

Do not print this page.

## Kure Atoll

Kure Atoll lies about 100 km WNW of Midway at longitude 178 degrees 20 minutes W and latitude 28 degrees 25 minutes N. As with all the Northwestern Hawaiian Islands, Kure Atoll is all that remains of a 28 million-year-old shield volcano. The atoll is about 10 km across. Kure Atoll lies at about 28 degrees 25 minutes north latitude. This position puts Kure Atoll farther from the equator than any other shallow-water coral reef ecosystem on the earth.

Its geographic position also puts Kure Atoll at the so-called “Darwin Point,” where erosion and coral growth are essentially the same. Over thousands of years, Kure has been slowly disappearing as it subsides, sea levels rise and erosion occurs. At the same time, the shallow-water coral reef ecosystems have been slowing growing. The average growth rate of coral on Kure is approximately 0.3 mm/year. The average subsidence of the Kure volcano is approximately 0.04 mm/year. As a result, Kure Atoll is growing at a meager 0.2 mm/year (Rauzon, 2001).

Further west, the Emperor Seamounts foretell the future of Kure Atoll and all the other islands in the Hawaiian Archipelago. These seamounts lie in water too cool for coral growth. As Kure Atoll continues its slow migration WNW atop the Pacific Plate, it too will eventually slip below the Pacific Ocean. However, because the Pacific Plate is moving at a leisurely 9 cm/year, Kure Atoll—and all the other Hawaiian Islands—will not disappear for sometime.

Kure Atoll currently is managed by the Hawai‘i Department of Land and Natural Resources as a state wildlife refuge. Kure Atoll also is considered part of the city of Honolulu and O‘ahu County, both of which are over 2,200 kilometers away. It is believed that Kure Atoll was discovered in 1825 by B. Morrell, Jr., the captain of the schooner Tartar. Numerous ships have crashed into Kure Atoll’s fringing reefs. Luckily, most of the survivors of these shipwrecks were rescued.

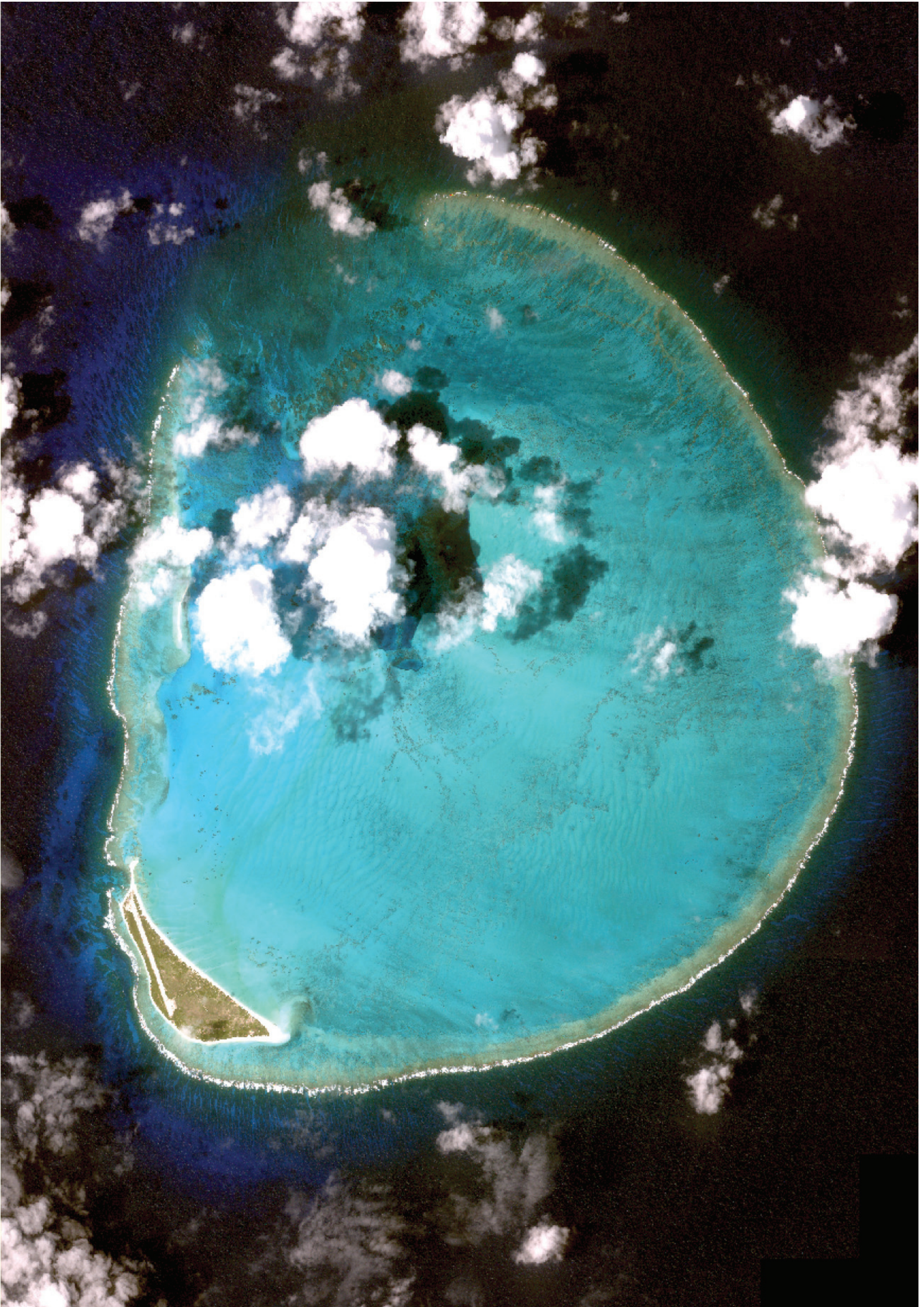
A true color IKONOS satellite image is provided for Kure Atoll. Due to its size, all additional maps of Kure Atoll fit on single map tile pages. Maps of 1:40,000 scale aggregated benthic habitats, 1:40,000 scale estimated bathymetry, and 1:40,000 scale detailed benthic habitats are provided for Kure Atoll. There is no map depicting any additional banks for Kure Atoll. A one-square-kilometer grid is included with all maps of Kure Atoll.

The area in square kilometers of aggregated benthic habitat cover types found at Kure Atoll, Northwestern Hawaiian Islands.

Hardbottom with >10% live coral	1.8
Hardbottom with >10% crustose coralline algae	0.7
Hardbottom (uncolonized)	11.6
Hardbottom with >10% macroalgae	5.8
Hardbottom with indeterminate cover	8.4
Unconsolidated with 10% or less macroalgae or seagrass	38.8
Unconsolidated with >10% macroalgae or seagrass	2.7
Total Habitat Area Classified	69.8

The area in square kilometers of benthic habitats found at Kure Atoll, Northwestern Hawaiian Islands.

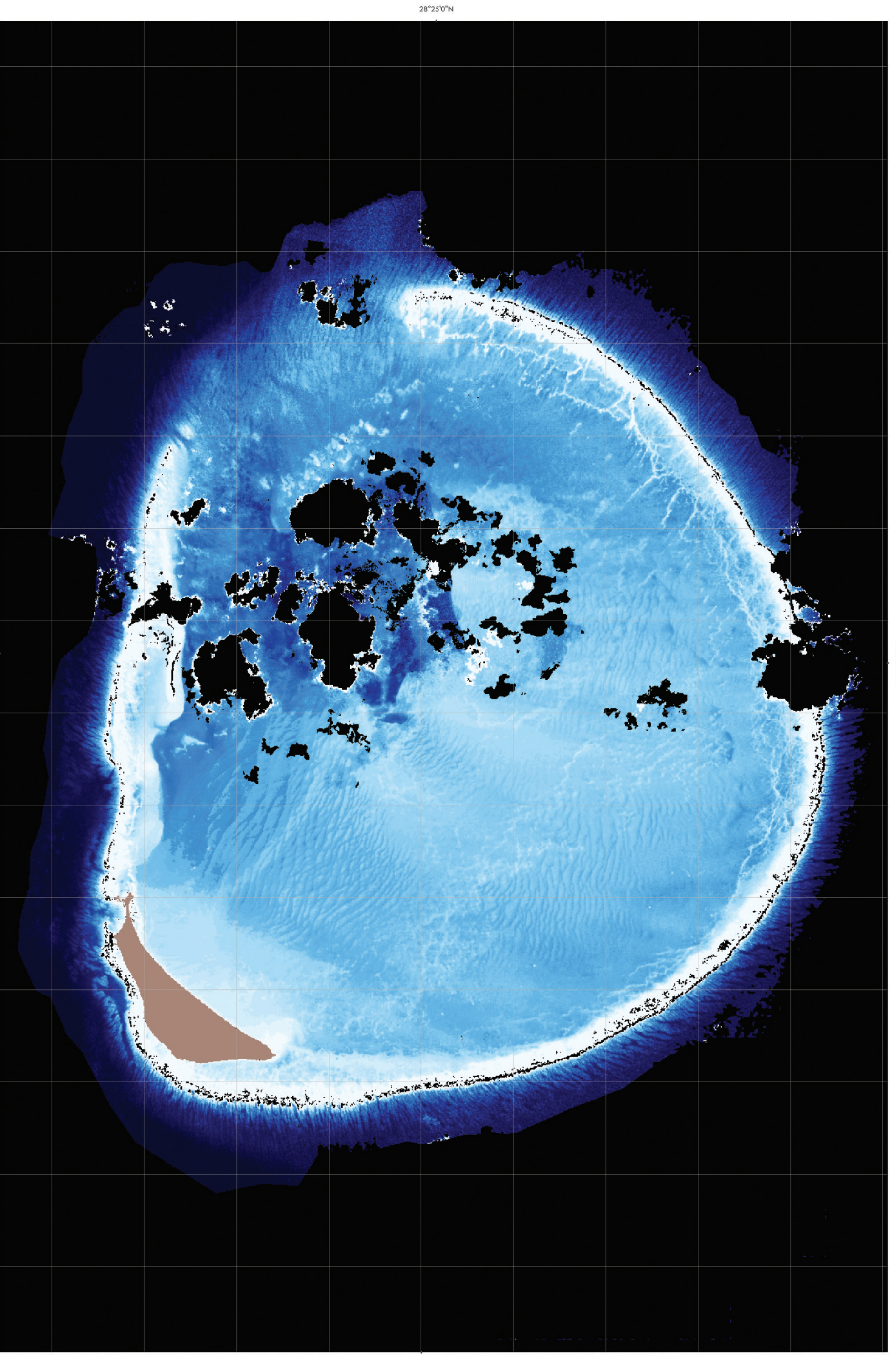
Unconsolidated (1000, refer to classification scheme for habitat description)	-
Sand (1100)	25.5
Sand with macroalgae (1120)	-
Sand with patchy (10–50% cover) macroalgae (1121)	-
Dense (>50%) macroalgae on sand (1122)	-
Unconsolidated Rubble (1300)	12.6
Unconsolidated Rubble with sparse (10–50% cover) algae (1301)	-
Unconsolidated Rubble with dense (>50% cover) algae (1302)	2.7
Sand and Rubble (1400)	-
Groove (1500)	0.7
Hardbottom (2000)	-
Hardbottom with sparse (10–50% cover) algae (2001)	-
Hardbottom with live coral (>10% cover) (2010)	1.0
Hardbottom, uncolonized (2020)	9.5
Hardbottom with crustose coralline algae (<10% cover) (2030)	-
Linear Reef (2100)	0.3
Linear Reef with live coral (<10% cover) (2110)	0.2
Linear Reef, uncolonized (2120)	-
Linear Reef, uncolonized with sparse (10–50% cover) algae (2121)	-
Linear Reef with crustose coralline algae (<10% cover) (2130)	-
Aggregated Coral Heads with live coral (>10% cover) (2210)	0.5
Spur and Groove (2300)	5.1
Patch Reef (2400)	3.0
Patch Reef with live coral (>10% cover) (2410)	-
Patch Reef, uncolonized (2420)	-
Patch Reef, uncolonized with sparse (10–50% cover) algae (2421)	-
Patch Reef with crustose coralline algae (<10% cover) (2430)	-
Aggregated Patch Reef (2500)	-
Aggregated Patch Reef with live coral (>10% cover) (2510)	-
Scattered Coral/Rock in Sand with live coral (>10% cover) (2610)	-
Pavement (2700)	0.1
Pavement with sparse (10–50% cover) algae (2701)	2.9
Pavement with dense (>50% cover) algae (2702)	2.9
Pavement with live coral (>10% cover) (2710)	<0.1
Pavement with live coral (<10% cover) and dense (>50% cover) algae (2712)	-
Pavement, uncolonized (2720)	2.1
Pavement, uncolonized with dense (>50% cover) algae (2722)	-
Pavement with crustose coralline algae (<10% cover) (2730)	0.7
Pavement with sand channels (2800)	-
Pavement with sand channels and live coral (>10% cover) (2810)	-
Pavement with sand channels, uncolonized (2820)	-
Volcanic Rock (2900)	-
Volcanic Rock with dense (>50% cover) algae (2902)	-
Volcanic Rock with live coral (>10% cover) (2910)	-
Volcanic Rock, uncolonized (2920)	-
Deep water (3010)	131.5
Reef crest (3020)	-
Dredged channel (3030)	-
Land (3100)	0.9
Cloud, Shadow, Surf, and No image data (3210, 3220, 3230, and 4000)	2.7
Unclassified (3300)	-
Total Habitat Area Classified	69.8
TOTAL Area in IKONOS image	205.0



*A true color IKONOS image of Kure Atoll, Northwestern Hawaiian Islands. No map tiles are needed to depict Kure Atoll.*

*A 1:40,000 scale estimated bathymetry map of Kure Atoll, Northwestern Hawaiian Islands.*

