdom under the rule of Kamehameha III. It is an age of progress, liberty, and schools. He has given the people a constitution, fixed laws, and secured them in the title to their lands. They enjoy a voice in the government and are making the laws that govern them.

The town is built near the seashore and its principal street is a mile long, intersected by a few others running at right angles. It is composed principally of grasshouses and many have well-tended gardens in which taro, bananas, cabbages, onions, and other vegetables are growing. The first census taken in Lahaina in 1846 lists 3,445 natives, 112 foreigners, 882 grasshouses, 155 adobe houses, 59 stone and wooden houses, 528 dogs, and 600 seamen.

MISSIONARIES

While the sailors from the whaleships came to Lahaina to seek temporary pleasures, the American missionaries came to stay. They came with their wives and families and were dedicated to creating communities peopled with God-fearing citizens and to establishing permanent homes, churches, educational institutions, and other "necessities" for civilization.

Their hard work and sincerity soon gained the respect of the ruling chiefs, many of whom were converted to Christianity. The chiefs actively supported the missionaries in passing laws against immorality and in building churches and schools.

The missionaries built their own homes, prepared their own food, made their own furniture, built schools and churches, printed leaflets and books, taught the natives to read, write, print, and sing. They translated the Bible, preached sermons, administered to the sick and distressed, and tried to have the Hawaiians adopt their standards of morality.

Missionary Wives

The presence of the missionary wives aided immeasurably in winning the confidence of the chiefs and the ultimate success of the missionaries. Besides attending to domestic duties (managing the households, entertaining guests, taking care of the children), teaching school and Bible classes, they taught the women to sew clothes and quilts. At one time, the American Board of Commissioners for Foreign Missions insisted that only married men should be sent to convert the natives. This created a dilemma for the young bachelor missionary candidates. The Board recommended suitable mates and the young men showed considerable ingenuity in acquiring wives. In one case, a young doctor called upon a likely prospect and finding her out, proposed to her sister, who accepted. Many had been married less than five weeks when they boarded the ships for the long and dangerous voyage to Hawaii.

Mrs. Charlotte Fowler Baldwin, accompanied her husband Rev. Dwight Baldwin, M.D. to Lahaina in 1835 and remained there until 1871. In addition to his missionary duties, Rev. Baldwin was a medical doctor and served as government physician for Maui, Molokai, and Lanai during the smallpox epidemic of 1853 and kept it controlled by his personal vigilance. Mrs. Baldwin's duties were typically numerous. In addition, she conducted a hospitable home where a visitor always received a warm welcome. Living at a seaport, they had much company and her dining table was set as often as three times in one evening. Many nights the children slept on the floor while visitors including missionaries and ship captains occupied their beds.

Mrs. Baldwin is described by her daughter Harriet. "My earliest recollections in her missionary labor is of the school she held for Hawaiian women beneath a grape vine which covered a large lanai just off her bedroom. Here, surrounded by women--twenty, thirty or more--she would teach sewing, knitting, and various other kinds of work. She also taught them singing, having herself a strong, sweet, and leading soprano voice. Hawaiians, natural born lovers of music, soon caught the idea of melody and song, and music had its charms to draw them more closely to listen and accept the teachings for a new and better life. Hearts had been won and many were the expressions of gratitude and love."

Harriet further recalls that as a child she and her brothers and sisters played on a large kou tree in front of their home and gathered and cracked the nuts that had fallen. Once a year, they were allowed to wear old clothes and rollick in the rain, splash one another, and sail their boats made of mimosa pods in the puddles. Every morning and evening, the family gathered for prayer and they observed the Sabbath. Music lessons weren't forgotten and the girls gathered around their mother to sew.

Schools

The missionaries first task was to learn the language and reduce it to a written form.

There were only 200 pupils enrolled in schools established by the missionaries at the end of 1821. In 1822, the missionaries printed the first English-Hawaiian speller and reader. With the Hawaiian language in print, learning to read became relatively easy and the chiefs took a more lively interest in public education. In 1824, Kamehameha decreed that all should learn the palapala--reading and writing. By the end of that year, 2,000 pupils were enrolled and in 1831 there were 1,100 schools and 52,000 pupils, about 40 percent of the population, enrolled.

It was clear that a handful of missionaries could not instruct all the pupils and give adequate supervision to the schools. So in 1831, Lahainaluna School was founded to train Hawaiian men to be school teachers or assistant pastors of rural congregations.

The early schools, like the early churches, were grass huts with adobe seats. In one instance, the natives converted surfboards into desks. A missionary's wife relates her experience of assisting in organizing the first school for native children in an unfurnished building. "The little urchins were not quite naked. We looked into their bright faces, asked their names, sang with them, and induced them to join us. We discovered that they possessed the requisites for musical culture, ear, and voice. We made drawings of natural history, which were hung for all to see. A description for each was taught them in the form of questions and answers and they were quick to comprehend and repeated readily.

The singing and pictures attracted other children. They sat on adobes (sun-dried bricks) covered with rush mats braided by their mothers. Slates and pencils added charm and the children delighted in copying pictures hung on the wall. Native women assisted in reading and the elements of arithmetic were taught. We gave them maps of the world, and the children were astounded at the littleness of their own islands."

Whaling

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Activities

This section should prove very appealing to youngsters who love adventure stories. A whaler's life was filled with danger, excitement, and back-breaking work as well as long hours of waiting for the sight of a whale.

1. What was the make-up of a crew? What was it like to be captain, 1st mate, harpooner, or cabin boy? Describe the crewmen's functions, "lay," meals, recreational activities (scurmshaw), medical care, housing, etc.
2. Describe the excitement that occurred when a whale was sighted and the chase, catch, and processing that followed.
3. Display and/or demonstration of sailor's knots.
4. One of the greatest novels of all time, *Moby Dick*, by Herman Melville, depicts life on a whaler during the height of the whaling industry. A book report accompanied with pictures would be very interesting.
5. Try scurmshawing a design on a used bar of soap.
Materials: Very sharp pencil; used bar of soap (dried thoroughly to harden); best to use "hard" soap, one with little cream; ink; brush (stiff scrub brush, painting brush); paper towels.
Procedure: Etch design deeply in soap; using a stiff brush, brush off all soap shavings in the grooves; brush with ink making sure all grooves are filled, let dry; wipe off ink on surface quickly with a slightly damp paper towel; dry with paper towel. Do not use too much water or soap will soften and melt design.

NOTE: A replica of the old whaleship *Essex* sits in the middle of Sea Life Park. The *Essex* met its fate over 150 years ago when it was rammed by a large sperm whale and sank in 10 minutes. The story of her survivors makes very interesting and somewhat gory reading as cannibalism was practiced among the survivors.

HISTORY OF THE WHALE FISHERY

Europe

The hunting of whales is a very old occupation of man dating far back into recorded history.

The earliest period of whaling dates back to the 12th century. The Basques, a people of northeastern Spain and southwestern France, were Europe's leading whalers and may have begun as early as the 9th century. Several whaling terms, such as the word "harpoon" comes from the Basque language.

At first, the Basques dealt only with stranded specimens. Stone watchtowers were later erected along the coast and manned during the spring and winter months when the Biscay right whales (*Eubalaena* spp.), passed along their shores in migration. As soon as the lookouts saw a whale spouting, they alerted the nearby villages by ringing bells and making smoky fires. Men and boys in small wooden boats rowed out beyond the breakers and drove the whales toward shore with their shouting and disturbances. As the whales swam toward shallow waters, they were killed with lances.

The right whales were ideal victims. They were comparatively slow making them relatively easy to hunt in small boats and not too difficult to kill with primitive weapons. They also floated after they were dead while other species sank. This made them the "right" whales to catch.

The right whales brought wealth to the Basques. The hunters not only used the mammal for food but marketed the baleen and oil throughout Europe where the oil became the principle fuel for lamps.

Before long, there were few right whales remaining in the Bay of Biscay. The whalers therefore built larger boats and struck out across the Atlantic to Iceland, Greenland, and as far as Newfoundland. They developed the process which converted the blubber into oil aboard a whaling boat.

In the early 17th century, the Basques lost their whaling supremacy to the Dutch and English. In seeking a northern passage to India, the Dutch discovered Spitzbergen and its surrounding rich whaling grounds. Competition was fierce between the two nations for the valuable oil and baleen of the Greenland right whales (*Balaena mysticetus*). The Dutch built shore stations where the whales could be stripped and boiled. One station on the island of Spitzbergen grew into a small, bustling town with thousands of men busy at the oil cookeries, besides shopkeepers, bakers, and artisans. The town was appropriately called "Blubbertown."

The Dutch and English had no more idea of the limitations of the natural resource of the sea than the whalers of the 19th and early 20th centuries. They hunted relentlessly and competently for the greatest immediate profit and soon killed off most of the Biscay and Greenland right whales in the northern hemisphere. The two species have never recovered from that early slaughter.

Asia

Halfway around the world, the Japanese hunted whales during the 16th century. They shared the same advantage with the Basques--whales in migration passed near their shores. Eventually, they too, ventured out to sea and hunted the California gray (*Eschrichtius gibbosus*), sperm (*Physeter catodon*), right (*Eubalaena* spp.), and humpback (*Megaptera novaeangliae*) whales.

Their methods were similar to that of the Europeans using small boats, harpoons, and lances. By the end of the 17th century, they perfected a new technique using enormous nets equipped with many empty barrels to serve as floaters. No fewer than 25 boats were required to round up an animal and handle the nets. After the whale was trapped, it was harpooned and speared.

South Pacific

Below the equator, the waters around New Zealand and Australia, became the center of the whaling industry during the 18th century. The southern right whales were killed by the thousands by the British, American, and French. Occasionally a sailor met his death not as a hunter but at the hands of the Maori of New Zealand who practiced cannibalism. By the end of the 1850's, the whaling population declined and hunting in the area drew to a close.

North America

Whaling in North America began about the time of the Basque whalers. It took great courage to whale in small boats in such frigid waters where overturning meant death. Religious ceremonies were held before and after hunts to give the crew courage and confidence. The Eskimos developed a technique of getting as close to a whale as they could in their skin-covered canoes and driving a mortal blow with a spear into the animal's lung. An inflated sealskin was used as a buoy which would float if the whale sank or dived.

The Aleutian Eskimos set out on one or two-man kayaks (small skin-covered and decked canoes propelled by a double-ended paddle) and attacked right, humpback, and other whales

with harpoons dipped in poison. The real nature of the poison, made from the root of aconite, was a carefully guarded secret among the Eskimo whale hunters. Having planted their spear, they paddled back to shore as quickly as possible. In two or three days, the whale died and was washed ashore.

The Indians of New England hunted the humpback and right whales in shallow coastal waters while some west coast tribes hunted the California gray in the bays of Baja, California. When the Pilgrims arrived in New England, they found the Indian tribes using fleets of bark canoes and harpoons with sharp, bone-head points and flights of arrows which they shot into the harpooned whale to hunt whales.

"Drift whales," which were dead or stranded on shore, were highly prized in the Plymouth and Massachusetts Bay colonies. In 1644, the town of Southampton was divided into four wards or precincts of eleven persons each to attend to drift whales. Two persons from each ward were selected by lot to cut up the drift whale.

A few years later, whaling expeditions consisting of several boats were sent out along the coast. These expeditions lasted about one or two weeks and the men camped along the shore at night.

In 1700 right whales were so plentiful within sight of land that watchtowers were built and manned along the shores. After the whale was caught, it was prepared and boiled in try-works set up on a beach, such as the Dutch had done in Spitzbergen a century earlier.

In 1712, while seeking right whales, Captain Christopher Hussey was blown by a strong northerly wind some distance from land and fell in with a school of sperm whales. He killed one and brought the valuable spermaceti and oil back to port. The sperm whale was a larger, stronger, and more fearful adversary than the right whale. But now, Americans were demanding more whale oil. Spermaceti, the wax contained in the sperm whale's head, was bringing high prices and every sperm whale furnished a ton of it.

As the right whales were becoming noticeably fewer, this event gave a new life to the whaling business. The enterprising New England whalers began building larger vessels to whale out the "deep" as it was called then to distinguish it from shore whaling.

Before long, the American sperm whale industry began to flourish. Whaling ships leaving from Nantucket, New Bedford, and other eastern ports hunted through all seasons of the year and young whales as well as old ones were targets. They journeyed several thousand miles, sometimes as far as Cape

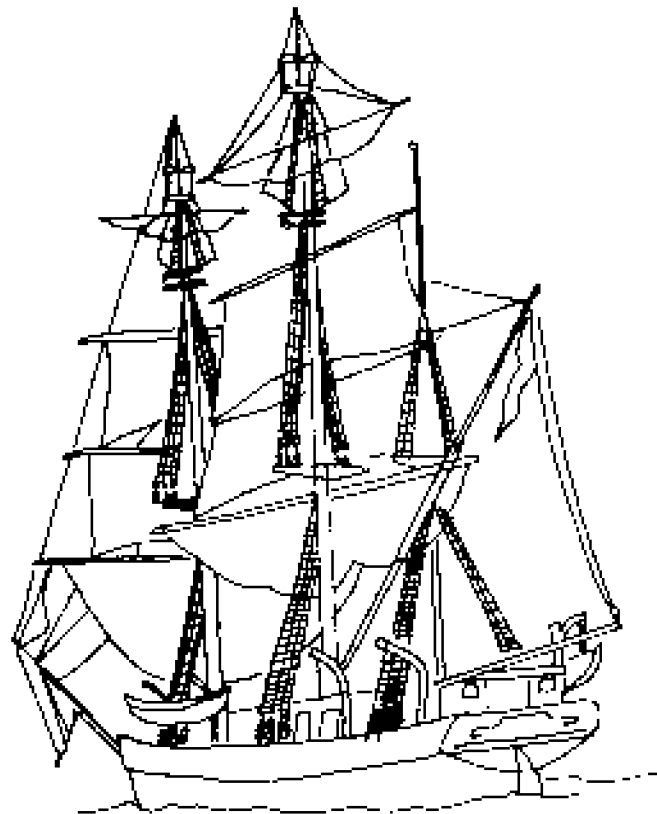
Horn in search of the sperm whale. By the late 1800's, they had rounded Cape Horn and were whaling off the Chile coast. The southern right whale was discovered in 1804 in the Antarctic. Between 1804 and 1817, 190,000 whales of this species were slaughtered.

The Nantucket whaling fleet was growing. The large 454 metric ton three-masters carrying six whaling boats and a crew of 40 began replacing the smaller ships. Even before the mid-1800's, extended expeditions were required to discover and kill sufficient numbers of whales to justify the expense. It became customary then for whaling voyages to last four or five years to enable them to return with a full load of whale oil. Some ships transferred their oil to cargo vessels at the distant ports of San Francisco or Hawaii before they returned again full of oil. In 1846, the industry reached its peak. Seventy thousand sailors were employed in 735 American whaling ships.

BEGINNING OF WHALING IN HAWAII

The first American whaleships, the *Balena* and *Equator*, arrived in Hawaii and harpooned a whale the same year Kamehameha I died and the kapu system was abolished. It was only a matter of time before Hawaii was visited by hundreds of whaling and merchant vessels every spring and fall. The ports of Honolulu and Lahaina became so crowded with ships that it was said that you could hop from one end of the harbor to the other by using the decks of the ships.

The American whaling fleets from Nantucket, New Bedford, and other New England ports, that fished out the whales in the Atlantic started to "round the Horn" to the Pacific where new sperm whaling grounds were discovered off the coast of Japan. Since Japan's ports were closed to foreigners during these three or four-year voyages the whaleships needed the ports of Honolulu and Lahaina which quickly became the whaling centers of the Pacific to dock for repairs, provisioning, and relaxation. Many ships came to the islands twice a year and visited more than one port. The increases after 1840 and 1851 were caused largely by the discovery of additional whaling grounds in the northern Pacific.



Effects of Whaling Industry

These seasonal invasions had a healthy effect upon individual initiative as well as upon the kingdom's economy. Income derived directly or indirectly from whaling ships surpassed that from all other trade. New businesses were established for supplying the ships; craftsmen, native and foreign, were attracted to the ports; agriculture was stimulated and cattle ranches were started.

The negative effects were also prevalent...lawlessness, drunkenness, and a disruption of a way of life. As grogshops and brothels prospered, whalers' lawlessness clashed with the local enforcement officials and missionary principles. Riots, shootings, burnings, sailors threatening natives and missionaries, and seamen demanding women all became a way of life.

The spread of diseases brought by foreigners contributed to the reduction in the Hawaiian population. At the time of Captain Cook's arrival in 1778, the native Hawaiians numbered 300,000. By 1820 their numbers had dropped to 135,000. In 1850, of the 1,422 births, three-fourths died at infancy. The population declined further to 85,000 and in 1890, only 40,000 remained.

The whaling industry had some effect upon the population of Hawaii. Between 1845 through 1847 nearly 2,000 eager Hawaiian youths enlisted as sailors on whaling vessels, many never returned to the islands. Local opposition developed because workers were being drawn from the plantation. Captains of ships were required to post \$100 bonds, which was later raised to \$300, as guarantees that the native sailors would be returned.

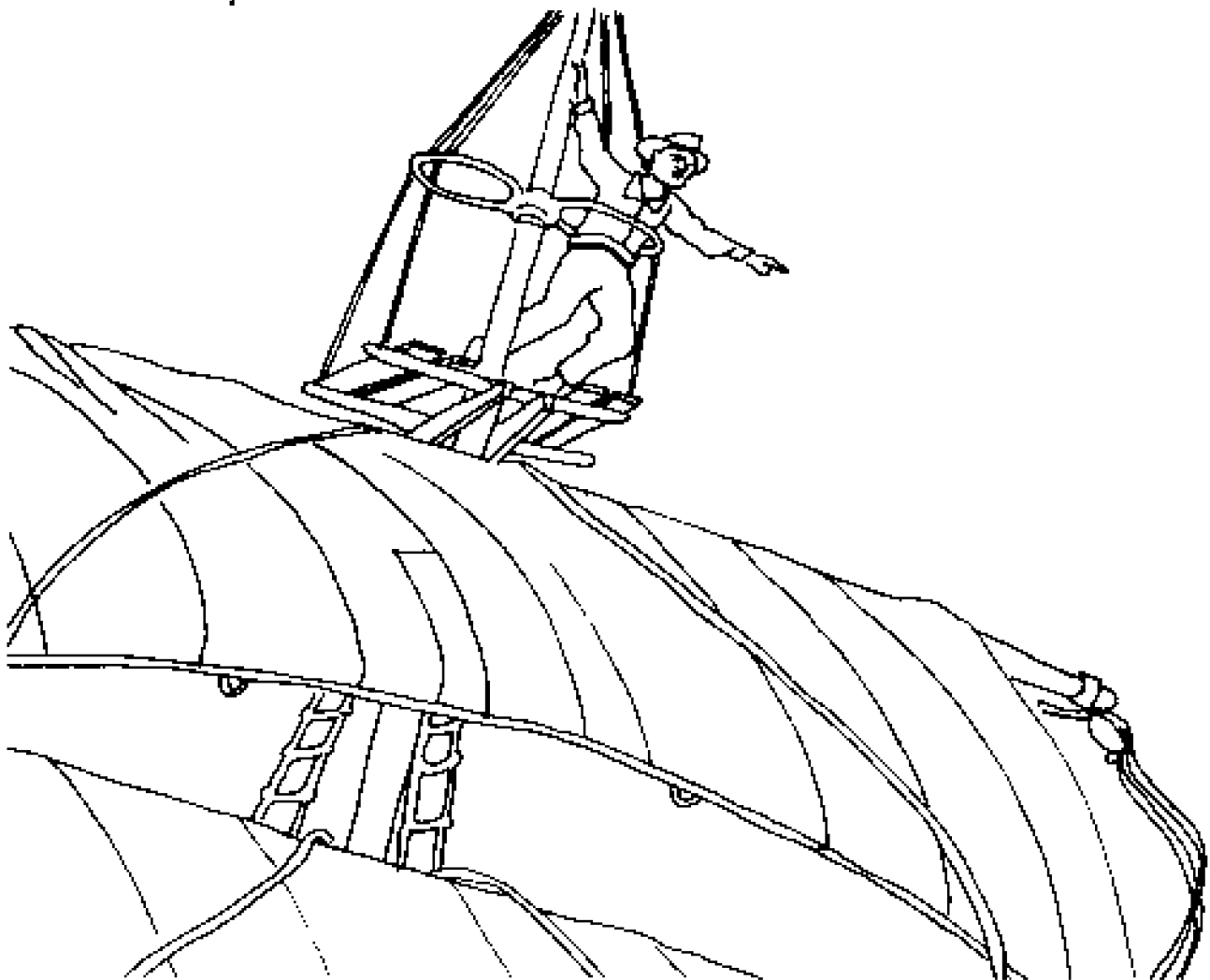
WHAT WAS AMERICA'S GOLDEN AGE OF WHALING LIKE?

