



"Navigating Change" is a project focusing on raising awareness and ultimately motivating people to change attitudes and behaviors to better care for our islands and our ocean resources. Partners in this project include private non-governmental organizations, state agencies and federal agencies that share a collective vision for creating a healthier future for Hawai'i and for our planet.

This collaborative multi-agency effort aims to change behaviors by creating an awareness of the ecological problems we face and by making it relevant to the decisions that confront us in our daily lives.



Acropora coral, French Frigate Shoals
Photo: NOWRAMP 2000

The Northwestern Hawaiian Islands represent an example of how we can learn to manage and care for a pristine and fragile ecosystem and apply these lessons back to the Main Hawaiian Islands, and the rest of the world.

In 2002 and 2003, a series of voyages to the Northwestern Hawaiian Islands will involve cultural practitioners, biologists, geologists, wildlife managers, and many other specialists. The crews of the voyaging canoe, Hōkūle'a and a number of scientific research vessels will bring us a clearer understanding of the environmental and spiritual importance of these islands.



French Frigate Shoals is an atoll consisting of a large, crescent-shaped reef surrounding numerous small, sandy islets. While the land area is only ¼ square kilometer (67 acres), the total coral reef area of the shoals is over 938 square kilometers (232,000 acres).

French Frigate Shoals exhibits the classic features of a well-developed coral atoll. The coral growth is atop an eroded volcano, which has been submerged for millions of years. A steep-sided basalt pinnacle juts out of the water in the center of the atoll. This unique rock formation is the last remnant of the original volcano. The pinnacle was named "La Pérouse Pinnacle" after Comte de La Pérouse, who visited the atoll in 1786.

Tern Island, a part of the atoll, was formed into a runway to serve as a refueling stop for planes enroute to Midway during World War II. The original seawall, runway, and some of the buildings remain. The U.S. Fish and Wildlife Service continues to maintain a field station there, which is staffed year-round by two permanent employees and a handful of volunteers.

The reef system associated with French Frigate Shoals supports the greatest variety of coral species in the NWHI. These include table, finger, and lobe corals. It also supports more than 600 species of invertebrates such as sponges, coral worms, snails, lobsters, crabs, shrimps and clams, oysters, sea urchins, and sea stars. Many of these are endemic species.

More than 150 species of algae live among the reefs, including red, green and brown algae. The outer reef waters support gray reef sharks, butterfly fish, and large schools of jacks and groupers.

Hundreds of green sea turtles inhabit French Frigate Shoals. Over 90% of the threatened Hawaiian population of green sea turtles travel to the shoals for safe nesting. Satellite tagging of these turtles indicates that most of them migrate to the Main Hawaiian Islands to feed before returning to French Frigate Shoals to breed. Some of these turtles travel northwest to feed, while others travel as far south as Johnston Atoll.

The many small islets of French Frigate Shoals provide refuge to the largest population of endangered Hawaiian monk seals. Preserving this atoll is critical to their survival.



At more than 1,000 acres, Laysan is the largest single landmass in the Northwestern Hawaiian Islands (NWHI). It extends about 1.6 kilometers across and 2.4 kilometers long. Its poi board shape was formed by geologic uplift and by coral growth. It has fringing reefs and a hypersaline (very salty) lake in its interior, the only lake in the NWHI. A white sand beach surrounds Laysan's beautiful lake and is topped by dry coastal grasses. Sedges grow thick near the lake's edge.

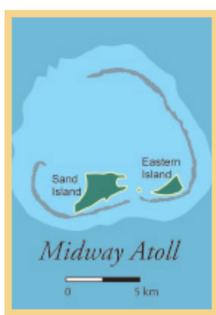
The island's easy access and large number of seabirds made it a base for guano miners and feather harvesters in the late 1800s and early 1900s. The effects of guano mining, feather poaching, and the introduction of rabbits in the early 1900s, caused the Laysan albatross population to plummet from about 1 million in 1891 to about 30,000 in 1923.

Due to the dramatic loss of vegetation caused by rabbits, several species of land birds became extinct, including the Laysan honeycreeper and the millerbird. Two endemic species of land birds survived the hardy Laysan finch and the Laysan duck along with one endemic plant species.