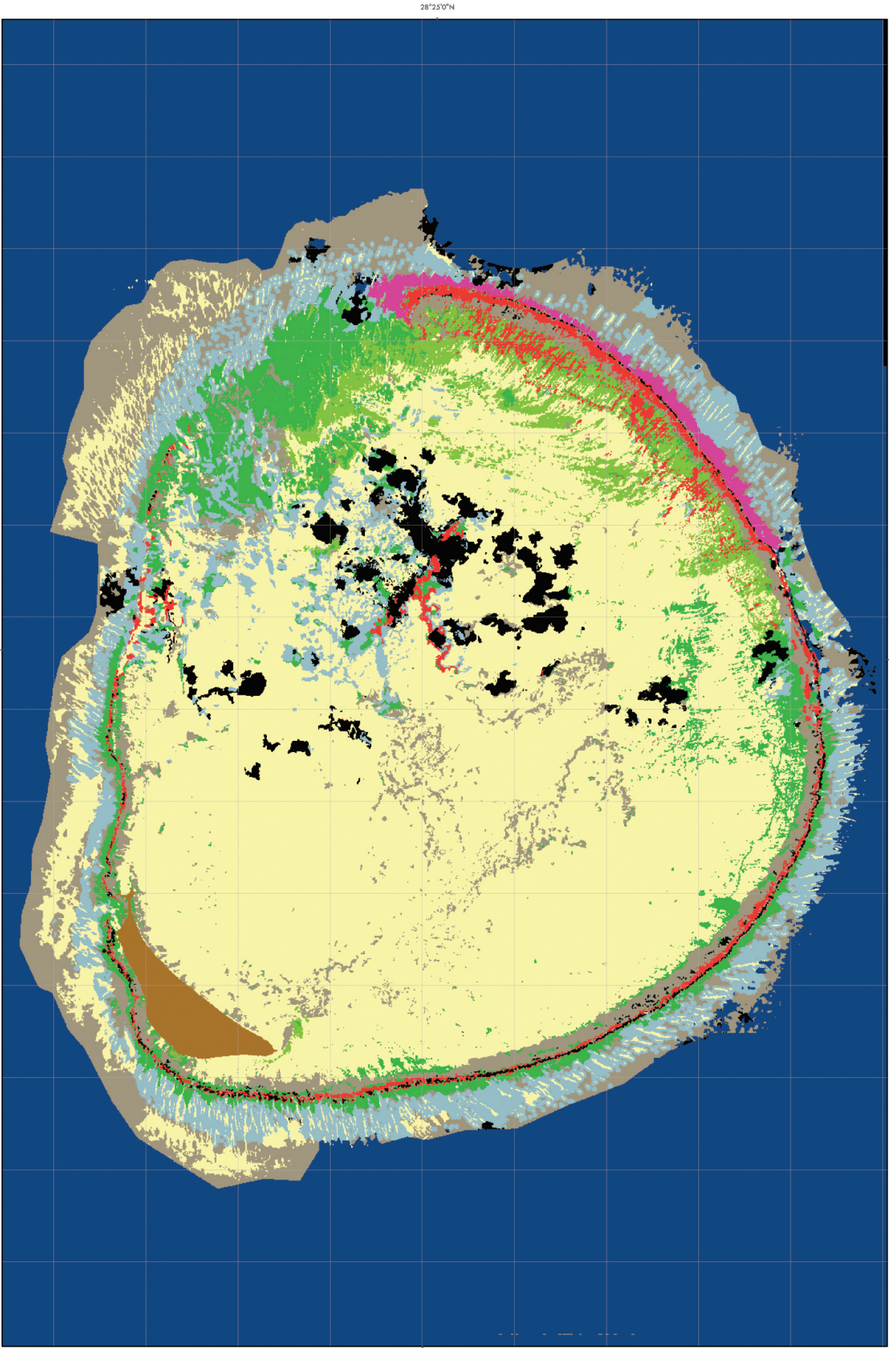
178°20'0"W



28°25'0"N

28°25'0"N

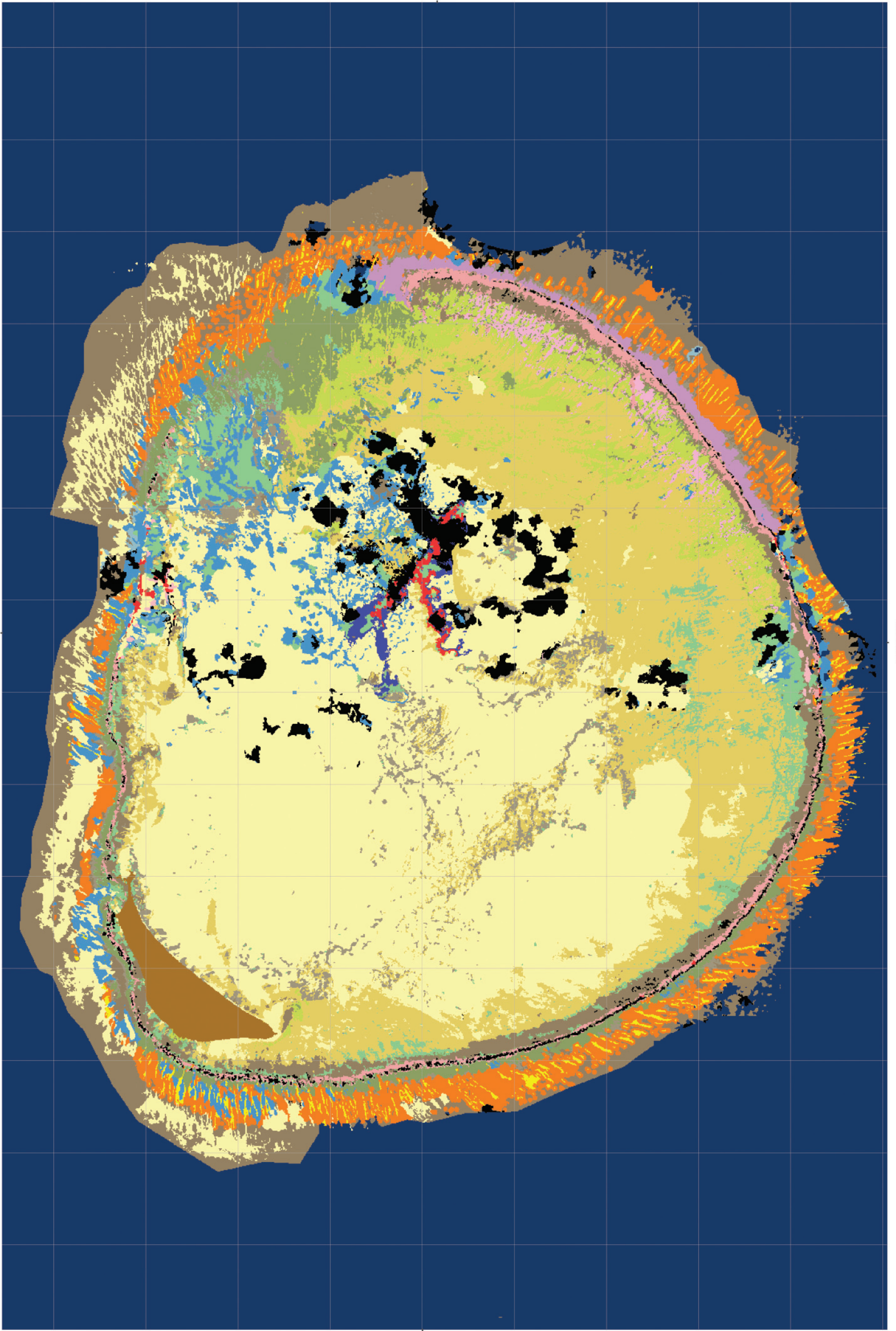
178°20'0"W



A 1:40,000 scale aggregated habitat cover map of Kure Atoll, Northwestern Hawaiian Islands.

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28°25'0"N



178°20'0"W

28°25'0"N

A 1:40,000 scale detailed habitat map of Kure Atoll, Northwestern Hawaiian Islands.

## Midway Atoll

Lying at longitude 177 degrees 20 minutes W and latitude 28 degrees 15 minutes N, Midway Atoll is what remains of a large shield volcano that, 28 million years ago, may have been as large as Lana'i. What remains now is a shallow water atoll about 10 kilometers across. As the Pacific Ocean washed away the top of the volcano, coral reefs grew. These coral reefs are now over 400 m thick. Two islands—Sand Island and East Island—and several migrating sandbars rise above the ocean surface. They provide habitat for hundreds of thousands of birds.

Midway was discovered in 1859 by N.C. Brooks, captain of the sealing ship *Gambia*. By claiming Midway for the United States under the Guano Act of 1856, Midway became the only island in the entire Hawaiian archipelago that was not part of the State of Hawai'i.

Midway is the most frequently visited locale in the Northwestern Hawaiian Islands. It lies nearly halfway between North America and Asia. It also lies almost halfway around the earth from Greenwich, England.

The islands of Midway Atoll have been extensively altered as a result of human habitation. Starting in 1869 with a project to blast the reefs and create a port on Sand Island, the ecology of Midway has been changing. Birds native to other NWHI islands, such as the Laysan Rail and Laysan Finch, were released at Midway. Ironwood trees from Australia were planted to act as windbreaks. Seventy-five percent of the 200 species of plants on Midway are introduced.

The location of Midway in the Pacific became important first to commercial airlines and, later, to the military. Midway was a convenient refueling stop on transpacific flights. It also became an important stop for Navy ships. Around 1940, the channel was widened, and construction of a Naval Air Station was completed. Midway's importance to the U.S. was brought into focus on December 7, 1941. Six months later, on June 3, 1942, a naval battle near Midway resulted in the U.S. Navy exacting a devastating defeat of the Japanese Navy. This battle was, by some accounts, the beginning of the end of the Japanese Navy's control of the Pacific Ocean.

After many years of occupation, the Navy officially turned the island over to the Fish and Wildlife Service on May 20, 1996. Now, the island is home to hundreds of thousands of birds and other animals. The Fish and Wildlife Service now manages the atoll as Midway Atoll National Wildlife Refuge.

Due to its size, two tiles are required to depict the 1:40,000 scale

detailed benthic habitats of Midway Atoll. Maps of 1:80,000 scale aggregated benthic habitats and 1:80,000 scale estimated bathymetry provided for Midway Atoll fit on single map tile pages. There is no map depicting any additional banks for Midway Atoll. A one-square-kilometer grid is included with all maps of Midway Atoll.

The area in square kilometers of aggregated benthic habitat cover types found at Midway Atoll, Northwestern Hawaiian Islands.

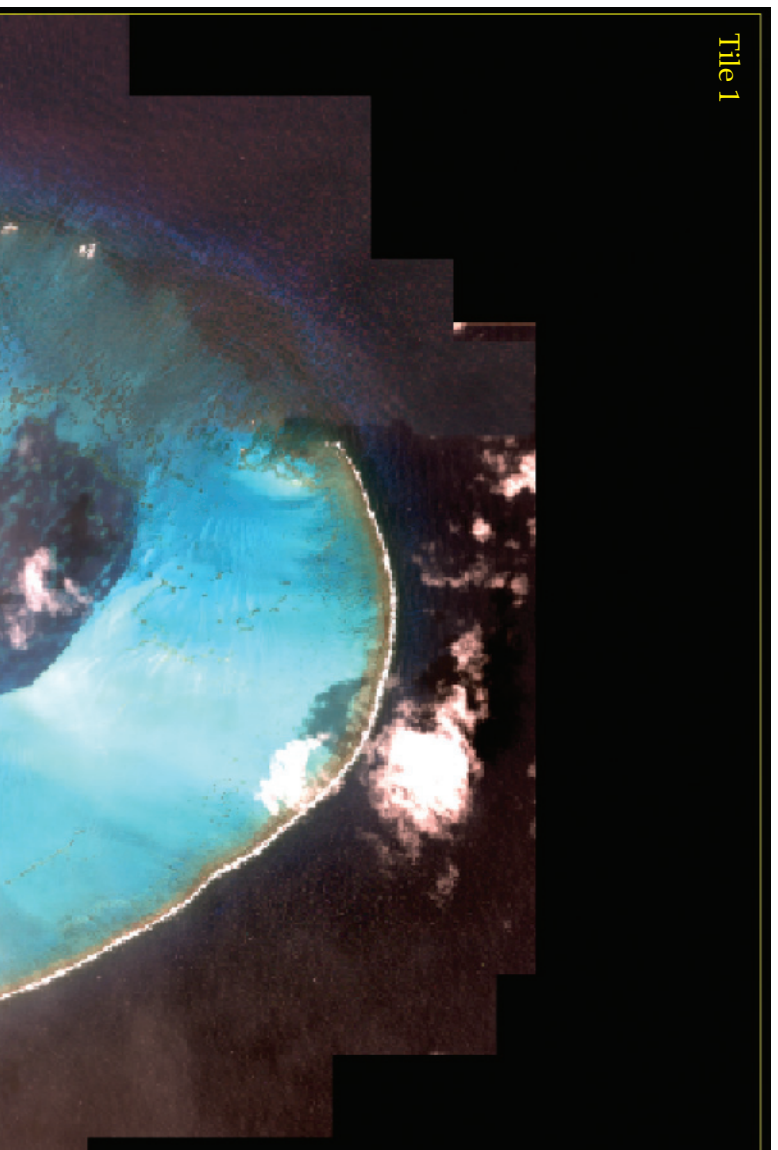
Hardbottom with >10% live coral	1.4
Hardbottom with >10% crustose coralline algae	0.1
Hardbottom (uncolonized)	14.9
Hardbottom with >10% macroalgae	22.4
Hardbottom with indeterminate cover	6.7
Unconsolidated with 10% or less macroalgae or seagrass	49.9
Unconsolidated with >10% macroalgae or seagrass	0.2
Total Habitat Area Classified	95.5

The area in square kilometers of benthic habitats found at Midway Atoll, Northwestern Hawaiian Islands.

Unconsolidated (1000, refer to classification scheme for habitat description)	-
Sand (1100)	49.2
Sand with macroalgae (1120)	0.2
Sand with patchy (10–50% cover) macroalgae (1121)	-
Dense (>50% macroalgae on sand (1122)	-
Unconsolidated Rubble (1300)	-
Unconsolidated Rubble with sparse (10–50% cover) algae (1301)	-
Unconsolidated Rubble with dense (>50% cover) algae (1302)	-
Sand and Rubble (1400)	-
Groove (1500)	0.7
Hardbottom (2000)	-
Hardbottom with sparse (10–50% cover) algae (2001)	-
Hardbottom with live coral (>10% cover) (2010)	0.6
Hardbottom, uncolonized (2020)	6.5
Hardbottom with crustose coralline algae (>10% cover) (2030)	<0.1
Linear Reef (2100)	0.2
Linear Reef with live coral (>10% cover) (2110)	-
Linear Reef, uncolonized (2120)	-
Linear Reef, uncolonized with sparse (10–50% cover) algae (2121)	-
Linear Reef with crustose coralline algae (>10% cover) (2130)	-
Aggregated Coral Heads with live coral (>10% cover) (2210)	-
Spur and Groove (2300)	2.9
Patch Reef (2400)	2.4
Patch Reef with live coral (>10% cover) (2410)	0.1
Patch Reef, uncolonized (2420)	-
Patch Reef, uncolonized with sparse (10–50% cover) algae (2421)	-
Patch Reef with crustose coralline algae (>10% cover) (2430)	-
Aggregated Patch Reef (2500)	-
Aggregated Patch Reef with live coral (>10% cover) (2510)	-
Scattered Coral/Rock in Sand with live coral (>10% cover) (2610)	-
Pavement (2700)	0.9
Pavement with sparse (10–50% cover) algae (2701)	3.4
Pavement with dense (>50% cover) algae (2702)	19.0
Pavement with live coral (>10% cover) (2710)	0.6
Pavement with live coral (>10% cover) and dense (>50% cover) algae (2712)	-
Pavement, uncolonized (2720)	7.5
Pavement, uncolonized with dense (>50% cover) algae (2722)	-
Pavement with crustose coralline algae (>10% cover) (2730)	-
Pavement with sand channels (2800)	0.2
Pavement with sand channels and live coral (>10% cover) (2810)	0.1
Pavement with sand channels, uncolonized (2820)	0.8
Volcanic Rock (2900)	-
Volcanic Rock with dense (>50% cover) algae (2902)	-
Volcanic Rock with live coral (>10% cover) (2910)	-
Volcanic Rock, uncolonized (2920)	-
Deep water (3010)	57.8
Reef crest (3020)	<0.1
Dredged channel (3030)	0.4
Land (3100)	6.0
Cloud, Shadow, Surf, and No image data (3210, 3220, 3230, and 4000)	12.4
Unclassified (3300)	-
Total Habitat Area Classified	95.5
TOTAL Area in IKONOS image	172.2