It was hard to imagine that men ever dared to attack the whale with harpoons thrown from small wooden boats. For pure size and power, there is no rival. But for the Yankee whaler, this dangerous combat was a way of life.

Thar She Blows

A man was always posted as lookout on two small boards called the "top-gallant crosstrees" which were fastened to the main mast of the ship. He was steadied by a waist-high iron hoop made fast to the mast a hundred feet above deck. He swayed back and forth for two dizzying hours before being relieved.

When a whale was sighted, the lookout cried, "A-a-a-ah blows! Thar she blows!" The ship below him erupted into action as his long drawn out cry sent a thrill through every man in the ship.

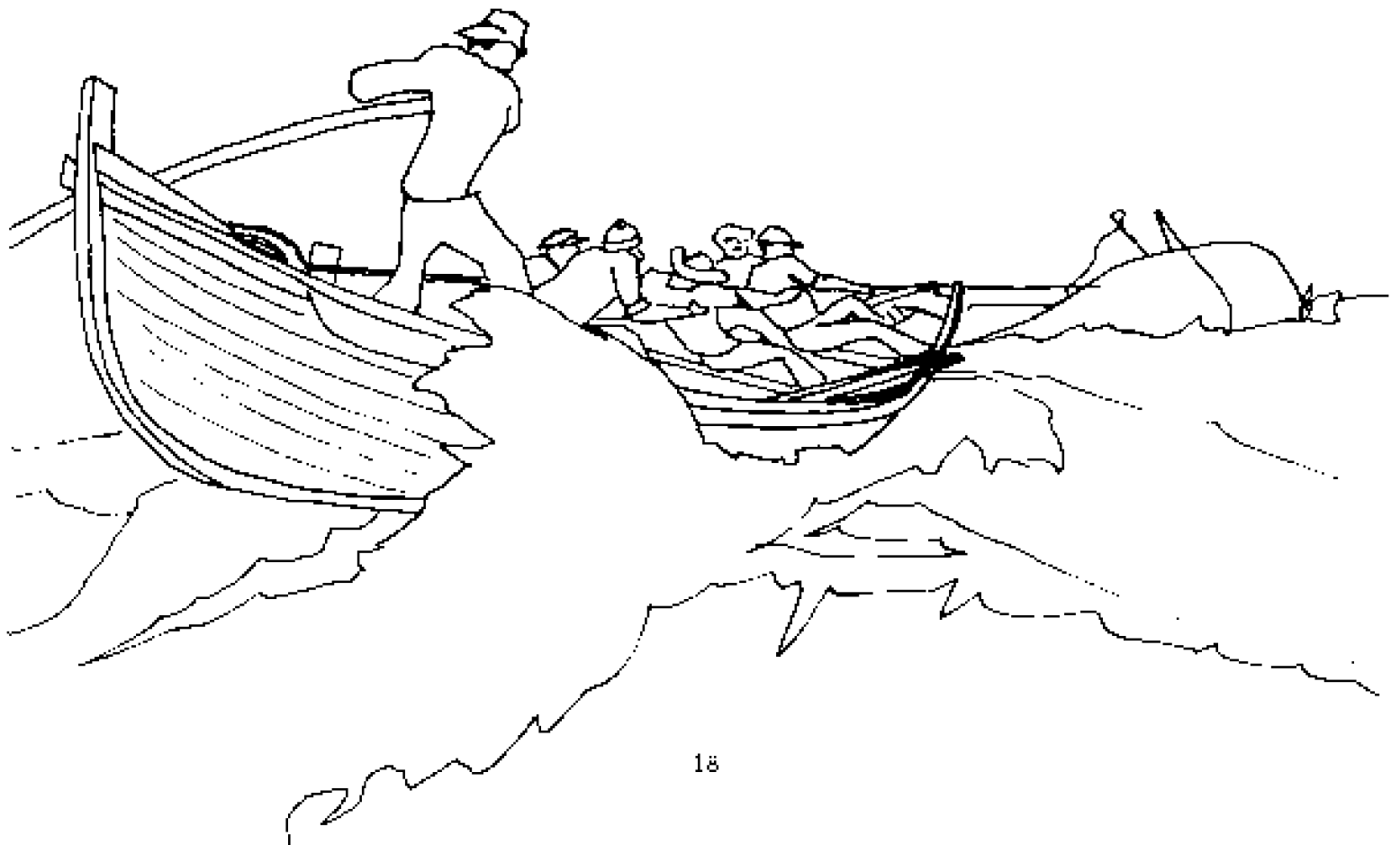


The Chase

Boats were lowered and the chase began! With much colorful and downright profane yelling, the boatsteerer urged the crew onward toward the spot perhaps 3.2 km away, where the whale may reappear for air again. When the whale came up for air, the whaleboats would be waiting. "Pull lads! Put your hack into it, me heroes!" As a boat approached throwing range, the boatsteerer or harpooner would stand up with his feet on the forward platform, his knee braced against the "clumsy cleat" at the bow of the boat, and harpoon the whale with all his might.

Boat and whale were now fated to fight it out. The whale may dive or lash his tail with thundering blows that could smash the boat to splinters. Sometimes the crew would be forced to abandon the boat, sacrificing the catch to save their lives. Or the whale may swim across the sea with terrifying speed, towing the whalemens on what was called a "Nantucket sleigh ride." The line whipped out of the tubs and whistled around the loggerheads so fast that the men poured water over the rope to keep it from being set on fire by friction.

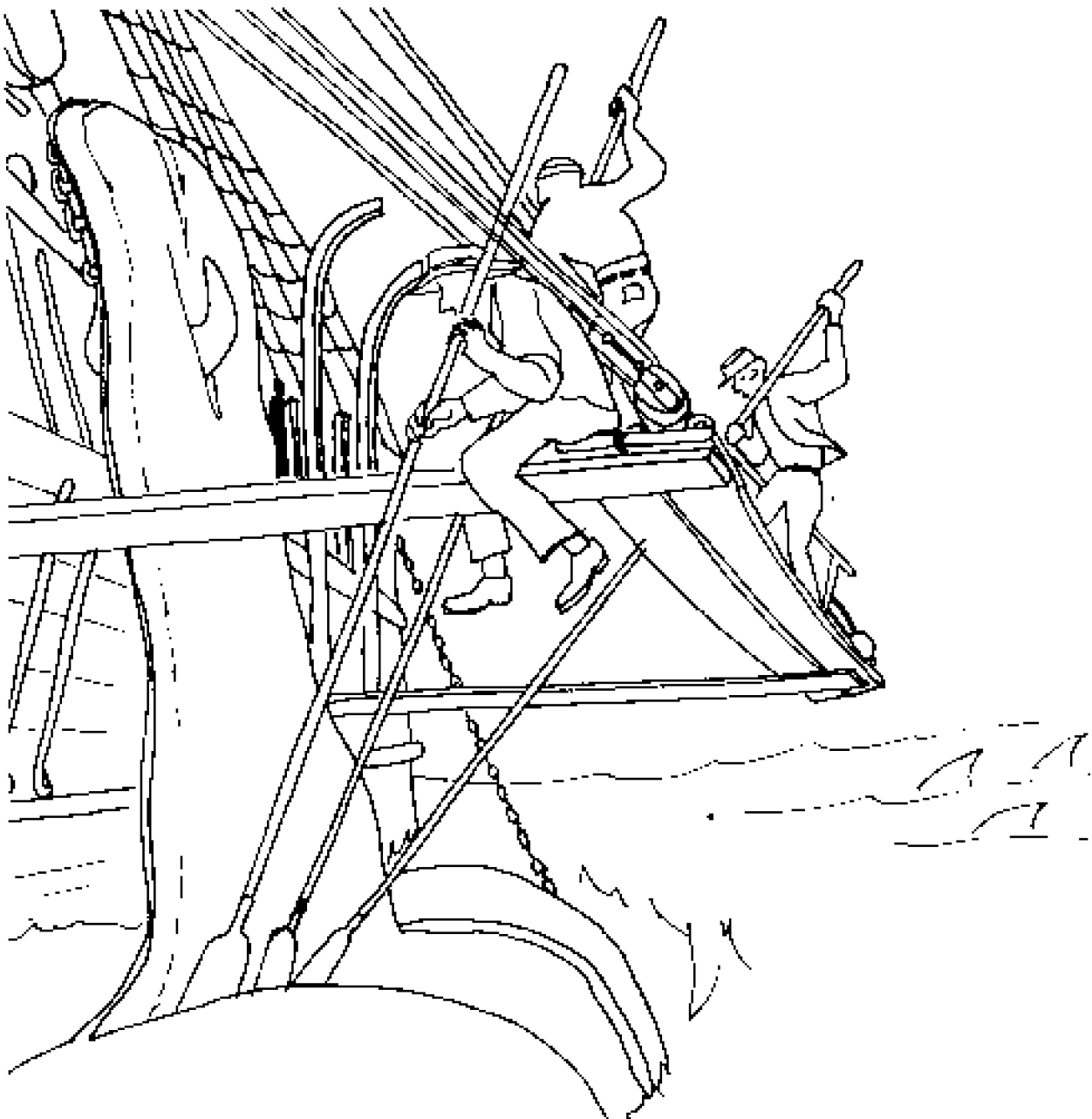
After the whale had tired of towing the boat in its attempt to escape, it would lay exhausted in the water alongside the boat. The officer-in-charge or boat header would change places with the boatsteerer and kill the whale with the plunge of a long iron lance.



Cutting In

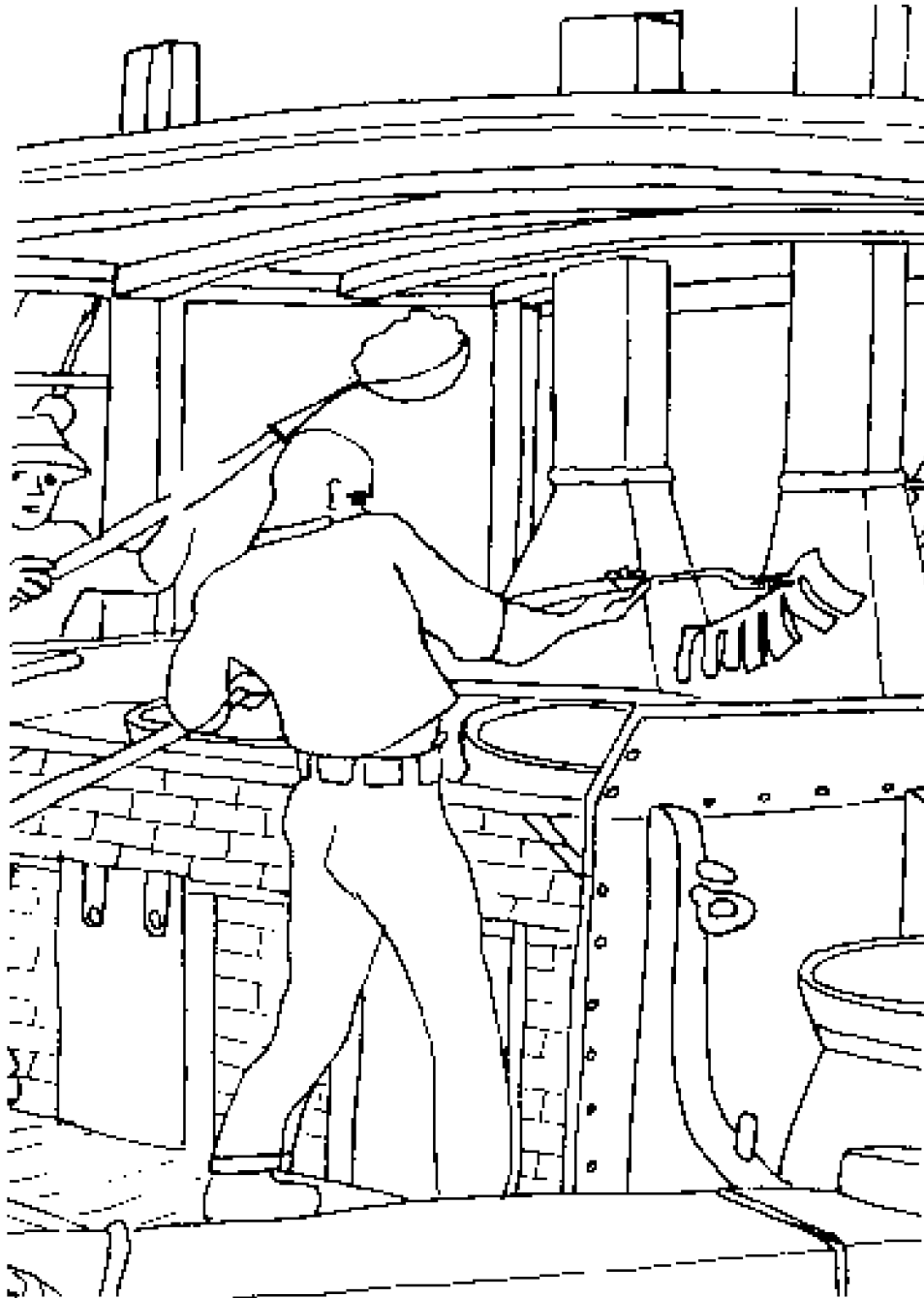
The enormous cadaver was towed back to the ship and the "cutting in" or removal of the blubber began.

Standing on a narrow platform called a cutting stage, the seamen labored with sharp spades until they had separated the whale's head from the body. The blubber was then cut in a continuous strip as the body rolled over and over unpeeling like an orange. As the men worked, the carcass was often surrounded by sharks sharing in the spoils. Large sections of blubber, "blanket pieces," were lifted aboard and stored temporarily in the ship's hold. When all the blubber had been removed, the stripped carcass was set adrift to be torn apart by the sharks.



Boiling

The blanket pieces were sliced to smaller "horse pieces" and further minced into smaller "bible leaves" resembling open pages. These pieces were thrown into the try-works, large brick furnaces containing two huge iron caldrons in which blubber was boiled. The men labored day and night for several days at the roaring try-works. The stench was incredible and the smoke suffocating. As the oil rose to the tops of the kettles, it was scooped off, cooled, strained, and stored in barrels. Each barrel contained 119 liters.



The real treasure was the head of the sperm whale. The case located on the upper part of the head contained up to 1,892 liters of spermaceti, a high grade oil used to make smokeless candles and to lubricate watches and other delicate machinery. The spermaceti was bailed out with buckets and stored in specially marked barrels.

Sperm whales' teeth were also valuable. When scrimshawed into art works, it found a good buyer's market. Pulling whales' teeth had its intricacies but the whalers had mastered the process and the teeth popped out like peas from a pod.

After the teeth were removed and all the oil and spermaceti had been stored in barrels below deck, the whalers spent several more days scrubbing the ship clean. The hunt for more whales would then resume.

Life of a Seaman on an American Whaleship

The work of a sailor on a whaleship was characterized by backbreaking labor following a catch and long periods of boredom. Repairing rigging, ropes and sails, spinning yarn for the many uses aboard ship and generally keeping the vessel in shape kept the crew busy for many hours.

They lived in crowded quarters and accepted iron discipline. If a man disobeyed an order, he might be flogged with a whip.

Whaling was dangerous. Many died in their small whaleboats, in the jaws of a whale, or under his huge thrashing tail, even a mother ship had been sunk by a whale. On the average a whaler lost a third of its crew because of deaths resulting from mutiny attempts or disease and desertions.

A seaman's diet was not appetizing. Salt pork and meat, mush, and hard bread washed down with plenty of black coffee sweetened with molasses became the mainstays of his diet. At the start of the voyage fresh meats were available and fruits and vegetables guarded against scurvy, but after months at sea, the fresh food supply would run out and many became ill.

The sailor who became ill was at the mercy of the captain of the ship who was known as the "methodical doctor" for in his medicine chest bottles were numbered and an accompanying master list gave the properties and uses of the medicine.

Besides the indispensable medicine chest was the "slop chest." This was the ship's store that stocked all the sundries and dry goods essential for a long voyage. If one of the crew needed a knife or a piece of clothing, he would have to buy it from the ship's slop chest, however, after a ship had been out at sea for a year, goods were sold at usually double the cost. Hats, shoes, clothing, toilet articles, soaps, sewing thread, stationery, and tobacco were among the items stocked. The latter was indispensable for it was more than a smoke. Tobacco was his companion through the many lonely hours of nightwatch and means of relaxation.

Perhaps because of the high cost of goods including clothing, many sailors became expert tailors. They mended coats and pantaloons with colorful patches until the original garment was unrecognizable. Their clothing was indeed colorful! They wore very wide pants which were held secured to their waists with belts which also provided a place to hold their knives which they used as an all around tool and dinner utensil.

The sailors spent their off-duty hours up in the bow of the ship in a small triangular room called a fore-castle or as they pronounced it, fo'c's'le. They talked, slept, or wrote letters in these crowded quarters. The walls of the fore-castle were lined with double decked bunks and the men slept on cork-husk mattresses often called "donkeys" breakfast."

The men sat on sea chests which held their few possessions. Fresh air entered through a single hatch which had to be closed if a storm came up, making the room unbearably stuffy. The room always smelled of sweat, smoke, mildewed socks, and garbage. Light came from a single swaying lamp and insects and rats were unwanted roommates.

When weeks passed and no whale was sighted, time hung heavy on the whaler's hands. The most welcomed sight to relieve their monotony would be the sight of another ship. Usually the ships would stop so that the men could visit or "gan" with each other. It was good to see new faces, hear new stories, eat different and perhaps fresh food, and pick up a letter or news from home. There were libraries aboard the ships for those who could read and many had a carpenter's shop as well. Men also engaged in wrestling contests, patched their clothes, told tall stories, joined in singing a rousing song or danced to the music of a fiddler or musician.

Those with artistic talents turned to the art of scrimshaw. Scrimshaw consisted of articles made from a whale's teeth or jawbone. The teeth were ivory and up to 28 cm long. The rough sides were filed smooth, then the tooth was polished in the sailor's hands for hours before he scratched pictures of ships, scenes of whale hunts, or loved ones. A good artist with a lot of patience created beautiful artwork that made highly attractive gifts. Many are now in museums.