Although introductions of alien species has changed the original fabric of the island's ecology, Laysan has benefited from years of concerted effort to malama (take care of) the island. The U.S. Fish and Wildlife Service has eliminated pests, including rats, rabbits, and weeds, and has restored native vegetation. Laysan exemplifies restorative island efforts and is considered one of the crown jewels of the NWHI.

Populations of the endangered Laysan finch and Laysan duck are similar in size to those recorded in the early 20th century. More bird species now live on, or visit, Laysan than any other island in the Northwestern Hawaiian Islands. Huge populations of nesting seabirds and migratory shorebirds visit the island, including black-footed and Laysan albatross, Christmas and wedge-tailed shearwaters, and bristle-thighed curlews.

Although the reef at Laysan is the smallest of the NWHI (145,334 acres), it is quite rich. Numerous green sea turtles and Hawaiian monk seals appear on the island. Several species of Hawaiian surgeonfish and large schools of convict tangs are in the shallow, wave-washed waters around the island. Twenty-seven species of stony coral are reported, and branching corals are common.



Midway, the best known of the Northwestern Hawaiian Islands (NWHI), is a circular-shaped atoll with three small islets (Sand, Eastern, and Spit) on the southern end of a lagoon. While its land area is small, about 1,535 acres, the atoll has approximately 85,929 acres of reef area.

Captain N.C. Brooks of the *Gambia* sailed to the atoll in 1859. After Brooks, the United States annexed it as the first insular possession to be claimed outside the U.S. continent. People visited Midway during the late 1800s primarily to collect feathers and eggs. Through the early 1900s, the United States recognized this "stepping stone across the Pacific" as a critical link for round-the-world communications and as a stop over for Pan American seaplanes. During World War II, Midway became a major U.S. military base. The atoll was attacked twice, once on December 7, 1941, after the attack on Pearl Harbor, and again during the pivotal Battle of Midway, which turned the tide of the war in America's favor. The atoll was designated as the National Memorial to the Battle of Midway in 2000.

In 1996, the once strategic naval base was turned over to the U.S. Fish and Wildlife Service to be managed as Midway Atoll National Wildlife Refuge. A massive U.S. Navy clean up prior to their departure removed tons of debris, leaky fuel tanks, and lead paint, as well as rats. Today a fulltime Refuge staff administers a small visitors' program, cares for its wildlife, restores native plant life, and protects historic resources.

Nearly two million birds of 19 species nest on Midway. The atoll has the largest Laysan albatross colony in the world. Other birds include black-footed albatross, red-tailed tropicbirds, white terns, black and brown noddies, shearwaters, and Bonin petrels. One of the rarest visitors is the endangered short-tailed albatross.

Three-fourths of Midway's plant species were introductions. These include weeds, ornamental shrubs, exotic vegetables, and trees such as coconut palms and ironwood. Major efforts are underway to control alien species and restore native habitats. The waters abound with dolphins, monk seals, and green sea turtles. More than 250 species of fish live in its waters, including hapu'upu'u (the rare Hawaiian grouper), ulua (jack), kumu (goatfish), and sharks. Beyond the reefs are pelagic fishes such as tuna and marlin.

Despite 100 years of human impact, the reef at Midway is rich and diverse. Sixteen species of stony coral have been reported, and scientists believe there may be many more. Marine habitats, including spurs, grooves, and sand channels, are home to several algae, seagrass meadows, urchins, bivalve clams, sponges and more.



Hōkūle'a, a replica of an ancient Polynesian canoe that has been voyaging since 1976, continues her journey with a voyage to the Northwestern Hawaiian Islands (NWHI).

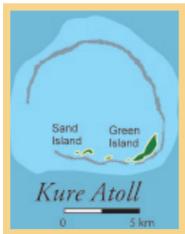
The mission of the Hōkūle'a is to perpetuate and care for the spiritual, cultural, and natural heritage of Hawai'i. The goal of the crew aboard Hōkūle'a is to teach the value of sustainable living on islands and finding a balance that preserves the environment and the cultural and natural resources while at the same time supplying the islands' residents with what they need to live.

The Northwestern Hawaiian Islands are kūpuna, or ancestors, to the Main Hawaiian Islands, the ones most commonly known. The NWHI are a 1,200 mile long archipelago (island chain) located northwest of the main islands. They emerged from the sea millions of years before even the oldest islands of the main chain, Ni'ihau and Kaua'i. Some of the native plants and animals found on the main islands originally migrated from these northern islands. The NWHI are the breeding grounds for endangered and rare species of seals, sea turtles and seabirds.