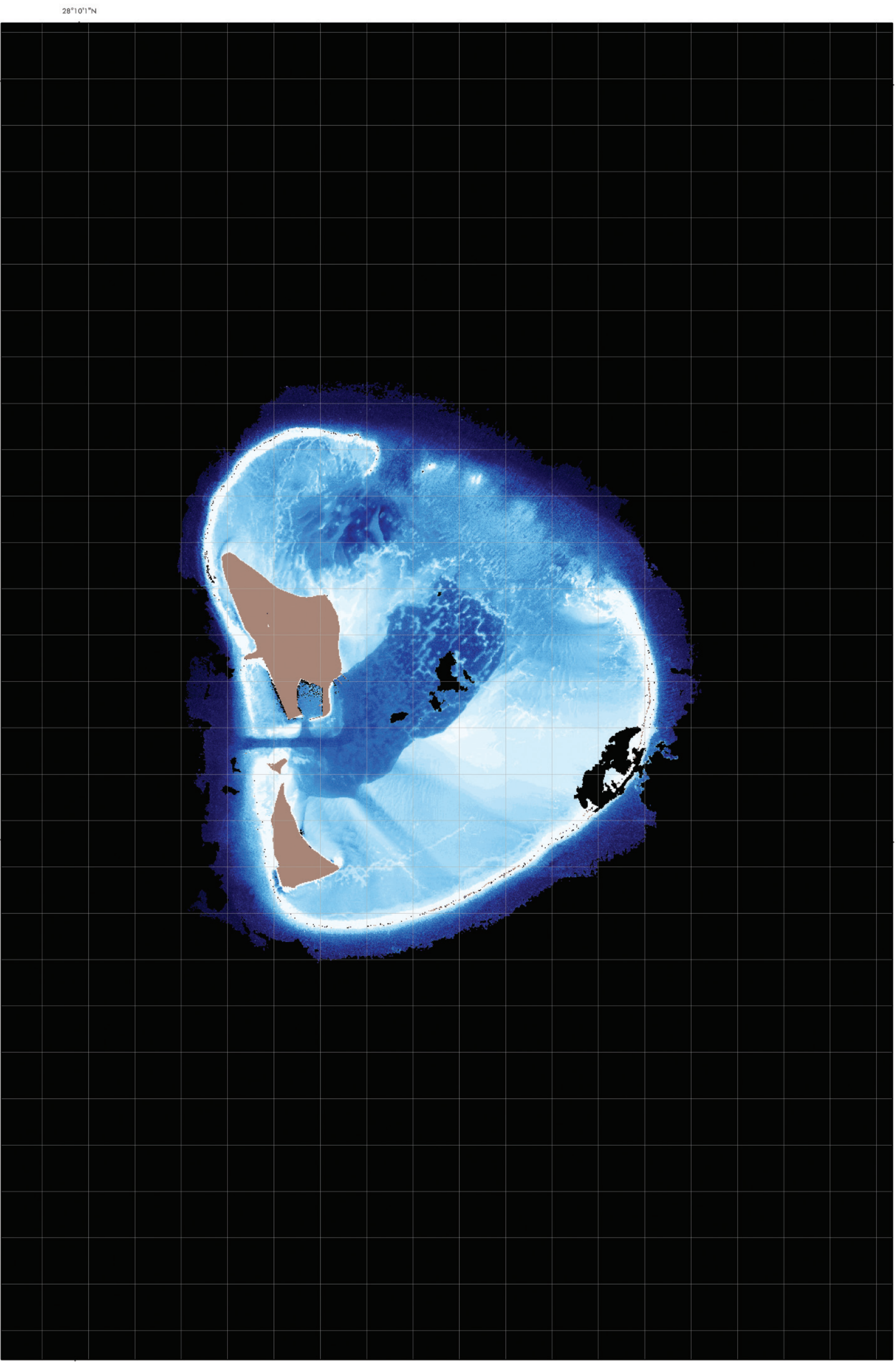
Tile 1



Tile 2



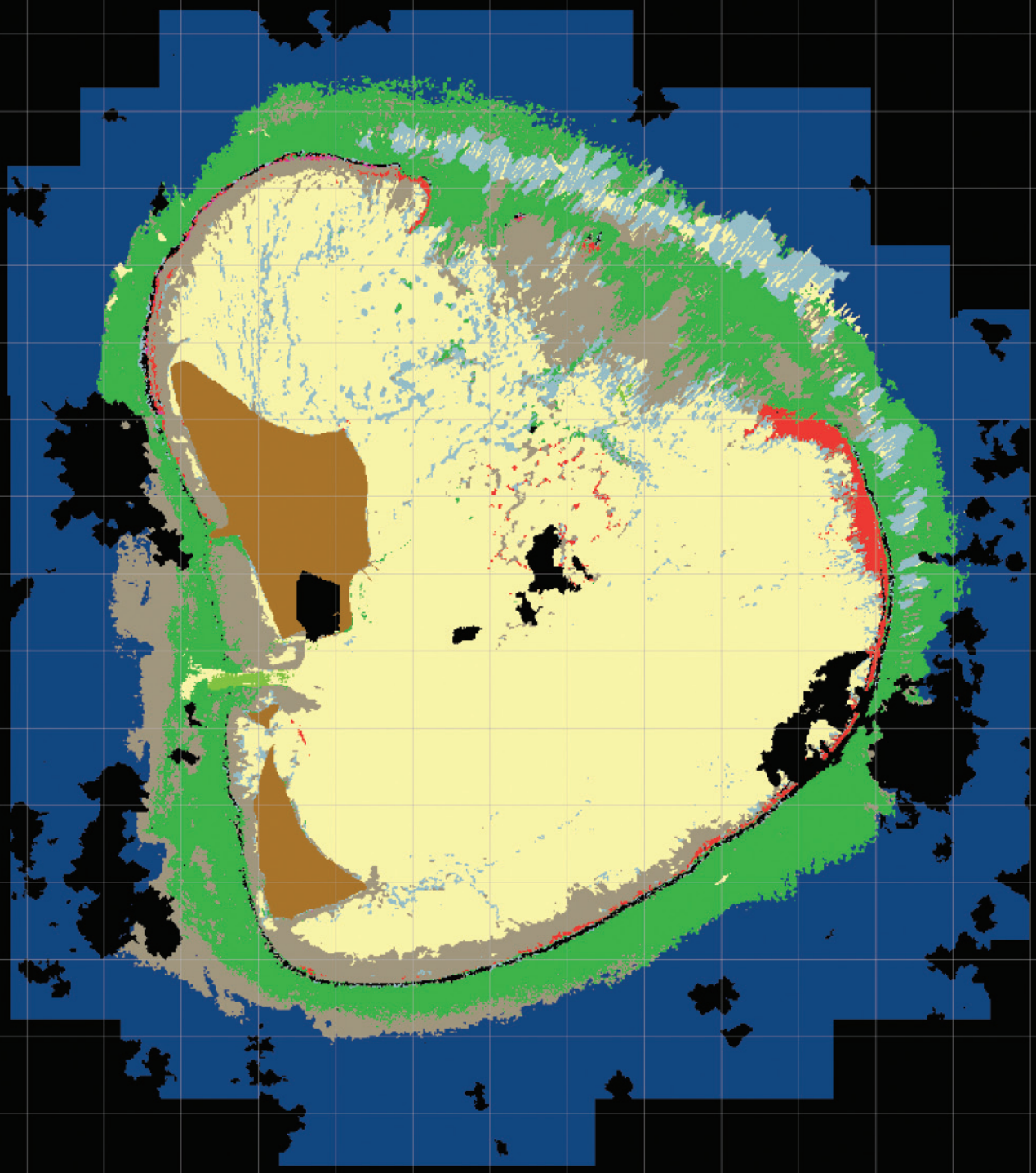
*A 1:80,000 scale estimated bathymetry map of Midway Atoll, Northwestern Hawaiian Islands.*



28°10'1"N

177°30'0"W

177°30'0"W



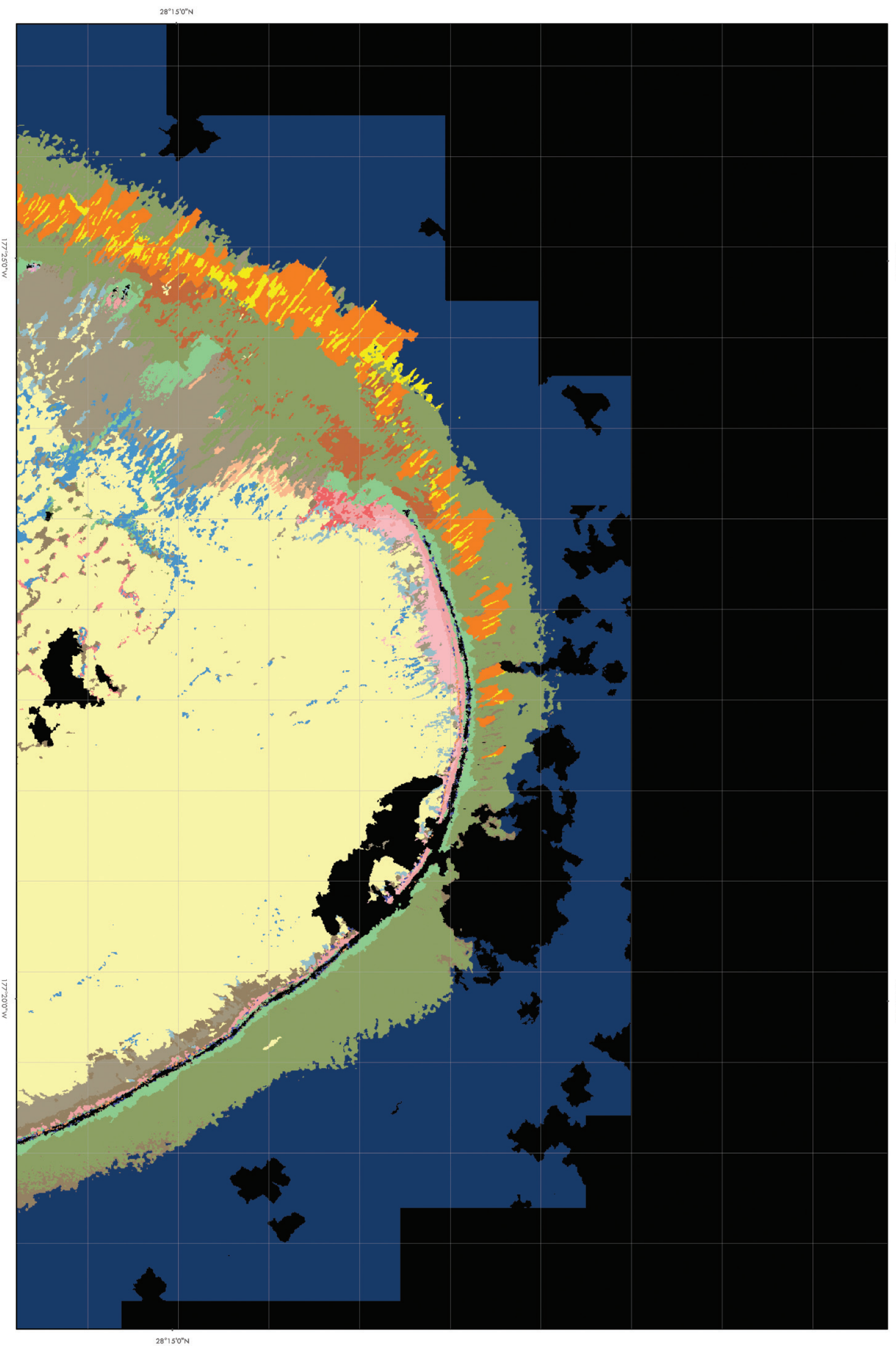
177°20'0"W

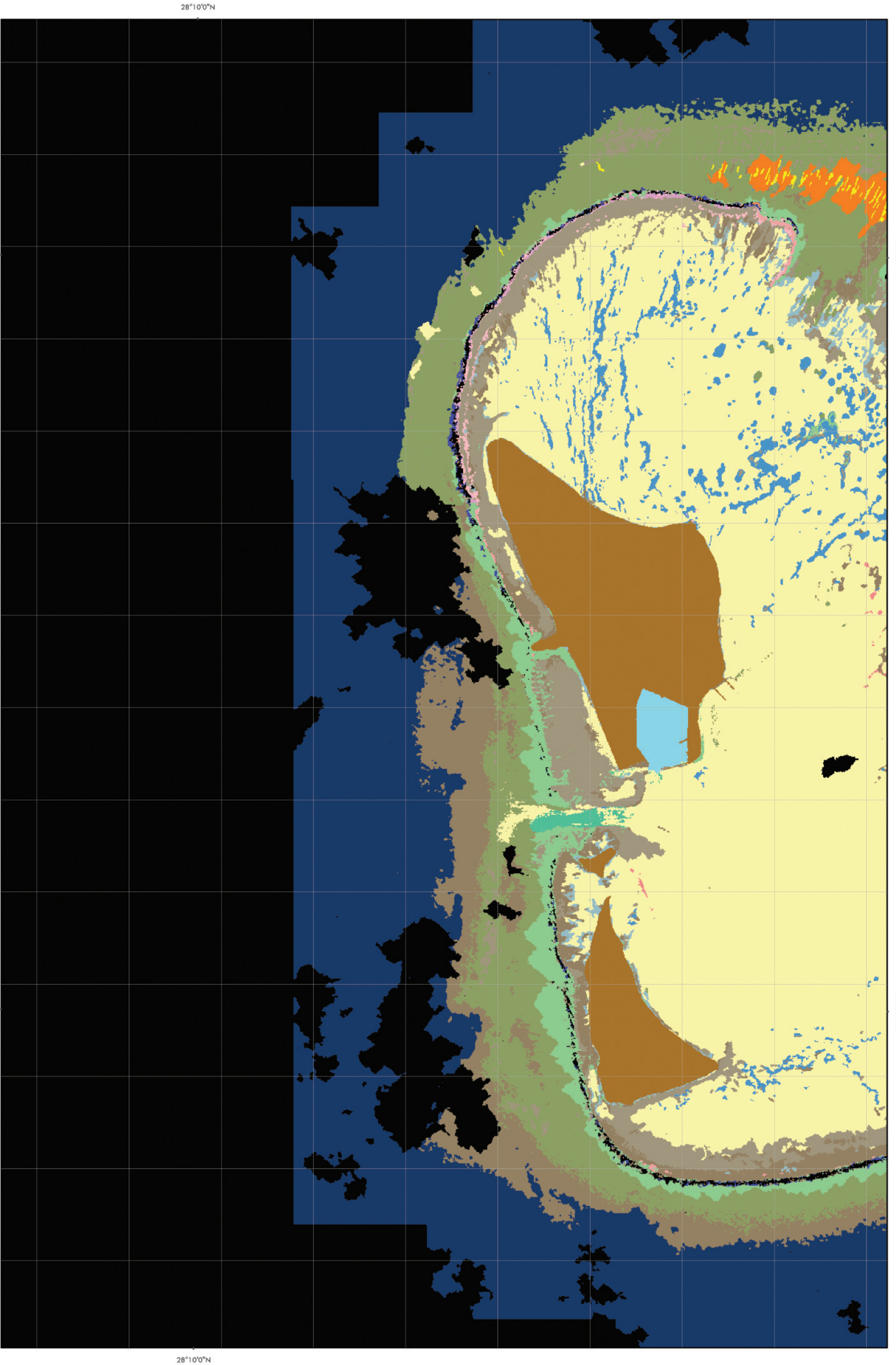
177°20'0"W

28°10'1"N

*A 1:80,000 scale aggregated habitat cover map of Midway Atoll, Northwestern Hawaiian Islands.*

*Title 1. A 1:40,000 scale detailed habitat map of Midway Atoll, Northwestern Hawaiian Islands.*





*Title 2. A 1:40,000 scale detailed habitat map of Midway Atoll, Northwestern Hawaiian Islands.*

## Pearl and Hermes Atoll

Lying at longitude 175 degrees 50 minutes W and latitude 27 degrees 50 minutes N, Pearl and Hermes Atoll is found approximately 400 km SE of Midway. Pearl and Hermes Atoll is what remains of a large shield volcano that, approximately 22 million years ago, may have been nearly as large as Lana'i. What remains now is a shallow water atoll about 32 km long and 20 kilometers wide covering an estimated 447 sq. km. There are several permanent and numerous ephemeral islets around the periphery and inside the atoll. The largest island is Southeast Island, which is 0.1 sq. km.