The method of payment in the whaling industry was unique. The men were not paid by the week or month. Instead their earnings consisted of a specified fractional share, known as a *lay*, of the total profits of the catch. The assigned fraction ranged from 1/8 for captains to 1/250 for a young and inexperienced cabin boy. The following is a result of a seaman's voyage of 4 years:



Sailors share reduced to money:		
1/180 lay		\$262.25
Less fitting shipping and Medicine Chest	\$10.00	
10 pr. ct. discount on \$262.25 (leakage and shrinkage)	26.22	
3 pr. ct. insurance on \$262.25	7.86	
Money originally advanced	70.00	
Interest on same	16.80	
Cash advanced during voyage	30.00	
Interest on same 1 pr. ct. pr. month	7.20	
Clothing which he was compelled to draw owing to his bad outfit	40.00	
		<u>\$208.08</u>
Amount to be received at the end of voyage		\$ 54.17

DECLINE OF THE AMERICAN WHALING INDUSTRY

About 1860, the whaling industry began its decline. The old whaling grounds were fished out. The drilling of America's first successful oil well in Pennsylvania in 1859 produced kerosene and because of its price and smokeless feature, it rapidly replaced whale oil as an illuminant. The cost of outfitting and refitting ships rose and the American Civil War cut the Pacific fleet in half. After the war in 1871, 33 ships which composed the bulk of the fleet, were caught in Arctic ice off the northern whaling grounds and had to be abandoned. A dozen more were similarly lost in 1876. The final blow to Lahaina came with the full development of San Francisco as a port and the opening of the transcontinental railroad. Slowly, the surviving whaleships turned to trading or sailed back to Europe or America. In 1877, only four whalers were listed in Hawaiian ports. The end came in 1880 when no whaling ships called on island ports.

The decline caused economic distress. Prices tumbled. Beef which sold for \$18 to \$35 a head two years before sold for as low as \$3.50 per head. Lahaina's agriculture entered into uncertain transition. People were out of work and many left Lahaina. Most of the missionaries, their work complete, also left.

Although the decline of the industry had a depressing effect on mercantile interests and the islands, it did not precipitate the acute disaster that had sometimes been predicted. This was partly due to the fact that the decline was a gradual and long drawn out process. As the number of whaleships and profits derived from catering to them fell off, island businessmen looked for brighter prospects in the development of agriculture, especially sugar. A new day was dawning; the sugar industry would gradually replace whaling as the chief income producer for the islands. Whaling had passed, taking with it something lusty and romantic. Life became more orderly and less exciting.

BIRTH OF MODERN WHALING

Modern whaling was born in 1868 with the invention of a harpoon with an explosive head by a Norwegian named Sven Foyn. The harpoon was fired out of a deck-mounted cannon and had a time delay bomb which insured explosion deep in the vitals. The pivoted crosspiece which was released upon discharge of the explosive prevented withdrawal of the harpoon and the whale was made fast to a manila line so it would not be lost. A later refinement was the pumping of compressed air into the harpooned whale to keep it afloat. Moreover, the advent of the steam engine made it possible for ships to approach to within an ideal distance for the harpoon cannon.

These new methods allowed whalers to attack the faster and more powerful whales. No specie was immune--blue, fin, humpbacks, gray, and sperm and more recently sei and minke whales fell prey.

By the turn of the century, whaling became profitable again because of new markets for whaling products and the use of modern weapons and techniques. Whaling stations, where the whale was brought to be processed, sprouted in the northern hemisphere. As whales became scarce north of the equator, attention turned southward with the discovery of rich whaling grounds in the Antarctic. In 1904, the first whaling station was built there, with most of the activity centered around the island of South Georgia. Frequently, old cargo ships, anchored in protected bays, performed as whaling stations.

In the 1920's and 1930's, the last significant refinement to modern whaling was made. A group of Norwegians developed the pelagic floating factory ship, a ship equipped to take on board and completely process whales hunted and killed by smaller catcher boats or killer boats, as they are oftentimes referred to.

Today's modern whale catchers are fine, powerful ships in the direct line descent from the earlier types. Some are equipped with sonar devices which indicate the whale's swimming direction and distance from the ship. The device is sent down into the ocean from the bottom of the ship and sends out signals. These ultrasonic waves bounce back from the diving animals and are received by a trained sonar operator who can distinguish the whales from floating alongside a whale. The gunner who is responsible for firing the cannons is the most important member of the crew. They depend on his experience and skill for the success of the operation.

After the whale has been killed, it is brought alongside where the whale is inflated with compressed air to keep it afloat. There are no longer any "right" whales to hunt so the ones being taken now would otherwise sink. A flag

on a pole with a radar buoy is then planted in the carcass. Then the ends of the tail flukes are cut off, an identifying numeral is cut in the skin and the whale is cast adrift, while the catcher ship goes hunting for the next victim. Flagged whales are picked up later and towed to the home shore station or to the pelagic floating factory.

The methods of processing whales on a pelagic whaleship are essentially the same as those used in the shore stations. The dead whale is brought up the slipway onto the flensing deck. Here the blubber is peeled off like a huge banana with the help of winches. It is cut into smaller pieces and fed down a chute to the deck below, where it goes through a mincing machine and into the boilers. Stoppier belly blubber, which is mixed with a good deal of muscle, is also cut into small strips but is boiled in a different type of cooker.

The carcass is then pulled forward from the flensing deck to the meat deck further forward. The meat is separated from the bones and dealt with in different ways. Some factories freeze them, others make meat meal and meat extract. The bones are very porous and contain a lot of oil so they are cut into chunks and boiled in pressure boilers.

Since space is limited on pelagic factory ships, they are supplied fuel oil by huge tankers which carry home their whale oil. Many are accompanied by refrigerated ships which transship the meat to port.

Marine Mammals

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Activities.

1. To understand how and why mammals are placed into different orders and broken down further into species, compare the similarities and differences:
 - a. Among all or between two orders or between two species of marine mammals
 - b. Between mammals and fish, specifically between a killer whale and a shark
 - c. Between marine and land mammals
2. Students can observe the intelligence of whales and sea lions at Sea Life Park and seals at the Waikiki Aquarium. They may want to pursue studies of their intelligence and training methods by directly interviewing the trainers at the aforementioned places after doing some background research.
3. A detailed study on a particular species or order of marine mammal could be very enlightening. Some display entertaining and unique characteristics. The sea otter would be a good example.

Suggested Excursions

1. Sea Life Park
2. Waikiki Aquarium

MARINE MAMMALS

All life began in the sea. Millions of years passed before life emerged from the sea to live on land. Mammals, including human beings in their primordial or primitive state, at one time, inhabited the sea. Most mammals still live on land; however, there have been four separate mammals which have gone back to live in water. They are commonly referred to as marine mammals and are represented by four distinct groups: (1) sea otter; (2) seal, sea lion, and walrus; (3) dugong and manatee; and (4) whale, dolphin, and porpoise.

These mammals adapted in their own way to an environment they were unaccustomed to. Legs became flippers, disappeared entirely, or changed into tails; bodies became streamlined as an aid to swimming and a layer of fat or blubber developed beneath the skin to keep the animal warm.

Mammals are classified in a group of animals called vertebrates. Unlike most animals, called invertebrates, vertebrates are supported by a backbone called the vertebrae that are usually composed of bone, but sometimes cartilage. Other vertebrates are the fish, amphibians, reptiles, and birds.

Mammals are classified into three groups: Monotremata or monotremes; Marsupialia or marsupials; and Placentalia or placentals. They are grouped according to differences in their anatomy and the manner in which they bear their young. Monotremata is contained in the subclass Prototheria and the Marsupialia and Placentalia are in the subclass Theria.

The monotremes, the only order in the Monotremata group, are the most primitive living mammals. They were probably isolated from an early period when mammals were evolving from reptiles and emerged as a wholly separate line. The last surviving monotremes, the duckbill or platypus and several species of spiny anteaters, exhibit many reptilian features such as laying eggs instead of giving birth to their young.

The second group of mammals, Marsupialia is also composed of only one order, the marsupials and includes kangaroos, wallabys, wombats, and koalas. They give birth to their young at an early state of development and thereafter carry them attached to the mother's nipples within a pouch on the mother's abdomen. This early birth is necessary because there is no well developed placenta through which the embryo can be nourished from the mother's body. This method of reproduction is a distinct advancement over the monotreme method for it affords more protection for the young at the most crucial early days of their lives. Like the monotremes, the marsupials also have a few reptilian features but both groups share distinct mammalian features that classify them as mammals.

All the other mammals belong to the third group, the Placentalia, and make up the vast majority of mammals living today. The young are retained inside the mother for a long period prior to birth, during which the developing embryo derives all its nourishment from the mother. This allows considerably more time for its complicated brain and body mechanisms to mature in a protected environment. It was the evolution of this extremely successful method of reproduction that enabled the placentals to colonize a variety of habitats: bats in the air, whales in the sea, otters in rivers, and mice and men on land. Placentals, because of their diversity are divided into eighteen different orders. The marine mammals belong to four of these orders:

(1) Carnivora, (2) Pinnipedia, (3) Sirenia, and (4) Cetacea.

What are the unique features of these mammals? How do they differ from the other four groups of vertebrates? Mammals are warm blooded but so are birds. They breathe air but so do birds, reptiles and most adult amphibians (fish breathe air too). With few exceptions, all mammals give birth to their young but many reptiles and fish also do this. How then do they differ from their vertebrate cousins? Characteristic features typical of placental mammals especially include:

1. Presence of true hair, which grows from tiny papillae in the outer layer of the skin. This hair has a valuable function as it forms an insulating covering to retain body heat. In some whales, hair is limited to a few bristles around the mouth, in others, it is lacking entirely although it may have appeared briefly in the embryonic stage of development. Instead, they have evolved a protective and insulating covering formed by layers of blubber.
2. Mammary glands which produce milk to feed their young. The word mammal characterizes the group since it is derived from the Latin word "mamma" meaning breast.
3. A large developed brain which is much more advanced than other animals. The evolution of a large brain has led to more varied behavior capable of adapting to changing conditions.
4. Presence of three bones in the inner ear, the malleus, incus, and stapes which transmit vibrations across the inner ear from the eardrum to the oval window.
5. A diaphragm which assists in the ventilation of the lungs.
6. A lower jaw composed of a single bone called the dentary. This dentary articulates with the squamosal and teeth to perform a variety of functions.

Order: Carnivora
Family: Mustelidae (sea otter)

The discovery of the sea otter (*Enhydra lutris*) off Carmel, California in 1938 caused one of the most exciting zoological events. It had been assumed that man had hunted the world's most valuable furbearer to extinction as it had not been seen since almost the turn of the century.

Sea otters are usually found within a mile off the southern California coast and around southern Alaskan and Aleutian Island waters in our hemisphere. Mature otters are about 152 cm long but 114 cm is an average size. The male weighs between 27 to 36 kg compared to 16 to 18 kg for females. They have paws and have retained hind legs with webbed toes that are short and specialized for swimming. Unlike all other marine mammals that possess thick layers of fat under their skin, sea otters have 2.5-cm long, thick, velvety fur coats to keep them buoyant and warm. Their color ranges from reddish-brown to almost black with gray and yellow tones around the head, throat, and chest. Their white-tipped hair give them a frosted look.

Sea otters spend most of their time floating and swimming on their backs among the kelp beds and often shading their eyes with their front paws. If they want to swim faster, they swim on their stomach and can travel at a speed of up to 16 km per hour. Playful and sociable, they live in groups of 30 or 40. Active in the daytime, they usually rest at night in thick kelp beds and will sometimes anchor themselves in them by wrapping strands of kelp around their bodies. Their chief enemies aside from man are the killer whale and sharks.

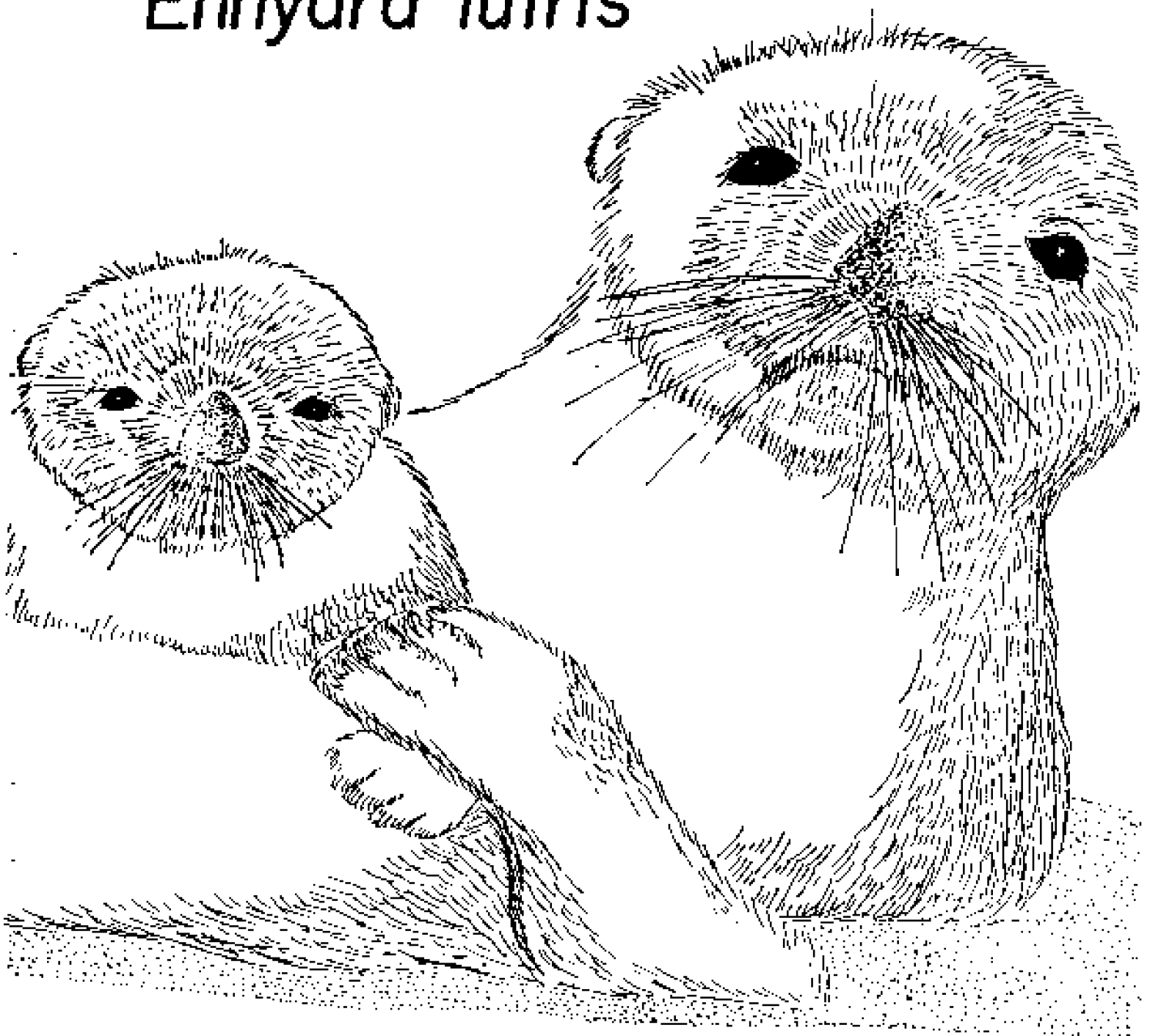
Sea urchins, crabs, fish, and mollusks make up the sea otter's diet. They dive between 3 to 18 m for their food but can dive as deep as 37 m and can remain submerged for 4 to 5 minutes. Off the California coast, they eat abalone, a favorite among seafood lovers, and have caused some conflict with abalone divers.

The sea otter is one of the few animals to use a tool. When he brings up any shellfish to the surface, he also brings up a flat stone. Floating on his back, he places the rock against his chest and uses it as an anvil. He holds the shellfish in his paws and smashes it against the rock and dines on the edible meat inside.

Sea otters begin breeding about 3 years of age. A single baby (rarely two) is born after an approximate gestation period of 8 to 9 months. Courtship, mating, and birth occur at sea. Compared to most carnivores, a sea otter pup is born at an advanced stage of development with his eyes open, a full set of teeth and completely furred. It may be as long as 43 cm and weighs between 1 to 2 kg.

A sea otter is a devoted mother, extremely affectionate and protective of her young. She constantly cuddles, grooms, and plays with her pup and nurses him while floating on her back. She anchors her baby safely to some seaweed when she dives for food but tucks him under her paw and dives with him in time of danger. The young usually stay with her even after another pup arrives the following year. Full growth is attained when the animal is about 4 years old.

Sea otter - *Enhydra lutris*



Order: Pinnipedia
Family: Otariidae (eared seals--sea lions and fur seals)
Family: Odobenidae (walruses)
Family: Phocidae (earless or true seals--elephant, monk,
bearded, etc.)

Pinnipedia are aquatic yet some species spend a fair amount of time on land while others spend very little time on shore. This order consists of 32 living species from 3 families. Some can live on land for years while some may spend up to 8 months of the year in water. At one time this order was considered a suborder of the order Carnivora but has since been separated and elevated to an order. Fossil evidence suggest that true seals came from otter-like ancestors and the sea lions, fur seals, and walruses came from bear-like ancestors.

Pinnipeds are most numerous in polar and temperate waters along the coasts of the world. Some ascend rivers or live in inland lakes. The monk seals are the only tropical pinnipeds and one species inhabits the waters of the north-western islands of the Hawaiian Islands.

Pinnipeds have made many changes to adapt to life at sea. Their bodies are elongated and streamlined and all four limbs have converted to flippers. The bones of the front limb and hind legs have shortened and are partly within the body and the toes and fingers are elongated and joined together with connective tissue and skin to form broad propelling surfaces. Their bodies are usually covered with hair and they all have a thick layer of blubber, both of which provide insulation to their bodies. All that remains of the tail is a stub a few cm long. The external ear has been reduced to a tiny flap in eared seals but the earless seals are, strictly speaking, misnamed because although they lack an external pinna, there is a very small ear flap hidden in the tube leading from the surface to the ear drum. The nostrils are slit-like and both ears and nostrils can be closed under water.

Even their teeth have adapted to holding fish, squid, and octopus that most pinnipeds feed on. Pinnipeds have an unusual habit of swallowing stones in varying numbers and sizes. Scientists have not determined the exact reason for this but various explanations have been given. One theory suggests the stones are necessary for grinding up parasites and food. Another says the stones weigh him down during fasting or when he is fat and buoyant. Seals are known to fast and survive many months so it is believed that these stones may provide bulk during these periods.

Pinnipeds are quite clumsy on land but are skillful swimmers and divers. They swim by using their flippers and entire trunk. In the eared seal and walrus families, locomotion is accomplished by the use of the forelimbs, whereas in the earless or true seal family, the hind legs supply the thrust. They can dive to depths of 183 m and stay submerged for a half hour. Their breathing mechanism allows for efficient use of available oxygen when the animal is underwater. Some species are migratory, some remain on land most of the time and others may spend as long as 8 months at sea.

Pinnipeds give birth ashore, on land or ice, and mate once a year. Gestation period is 8 to 12 months.

Predators of pinnipeds include large sharks, killer whales, polar bears, leopard seals, and walruses. Man, the greatest predator, have always hunted certain pinnipeds for their hides, oil, meat, and tusks.

Recent studies indicate that some pinnipeds produce underwater sounds which may be used in communication and echo-location.

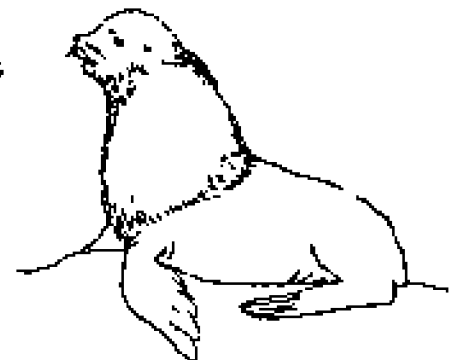
Family Otariidae

This family, commonly called the "eared seals," includes the sea lions and fur seals. They inhabit arctic, temperate, and subtropical coastal waters.