The islands are treasures of Hawaiian cultural heritage. Evidence of houses and fields have been found on Nihoa. On two islands, Nihoa and Mokumanamana (Necker), remains of ancient places of worship and burial sites have been found. Ancestral bones were removed by researchers in 1923 and, in 1997, returned to the islands and reburied by native Hawaiians.

As kupuna, the NWHI deserve special care. When they visit some of the islands, the Hōkūle'a crew will practice cultural protocols (proper ways of acting) that express respect for the islands and for the spiritual, cultural, and natural heritage these islands represent. The crew will also practice ecological protocols to ensure they minimize any negative impacts to the natural environment.

With her next voyage, the Hōkūle'a navigates a course toward a better understanding of traditional Hawaiian values, such as mālama (to care for), kia'i (to watch over) and kuleana (to be responsible for). These values guide us in living in balance with the environment. The voyage will also promote a stronger awareness of the ecosystems of which we are a part, human impacts on those ecosystems, and ways of caring for the places that we visit and inhabit.



Kure Atoll is the most remote of the Northwestern Hawaiian Islands, and the northern-most coral atoll in the world. Kure is an oval-shaped atoll, which is 10 km at its maximum diameter and 91 km west-northwest of Midway Atoll at the extreme northwest end of the Hawaiian archipelago. Green Island is the only permanent island in the atoll. The island is a nesting area for shearwaters, petrels, tropicbirds, boobies, frigatebirds, albatrosses, terns and noddies. It is also a wintering area for a variety of migratory bird species from North America and Asia.

Prior to 1827 Kure Atoll was visited by a half a dozen ships, and given a new name after each visit. Beginning in 1837, numerous ships have run aground on the reefs at Kure (previously known as Cure Island), and crews were stranded on the atoll for up to nine months at a time, eating monk seals, turtles and seabirds to survive.

On September 20, 1886, the ship *Waialeale* arrived at Kure and James Boyd took possession of the island in the name of King Kalākaua and the Hawaiian Kingdom. The ship's crew built a shack and left provisions and water tanks for shipwrecked sailors. In 1894 the island was leased for guano mining, but no mining was ever done. Kure Atoll was acquired by the United States of America as part of the Territory of Hawaii on July 7, 1898. In 1909, President Theodore Roosevelt made Kure part of the Hawaiian Islands Bird Reservation, reserving the atoll for the Department of Agriculture as a preserve for native birds.

Despite its northern location and relatively cool waters, the aquatic habitats of Kure house a diversity of corals and large invertebrates such as echinoderms, crustacea and mollusks. The turquoise waters of the lagoon and near-shore reefs support large schools of dolphins, jacks, sharks, goatfish, and chub, as well as morays, knifejaws, masked angelfish and rare native groupers. Recent aquatic surveys have identified rare fish species and behaviors seldom seen in the Main Hawaiian Islands, raising additional questions about the effects of human activities on marine ecosystems.

Kure Atoll is an important pupping and resting area for Hawaiian Monk seals. The Kure Atoll sub-population of monk seals apparently declined during the 1960s due to increased human disturbance from the Coast Guard station, but has been increasing in recent years. The monk seal population size at Kure is currently about 100-125 animals.

Other issues facing the atoll include threats from marine debris. The atoll lies in the path of a major Pacific current, resulting in tons of fishing nets and debris washing up on the reefs and beaches, which pose an entanglement hazard for monk seals, turtles, seabirds, fish and lobsters.



About 20 million years ago, geologic forces raised the tip of a huge coral bank above sea level. Today, Lisianski Island is 1.5 square kilometers (381 acres), about the size of Honolulu. Its highest point is a sand dune about 40 feet above sea level. Though the island is small, the reef area to the southeast, called Neva Shoals, is huge, covering 979 square kilometers, an area nearly the size of O'ahu.

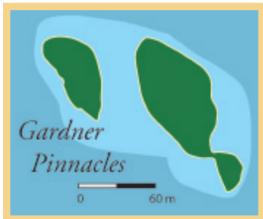
A Hawaiian gourd calabash was spotted on the beach of Lisianski in 1805, when the ship *Neva* ran aground there. Captain Iurii Lisianskii (aka Urey Lisianski) jettisoned some of the ship's cargo, including cannons, to free the ship from the shallow waters.