Pearl and Hermes Atoll was discovered when the whaling ship Pearl ran aground in 1822. Its sister ship, the Hermes, also ran aground while trying to help the Pearl. The crews of both ships were able to leave the atoll and return to Honolulu. Originally claimed by King Kamehameha III in 1854, Pearl and Hermes Atoll was later claimed for the U.S. by Captain N. C. Brooks of the Gambia in 1859.

The islands of Pearl and Hermes Atoll provide resting and nesting areas for an estimated 160,000 birds of 17 species. The Fish and Wildlife Service surveys indicate that up to 20 percent of the world's Black-footed Albatrosses nest at Pearl and Hermes. It also is an important nesting site for the Tristram's Storm-Petrels and has the only recorded nesting site of the Little Tern. Over the years, several of the NWHI's rare endemic birds have been introduced to Pearl and Hermes. The Laysan Finches brought to the Atoll appear to have survived; the same cannot be said for the Laysan Ducks and Laysan Rails.

Pearl and Hermes Atoll has been extensively impacted by marine debris washing ashore and fouling the Atoll's reefs. The debris appears to be coming from the North Pacific Gyre, a slow-moving current that traps discarded nets and other waste. As it moves around the northern Pacific, the gyre interacts with the islands and atolls of the NWHI. Marine debris carried by the gyre are captured by the NWHI atolls; Pearl and Hermes is the most affected. The debris damages reefs, entangles fish and marine mammals, and may be introducing alien marine organisms to the NWHI. In the last few years, thousands of kilograms of debris have been removed from Pearl and Hermes and other NWHI atolls.

Due to its size, two map tiles are required to depict the 1:80,000 scale estimated bathymetry. Two map tiles are required to depict the 1:80,000 scale aggregated habitat cover maps. Six map tiles are required to depict the 1:40,000 scale detailed benthic habitats of Pearl and Hermes Atoll. No map exists depicting any

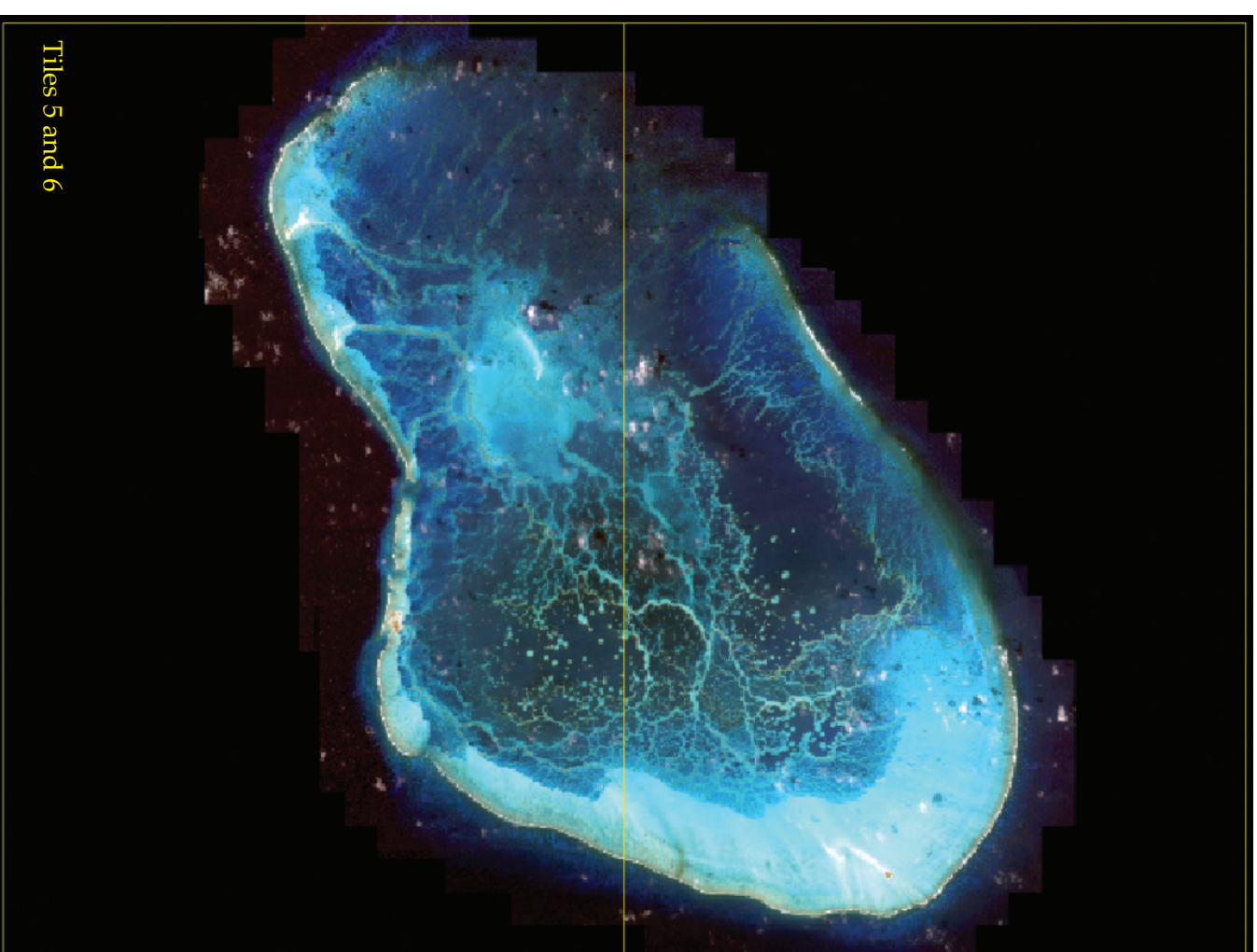
additional banks for Pearl and Hermes Atoll. A one-square-kilometer grid is included with all maps of Pearl and Hermes Atoll.

The area in square kilometers of aggregated benthic habitat cover types found at Pearl and Hermes Atoll, Northwestern Hawaiian Islands.

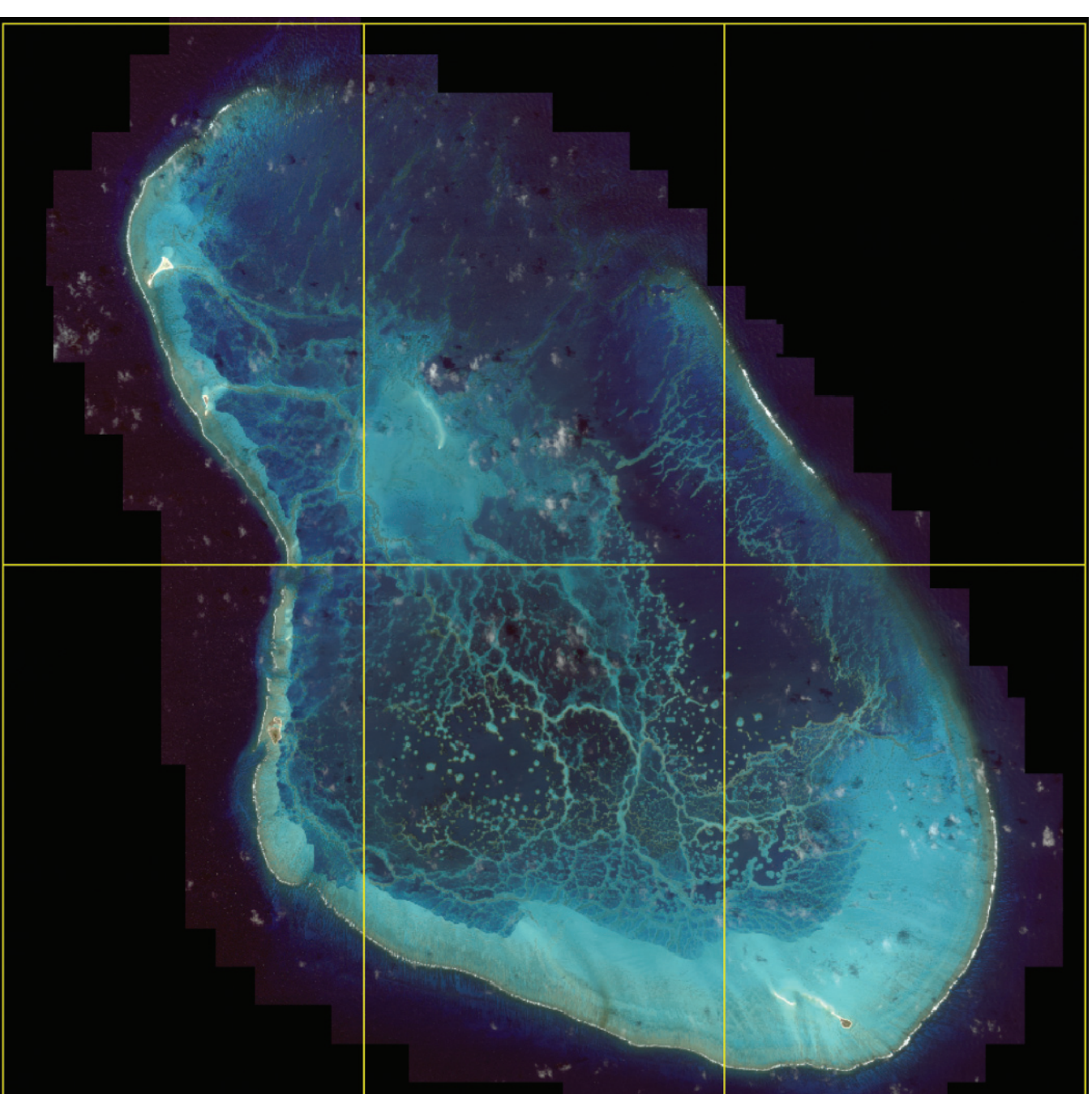
Hardbottom with >10% live coral	20.3
Hardbottom with >10% crustose coralline algae	-
Hardbottom (uncolonized)	13.7
Hardbottom with >10% macroalgae	62.2
Hardbottom with indeterminate cover	49.3
Unconsolidated with 10% or less macroalgae or seagrass	226.2
Unconsolidated with >10% macroalgae or seagrass	19.9
Total Habitat Area Classified	391.6

The area in square kilometers of benthic habitats found at Pearl and Hermes Atoll, Northwestern Hawaiian Islands.

Unconsolidated (1000, refer to classification scheme for habitat description)	141.9
Sand (1100)	60.4
Sand with macroalgae (1120)	-
Sand with patchy (10-50% cover) macroalgae (1121)	-
Dense (>50%) macroalgae on sand (1122)	-
Unconsolidated Rubble (1300)	14.5
Unconsolidated Rubble with sparse (10-50% cover) algae (1301)	14.2
Unconsolidated Rubble with dense (>50% cover) algae (1302)	5.6
Sand and Rubble (1400)	7.0
Groove (1500)	2.5
Hardbottom (2000)	8.3
Hardbottom with sparse (10-50% cover) algae (2001)	52.3
Hardbottom with live coral (<10% cover) (2010)	-
Hardbottom, uncolonized (2020)	-
Hardbottom with crustose coralline algae (>10% cover) (2030)	-
Linear Reef (2100)	2.9
Linear Reef with live coral (<10% cover) (2110)	6.7
Linear Reef, uncolonized (2120)	-
Linear Reef, uncolonized with sparse (10-50% cover) algae (2121)	-
Linear Reef with crustose coralline algae (<10% cover) (2130)	-
Aggregated Coral Heads with live coral (<10% cover) (2210)	-
Spur and Groove (2300)	6.8
Patch Reef (2400)	11.0
Patch Reef with live coral (>10% cover) (2410)	0.5
Patch Reef, uncolonized (2420)	-
Patch Reef, uncolonized with sparse (10-50% cover) algae (2421)	-
Patch Reef with crustose coralline algae (>10% cover) (2430)	-
Aggregated Patch Reef (2500)	6.2
Aggregated Patch Reef with live coral (<10% cover) (2510)	-
Scattered Coral/Rock in Sand with live coral (>10% cover) (2610)	-
Pavement (2700)	13.8
Pavement with sparse (10-50% cover) algae (2701)	3.5
Pavement with dense (>50% cover) algae (2702)	1.3
Pavement with live coral (<10% cover) (2710)	7.9
Pavement with live coral (<10% cover) and dense (>50% cover) algae (2712)	5.1
Pavement, uncolonized (2720)	13.7
Pavement, uncolonized with dense (>50% cover) algae (2722)	-
Pavement with crustose coralline algae (<10% cover) (2730)	-
Pavement with sand channels (2800)	0.4
Pavement with sand channels and live coral (>10% cover) (2810)	-
Pavement with sand channels, uncolonized (2820)	-
Volcanic Rock (2900)	-
Volcanic Rock with dense (>50% cover) algae (2902)	-
Volcanic Rock with live coral (<10% cover) (2910)	-
Volcanic Rock, uncolonized (2920)	-
Deep water (3010)	156.7
Reef crest (3020)	-
Dredged channel (3030)	-
Land (3100)	0.5
Cloud, Shadow, Surf, and No image data (3210, 3220, 3230, and 4000)	19.2
Unclassified (3300)	-
Total Habitat Area Classified	391.6
TOTAL Area in IKONOS image	562.9



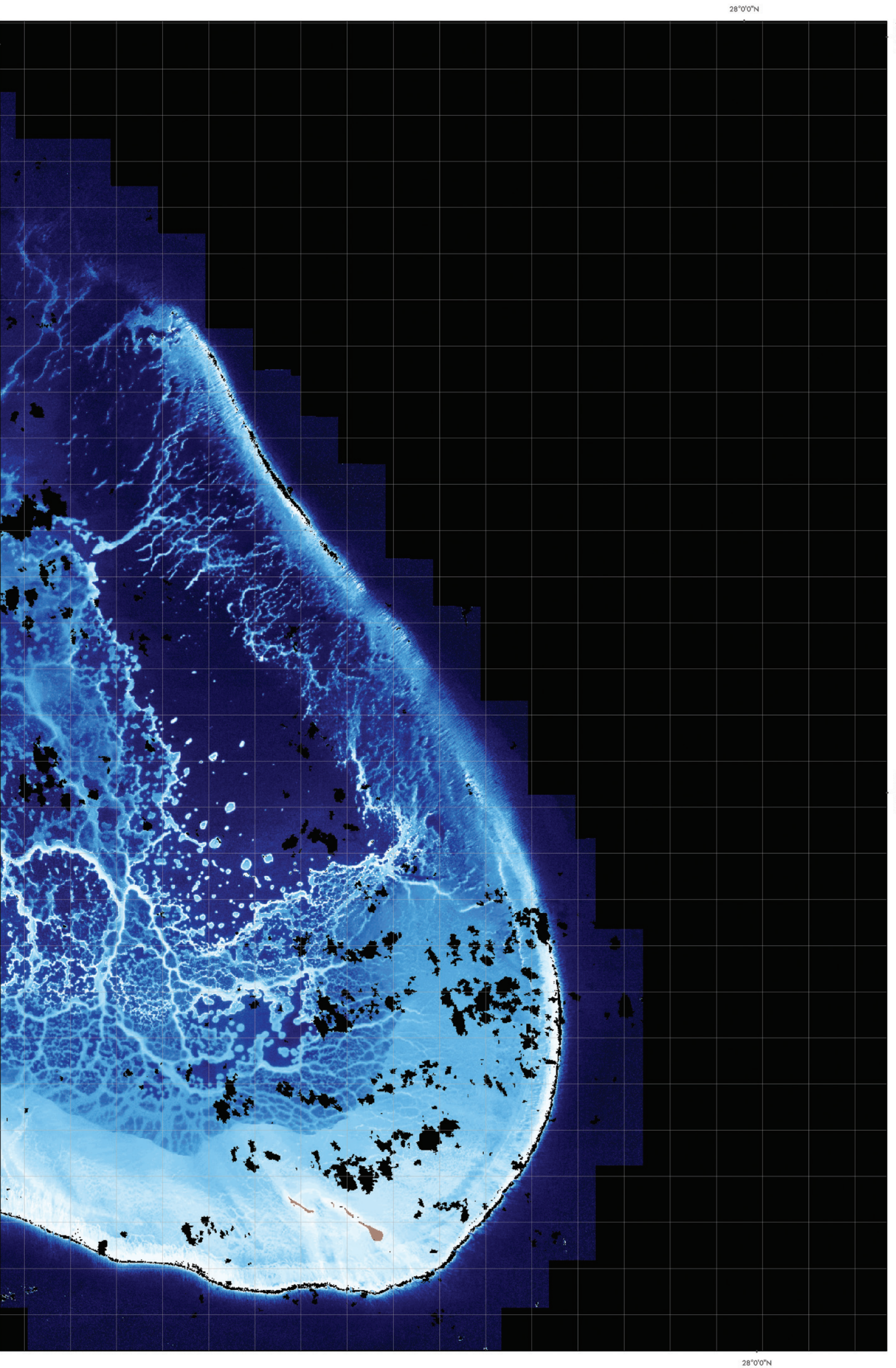
*Index of 1:80,000 tiles*



*Index of 1:40,000 tiles*

*Index maps indicating the locations of map tiles for the 1:40,000 scale detailed habitat maps and the 1:80,000 scale aggregated cover, estimated bathymetry, and bank of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*