Members of this family as well as the family Odobenidae are more adaptable to "walking" on land. Their hind limbs can be turned forward to help support the body so that all four limbs can be used in walking or running in a somewhat dog-like position. The forelimbs of both families are also ear-like, measuring more than one fourth the body length and serve as the primary means of propulsion in the water. The soles of the hind limbs are held together and used as a rudder.

They range in length from 2 to 4 m and weigh from 34 to 909 kg with males being much larger than the females. Sea lions are covered with a layer of coarse hair, although fine underhairs are present. The underfur is distinct and important in the fur seals. For this reason the sea lion is valuable, mainly for its leather pelt, while the fur seals were hunted for their fur and blubber.

Sea lions and fur seals feed mainly on fish but they also eat mollusks, such as squid, cuttlefish, octopus, and crustaceans. One genus of sea lions will sometimes feed on penguins.



The breeding habits of otariids are exclusively marine, never freshwater. The males arrive first at the breeding grounds, establish territories, and collect harems. They are polygamous, having from 6 to 100 females in their harems, depending on the species and strength of the bull. They are busy for the next 2 months, mating, challenging and fighting. The females give birth about a week after they arrive on land and mate with the bulls soon after.

One of the most well-known sea lion is the California sea lion you may have seen at Sea Life Park or other oceanariums. Although other pinnipeds are sometimes used, the California sea lion is the one that is commonly used for performances.

Family: Odobenidae

This family consists of only one species--the walrus. They inhabit the open water of the Arctic Ocean near the polar ice in herds of 100 animals or more. Most migrate to the south with the advance of the arctic ice during the winter and return when the ice retreats. While migrating, they ride on the ice floes until they are carried off course at which time they will abandon the floes and swim toward their destination.

Male walruses may grow to be as long as 4 m and weigh 1,364 kg while females are about 1 m shorter and weigh up to 818 kg.

Walruses have a thick, bulging body form, a short neck, rounded head and muzzle, a tough wrinkled, thinly-haired skin which may be as thick as 6 cm. The underlying insulating blubber may be as thick as 9 cm. They have small eyes and their external ears is a low wrinkle of skin.

Walruses have foreflippers that are like those of eared seals, ear-shaped, about one-fourth the body length, and used for swimming. Their hind limbs are also like that of the eared seals and are used to walk and run upright.

The upper canines which develop into ivory tusks serve as the walruses unique feature. A single tusk may attain a length of over 1 m in the male and weigh about 5 kg. The female tusks are shorter and slenderer than the male's. They use their tusks to haul themselves onto the ice, to defend themselves against killer whales and polar bears, and to dig up food from the ocean floor. The tusk stir the gravelly sea bottom while his sensitive lips and snout bristles separate the various kinds of shellfish from the mud and pebbles. In spite of their diet, they seldom swallow the shells of their prey by carefully sucking out the flesh.

The walrus's breeding habitat is exclusively marine. They are also polygamous but do not gather harems. The newborn is carefully guarded by its mother against danger and travels on the mother's neck even when she swims and dives. Pups nurse for about 18 months, at which time the tusks, necessary for digging up food, have developed sufficiently. As a result of this long dependency, walrus do not breed more than every other year.

Family: Phocidae

This family of seals is usually referred to as the true or earless seals as they lack the external pinna of the family Otariidae. They inhabit coastal and oceanic waters in the polar, temperate and tropical regions of the world and certain fresh water lakes.

Phocids are not as well-adapted to "walking" on land as the first two families of pinnipeds because they cannot turn their hind limbs forward. They wriggle and hunch their bodies to propel themselves on land, rolling or sliding whenever possible.

Their foreflippers are placed far forward and are much smaller than that of the eared seals and walrus. Unlike the latter, the foreflippers are not used as a primary means of propulsion. Instead they propel themselves by the hind flippers moving in lateral fish-like movements. They frequently swim on their backs or stand upright by "treading" with their foreflippers.

Phocids measure from about 1 to 6 meters in length and weigh approximately 91 to 2,727 kg. This range includes the smallest ringed seal to the largest elephant seal. Fish, shellfish, cuttlefish, squid, and octopus are their favorite food. Some feed mainly on invertebrates and the weaned young of other species and the leopard seal preys regularly on birds or other seals. Some members are able to fast for long periods of up to 4 months.

Unlike their eared seal cousins, most earless seals do not gather large harems. The males establish territories and live with a single female during the mating season. Some phocids mate soon after birth while others wait four months. Earless seals usually live in marine habitats but may often choose to live at a river mouth.

The only tropical pinnipeds are 3 species of monk seals. The Hawaiian monk seal (*Monachus monkseals*) found on the northwestern island of our Hawaiian Islands, is one of them. The Waikiki Aquarium boasts of the only monk seal in captivity.

Hawaiian monk seals (*Monachus schauinslandi*) are found on the leeward, Northwestern Hawaiian Islands. They have been occasionally sighted near the main Hawaiian Islands and Johnston Islands.

The average adult male is about 2 m long and weighs approximately 173 kg. The female is not much longer but is much heavier weighing about 243 kg. They have grayish coats which change to a tan and greenish color from the algae that grows on their fur.

Although monk seals have declined to perilously low numbers, their population of about 1,200 appears fairly stable due to conservation measures that have been enacted to protect them.

They feed mostly on lobsters, moray eels, octopi, and slow swimming fish and need to keep a watchful eye on sharks, their chief predators, as they search for food.

Recent studies have found that monk seals have adapted their behavior to protect themselves against sharks. They find refuge in underwater caves, where they blow and create bubbles which they use as a reserve. This enables them to stay under water for possibly up to an hour when they normally can hold their breath for only 25 minutes.

Monk seals will find white sandy beaches adjacent to shallow protected waters to give birth. The newborn pups are jet black and weigh about 16 kg. After a few days, the mothers will take their pups for a swim in the shallow surrounding waters. She continues to nurse the pup for 5-6 weeks during which time his weight quadruples and she departs suddenly. The "roly-poly" baby, who has quite a feed reserve after nursing for 5-6 weeks, will "cry" for his mother. When he becomes hungry and his mother does not return to feed him, he will venture forth into the ocean and seek food for himself.

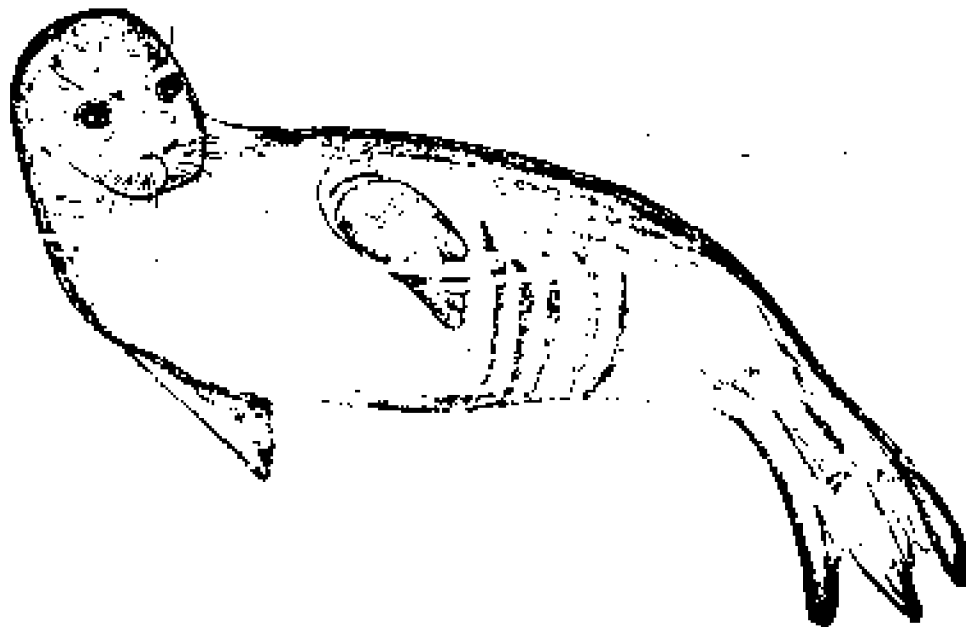
Friday is the only monk seal in captivity in the world. Friday is a Hawaiian monk seal (*Monachus schauinslandi*) one of three species of monk seals of the genus *Monachus*. Species classified in this genus are the only tropical seals. The other two species are the Mediterranean monk seal (*Monachus monachus*) of the Black Sea, the Mediterranean and adjacent areas and the now extinct Caribbean monk seal (*Monachus tropicalis*) which once thrived along the shores and islands of the Caribbean and the Gulf of Mexico.

You can find Friday at the Waikiki Aquarium swimming around the seal pond in circles, washing his face or sleeping lazily on the island in the middle of the pond. His trainers have taught him to perform a few "tricks" much to the delight of aquarium-goers. He "sings" in a low growl, claps his

forelimbs while swimming on his back, or returns a ball in exchange for herring, aku or mackerel that make up his diet. The herring is frozen to insure against parasites. In addition to the fish, Friday receives an ulcer pill every morning because autopsies revealed that death of captive monk seals was due to ulcers. They do not appear to favor human activity in their natural habitat on remote islands and have been known on occasion to abandon a populated island in favor of an unpopulated one.

Friday was named after his arrival date which was Friday, December 13, 1963. He's about 2 m long and weighs approximately 159 kg. His gray coat is spotted with white on the upper portion of his body. One of his trainers reports that Friday is quite a temperamental seal. He may be very cooperative one day but totally uncooperative the next. He doesn't like people getting too close to him and will bite. You'll see his trainers pet his "roommates" harbor seals, Calia and Baby, but never Friday.

FAMILY PHOCIDAE



Hawaiian monk seal (*Monachus schauinslandi*)

Order: Sirenia
Family: Trichechidae (manatee)
Family: Dugongidae (dugong)

For thousands of years, sailors returned to their ports with tales of having seen strange creatures that were part woman and part fish. We know today that these "mermaids" are the manatee and dugong that belong to the third group of marine mammals called Sirenia or sea cows. This group, named after "the sirens" or sea nymphs in ancient myths who lured sailors with their songs is comprised of three species from the manatee family and one species from the dugong family. A fifth species from the dugong family, the 9 m, 3 metric ton Steller's sea cow, of the Bering Sea became extinct in 1768, only 27 years after discovery to whalers who slaughtered it for food.

Sea cows represent a more pronounced step back to aquatic life than sea otters. They are totally aquatic, have flippers instead of forelegs and have lost all trace of their hind limbs. Their bodies are rounded and fish-like and slim down to a broad flat horizontal tail similar to that of the whales. The manatee's tail is rounded while the dugong's has a crescentic notch resembling a cetacean's fluke. They swim solely with their tail and hind part of their body. Their place in the kinship of animals is puzzling although their anatomy links them with elephants.

How the manatee or dugong was mistaken for a beautiful mermaid is cause for question. Their head is rounded and the nostrils sit high on the snout which is short and like a muzzle. Bald with a few bristles around the mouth and no external ear, they have small eyes and a neck region that is barely discernable. What may have started these tales are the female sea cows' habit of standing up in water along rocks exposing their breasts.

Sirenias may travel alone, in pairs, or in groups of 3 to 6 individuals. Generally slow and inoffensive, they lead quiet peaceful lives. They often doze in the water with only the humps of their backs above the water and wake up every few minutes just to raise their heads to take a breath of air. They can, however, remain submerged for as long as 15 minutes. They are vegetarians and feed on water plants and seaweed, stuffing enormous amounts into their mouths with their flipper-like forearms. They have been known to clear canals and other waterways of heavy accumulation of weeds and algae. For this reason conservationists have thought of breeding these animals in certain waterways to keep them clear of choking weeds.

Manatees and dugongs have been prized for their meat and oil from their blubber. The leather of the manatee is suitable for the manufacture of a variety of leather goods. Many Eastern people believe various parts of the dugong have magical and medicinal properties.

MANATEE EXPRESSIONS

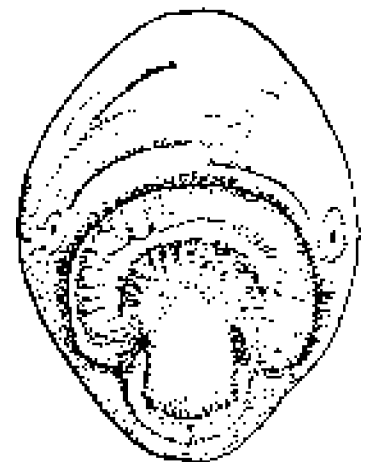
Family: Trichechidae (manatee)

Manatees are found in the Caribbean from Florida to the West Indies, the Amazon basin and western Africa. Some manatees inhabit fresh water rivers.

Dull-grayish in color, they grow to a length between 2 to 4 m and weigh about 227 to 545 kg.

When manatees meet, they may greet one another by rubbing their muzzles together first below the water, then above the water. They are inquisitive animals and sometimes rise near a fisherman's boat to inspect the area.

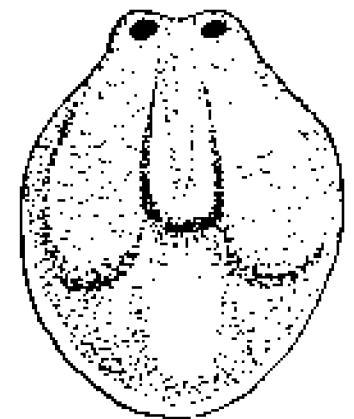
Little is known of the manatee breeding habits. They are believed to first breed between their third and fourth year, every other year. They mate and give birth to usually one calf in water after a period of gestation that may last from 6 months to a year. The newborn is 762 to 914 mm long and weighs about 18 to 27 kg. Immediately after birth, the calf is brought to the surface by the mother. Within 12 hours, she has usually trained him to submerge on its own by repeatedly but gently dunking him in the water and lifting him up again. The newborn sometimes rides on his mother's back and she nurses him underwater. The young will stay with his mother for as long as 2 years and reach full maturity at 4 years.



Family: Dugongidae (dugong)

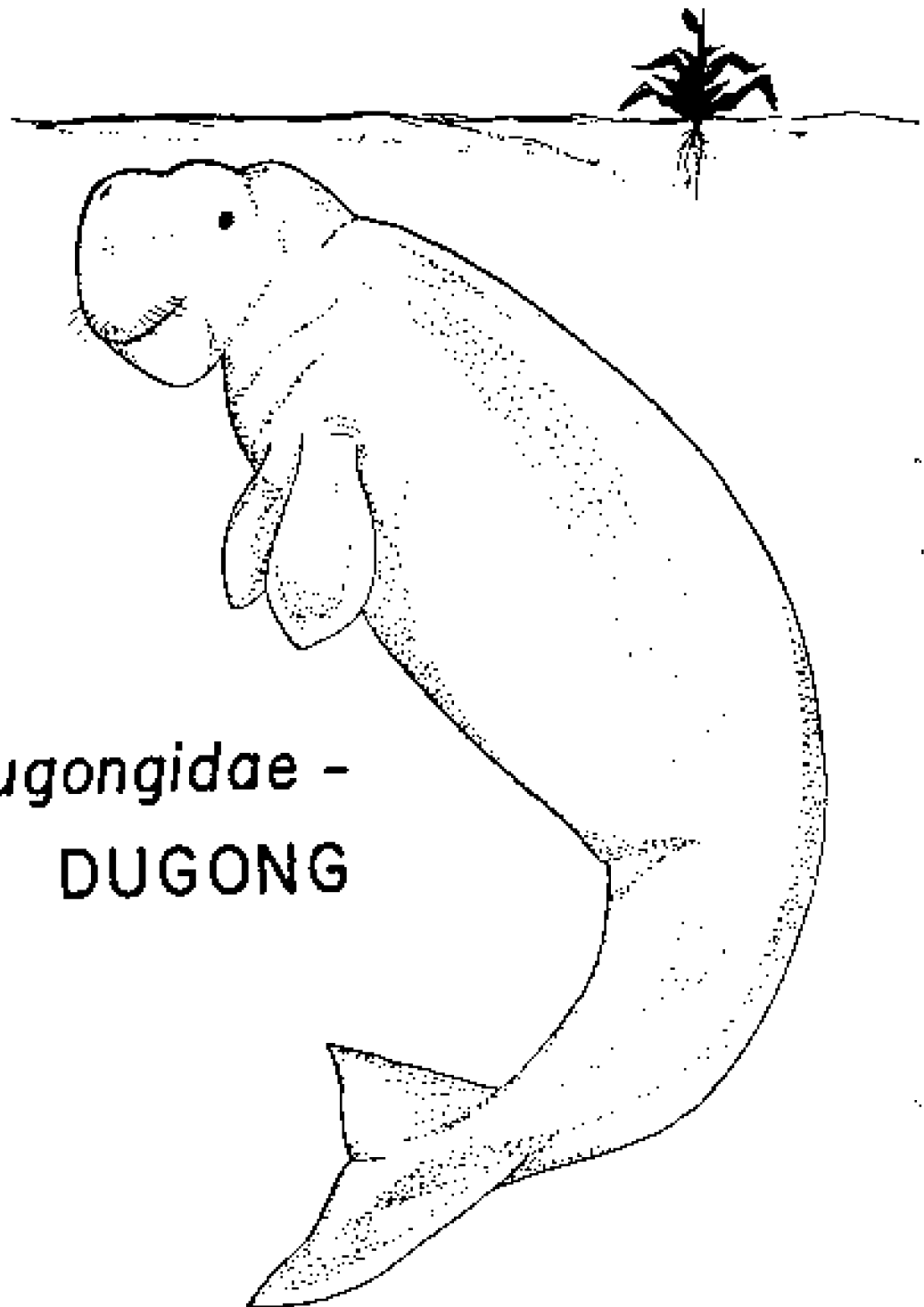
The dugongs' habitat is far removed from the manatees'. He is found in the Indian Ocean from the east coast of Africa to the Malayan archipelago as far as Palau in the Trust Territory and the northern coast of Australia. They are never found in fresh water rivers as are some manatees.

Dugongs differ from manatees in several aspects. There are some detailed anatomical differences but more visually, their bodies are more streamlined and lack the manatee's pronounced skin creases. Aside from the different shapes of their tails, their heads are proportionately larger and their flippers shorter than the manatee's. Dugongs reach a length of 2 to 3 m and weigh about 273 kg. They are dark gray above and white below.



While feeding, the dugong rips out an entire plant, swishes it back and forth in the water to remove the sand and swallows it with little chewing or in a single gulp. Or they may pile these plants methodically along the shore and return to eat them after gathering a sufficient supply.

Little is also known of the dugong's breeding habits. There is usually only one calf after a gestation period of a year.



**Family *Dugongidae* -
DUGONG**

Order: Cetacea

Cetacea represent the most complete transition to aquatic living. The whales, dolphins, and porpoises in this group are found in all the oceans of the world and in certain rivers and lakes. The larger whales migrate to the polar areas during the summer to feed and to the warmer areas during the winter to reproduce. The approximate 90 species are divided into two suborders: Odontoceti or toothed whales and Mysticeti or baleen or whalebone whales.

Cetaceans live entirely in the water and have adapted so well to aquatic life that they are often thought of as fish instead of mammal. They have torpedo-shaped bodies ending in a tail fluke set in a horizontal plane as opposed to the vertical tail fin of a fish. The tail fluke which moves up and down acts as a propeller driving him forward or raising and lowering him through the water. The forelimbs are converted to flippers and the supporting skeleton clearly shows a humerus, ulna, wrist bones, and finger bones like those of a typical land mammal. However, instead of only three finger bones, there may be up to a dozen digits enabling an increase in length in the flipper which serves as balancing and steering organs. By contrast, there is an absence of hind limbs.

Whales have no hair except for a few bristles on the head and a thin outer skin. Under the skin, however, is a layer of blubber that acts as an insulator in heat regulation. It ranges in thickness from an inch in a 2 m porpoise to 31 cm in larger whales.