A vessel picking up survivors of a shipwreck introduced rats to the island in 1844. Later, rabbits and mice devastated the island's ecology and are believed to have caused the demise of the Laysan rail. Feather collecting began on Lisianski about 1904. In response to public outcry about the feather trade, Theodore Roosevelt established the Hawaiian Island Bird Reservation, which included Lisianski, in 1909. An armed party landed on the island in 1910. They arrested feather poachers and confiscated and destroyed about 1.4 tons of feathers, representing 140,400 birds.

Today, Hawaiian monk seals and green sea turtles are common visitors to Lisianski's sandy white beaches. Migratory shorebirds seen on the island include the kōlea (golden plover), 'ululi (wandering tatter), and kioea (bristle-thighed curlew). Nearly three-fourths of the Bonin petrels nesting in Hawai'i make this island their home. In some years, more than a million sooty terns visit Lisianski.

Reef fishes of the nearshore waters are abundant and diverse. Researchers have found predators near Lisianski's reefs such as sharks to be very aggressive. Even ulua (Trevally jacks) will harass divers and small boats. The reefs are called "coral gardens" by some scientists because of their abundance of coral. Twenty-four different species of coral were found in one major survey at Lisianski.

A wide variety of algae are commonly found close to the island, and some researchers think that this results from guano (bird droppings) washing into the ocean and providing nutrients for the algae.



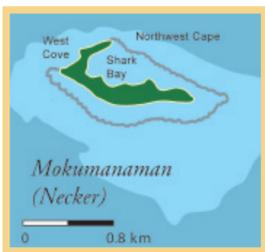
When the two pinnacles of volcanic rock between French Frigate Shoals and Maro Reef come into view, mariners know they have reached Gardner Pinnacles. This 5-acre island comprises the smallest land area of any of the Northwestern Hawaiian Islands (NWHI). Underwater shelves reach outward from the pinnacles and extend over an area of 2,446 square kilometers (604,000 acres).

In 1820, Captain Joseph Allen of the Nantucket whaler, *Maro*, reported seeing "a new island or rock not laid down on any of our charts. . . . It has two detached humps. . . . We call it Gardner's Island."

Gardner Pinnacles is known for its abundance of giant 'ōpīhi, the endemic Hawaiian limpet. The islands' rocky inter-tidal areas are an ideal habitat for 'ōpīhi. Coral species of many varieties are distributed throughout the pinnacles' reef system. Acropora table corals have been noted on the leeward side, while tube, stony, and soft corals have been found throughout the reef. The underwater shelves around Gardner Pinnacles provide habitat for some of the highest recorded numbers of fish species in the Northwestern Hawaiian Islands.

Gardner Pinnacles is home to seabirds, insects, and only one species of plant, the succulent sea purslane. Scientists have observed 19 species of seabirds, 12 of which breed on the steep cliffs, including the rare blue gray noddy.

Despite its small size and isolation, the island has a surprisingly wide array of insects. Spiders, mites, moths, centipedes, flies, beetles, isopods and earwigs, among others, are found on Gardner Pinnacles. Recently a researcher visiting the island found what he believes are two new species of spiders. He also found a third spider previously not known from Gardner Pinnacles.



About 155 miles northwest of Nihoa lies Mokumanamana, a small basalt island that is 1/6 square kilometers, or 46 acres, in size. Although the island is the second smallest of the NWHI, it has the second largest surrounding marine habitat (almost 385,000 acres). Large offshore areas include Shark Bay on the north side, West Cove and Northwest Cape as well as miles of shallow reef to the southeast.

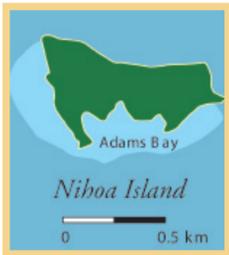
Mokumanamana is known for its numerous wahi pana (storied places) and mea makamae (cultural objects). Fifty-five cultural places are known, of which 33 are religious, 17 are shelter caves, and 2 sites are of unknown function. These cultural sites are thought to date primarily before the habitation sites on Nihoa Island were abandoned in the eighteenth century.