*Title 3. A 1:80,000 scale estimated bathymetry map of the northern portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*



28°0'0"N

175°0'0"W

175°50'0"W

28°0'0"N

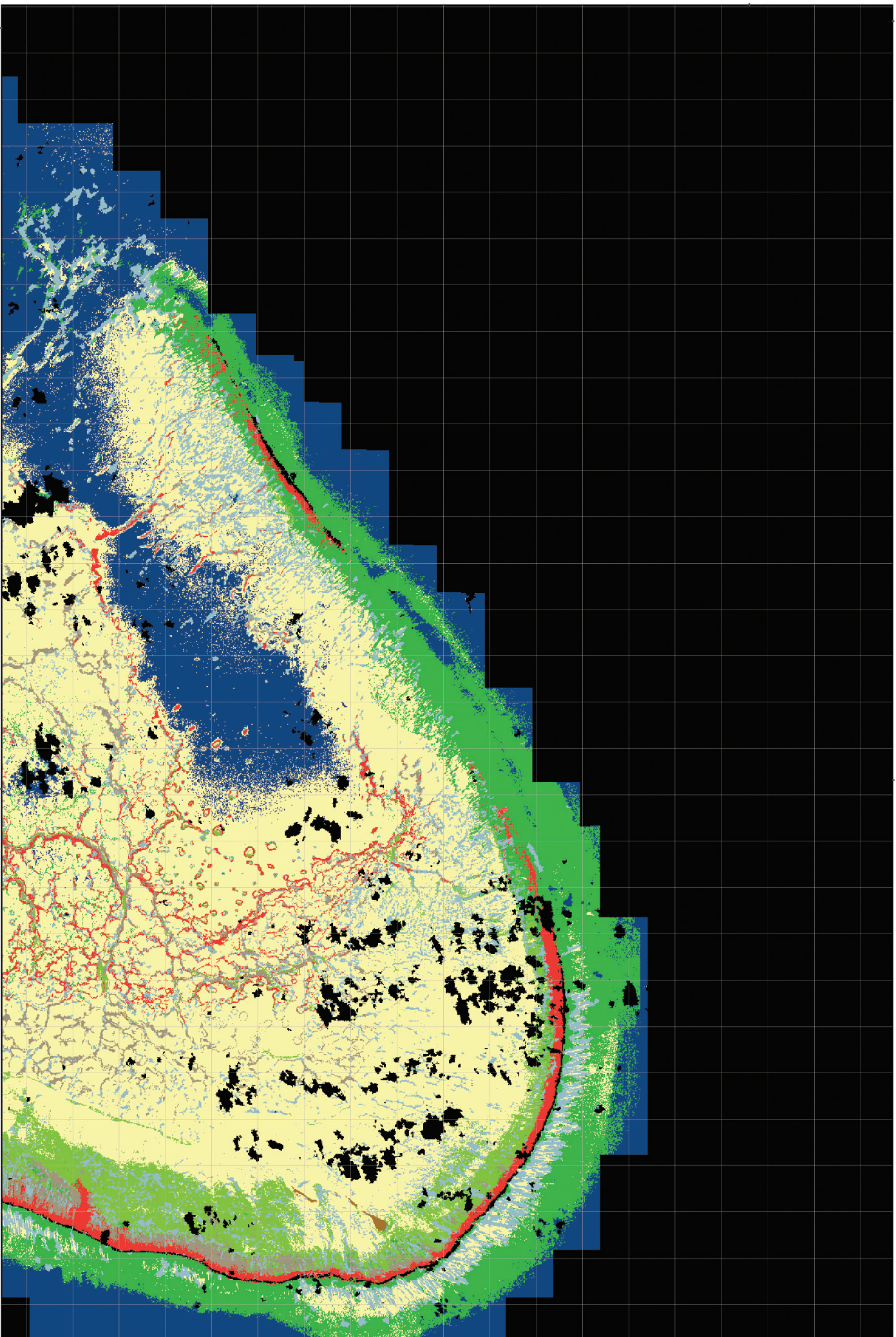
175°0'0"W

175°50'0"W



28°0'0"N

175°0'0"W



175°50'0"W

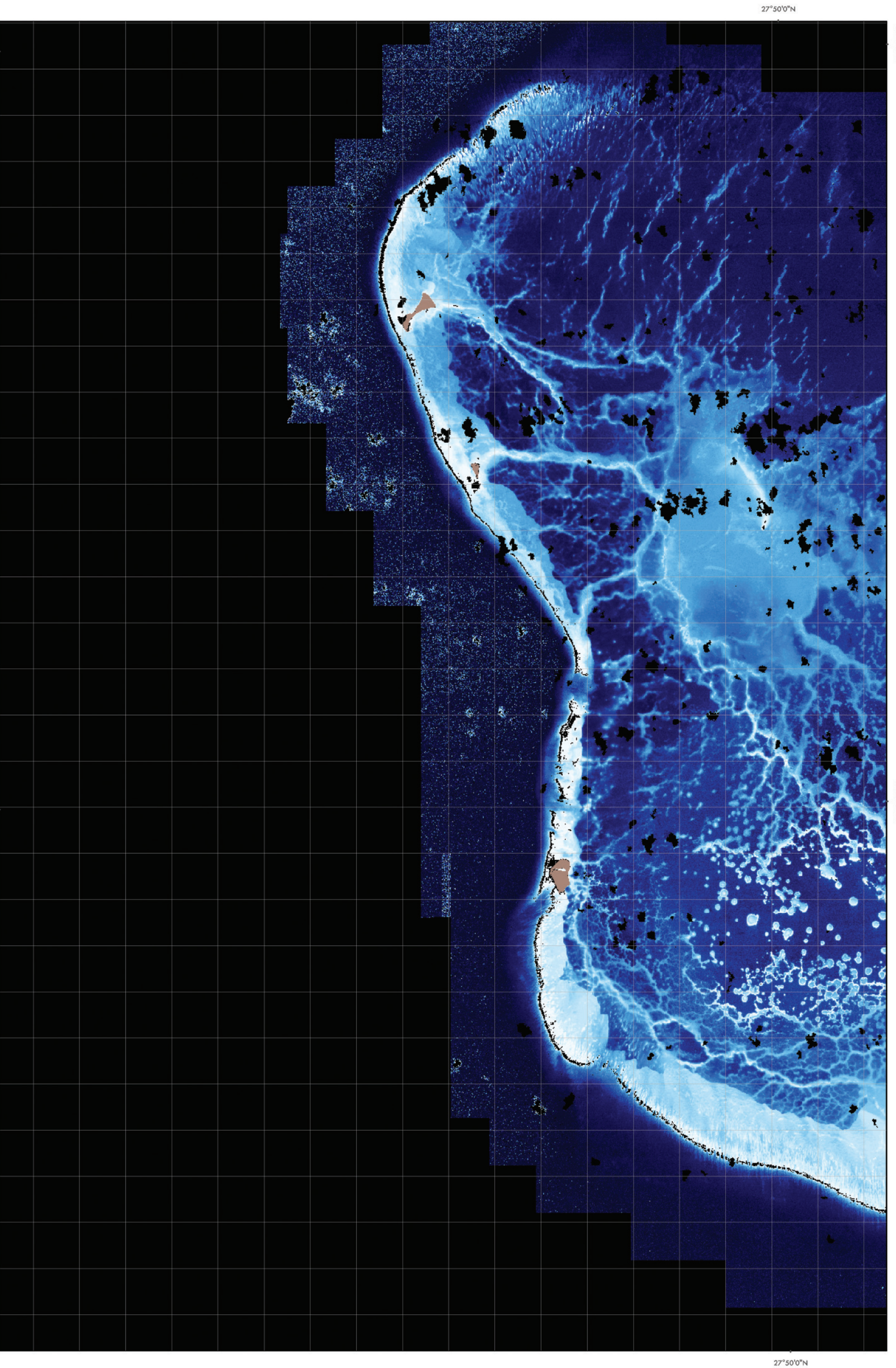
28°0'0"N

176°0'0"W

175°50'0"W

*Title 4. A 1:80,000 scale aggregated habitat cover map of the northern portion of Pearl and Hermes Atoll.*

*Title 5. A 1:80,000 scale estimated bathymetry map of the southern portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*