Whales breathe through a "blowhole" situated atop its head. Toothed whales have a single blowhole; baleen whales have a double blowhole. When the animal submerges, the blowhole is closed by a nasal plug and its associated muscles. When the whale resurfaces, the spout you see is the result of the powerful act of expiration and the sudden expansion of the expelled air containing water vapor and oily and mucous secretions which fill the air spaces and produce sufficient cooling to condense the moisture. Whales are often recognizable by the shape of the "blow."



HUMPBACK WHALE

(Megaptera novaeangliae)

Cetaceans can dive to great depths and stay submerged for long periods of time. To do this, they have made several adaptations: (a) whales store oxygen in the hemoglobin of the blood and myoglobin of the muscles which account for 80% to 90% of the oxygen supply utilized during prolonged diving; (b) arterial networks act as shunts maintaining a normal supply of blood to the brain but a smaller supply to the muscles; (the whales utilizes the oxygen supply upon resurfacing and breathing sufficiently); (c) the whale's heartbeat is reduced and thereby utilizes less oxygen and (d) the brain remains unaffected by the accumulation of carbon dioxide in the rest of the body. Their eyes are protected against the salt water by a greasy substance secreted by the tear ducts.

Some whales lack a sense of smell and their vision appears adequate but their hearing is acute although they have no external ears.

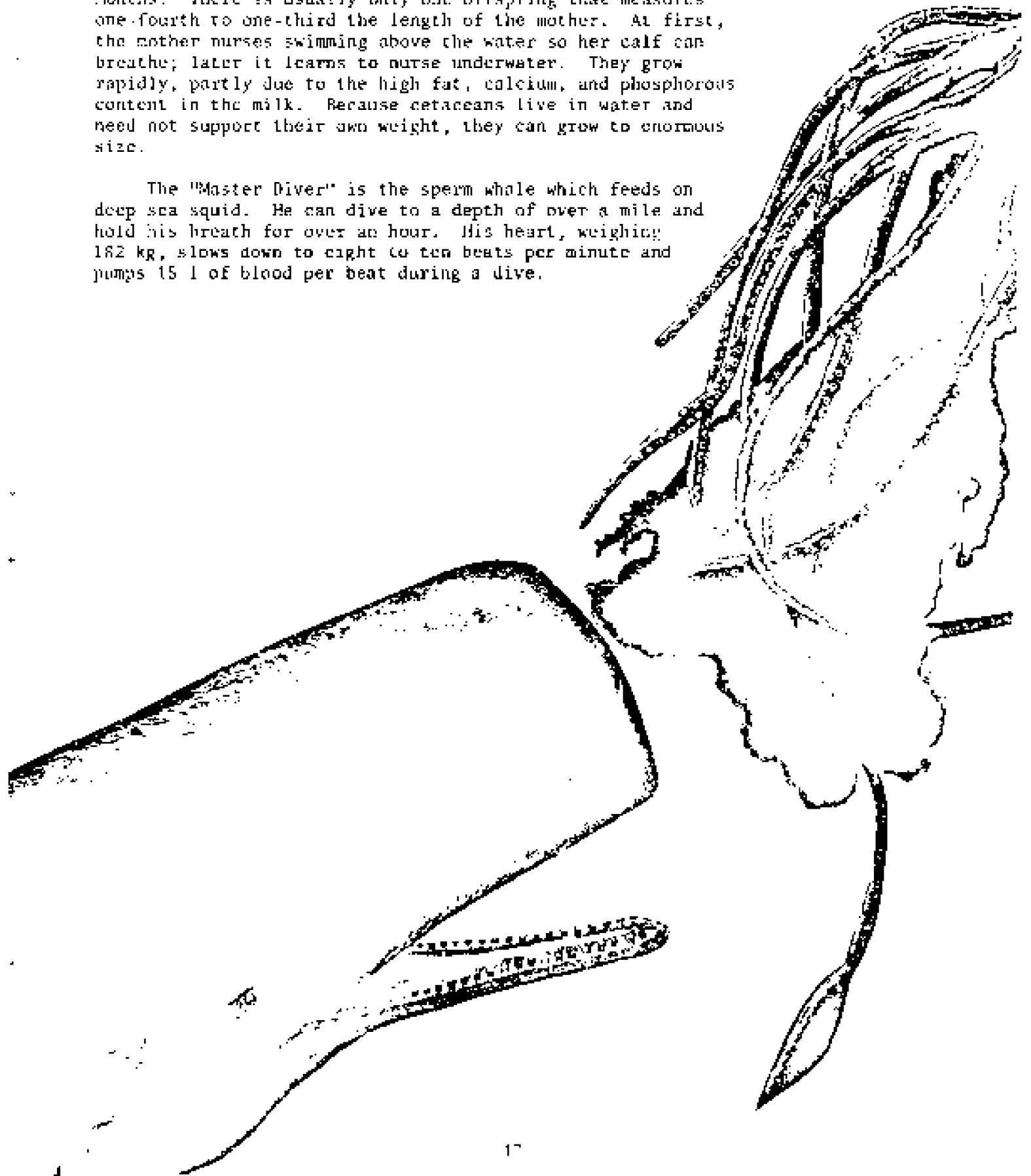
Research indicate that cetaceans, especially odontocetes, have a natural sonar device. Their use varies greatly among the different whales and is found to be quite limited with the mystacetes. Their sonar system, which can detect the presence and location of objects under water by measuring the direction and return time of a sound echo, is very complex and often referred to as echo-location. They depend on echo-location for orientation, detection of obstacles and enemies, securing of food, and communication among themselves. In captivity, experiments have shown that dolphins can distinguish between fish of different sizes, a piece of fish from a similar inedible object the same size and could find their way in the dark through a steel mesh curtain, avoiding gaps blocked by transparent plexiglass.

Although lacking vocal chords, whales "speak" and "sing" by grunts, whistling, repeated clicking sounds, squeaks, and various other sounds. Most scientists agree that sound is produced by the movement of air between air sacs along the respiratory tract in the head. This creates vibrations which are often directed outward through the "melon" in the head. These vibrations are probably caused by the vibrating nasal bones against the skull.

Cetaceans enjoy "playing" which may also serve as a means of communication. In "spy hopping," gray whales stand in an erect position and rotate their heads while observing and navigating in migration down the west coast of California. They are seen "breaching," which is leaping out of the water and doing a spectacular back flop, causing a very loud noise. When they are "tail sailing," the right whale dives straight into the water, sets its tail straight up above the surface at right angles to the wind and "sails." Humpbacks enjoy laying on the surface of the water, slapping their long fins back and forth in the water and "fluke slapping" with their head in the water and their flukes upright, slapping back and forth above the water.

The gestation period in most cetaceans is 11 to 16 months. There is usually only one offspring that measures one-fourth to one-third the length of the mother. At first, the mother nurses swimming above the water so her calf can breathe; later it learns to nurse underwater. They grow rapidly, partly due to the high fat, calcium, and phosphorous content in the milk. Because cetaceans live in water and need not support their own weight, they can grow to enormous size.

The "Master Diver" is the sperm whale which feeds on deep sea squid. He can dive to a depth of over a mile and hold his breath for over an hour. His heart, weighing 182 kg, slows down to eight or ten beats per minute and pumps 15 l of blood per beat during a dive.



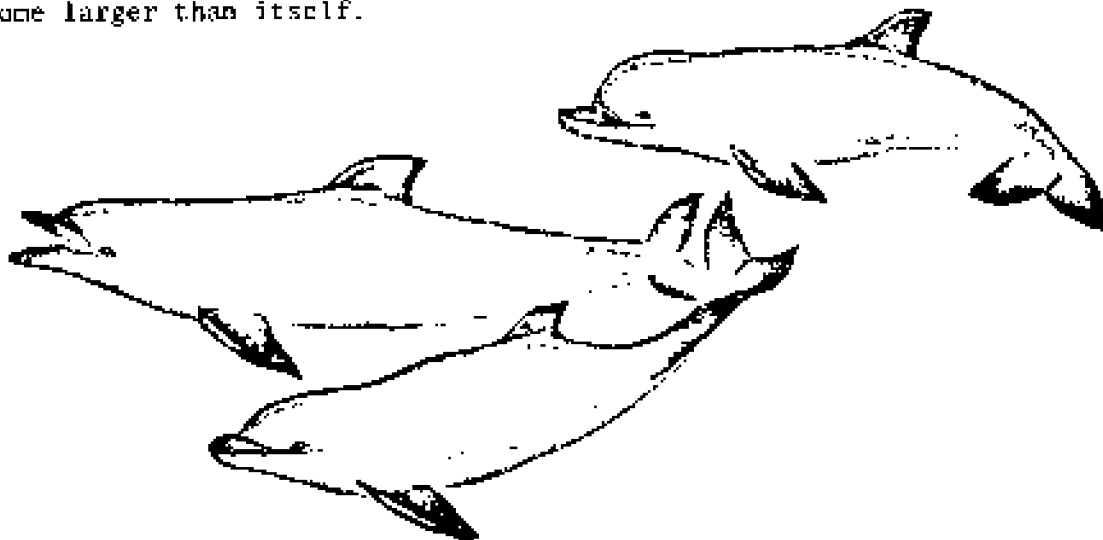
Suborder: Odontoceti (toothed whales)

Toothed whales compose the majority of cetaceans and include the smallest 1 m dolphins and porpoises to 18 m sperm whales. Aside from the latter, most of the toothed whales are the smaller whales. Their head and mouth are also usually proportionately smaller than the baleen whales. They all possess teeth in one or both of their jaws ranging from 2 to over 200. The narwhal, *Monodon monoceros*, is the only exception. The adult male has a 2 to 3 m single, spiral, tusklike canine. The other tooth does not break the gum while both are rudimentary and not external in the female.

There is no relation between the size of the animal and the number of teeth. One of the largest porpoises, the 11 m bottle-nosed whale, *Hyperoodon ampullatus*, has but a single pair of teeth while the 1.5 m La Plata river dolphin, *Steno dalphus blainville*, possesses two rows of fine teeth numbering 210 to 240 teeth. The largest toothed whale, the sperm whale, *Physeter catodon*, has teeth only on the lower jaw and they number between 18 to 28 teeth per side. The numbers usually correlate with use; a porpoise's long mouth with many teeth is designed to ensure the hooking and retention of slippery active fish while a small mouth with few teeth is adequate for consuming squid and weak swimming fishes.

The names 'dolphins' and 'porpoises' are used for some species of toothed whales and often used interchangeably. For example, bottle-nosed dolphins are also called bottle-nosed porpoises. Usually, dolphins are small to moderate size with a beaklike snout and a slender, streamlined body whereas a porpoise is relatively small with a blunt snout and a rather stocky body.

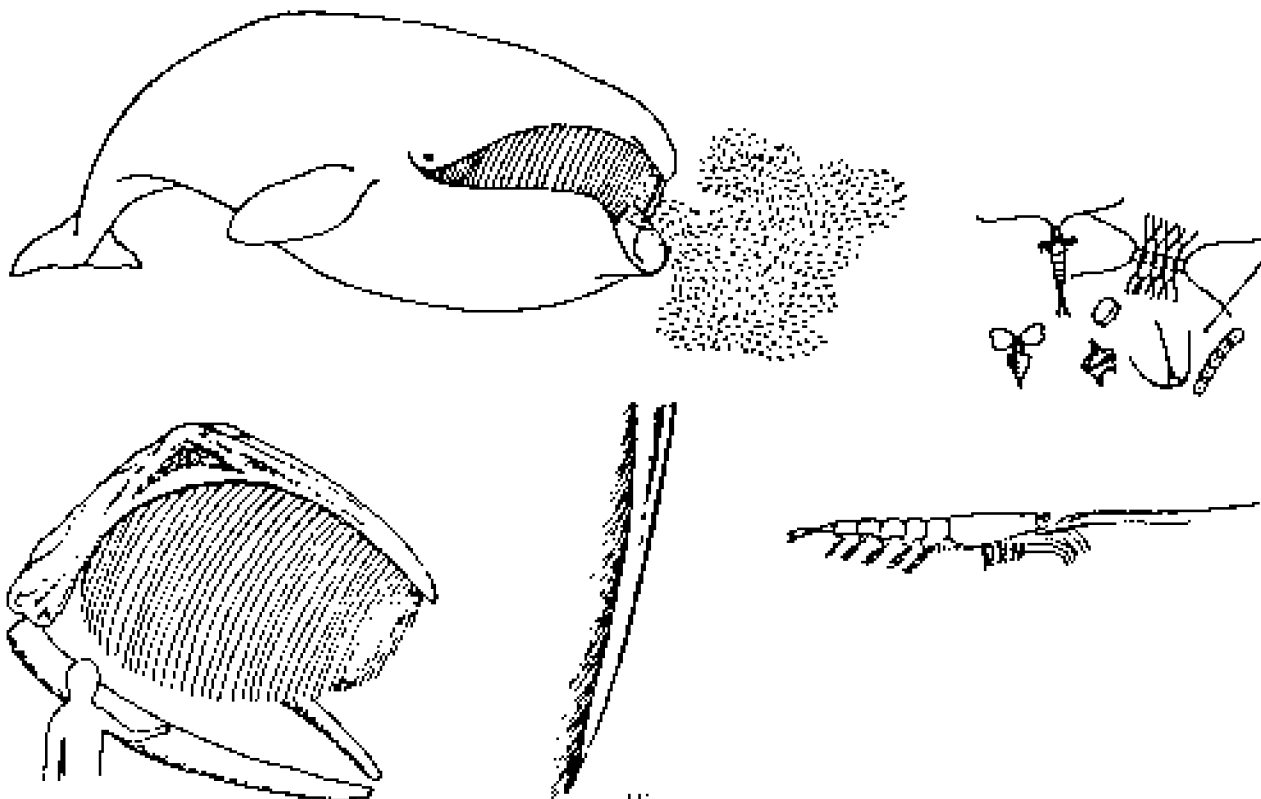
The toothed whales feed mainly on squid and fish. A notable exception is the killer whale, *Orcinus orca*, whose diet consists of sea otters, seals, birds, and other whales, some larger than itself.



Suborder: Mysticeti (baleen or whalebone whale)

Baleen whales are fewer in number but include the large whales and the largest mammal, the blue whale, *Balaenoptera musculus*. Blue whales have grown to be as large as 31 m and 118 metric tons. Included also in this group, is the humpback whale, *Megaptera novaeangliae*, which was recently declared Hawaii's official state marine mammal. Humpback whales migrate to Hawaiian waters every winter from the north to breed off the coast of Maui. Most of the whales hunted by man are also found in this group: right (Greenland or bowhead, Biscay); gray, blue, *B. musculus*; fin; sei; minke; and humpback, *M. novaeangliae*.

Baleen whales, unlike toothed whales, possess baleen plates or whalebone, numbering several hundred, hanging from the roof of the mouth. The baleen, acting as strainers, is frayed on the inner edge and looks like a tangled mass of hair. A feeding baleen whale opens his mouth and draws a large quantity of planktonic organisms, including krill and sometimes small fish, into his mouth. As the whale closes his mouth, it raises its tongue and floor of the mouth squeezing out the surplus water through the baleen plates. The food is caught in the frayed inner surface of the baleen ready to be swallowed. Some of the baleen whales, called rorquals, like the humpback and fin whales, have small heads (although baleen whales as a group have large heads). They have accordian pleated throats that expand greatly to compensate for this limitation and thereby increase their ability to gather food.



Humpback Whale (*Megaptera novaeangliae*)

Physical Characteristics:

Length: 15 meters
Weight: 41 metric tons
newborn are slightly under 1 metric ton

Stocky body, very long flippers reaching almost a third of its body length and knobby protuberances on its head and lower margin of its flippers. Body is black with varying amounts of white underneath and the under surface of the flippers is white. The 400 baleen plates on each "side" of its mouth are up to 61 cm in length and are gray to black.

Range:

Engage in regular migration in all oceans, wintering in tropical waters to breed and summering in temperate or cool waters.

Population:

Numbers reduced to 7,000 from as high as 50,000.

Food:

Plankton (especially krill, a shrimplike euphausid, 5 cm long) and small fishes.

Behavior:

Humpback are the most vocal and melodious of the large whales and communicate with their "singing."

They also like to "play." They will lie on the water surface slapping their long fins back and forth in the water or dive vertically into the water leaving their flukes above water and slapping them back and forth. They are often seen "breaching" which is leaping out of the water and doing a spectacular back flop causing quite a loud noise. This latter behavior may also have some communication value.



CONSERVATION EFFORTS

When the ancestors of the sea otter, seals, sea cows and whales chose the sea as their primary environment, they presumably did so to escape competition for food and living space and to exploit a rich food supply. It is evident they successfully adjusted to aquatic life. All was fine until man developed weapons and ships and ruthlessly hunted some marine mammals to extinction or near extinction, drastically reducing their numbers. Long gestation and nursing periods add to the difficulty marine mammals have of replacing themselves once they have been hunted extensively.

There are currently two federal laws that protect marine mammals, The Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

Marine Mammal Protection Act of 1972

The general provisions of this act call for a moratorium, with limited exceptions, on the taking or importing of marine mammal products. These animals include whales, dolphins, porpoises, seals, sea lions, walruses, and polar bears. Polar bears are not genetically classified as a marine mammal but have been included for administrative purposes because ecologically they belong in the realm of marine mammals. The import prohibition does not apply to marine mammals taken prior to December 21, 1972 unless they are on the endangered species list. Penalties up to \$20,000 and one year in prison are also provided in the act.

The National Marine Fisheries Services, a part of the National Oceanic and Atmospheric Administration within the Department of Commerce, is responsible for administering the Act as it relates to whales, porpoises, seals, and sea lions. The Department of Interior, through its U.S. Fish and Wildlife Service, is responsible for the other marine mammals including polar bears, walruses, manatees, dugongs, and sea otters.

The list of thorny questions and problems have continued to grow since the act has been in effect. To cite a few, how do you accommodate:

1. The scientists, who need specimens for studying marine mammals to better understand them and aquariums that want to use marine mammals for display and educational purposes?

2. The native Americans, including Aleutians, Indians, and Eskimos who have always hunted marine mammals for food and the making of handicrafts?
3. Marine mammals that are an established harvestable resource such as fur seals?
4. The inadvertent killing of marine mammals in conjunction with commercial fishing operations? For some reason, porpoises and yellowfin tuna are often found swimming together. When the enormous purse seine nets are drawn in, the porpoises get tangled in the nets and drown. This fishing method resulted in the deaths of 34 porpoises per ton of yellowfin tuna caught. Since the passage of this act, the fishermen and government agencies have made a concerted effort to reduce the mortality rate. The Medina net, with a special section of nets along the upper edge of the seine and the process of "backing down" or pulling the edge of the net under water to allow the porpoises to escape and other improved technical devices and methods have helped to reduce the incidental porpoise deaths to .91 metric ton of yellowfin.

The following regulations have been adopted to provide exemptions:

1. Provision of permit procedures for the taking of marine mammals for research or public display.
2. Exemptions for Aleutians, Indians and Eskimos from the basic provisions of this act to allow a continuation of subsistence hunting. However, the recent International Whaling Commission's resolution adopted at the last meeting in June 1977, which forbids subsistence hunting of hawhead whales, is contradictory to this regulation. Various government agencies and the native Americans are currently trying to work toward an equitable solution.
3. Exemption of the Pribilof Island fur seal program from the moratorium and provision of studies on the advisability of changes.
4. Requirement for commercial fishermen to have a permit for the incidental taking of marine mammals during fishing operations and provision for research to improve fishing techniques and gear. The National Marine Fisheries Service has established yearly quotas (62,000 for 1977) for porpoises with an eventual goal of zero kill. The tuna fishermen have done amazingly well considering the problems they have met under the NMFS's

requirement for employing new gear technology, including installation of 3 cm fine mesh nets, while under quota and restrictions and contradictory court decisions.