Because the island is small, dry, and has little soil suitable for agriculture, Hawaiians probably traveled to Mokumanamana from Nihoa and other Hawaiian Islands primarily for religious purposes. In addition to constructing religious structures, Hawaiians made ki'i pōhaku or stone human images while on Mokumanamana. More than 11 of these stone ki'i are known. Other activities that took place on the island are indicated by the production and use of stone adzes, grindstones, stone bowls, and fishing tools.

In 1786 Comte de La Pérouse visited Mokumanamana and named it "Necker Island" after Jacques Necker, the finance minister under Louis XVI. In 1857, Kamehameha IV sent Captain John Paty to claim Mokumanamana for the Kingdom of Hawai'i. His claim was contested until 1894, when the island was annexed by Hawai'i's Provisional Government. The Tanager Expedition visited Mokumanamana in 1923-24 to conduct biological and cultural research. Members of the Native Hawaiian organization Hui Malama I Na Kūpuna O Hawai'i Nei visited Mokumanamana in 1997 to rebury ancestral human bones that were removed from the island in the 1920s.

Terrestrial animal life on Mokumanamana includes the blue gray noddy, land snails, wolf spiders, bird ticks, and 15 endemic insects. Marine life includes gray reef sharks and manta rays. Hawaiian monk seals are seen on the island's rocky shores. A great abundance and diversity of sea cucumbers, sea urchins, and lobsters are found in Shark Bay. Little coral life exists in the shallow areas due to the constant wave action that scours the underwater basalt. Most reef life is found in holes and elevated areas protected from the currents. Below the shallow reef are extensive deeper "shelves" that extend many miles from the island, especially to the southeast. These broad offshore areas are used for commercial fishing.

Visiting Mokumanamana is permitted only for scientific, educational and cultural purposes in order to protect its significant natural and cultural resources. Approval must be given by the U.S. Fish and Wildlife Service and is mostly granted to those doing cultural and scientific activities.



Nihoa is unlike any of the other Northwestern Hawaiian Islands (NWHI) with its 900 foot cliffs, basalt rock surface, and tiny beach. This small island is about 1 square kilometers (171 acres) and is at the southeastern end of the NWHI chain.

Although difficult to imagine today, this remote land of rugged cliffs and steep valleys provided a home for Hawaiians between A.D. 1000 and A.D. 1700. More than 80 cultural sites are known, including habitation terraces and bluff shelters, religious places, agricultural terraces, and burial caves. Many of the mea makamae (cultural objects) and structures associated with these wahi pana (cultural places) are similar to many found throughout the Main Hawaiian Islands. It is believed that the abundance of natural resources and at least three freshwater seeps may have supported a population of 175 people.

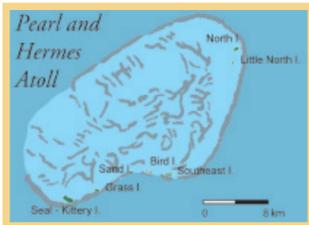
Nihoa was no longer occupied when Captain Douglas visited the island in 1789. Queen Ka'ahumanu visited Nihoa in 1822 and annexed it as part of Hawai'i. In 1857, King Kamehameha IV officially annexed the island as part of the Hawaiian Kingdom. In 1885, Queen Lili'uokalani and her 200-person entourage visited Nihoa. In 1909, Nihoa and the other islands, islets, and reefs of the NWHI (except Midway) were recognized by the United States as a valuable treasure to be protected in perpetuity as the Hawaiian Islands Bird Reservation. "The Reservation" was the forerunner of one of the earliest established National Wildlife Refuges in the country.

In 1923-24, the Tanager Expedition visited Nihoa to conduct cultural and biological research. In 1997, the Native Hawaiian group Hui Malama I Na Kūpuna O Hawai'i Nei returned ancestral bones to Nihoa that have been removed from the island decades earlier.

The island's rugged landscape may seem uninhabitable from a distance but the very essence of Nihoa is life, a treasure chest of species found nowhere else in the world. Niches in rocky outcroppings support some of the most unique and varied insect, seabird, and plant life of all the NWHI.

Seventy-two terrestrial arthropods including giant crickets and earwigs, and two endemic landbirds, the Nihoa finch and Nihoa millerbird, are found only on Nihoa. Native endangered plants include a loulu or fan palm and 'ohai shrub. Basalt underlies most shallow water habitats surrounding Nihoa. Limu (algae), wana (sea urchin), and 'ōpīhi (limpet) inhabit these shallow waters, while sharks and jacks hover in deeper waters offshore.