176°00'W

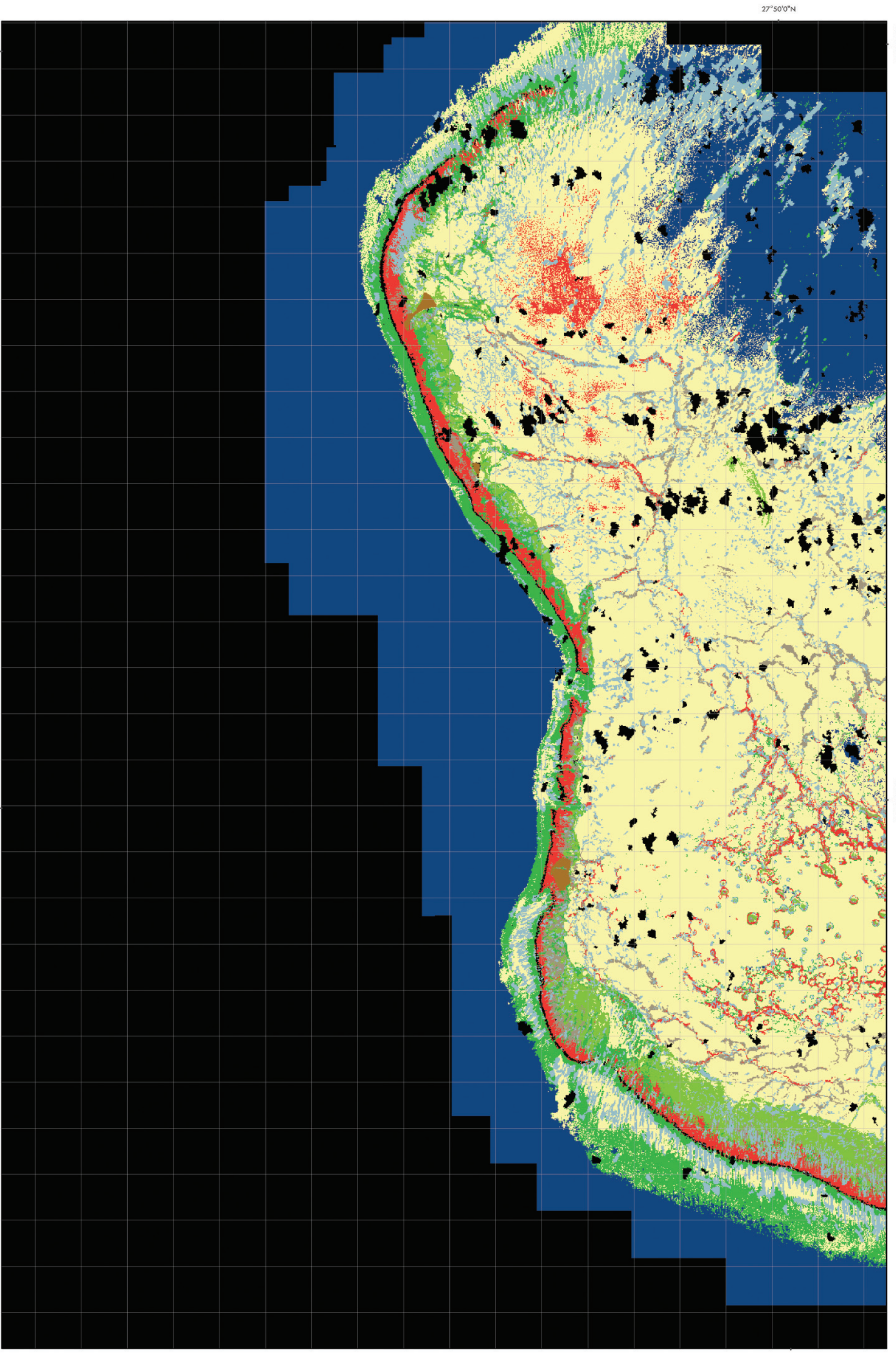
175°50'W

27°50'0"N

176°00'W

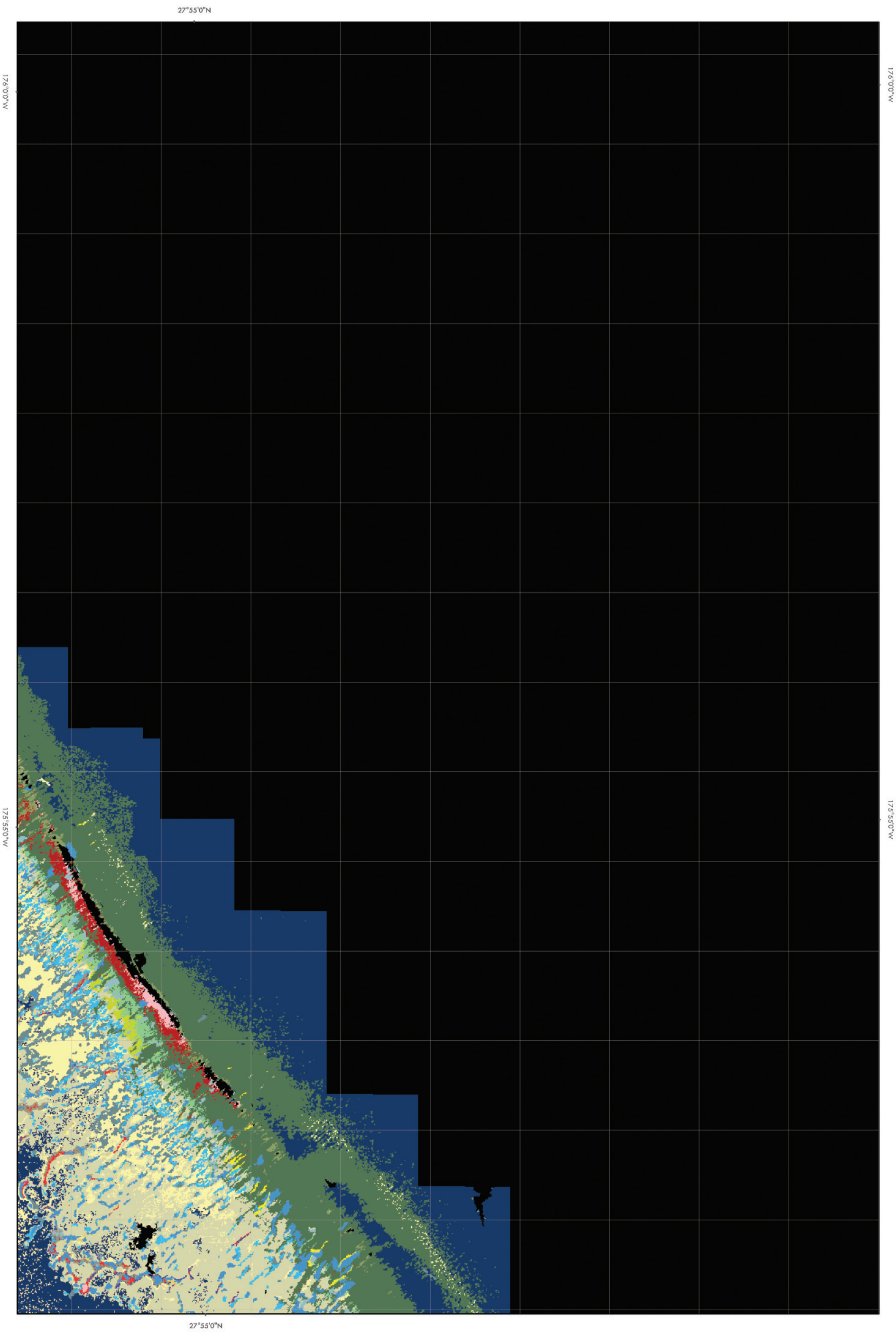
175°50'W

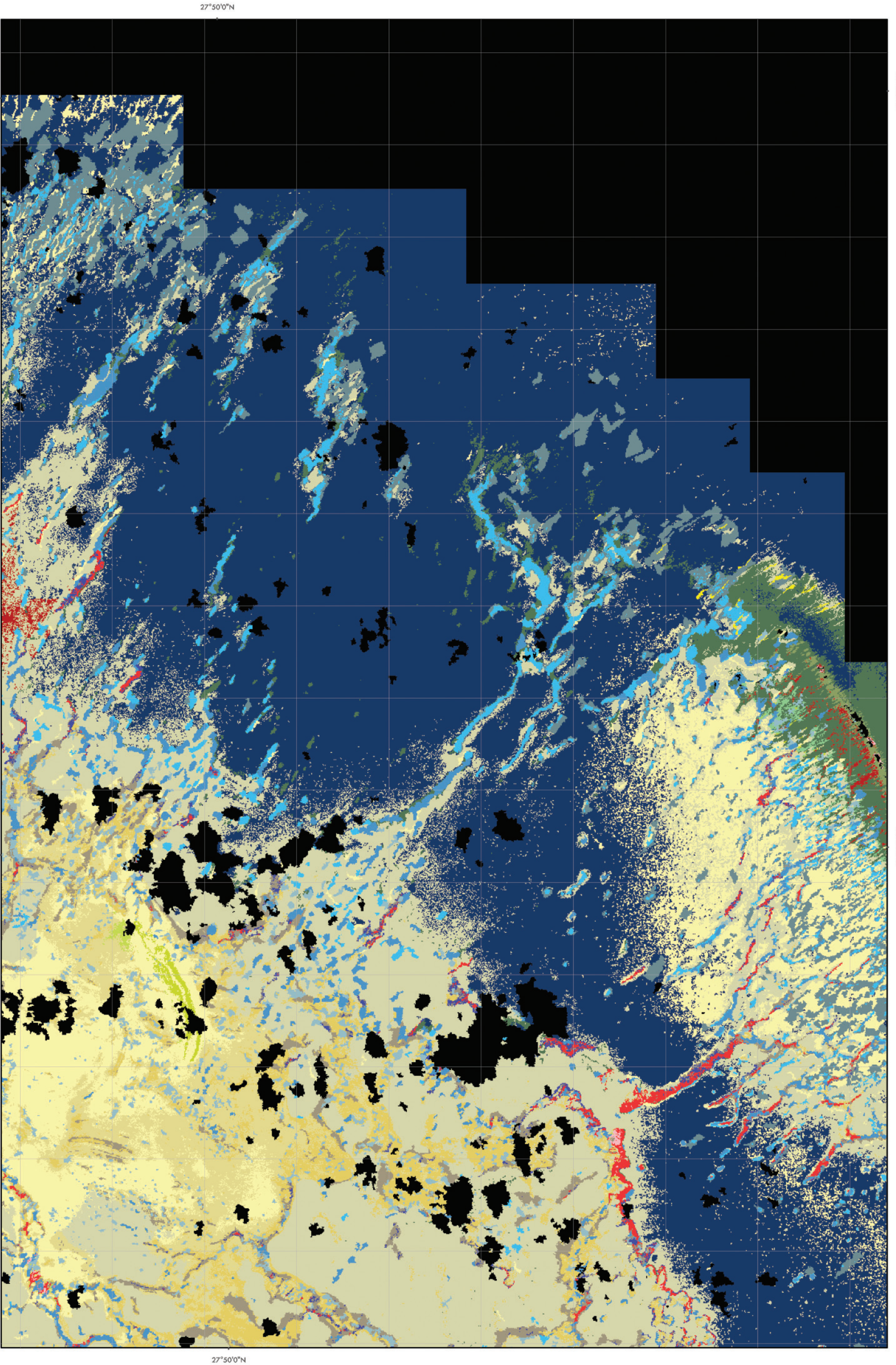
27°50'0"N



*Tile 6. A 1:80,000 scale aggregated habitat cover map of the southern portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*

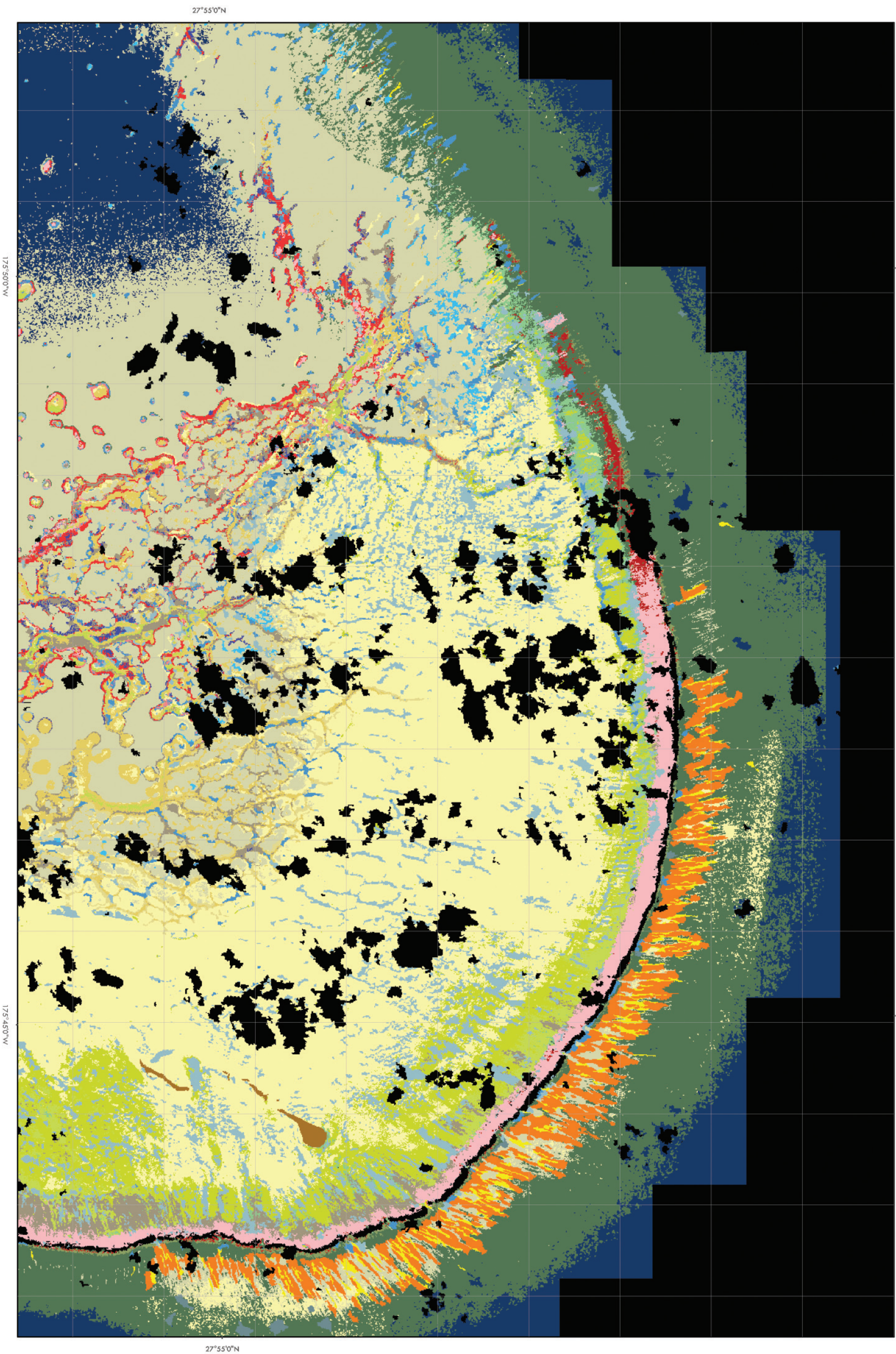
*Tile 7. A 1:40,000 scale detailed benthic habitat map of the northwest corner of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*



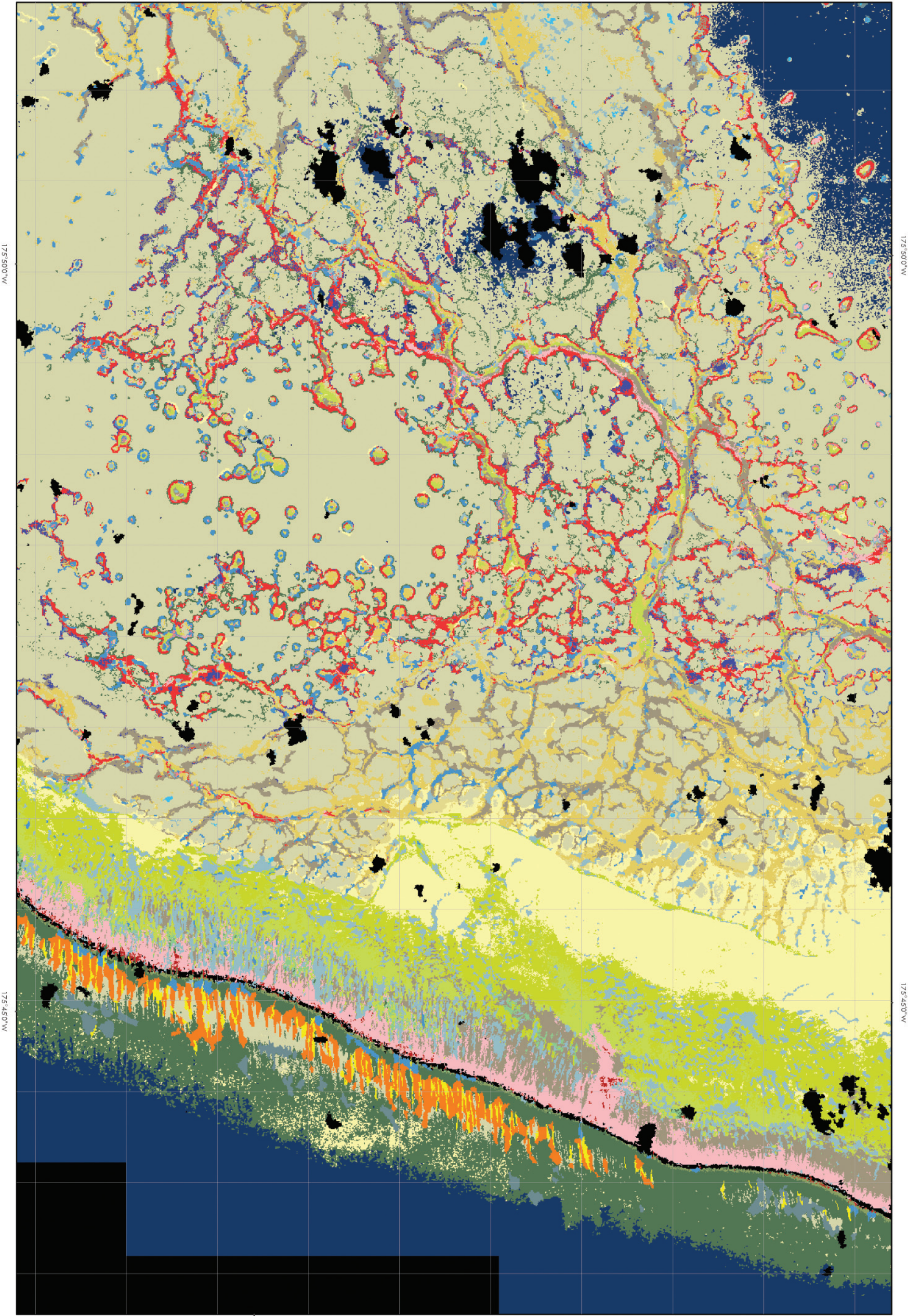


*Tile 8. A 1:40,000 scale detailed benthic habitat map of the west central portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*

*Title 9. A 1:40,000 scale detailed benthic habitat map of the northeast corner of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*