The act could affect everyone who comes in contact with marine mammals or its products. To prevent your committing an inadvertent federal offense, remember the following:

1. The federal statute prevents the killing, capturing, or harassing of any marine mammal. If you should find a baby seal washed ashore, you may not take it home and care for it. If you should see a stranded whale, call the National Marine Fisheries Service office which is listed under the US Government, Commerce Department, in your local telephone directory. Are you guilty of inadvertently harassing the humpback whales while they are breeding off the coast of Maui during the winter months, by riding your boat too close to their breeding grounds?
2. The federal statute further prevents the importation of marine mammal products unless it was taken prior to December 21, 1977. Even at that, you must document the fact that the marine mammal it was taken from was taken prior to that date. If not, the custom officials will hold the item until you obtain proper documentation. Otherwise, the item is refused entry or seized.

Endangered Species Act of 1973

The objective of the Endangered Species Act is to conserve species of fish, wildlife, and plants that are in danger of extinction. The law provides that it is unlawful (with certain limited exceptions), to take, or to import into, or export from, the United States any species designated as "endangered" on the official list published by the Secretary of the Interior, or any part of or product made from such species. Any of the listed species or parts of or products made from such species may be subject to seizure by U.S. agents if imported or exported. Penalties up to \$20,000 and one year in prison are also provided in the act. A second category of species, that of "threatened" species, is provided for in the Act and may also be subject to import and export limitations.

The responsibility for administering the act as far as marine mammals are concerned, are similar to that of the Marine Mammal Protection Act. The National Marine Fisheries Service, an agency of the Department of Commerce, is responsible for the remaining marine mammals.

The implications of this act and how it affects the average citizen regarding marine mammals, would be similar to those of the Marine Mammal Protection Act. The Endangered Species Act simply pinpoints only the endangered species.

The following is a list of endangered marine mammals:

<i>Enhydra lutris nereis</i>	Southern sea otter
<i>Monachus monachus</i>	Mediterranean monk seal
<i>Monachus schauinslandi</i>	Hawaiian monk seal
<i>Trichechus inunguis</i>	Amazonian manatee
<i>Trichechus senegalensis</i>	West Indian (Florida) manatee
<i>Eschrichtium robustus</i> (<i>Glaucois</i> , <i>Sibbaldus</i>)	Gray whale
<i>Balaenoptera musculus</i>	Blue whale
<i>Megaptera novaeangliae</i>	Humpback whale
<i>Balaena mysticetus</i>	Bowhead or Greenland whale
<i>Eubalaena</i> - spp.	Right whales
<i>Balaenoptera physalus</i>	Fin or finback whale
<i>Balaenoptera borealis</i>	Sei whale
<i>Physeter catodon</i>	Sperm whale

Whale Conservation Efforts and Laws

In the late 1920's it became apparent that the stock of whales was declining. The very efficiency of the pelagic whalers and their catchers was taking a toll far greater than the whalemen realized. They were able to pursue whales wherever they congregated and catch them in large numbers. Twentieth century whaling has been much more destructive with respect to whales than the great romantic period of Yankee whaling. A hundred years ago, a whaler's three year expedition netted him about 37 whales. Today, a whaler's weapons and fast boats allow two or three whales to be killed in a day, thus, modern technology gives the whaler the power to wipe out all whales to extinction.

The whalers finally realized that if they continued to slaughter whales at the same rate, there would be no whales left to slaughter. This led to agreements among the major whaling countries--to formulate some controls on the industry.

In 1937, the first International Whaling Agreement was drawn by nine nations and became the forerunner of the International Whaling Convention. Some of the provisions under the agreement stated that operations were to be restricted to a three-month season, the number of ships used was to be limited, and minimum catch-size of the different species were set to conserve stocks by giving the young whales time to reach breeding size. This agreement was in force until World War II during which time whaling ceased almost entirely as many whaling ships were converted into oil tankers.

In 1946, the International Whaling Convention for the Regulation of Whaling was signed in Washington. The Convention had as its objective, the proper conservation of world whale stocks, thus making possible the orderly development of the whaling industry. The Convention established an International Whaling Commission (IWC) composed of a representative from each of the member nations to review the regulations taking into account the latest catch statistics and the results of scientific research of whale stocks, migration patterns, geographical limits, breeding capacity, age structure, and population dynamics. The member nations today are Argentina, Australia, Brazil, Canada, Denmark, France, Iceland, Japan, Mexico, Norway, Panama, South Africa, USSR, United Kingdom, and the United States. All of the members engaged in commercial whaling at one time or another but only Australia, Brazil, Iceland, Norway, Japan, and USSR are whaling today. Japan and USSR, the major whaling countries, operate pelagic factory ships while the other countries operate out of shore stations.

The provisions of the Convention require that the regulatory measures proposed by the commission shall be based on scientific findings and shall take into consideration the public interest, including conservationists and consumers of whaling products as well as the whaling industry. For scientific guidance, the commission is advised by a Scientific Committee of biologists.

The commission has used various means of regulation of commercial whaling, including the fixing of open and closed seasons, open and closed areas, size limits for each species, annual quotas of whales by individual species and geographical areas, and the protection of certain species. Today, only the sperm, sei, Bryde, and minke whales are allowed to be taken.

Relative to quotas, in 1946, the members agreed that a whale quota could not be stated as a certain number of whales, realizing that different species of whales grow to be different sizes, and thus yielded different amounts of oil. To institute a standard unit of measure they established a Blue Whale Unit (BWU), a unit designating the quantity of oil furnished by one blue whale, which is the largest of all whales. A formula was developed whereby one blue whale equaled two finbacks, two-and-one-half humpbacks, or six sei whales. These were the four species of whales primarily pursued at that time. However, the IWC, in a series of decisions in the 1970's, decided to abandon the BWU system since it was detrimental to certain species. Hence, quotas have been established for individual species by ocean areas rather than the ocean as a whole. The system was strongly urged by the Commission's Scientific Committee.

Another significant step toward the establishment of quotas came with the adoption of the New Management Procedures drafted by the Scientific Committee in 1975. These procedures set the criteria for determining quotas according to the status of individual whale populations. In other words, if the population of a particular species decreased to a certain point deemed significant according to the new procedures, quotas would be adjusted accordingly. In recent years, the overall quota has steadily decreased.

At the IWC meeting held in June 1977 in Australia, four major provisions were adopted, two of which were amended at the most recent IWC meeting held in Japan. The two unamended provisions adopted in June were:

1. The IWC failed to completely close the loopholes relative to whaling by non-member nations but made substantial steps toward this end. The commission called on its members to take "all practicable steps" to prevent the sale of surplus whaling equipment and expertise to non-member whaling countries and to stop the importation

of whale products from these nations. Whaling by non-member nations have been a major problem threatening whale conservation. They include the countries of Peru, Somalia, South Korea, Chile, Spain, Portugal, and China. These countries have rejected invitations to join the commission. They whale as they please with no regard for quotas or protected species and are not subject to any sanctions from the IWC countries. With the passage of these two resolutions, hopefully this problem will be reduced significantly.

2. The provision that allowed its members to issue scientific permits to themselves to take whales not included under the quota was amended. This issue came about when Japan allowed itself a take of 240 Bryde whales for scientific study, with plans to commercially process the carcasses. The Scientific Committee henceforth, will review and make recommendations on all such permits. Since Committee approval is not required, there is no legal effect of the IWC action, but it could bring to bear the force of world opinion should a nation ignore the recommendation.

A two-day extraordinary meeting of the IWC was called in December 1977 in Japan to reconsider the other two provisions adopted at the June 1977 meeting in Australia. The amended provisions are:

1. The lifting of the total ban on bowhead whaling to permit the American Eskimos to kill 12 bowheads or make 18 strikes each year. Eskimos have denounced the quota as "too low and totally irresponsible."
2. Increased the sperm whale catch quota from 763 to 6,444. The total whale quota for the 1978 season will now be 23,520. This is still a reduction from the 1977 catch quota of 28,050 which was a reduction from the 33,939 quota set for 1976.

Meanwhile pressures have mounted for putting a permanent end to whaling. Lower quotas, fewer whales, higher costs, and public outcry have forced a reduction in the Japanese and Soviet operations during the past few years. The Japanese have already merged their operations into a Japan Joint Whaling Company. The Japanese and the Soviets are now considering a combined North Pacific whaling fleet, which may involve a Japanese mothership operating with Soviet catcherboats.

Domestically, the US has demonstrated its concern for the protection and conservation of world whale stocks with the passage of the Endangered Species Act in 1969 and a new act in 1973 and the Mammal Protection Act in 1972.

Maritime History of Hawaii and the World

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Activities

1. Have students see how the occurrence of an event relates to another or many other events. For example, Columbus' discovery of land on the other side of the Atlantic Ocean opened the way for the explorers that followed. They were no longer afraid of "falling off" a flat earth and sought new routes to the East Indies and lands to claim for their respective countries.
2. Why did Hawaii become a favorite stop for provisioning ships from the early 1800's? Discuss Hawaii's strategic location in the Pacific with the aid of a map of the world, the rich East Indies trade, and the sandalwood and whaling industries. Students need to be made aware that the transcontinental railroad and Panama Canal were not yet built. Airplanes of course, were not even heard of.
3. Students may wish to research different kinds of ships--sailing ships, steamers, nuclear submarines, aircraft carriers, etc. Many of the students may have models that they can share with the class.

Suggested Excursions

1. Matson Navigation Company has converted a container to a slide theater for a presentation of the Matson story.
2. Aloha Tower
3. Falls of Clyde

MARITIME HISTORY OF HAWAII

<u>Year(s) (A.D.)</u>	<u>Event</u>
600	Chinese trading with people of the Caroline Islands and Philippines.
604	Peru and Chile - Pisco inundated by tsunamis
605	Japan tsunamis - 3,800 dead
684	Great tsunami in Japan - 2 villages sank, 800 meters inundation (approx. 1/2 mile) inland from shoreline
Before 750	EARLY POLYNESIANS SETTLED IN HAWAII
869	San Riku tsunami, Japan - 1,000 deaths
960 - 1279	Chinese invented magnetic compass, stern-post rudder, watertight compass, and produced world's first printed maps
1000	Viking Leif Ericson landed on what we now call Newfoundland in Canada
1394 - 1460	Henry the Navigator founded a school of navigation and map-making
Early 1400's	Chinese advanced in shipbuilding and navigation
1486	Diaz rounded Cape of Good Hope and opened up sea route to India
1492	Columbus discovered New World marking the beginning of European exploration and settlement of the Pacific and new world
1498	Va Gama sailed around Cape of Good Hope and arrived on the west coast of India, establishing trading posts in the East Indies
	Japan tsunami - 1,000 homes washed away on Honshu
1513	Balboa discovers the Pacific Ocean
1519 - 1522	Magellan became first European to sail across the Pacific Ocean
1523 - 1768	Other European explorers followed Magellan and established more trade in the Pacific and the East Indies
1550	Spanish founded Acapulco in Mexico, an important port for the Spanish, and starting point for trading expeditions with the far east and the Philippines
1567	Mendana reached the Solomon Islands and discovered the first important Polynesian group
1577 - 1580	Drake became the first Englishman to sail around the world in two years, nine and one-half months
1611	Great San Riku tsunami, Japan - 1,700 deaths

1620 FIRST OFFICIALLY RECORDED SHIPWRECK IN THE ISLANDS

Pilgrims arrived at Plymouth, Massachusetts on the *Mayflower*

1642 Dutchman Tasman circumnavigates Australia, also discovers Tasmania and New Zealand

1687 Newton establishes the relationship of ocean tidal movement to the moon

1703 Sagami Sea tsunami, Japan - 1,000 homes destroyed

1707 Great Tokaido tsunami, Japan - 30,000 deaths

1737 Kamoharua tsunami - 31 m. above sea level

1746 Peru tsunami

1771 Ryukyu Islands tsunami - 900 deaths

1775 First American submarine is built

1776 Congress adopted the Declaration of Independence declaring the colonies' independence from England

1778 CAPTAIN JAMES COOK DISCOVERED THE HAWAIIAN ISLANDS

1786 FIRST WRITTEN ACCOUNT OF FOREIGN VESSELS, TO COME TO THE ISLANDS AFTER COOK

1789 George Washington elected first President of the United States

1790 THE *PAIK AMERICAN* (a schooner) BECAME FIRST FOREIGN-BUILT VESSEL IN KAMEHAMEHA I'S NAVY

1792 - 1794 CAPTAIN GEORGE VANCOUVER MADE THREE VISITS TO THE HAWAIIAN ISLANDS; BROUGHT THE FIRST LIVESTOCK EVER BROUGHT TO HAWAII. ASSUMED THE ROLE OF MISSIONARY AND SOWED THE FIRST SEEDS OF CHRISTIANITY

1806 THE FIRST RECORDED ORIENTAL JUNK TRAGEDY WITH SURVIVORS TAKEN TO HONOLULU

1813 FIRST REPORTED TSUNAMI IN KONA, HAWAII

1819 KAMEHAMEHA I, FIRST HAWAIIAN KING WHO UNITED ALL THE ISLANDS, DIED AT AGE OF 60 YEARS

KAPU SYSTEM WAS OVERTHROWN

FIRST WHALING VESSELS, *BALAZOVA* AND *EQUATOR*, ARRIVED IN HAWAII

1820 ARRIVAL OF THE FIRST MISSIONARIES IN HAWAII

KAMEHAMEHA II (LIHOIHO) PURCHASED "CLEOPATRA'S BARGE" AND RENAMED HER "HAAHEO O HAWAII"

1822 Tsunami hits Valparaiso, Chile
 THE OWYEE, COMMANDED BY JOHN DOMINIS, WAS ACTIVELY ENGAGED IN THE FUR AND SANDALWOOD TRADE WITH CHINA

1826 MOSQUITOS INTRODUCED AT LAHAINA, MAUI, BY THE WHALER WELLINGTON

1831 WHALER AVENTICK BROUGHT THE 5TH COMPANY OF MISSIONARIES TO HAWAII

1837 CHILE TSUNAMI - DAMAGE IN HAWAII - 16 DEATHS, 170 HOMES DESTROYED

1840 THE CONSTITUTION FOR THE HAWAIIAN ISLANDS WAS ESTABLISHED
 THE FIRST LIGHTHOUSE WAS CONSTRUCTED AT LAHAINA, MAUI

1846 PEAK YEAR FOR THE HAWAII WHALING INDUSTRY

1848 Gold is discovered at Sutter's Mill in California

1848 - 1868 CLIPPER SHIPS WERE PROVIDING SERVICE BETWEEN ORIENTAL PORTS OR HAWAII AND THE UNITED STATES

1850 HUNNEWELL, PEIRCE, AND BREWER FORMED A PARTNERSHIP FOR A FREIGHTING BUSINESS KNOWN AS C. BREWER AND CO., AND REACHED OUT TO MANY WORLD PORTS

After 1850 PACKET BOATS PROVIDED FREQUENT CARGO AND PASSENGER SERVICE BETWEEN SAN FRANCISCO AND HONOLULU

1851 HAWAII PARTICIPATING DIRECTLY IN THE WHALING INDUSTRY
 TWO SCHOONERS RAN PASSENGERS, CARGO, AND MAIL BETWEEN HONOLULU AND LAHAINA ON ALTERNATING BASIS

1852 FIRST INDENTURED LABORERS (CHINESE) ARRIVE IN HAWAII

1853 AZAMAL BECAME FIRST STEAMSHIP TO OFFER INTERISLAND SERVICE

1854 December 23 - Tokaido tsunami, Japan - 1,600 homes wrecked
 December 24 - Nankaido tsunami, Japan - 1,500 homes washed away, 3,000 deaths

1859 - 1869 The 166 km long Suez Canal, connecting the Red Sea and the Mediterranean Sea is built

1860 Abraham Lincoln is elected president

- 1866 THE SS AJAX INAUGURATED MONTHLY STEAMER SERVICE BETWEEN HONOLULU AND SAN FRANCISCO
- 1867 CONGRESS PROVIDED AN ANNUAL SUBSIDY PROVIDING REGULAR MONTHLY MAIL SERVICE FROM SAN FRANCISCO TO HONOLULU
- 1868 MAJOR LOCAL TSUNAMI - SOUTH PUNA, KAU COAST - 81 DEATHS
Peru tsunamis - ships carried inland; severe damage in Hawaii - 46 deaths
- 1869 First transcontinental railroad is completed
HONOLULU HARBOR ACQUIRES A PERMANENT LIGHTHOUSE - THE SECOND BUILT IN HAWAII
- 1877 LIKELIKE WAS ONE OF THE MORE SUCCESSFUL OF THE INTERISLAND STEAMERS--SERVED THE ISLANDS FOR 20 YEARS
Chile tsunamis - in Hawaii, 5 deaths, 37 homes destroyed
- 1878 OAHU'S FIRST TELEPHONE COMPANY, HAWAIIAN BELL TELEPHONE CO., WAS FORMED
FALLS OF CLYDE BULL
- 1881 SARKENTINE WM. G. TRAIN (316 metric ton) DESIGNED FOR SUGAR TRADE
- 1887 THE KAIMALOHA, A 170-TON COPRA SHIP, WAS PURCHASED TO BECOME THE FLAGSHIP OF THE HAWAIIAN NAVY
- 1889 SARKENTINE IMPROVED, A 608 METRIC TON VESSEL, USED FOR SUGAR TRADE
- 1891 HAWAIIAN ELECTRIC CO. (HECO) STARTED SERVICE ON THE ISLAND OF OAHU
- 1895 HAWAIIAN SUGAR PLANTERS ASSOCIATION IS ORGANIZED
- 1896 Japan tsunamis - 2,700 deaths
- 1898 THE SCHOONER MARY E. FOSTER SPENT HER ENTIRE CAREER IN THE LUMBER TRADE TO HAWAII FROM PUGET SOUND LUMBER PORTS
US NAVY COAL DEPOT WAS ESTABLISHED ON HONOLULU'S WATERFRONT
HAWAII BECOMES A TERRITORY OF THE US
TOYO KISEN KAISHA OR ORIENTAL STEAMSHIP CO. WAS THE FIRST JAPANESE LINE TO OPERATE REGULAR PASSENGER AND MAIL SERVICE BETWEEN THE ORIENT AND SAN FRANCISCO VIA HONOLULU

1899 THE STEEL BARK *KAIOWANI*, ONE OF THE LARGEST OF HER RTG EVER BUILT IN THE US, WAS ACTIVE CARRYING SUGAR AND LATER COAL BETWEEN HAWAII AND THE MAINLAND

COROKICHI NAKASUGI, CONSIDERED THE FATHER OF COMMERCIAL FISHING IN HAWAII, ARRIVED IN HONOLULU

1900 YOUNG BROTHERS COMPANY BEGAN PROVIDING HARBOR SERVICE CARRYING CARGO TO SHIPS WITHIN THE HARBOR

1901 REPRESENTATIVE BUSINESS MEN RECOGNIZING THE COMMERCIAL POSSIBILITIES OF THE TOURIST INDUSTRY, TOOK THE FIRST STEP TO ORGANIZE A PLAN TO ATTRACT VISITORS TO HAWAII