In order to protect the island's fragile ecosystem, few visitors are allowed on Nihoa and strict protocols are required. Approval must be given by the U.S. Fish and Wildlife Service and is mostly granted to those doing cultural and scientific research.



Pearl and Hermes Atoll is a true atoll that is primarily underwater and has numerous islets, seven of which are above sea level. While total land area is only 0.32 square kilometers (80 acres), the reef area is huge, over 770 square kilometers (194,000 acres). The atoll is ever changing, with islets emerging and subsiding.

The atoll is named after two English whaling ships, the *Pearl* and the *Hermes*, which wrecked on the reef during a storm in 1822. In 1854, King Kamehameha III claimed the atoll as part of the Hawaiian Kingdom.

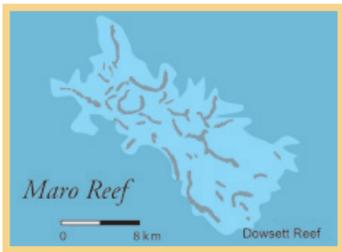
Since the atoll's land base is small, it was largely spared the ravages of guano miners and feather hunters. The atoll abounds with birds. Presently, about 160,000 birds from 22 species may be seen at Pearl and Hermes. They include black-footed albatrosses, Tristram's storm petrels, and one of two recorded Hawaiian nest sites of Little terns. The endangered Laysan Finch was introduced to the atoll in 1967 in an attempt to establish a "back-up" population.

The sandbar islets support coastal dry grasses, vines, and herbal plants, including 13 native species and 7 introduced species. The plants survive because they are salt-tolerant and able to recover from frequent flooding events.

Hawaiian monk seals and green sea turtles breed and feed at Pearl and Hermes, which is also a mating area for spinner dolphins. The atoll has the highest standing stock of fish and the highest number of fish species in the NWHI. These include saber squirrelfish, eels, Galapagos sharks, sandbar sharks, ulua (big jacks), angelfish, 'awoewo (bigeye), uhu (parrotfish), and numerous lobsters. Hiding between the unique reef and lagoons are very unusual invertebrate habitats. Several sponges collected recently may be new to science.

Black-lipped pearl oysters, at one time very common, were harvested in the late 1920s to make buttons from their shells. Over-harvested, the oysters were nearly eliminated. Few oysters remain today, long after oyster harvesting was declared illegal in 1929.

While there has been less negative human impact on this atoll than others in the NWHI, problems with marine debris and the occasional shipwreck still occur. Continuing to minimize human contact may preserve the wildlife and marine life in this extensive reef ecosystem.



Maro Reef is the largest coral reef in the Northwestern Hawaiian Islands (NWHI), with over 1,934 square kilometers (approximately 746 square miles or 478,000 acres) of reef area. Unlike classic ring-shaped atolls, Maro is a complex maze of linear reefs that radiate out from the center like the spokes of a wheel. It is named after the whaling ship *Maro*, which traveled these waters in 1820.

Marine habitats of Maro Reef range from sandy lagoons to steep reef slopes, large coral heads, ocean pinnacles, and patch reefs. Gaps in the reef cause waves to sweep into the lagoon clouding some areas with silt and sand.

Maro Reef is very large and hard to navigate, making it difficult for scientists to study. It has a greater abundance and diversity of coral than any other reef system in the NWHI chain. Many areas of the reef, particularly on the west side, have a large number of coral species, including *Montipora capitata* and *Porites compressa*. Maro Reef has a large amount of the hard, pink crusty algae that grows on coral called "coralline algae" that acts like cement and holds the coral together in high surf. The reefs support numerous butterflyfish and surgeonfish species. Large ulua (jack) and 'ōmilu (bluefin trevally) have been seen in the reef's open waters, along with white-tip sharks and gray reef sharks.

Some researchers believe that, while Maro Reef has very healthy reefs, it may be "on the verge of drowning" because the reefs are narrow, unconnected, and unprotected from storm waves. Others feel that the health of the corals suggest that Maro Reef is a complicated reef system on a large seamount, living in balance with the elements.



Navigating Change
Northwestern Hawaiian Islands



For more information, please visit www.navigatingchange.org