27°50'0"N



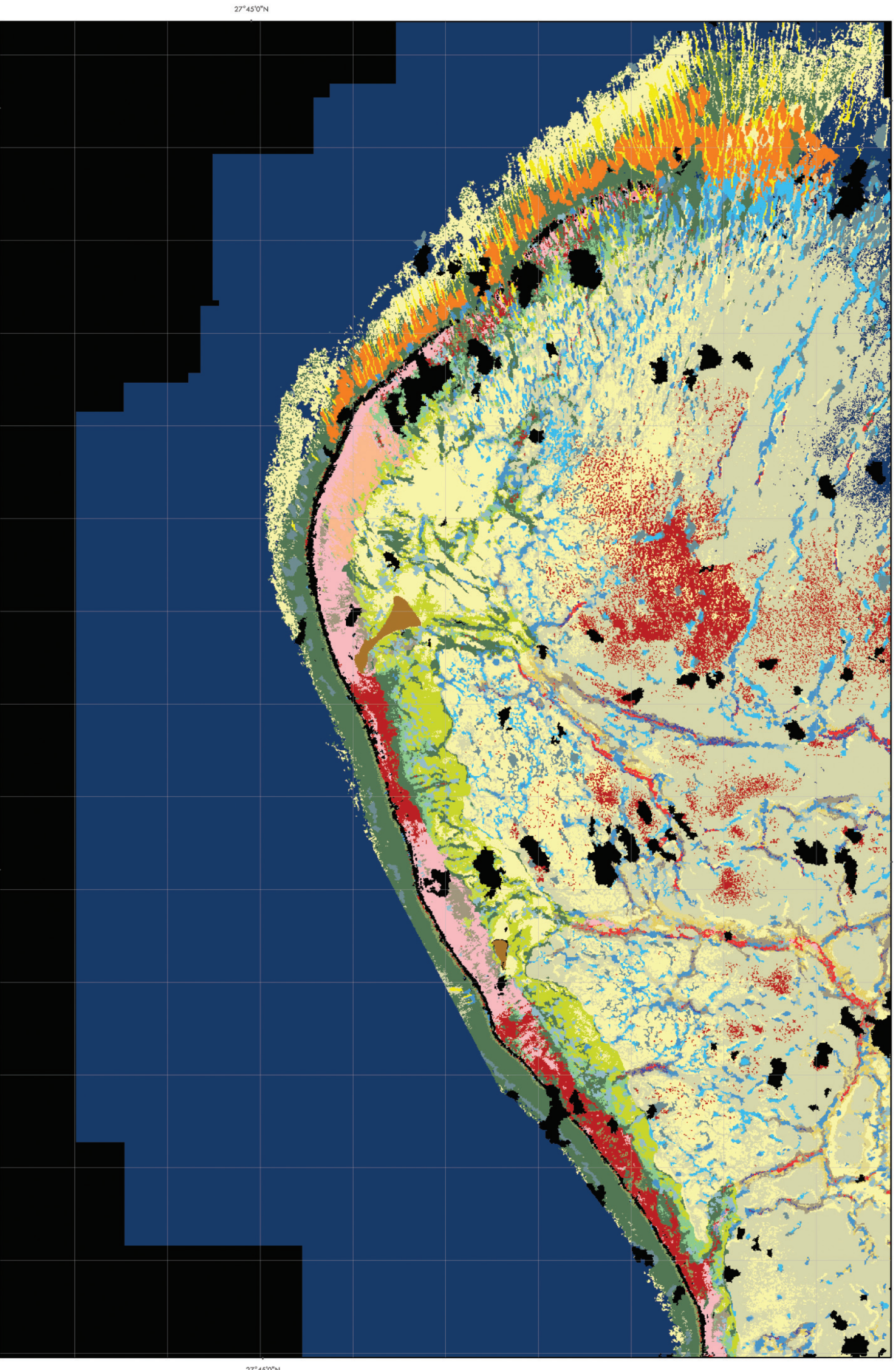
175°50'0"W

175°45'0"W

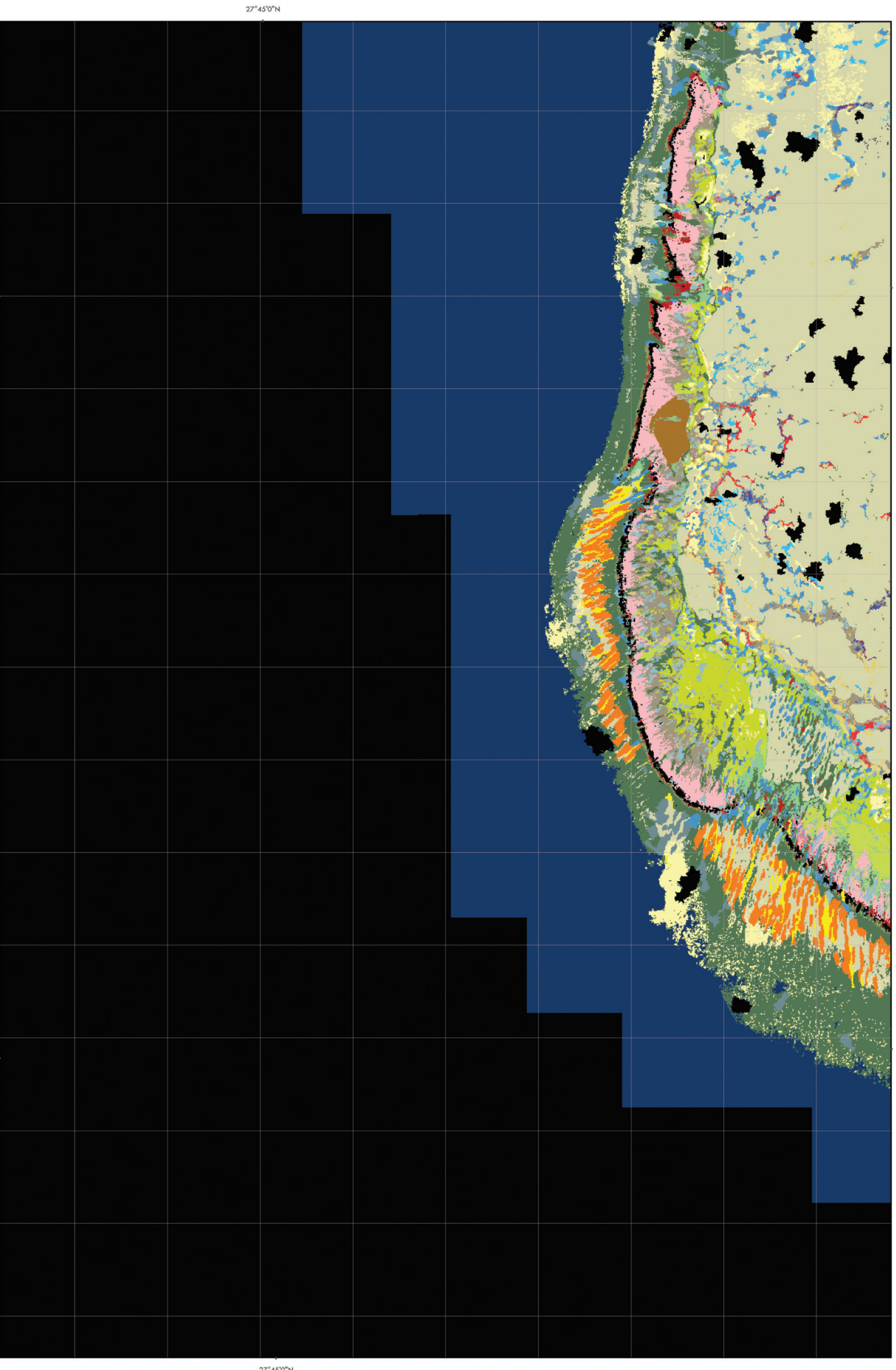
27°50'0"N

*Title 10. A 1:40,000 scale detailed benthic habitat map of the east central portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*

*Title 11. A 1:40,000 scale detailed benthic habitat map of the southwest portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*







*Title 12. A 1:40,000 scale detailed benthic habitat map of the southeast portion of Pearl and Hermes Atoll, Northwestern Hawaiian Islands.*

## Lisianski Island

Lying at longitude 173 degrees 58 minutes W and latitude 26 degrees 4 minutes N, Lisianski is found approximately 675 km ESE of Midway and 1,540 kilometers from Kaua'i. Lisianski Island is about 1.6 sq. km in size and is surrounded by a vast shallow-water coral reef ecosystem called Neva Shoal. Neva Shoal is estimated to be 1,158 sq. km in size. Lisianski Island and Neva Shoal were formed approximately 20 million years ago when the underlying shield volcano and a portion of the associated coral reef bank were lifted above sea level.

Neva Shoal was discovered by and is named after the Russian ship Neva—captained by Urey Lisianski—that ran aground on the reef in 1805. Numerous other ships ran aground the reefs at Lisianski over the years. Survivors reported that bird guano and feathers were available on Lisianski in quantities large enough to harvest. While guano mining never became profitable, harvesting bird wings and feathers did. Within a few years, starting in 1904, it is estimated that over 1 million birds were killed on Lisianski alone for feathers, meat, and wings. The public outcry was so loud that President Theodore Roosevelt signed an Executive Order in 1909 to establish the Hawaiian Island Bird Sanctuary. This bird sanctuary would later become the Hawaiian Islands National Wildlife Refuge. Today, the island also hosts the largest breeding colony of Bonin Petrels in Hawai'i. Three-fourths of all breeding pairs in the entire state breed here.

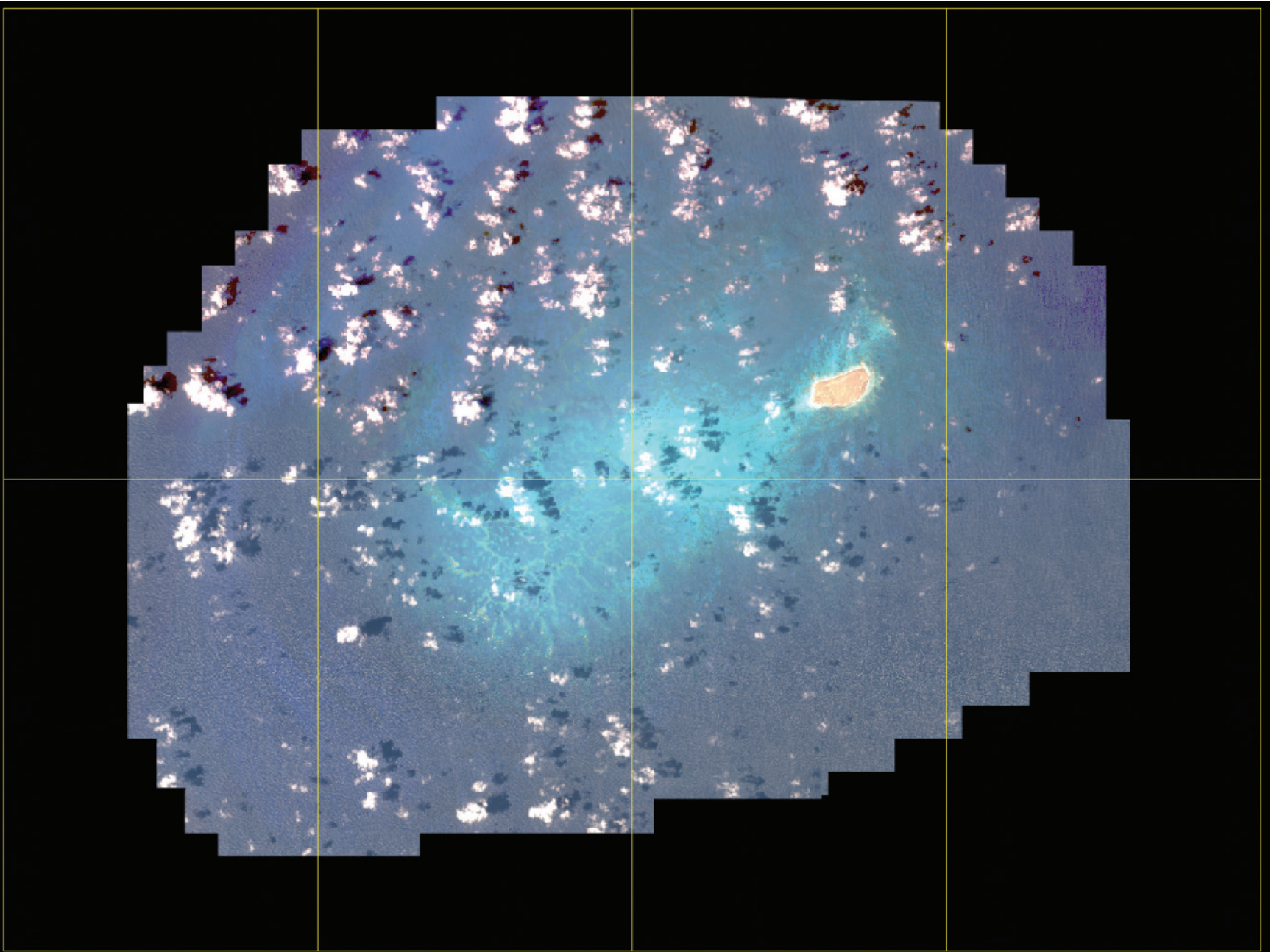
Due to its size, two map tiles are required to depict the 1:80,000 scale estimated bathymetry. Two map tiles are required to depict the 1:80,000 scale aggregated habitat cover maps. Eight map tiles are required to depict the 1:40,000 scale detailed benthic habitats of Lisianski Island. Two 1:80,000 scale map tiles are included to depict the extensive shallow-water bank area around Lisianski Island. A one-square-kilometer grid is included with all maps of Lisianski Island.

The area in square kilometers of aggregated benthic habitat cover types found at Lisianski Island, Northwestern Hawaiian Islands.

Hardbottom with >10% live coral	16.4
Hardbottom with >10% crustose coralline algae	-
Hardbottom (uncolonized)	0.9
Hardbottom with >10% macroalgae	6.1
Hardbottom with indeterminate cover	183.5
Unconsolidated with 10% or less macroalgae or seagrass	231.8
Unconsolidated with >10% macroalgae or seagrass	-
Total Habitat Area Classified	438.7

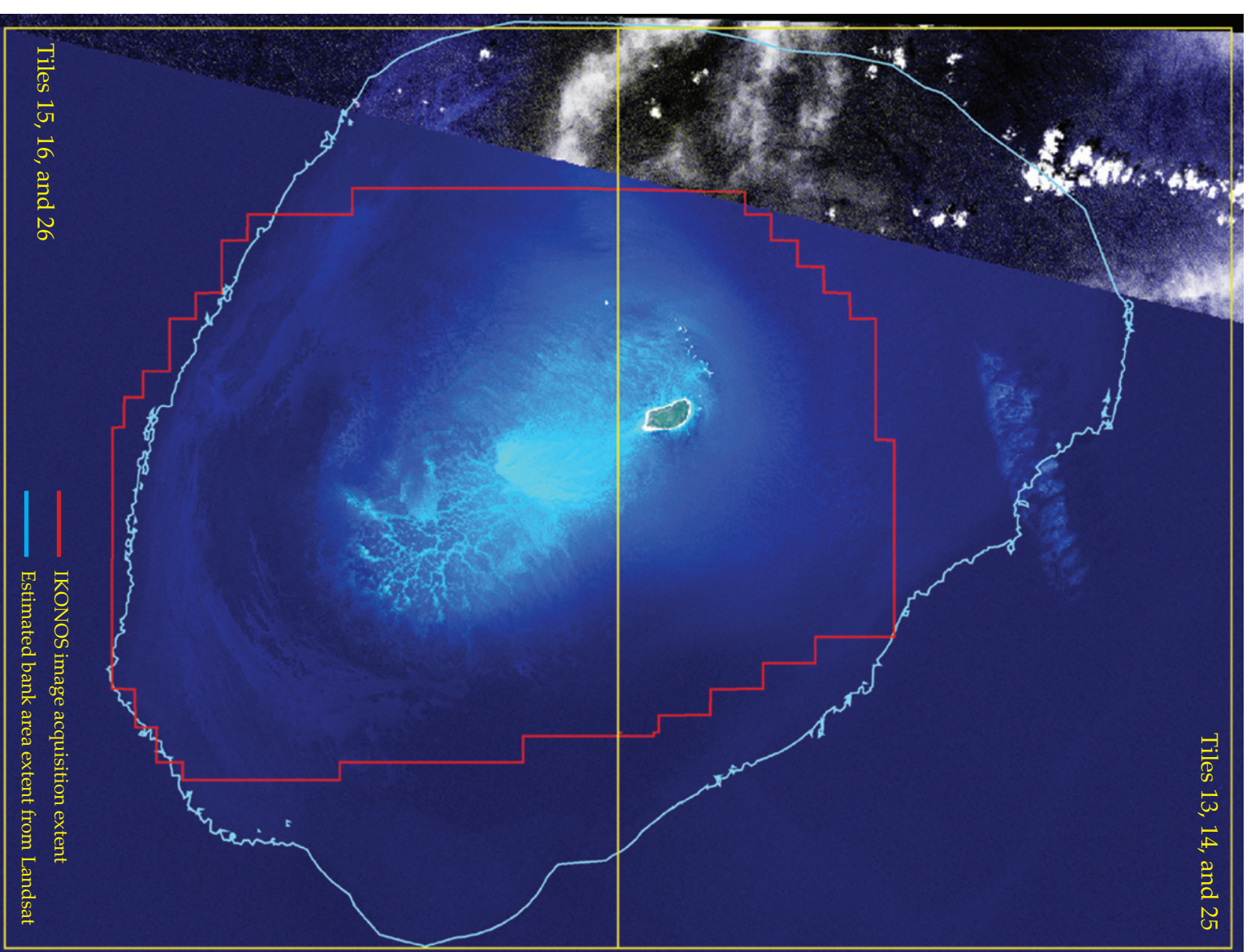
The area in square kilometers of benthic habitats found at Lisianski Island, Northwestern Hawaiian Islands.