MATSON NAVIGATION COMPANY WAS ORGANIZED

1903 Wright Brothers (Orville and Wilbur) tested a successful airplane

1908 Henry Ford produced his first Model T car

1909 THE TALLEST LIGHTHOUSE, THE MOLOKAI LIGHT, WAS BUILT

Early 1900's and by 1912 FIRST FISH AUCTION HELD IN HONOLULU

1911 THE *KILAUEA III* ADDED A NEW DIMENSION IN INTERISLAND STEAMER TRAVEL--LARGER PASSENGER CARRYING CAPACITY

1912 DILLINGHAM SHIPYARD BEGAN AS THE EQUIPMENT MAINTENANCE DIVISION FOR HAWAIIAN BREKING

1914 ARRIVAL OF THE FIRST SUBMARINES ASSIGNED TO HAWAII

Panama Canal is officially opened, bringing Hawaii closer to the eastern United States

1917 HAWAIIAN TUNA PACKERS BEGAN OPERATIONS

1922 Chile tsunami

1923 Kamchatka tsunami - 1 DEATH IN KAHIGLUI, MAHI; 868 homes destroyed at Sagami Bay, Japan

1925 ALOHA TOWER BUILT--BECAME ONE OF HONOLULU'S MAJOR LANDMARKS

1927 THE FIRST LUXURY LINER, MATSON'S SS *MATSONO*, ENTERED SERVICE

Lindberg makes the first solo flight across the Atlantic Ocean

1930 TUSITOLA, THE LAST AMERICAN FLAG FULL-RIGGED
MERCHANT VESSEL DEPARTED HONOLULU

1931 RADIOTELEPHONE SERVICE INAUGURATED BETWEEN
THE ISLANDS AND THE MAINLAND

1933 Japan tsunami

1936 PAN AMERICAN LAUNCHED ITS FIRST TRANSPACIFIC
PASSENGER SERVICE TO HAWAII, GUAM, AND
MANILA

1939 THE LIGHT CRUISER USS *HOWELLS* WAS ASSIGNED
TO THE PACIFIC FLEET BASED AT PEARL
HARBOR

1941 THE AMERICAN BATTLESHIP *ARIZONA* EXPLODED
AND SANK IN PEARL HARBOR AFTER SURPRISE
ATTACK BY JAPANESE

1946 WORST TSUNAMI IN HAWAII'S HISTORY -
159 deaths and \$26 million damage

1948 THE TSUNAMI WARNING SYSTEM WAS DEVELOPED

1949 WORST MARITIME STRIKE IN HAWAII'S HISTORY
COSTING MORE THAN \$100,000,000

1952 Kamchatka tsunami - \$1 million damage

1957 Aleutian Islands tsunami - DAMAGE ON KAUAI
AND MAUI

HAWAIIAN TELEPHONE COMPLETED LAYING THE
FIRST SUBMARINE TELEPHONE CABLE IN THE
PACIFIC ENDING TRANSPACIFIC RADIO-
TELEPHONE SERVICE

1958 FREIGHTER *HAWAIIAN MERCHANT* INAUGURATED
ITS CONTAINERIZED CARGO SHIPMENTS

BLACK CORAL DISCOVERED BY DIVERS OFF
LAHAINA, MAUI

1959 HAWAII BECOMES THE 50th STATE

1960 CHEVRON'S HAWAIIAN REFINERY WAS BUILT

Chile tsunami - \$22 MILLION DAMAGE IN HILO
AND 61 DEATHS; very little damage
elsewhere

1961 DILLINGHAM TUG AND BARGE CREATED, SEPARATING
HARBOR OPERATIONS AND TOW BOAT AND BARGE
ACTIVITIES FROM YOUNG BROTHERS FREIGHT
SERVICE

USS *ENTERPRISE*, a second nuclear powered
ship, was built

First Americans orbit the earth

1962 West Coast dock strike

1964 Alaska Tsunami - \$64,000 DAMAGE TO HAWAII

1965 First Americans "walk" in space

1966 HAWAIIAN TELEPHONE CO. INTRODUCED FIRST
"LIVE" TELEVISION PROGRAM TO HAWAII FROM
MAINLAND VIA COMMUNICATIONS SATELLITE

1967 THE HAWAIIAN PRINCESS, A SPECIALIZED MATSON
INTERISLAND CARGO CONTAINER VESSEL
BEGINS SERVICE TO OTHER ISLANDS

1969 Neil Armstrong becomes the first man to
walk on the moon
MANGANESE NODULES RECOGNIZED AS POTENTIALLY
VALUABLE RESOURCE

1970 MATSON DISCONTINUED PASSENGER SERVICE TO
CONCENTRATE ON CARGO TRADE

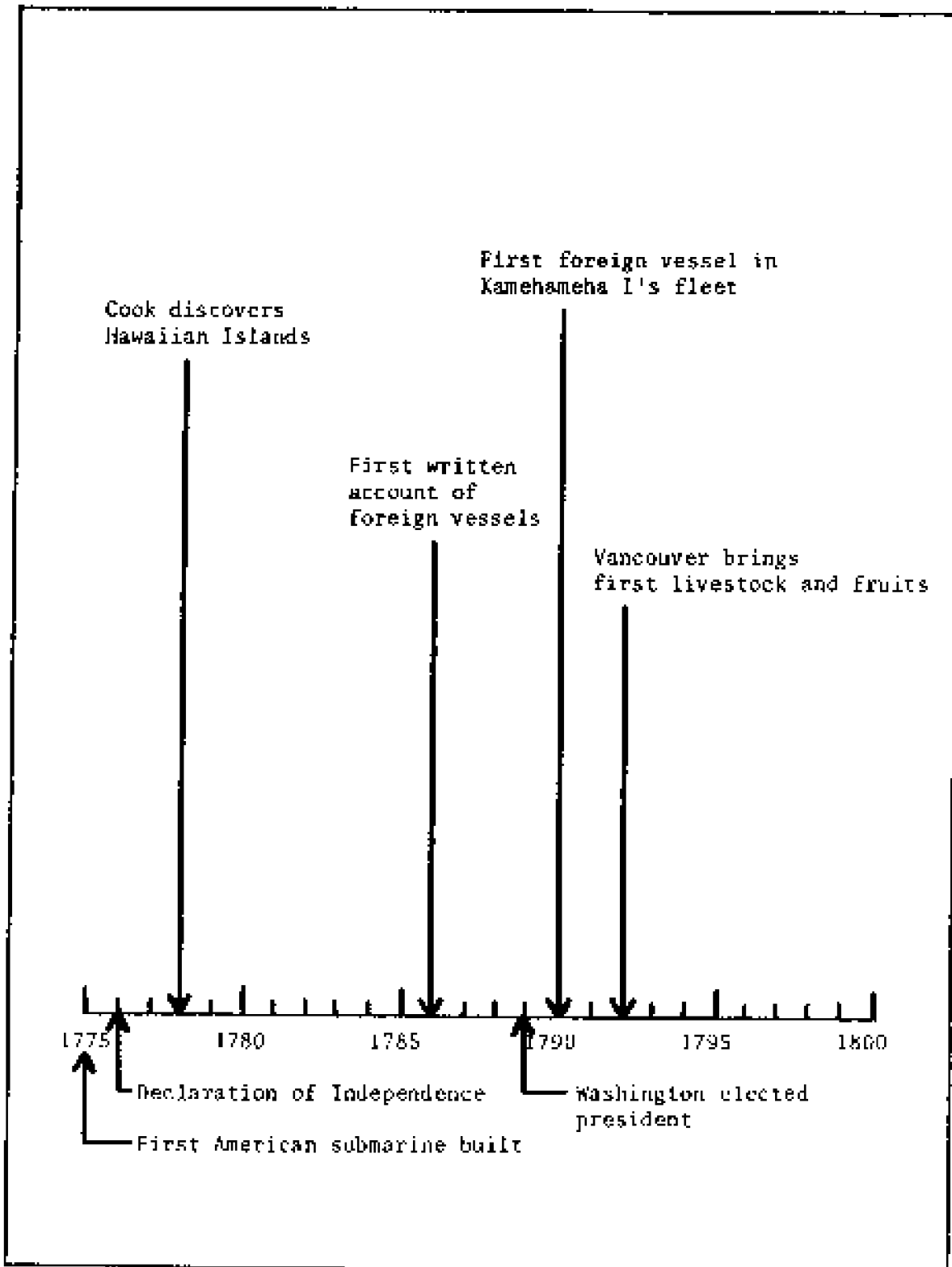
1971 - 1972 100-DAY WEST COAST LABOR DISPUTE

1972 THE HUGHES *SEASPAR EXPLORER* WAS LAUNCHED TO
RECOVER THE SUNKEN RUSSIAN SUBMARINE
NORTHWEST OF OAHU

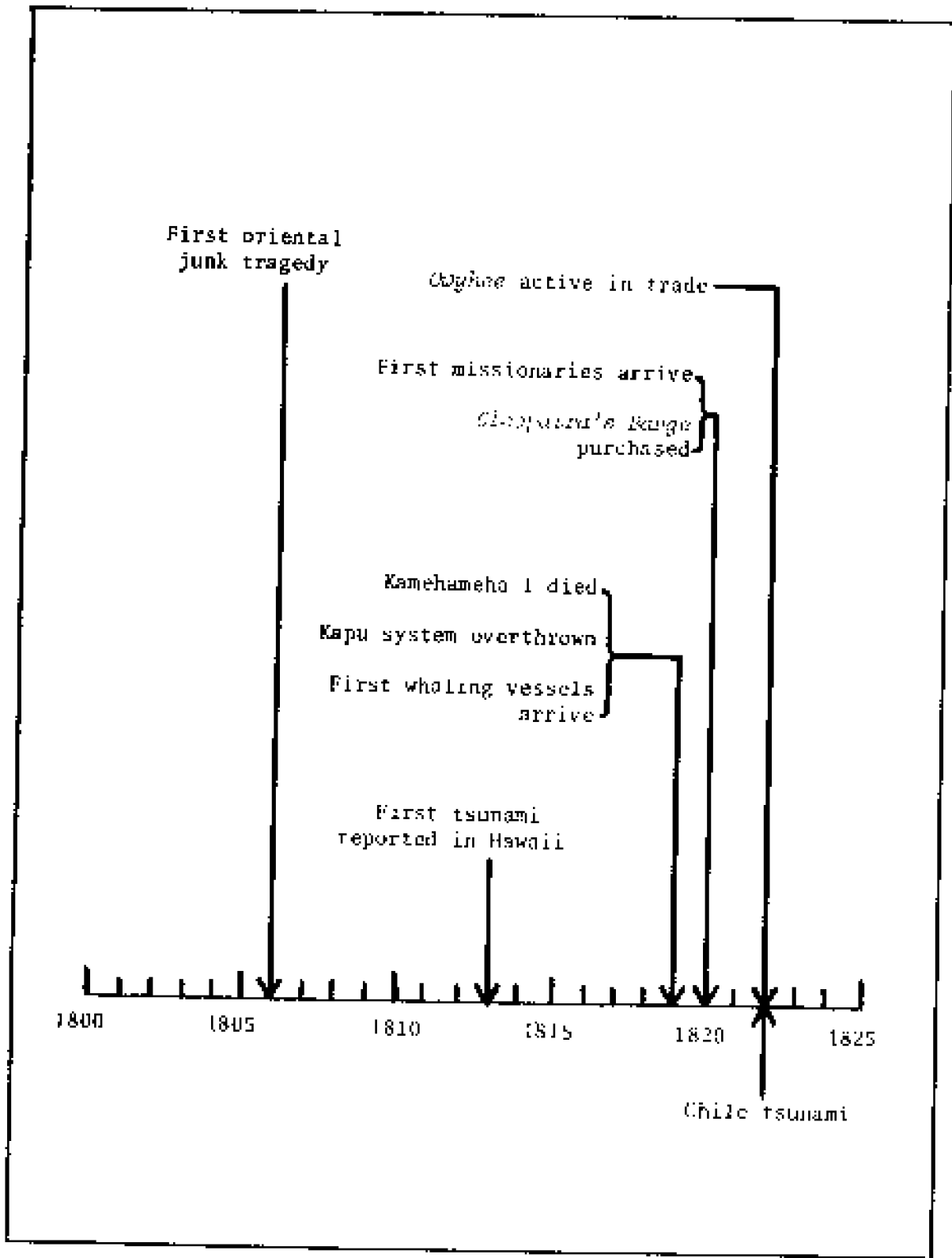
1973 MATSON INTRODUCED "ROLL-ON ROLL-OFF"
TRAILERSHIP SERVICE

1975 LOCAL TSUNAMI - SOUTH PUNA - 2 deaths;
not much damage
JUNE 15th. SEAFILITE'S INTERISLAND
HYDROFOIL SERVICE BEGAN

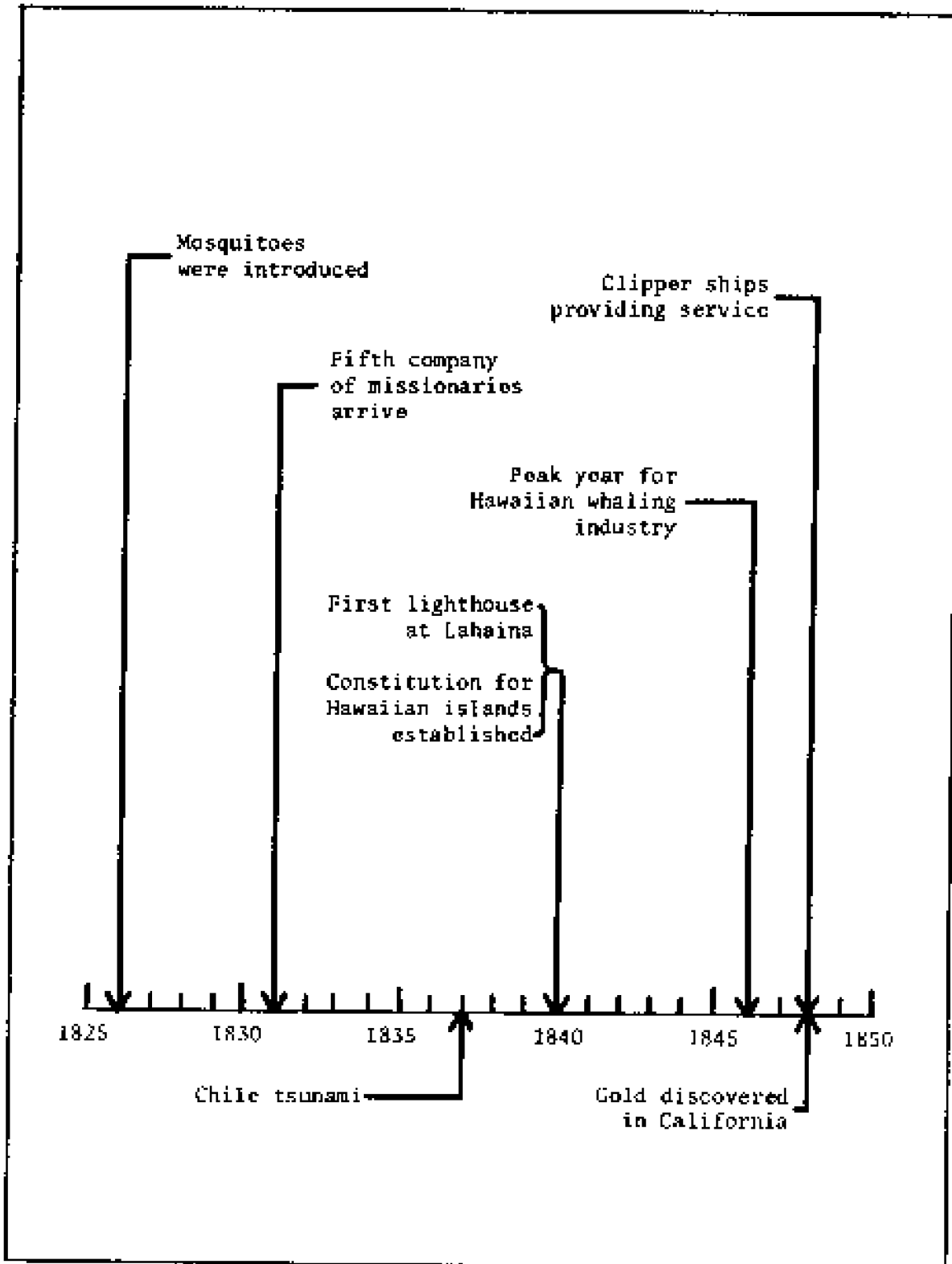
1976 MAY 1st. THE *MOKULUA* MADE HER HISTORIC
9654 KM VOYAGE FROM HAWAII TO TAHITI
IN 36 DAYS
The Fishery Conservation and Management Act
was enacted--created 200-mile fisheries
zone



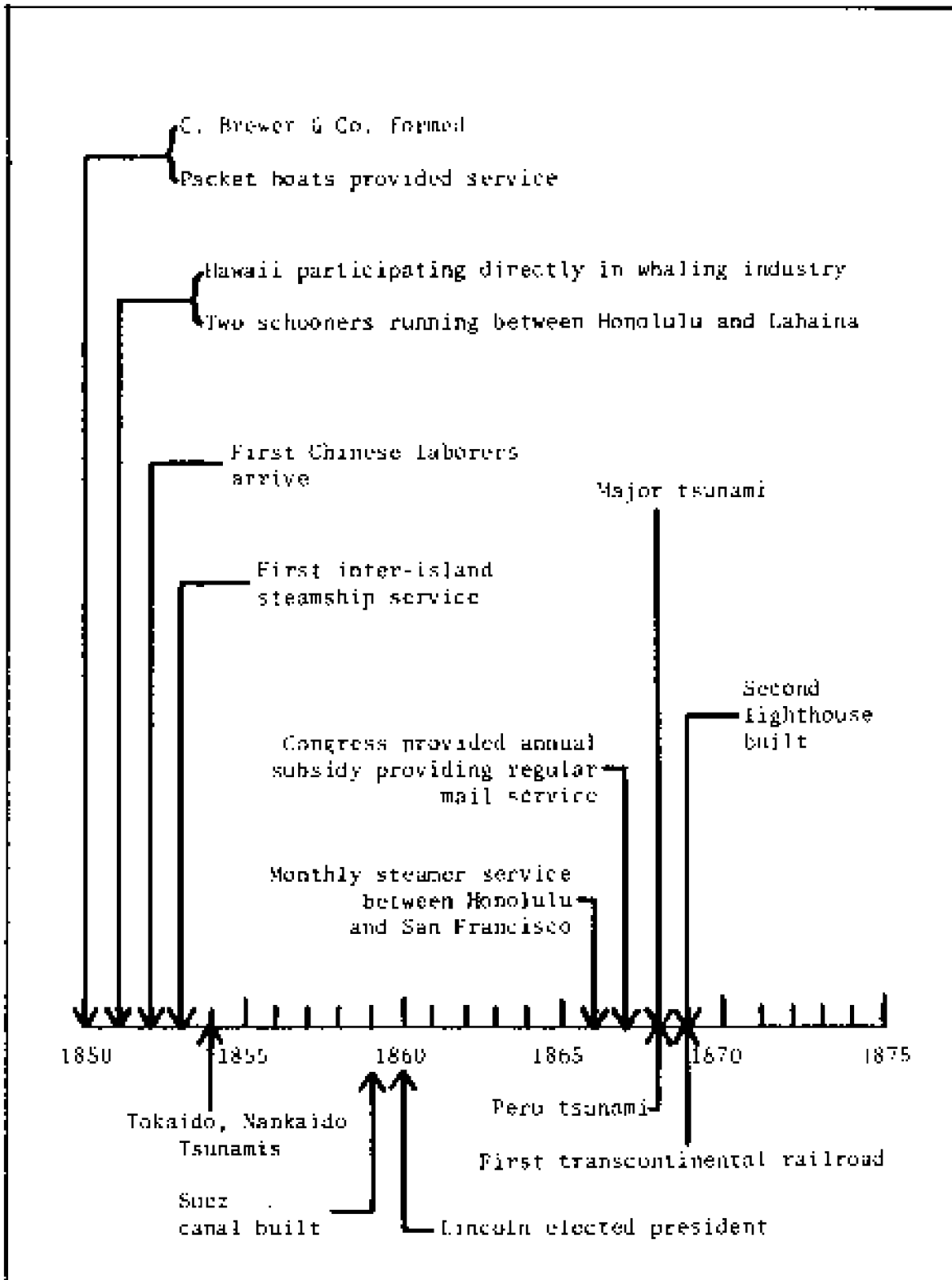
1775 - 1800



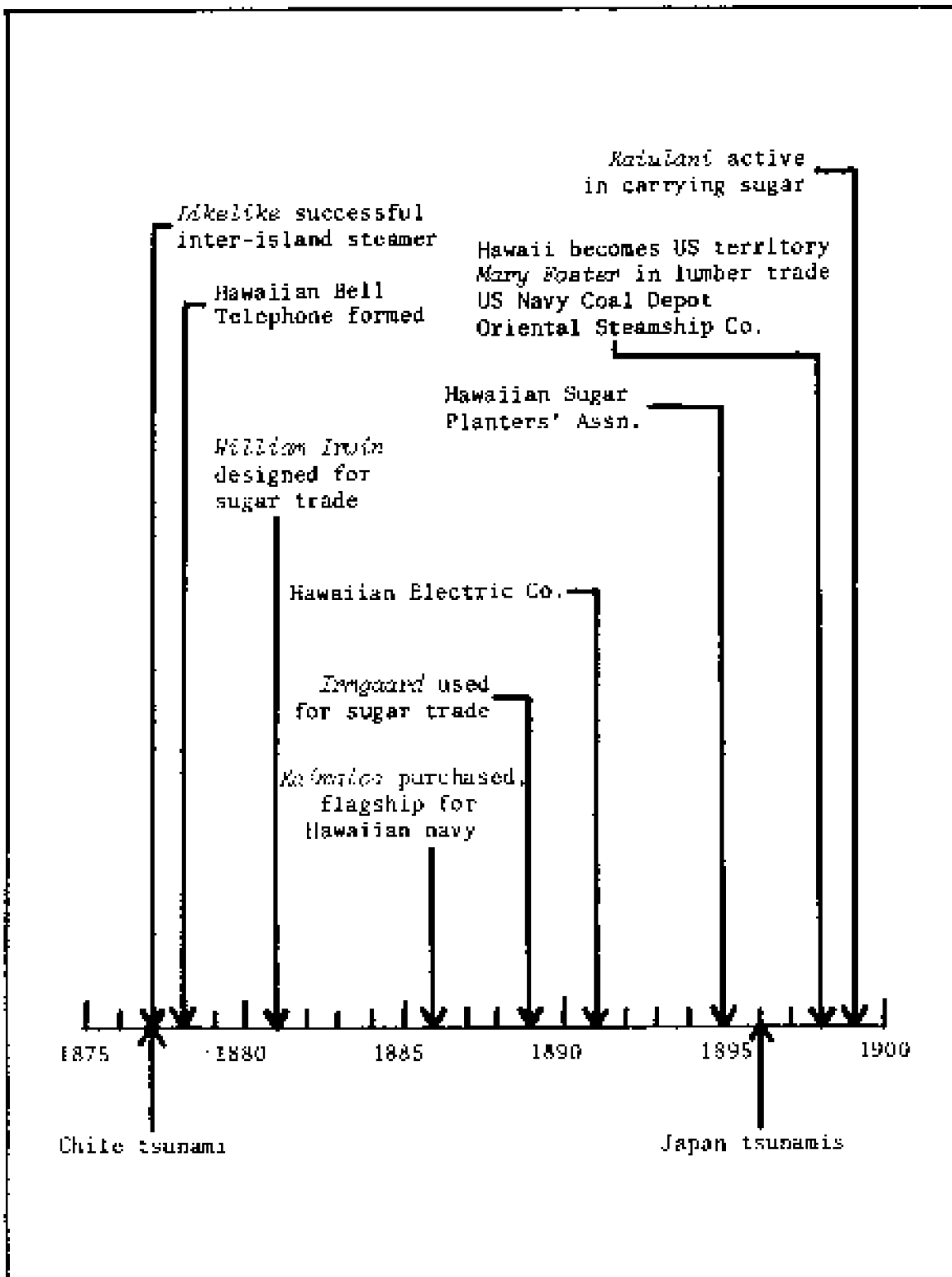
1800 - 1825



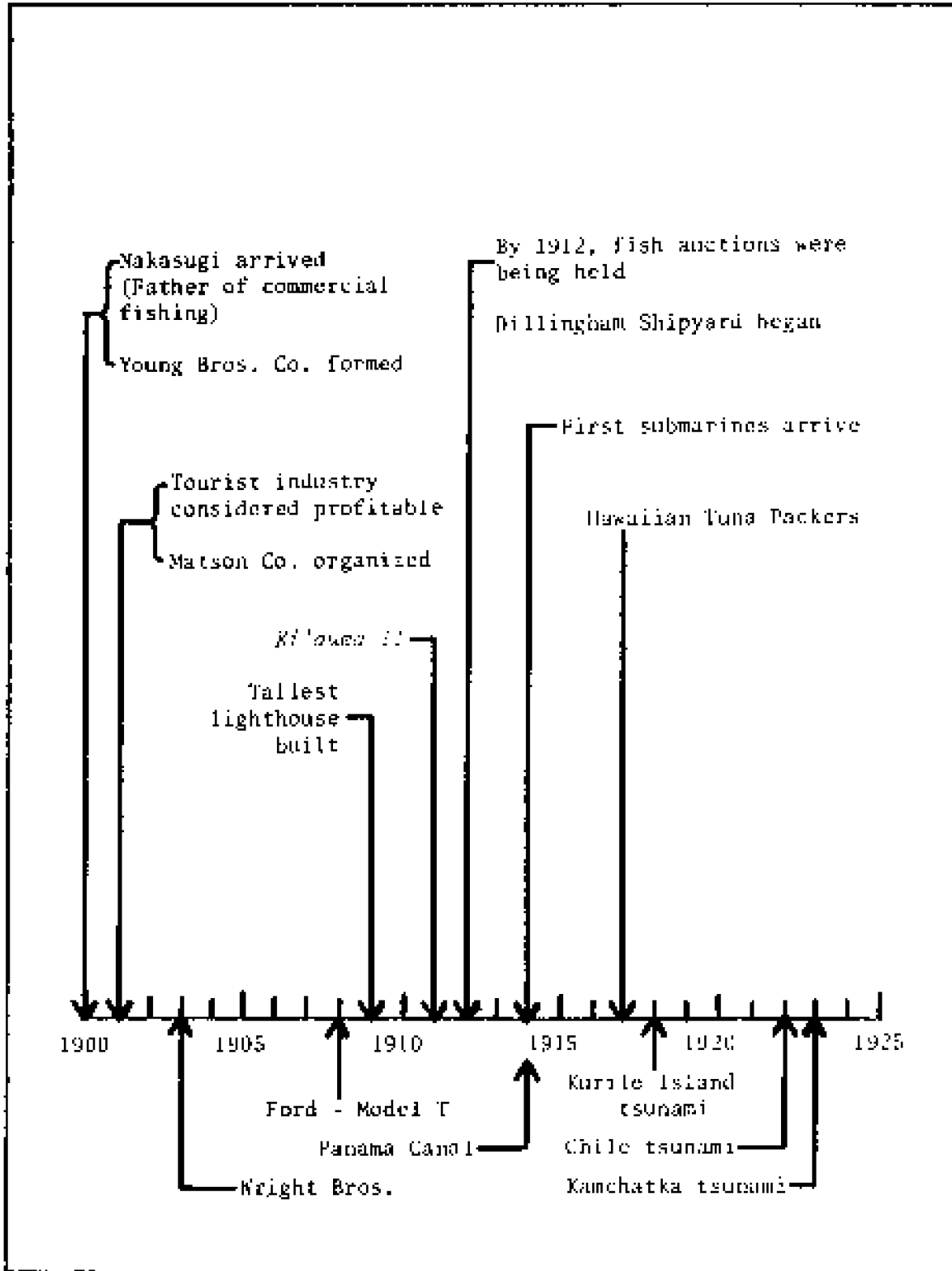
1825 - 1850



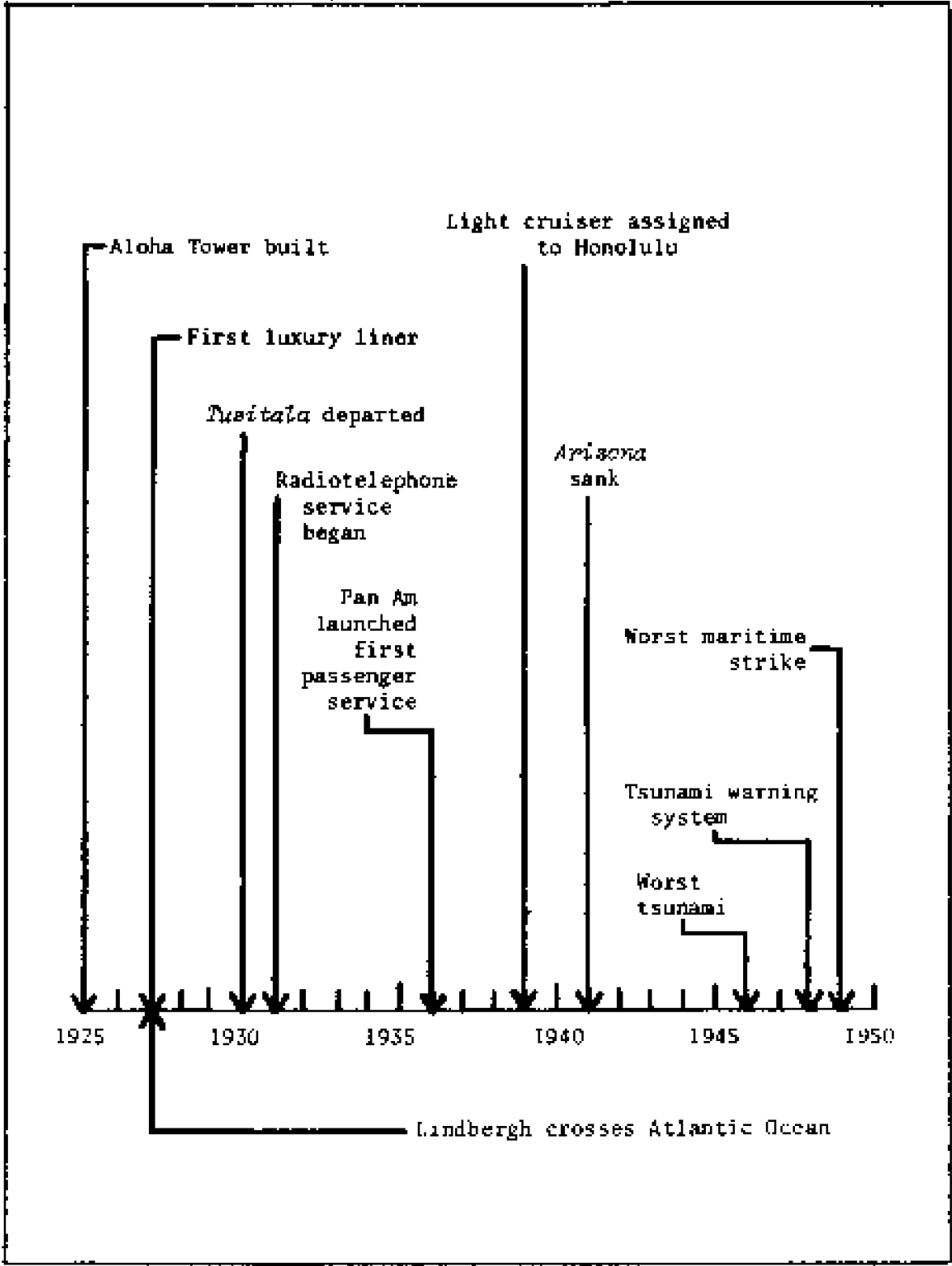
1850 - 1875



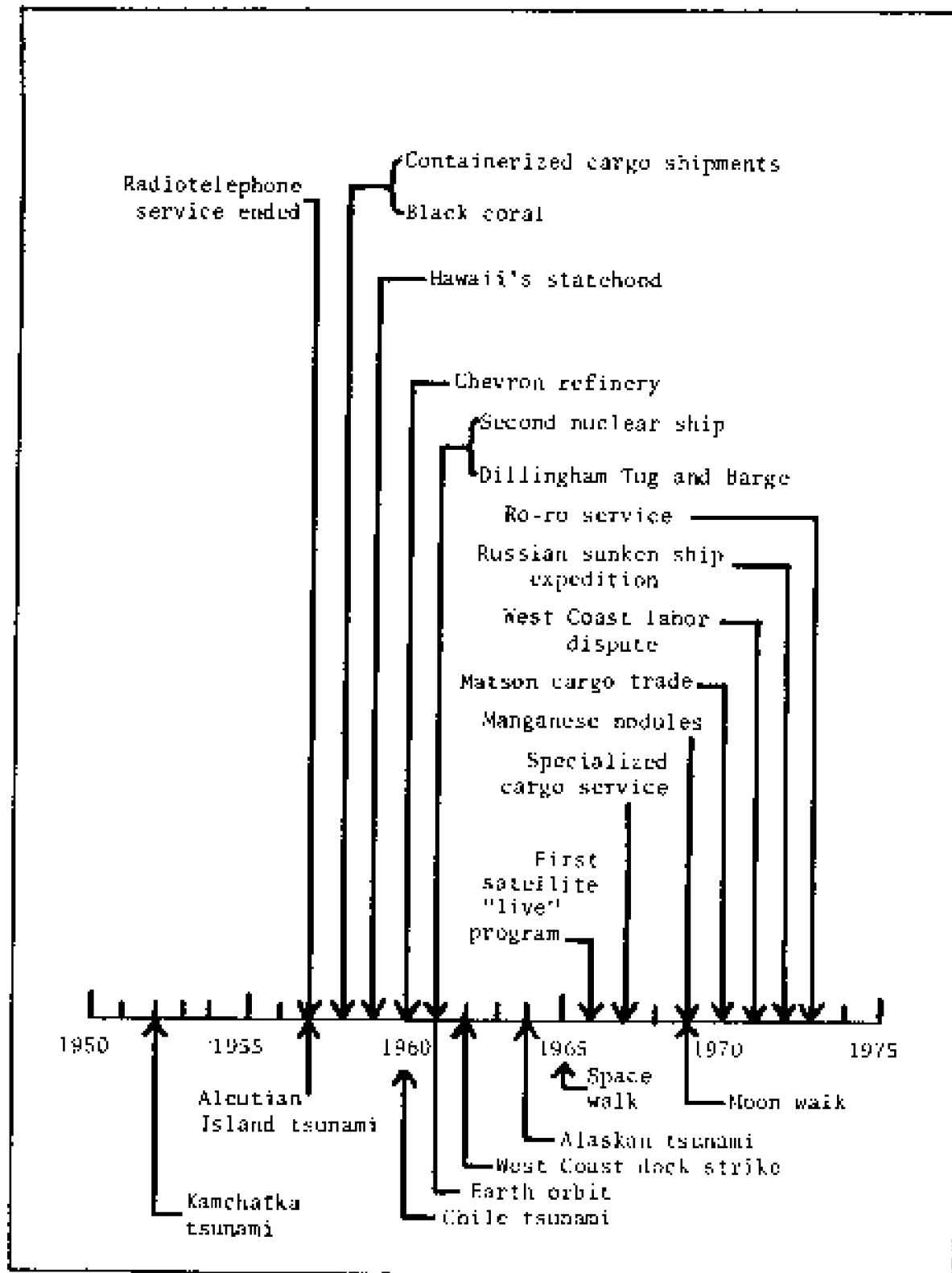
1875 - 1900



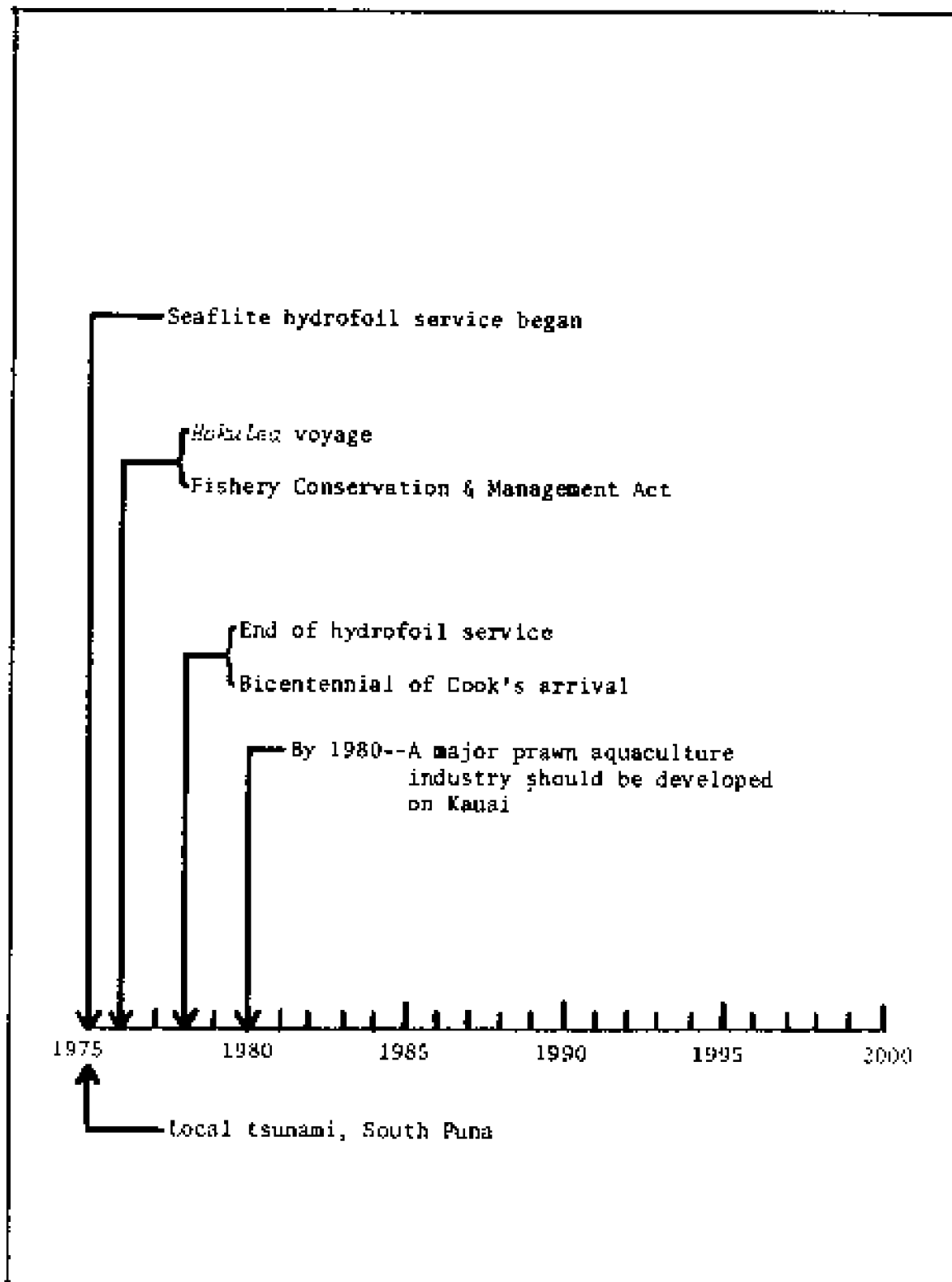
1900 - 1925



1925 - 1950



1950 - 1975



1975 - 2000