Unconsolidated (1000, refer to classification scheme for habitat description)	75.4
Sand (1100)	72.3
Sand with macroalgae (1120)	-
Sand with patchy (10-50% cover) macroalgae (1121)	-
Dense (>50% macroalgae on sand) (1122)	-
Unconsolidated Rubble (1300)	16.9
Unconsolidated Rubble with sparse (10-50% cover) algae (1301)	-
Unconsolidated Rubble with dense (>50% cover) (1302)	-
Sand and Rubble (1400)	67.2
Groove (1500)	-
Hardbottom (2000)	155.7
Hardbottom with sparse (10-50% cover) algae (2001)	6.0
Hardbottom with live coral (<10% cover) (2010)	7.1
Hardbottom, uncolonized (2020)	-
Hardbottom with crustose coralline algae (>10% cover) (2030)	-
Linear Reef (2100)	-
Linear Reef with live coral (>10% cover) (2110)	-
Linear Reef, uncolonized (2120)	-
Linear Reef, uncolonized with sparse (10-50% cover) algae (2121)	-
Linear Reef with crustose coralline algae (>10% cover) (2130)	-
Aggregated Coral Heads with live coral (>10% cover) (2210)	-
Spur and Groove (2300)	-
Patch Reef (2400)	-
Patch Reef with live coral (>10% cover) (2410)	-
Patch Reef, uncolonized (2420)	-
Patch Reef, uncolonized with sparse (10-50% cover) algae (2421)	-
Patch Reef with crustose coralline algae (>10% cover) (2430)	-
Aggregated Patch Reef (2500)	18.4
Aggregated Patch Reef with live coral (>10% cover) (2510)	8.7
Scattered Coral/Rock in Sand with live coral (>10% cover) (2610)	-
Pavement (2700)	9.4
Pavement with sparse (10-50% cover) algae (2701)	-
Pavement with dense (>50% cover) algae (2702)	<0.1
Pavement with live coral (<10% cover) (2710)	0.5
Pavement with live coral (>10% cover) and dense (>50% cover) algae (2712)	-
Pavement, uncolonized (2720)	0.9
Pavement, uncolonized with dense (>50% cover) algae (2722)	-
Pavement with crustose coralline algae (<10% cover) (2730)	-
Pavement with sand channels (2800)	-
Pavement with sand channels and live coral (>10% cover) (2810)	-
Pavement with sand channels, uncolonized (2820)	-
Volcanic Rock (2900)	-
Volcanic Rock with dense (>50% cover) algae (2902)	-
Volcanic Rock with live coral (>10% cover) (2910)	-
Volcanic Rock, uncolonized (2920)	-
Deep water (3010)	59.3
Reef crest (3020)	-
Dredged channel (3030)	-
Land (3100)	1.5
Cloud, Shadow, Surf, and No image data (3210, 3220, 3230, and 4000)	93.3
Unclassified (3300)	-
Total Habitat Area Classified	438.7
TOTAL Area in IKONOS image	592.8



*Index of 1:40,000 tiles*

*Index maps indicating the locations of map tiles for the 1:40,000 scale detailed habitat maps and the 1:80,000 scale aggregated cover, estimated bathymetry, and bank of Lisianski Island, Northwestern Hawaiian Islands.*



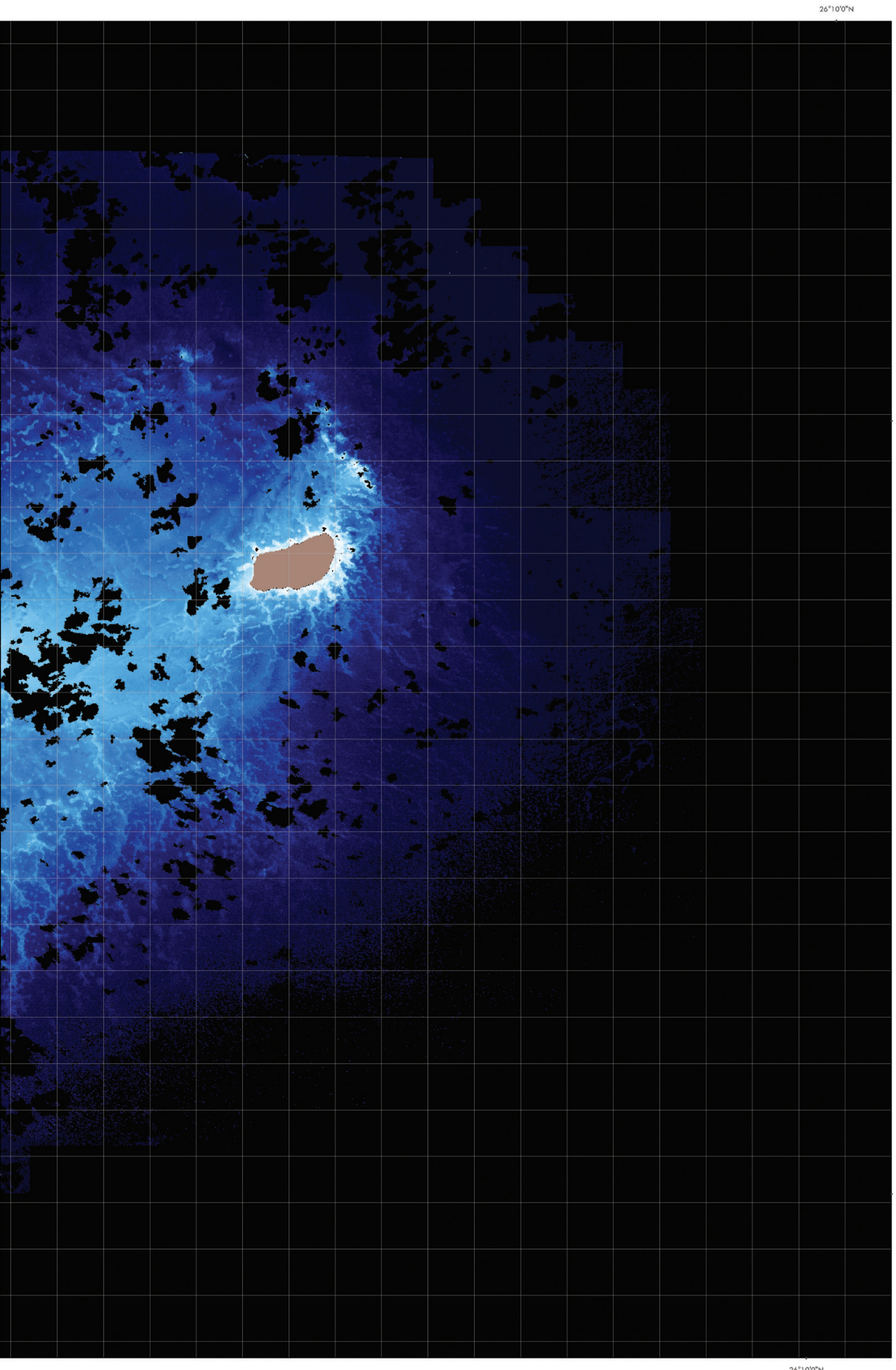
*Tiles 13, 14, and 25*

*— IKONOS image acquisition extent*  
*— Estimated bank area extent from Landsat*

*Tiles 15, 16, and 26*

*Index of 1:80,000 tiles*

*Tile 13. A 1:80,000 scale estimated bathymetry map of the northern portion of Lisianski Island, Northwestern Hawaiian Islands.*



174°00'W

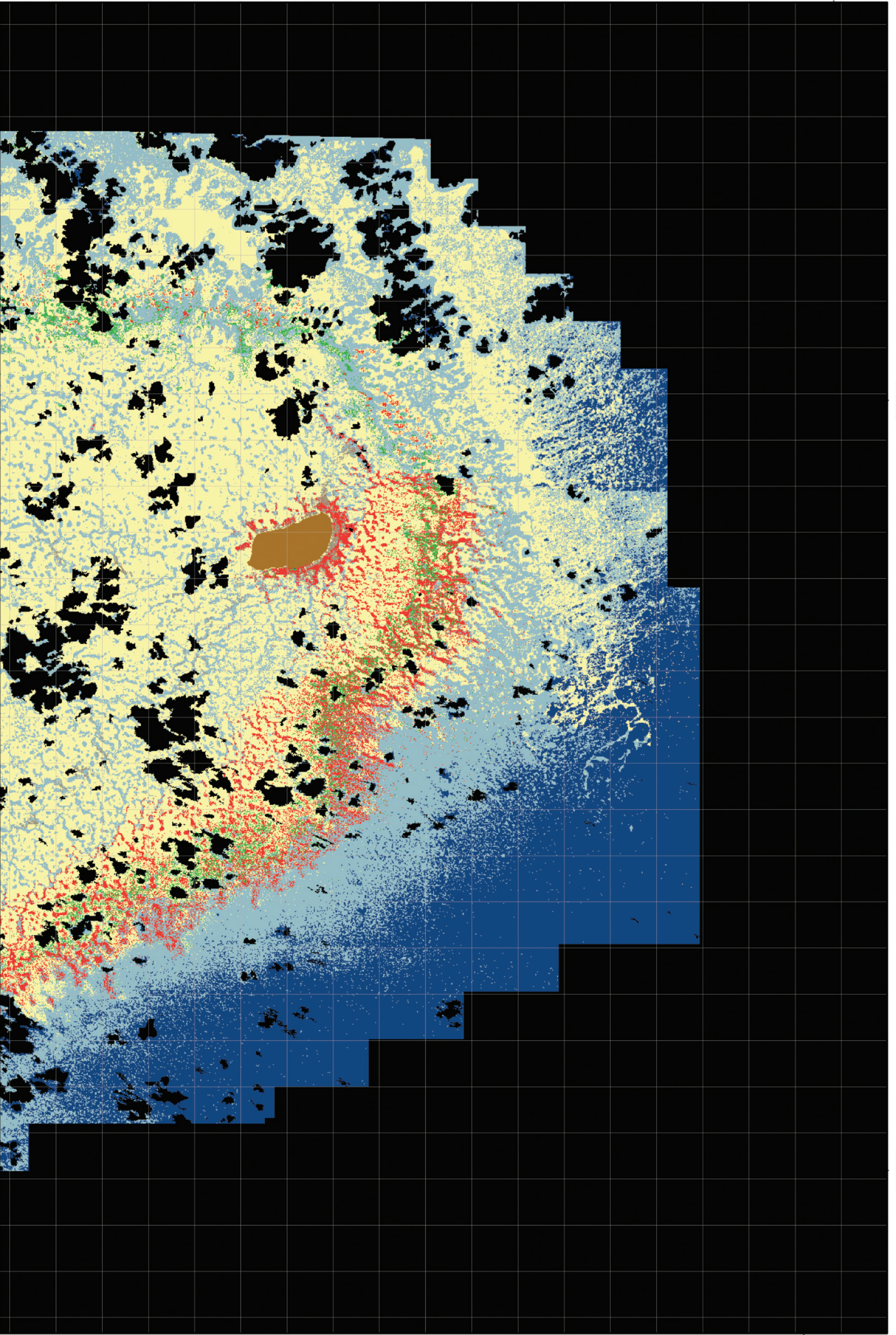
173°50'W

26°10'1"N

174°50'0"W

173°50'0"W

26°10'1"N

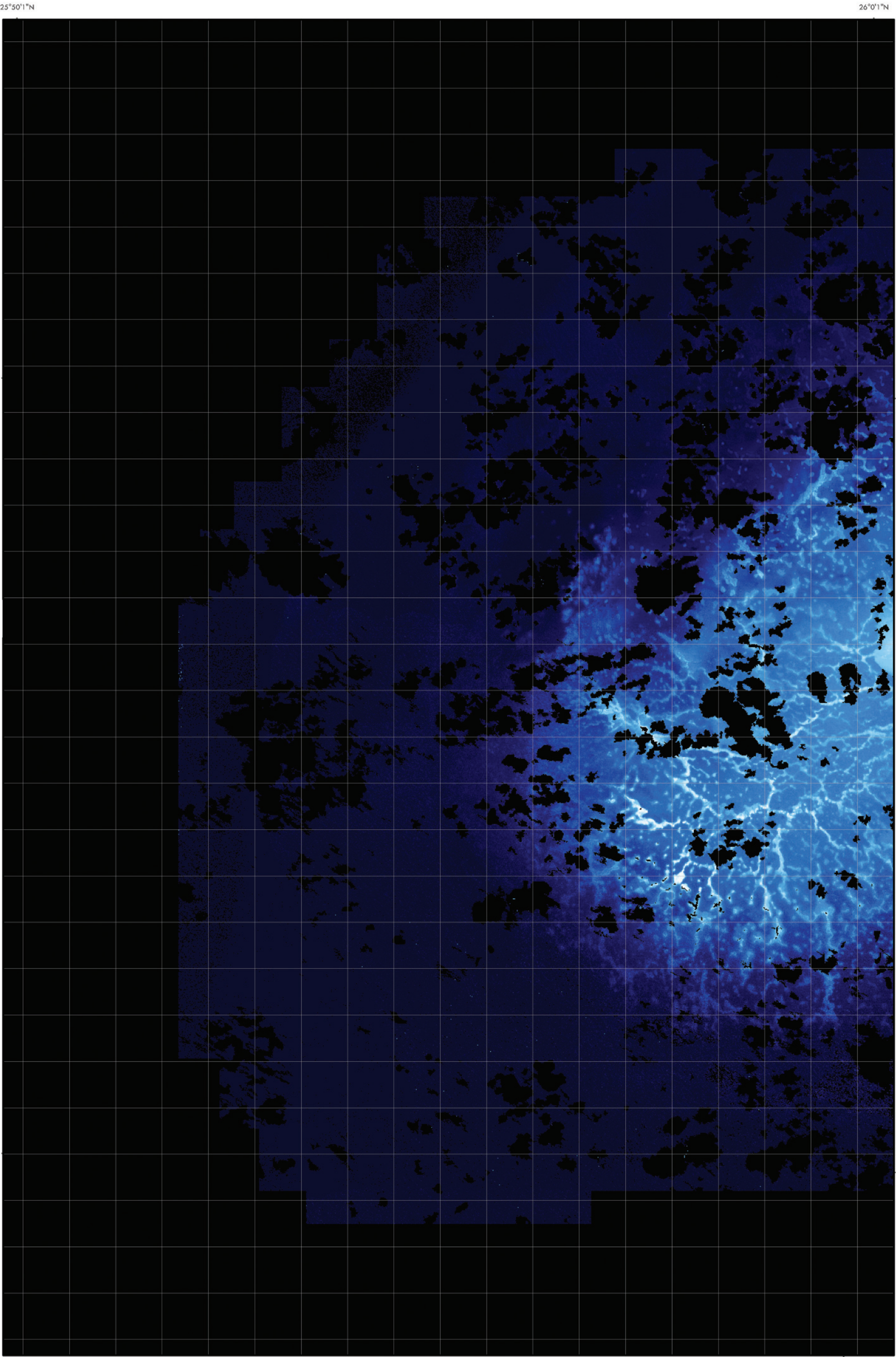


174°600"W

173°500"W

Tile 14. A 1:80,000 scale aggregated cover map of the southern portion Lisianski Island, Northwestern Hawaiian Islands.

*Tile 15. A 1:80,000 scale estimated bathymetry map of the southern portion Lisianski Island, Northwestern Hawaiian Islands.*



26°0'1"N

173°50'0"W

174°50'0"W

26°0'1"N

25°50'1"N

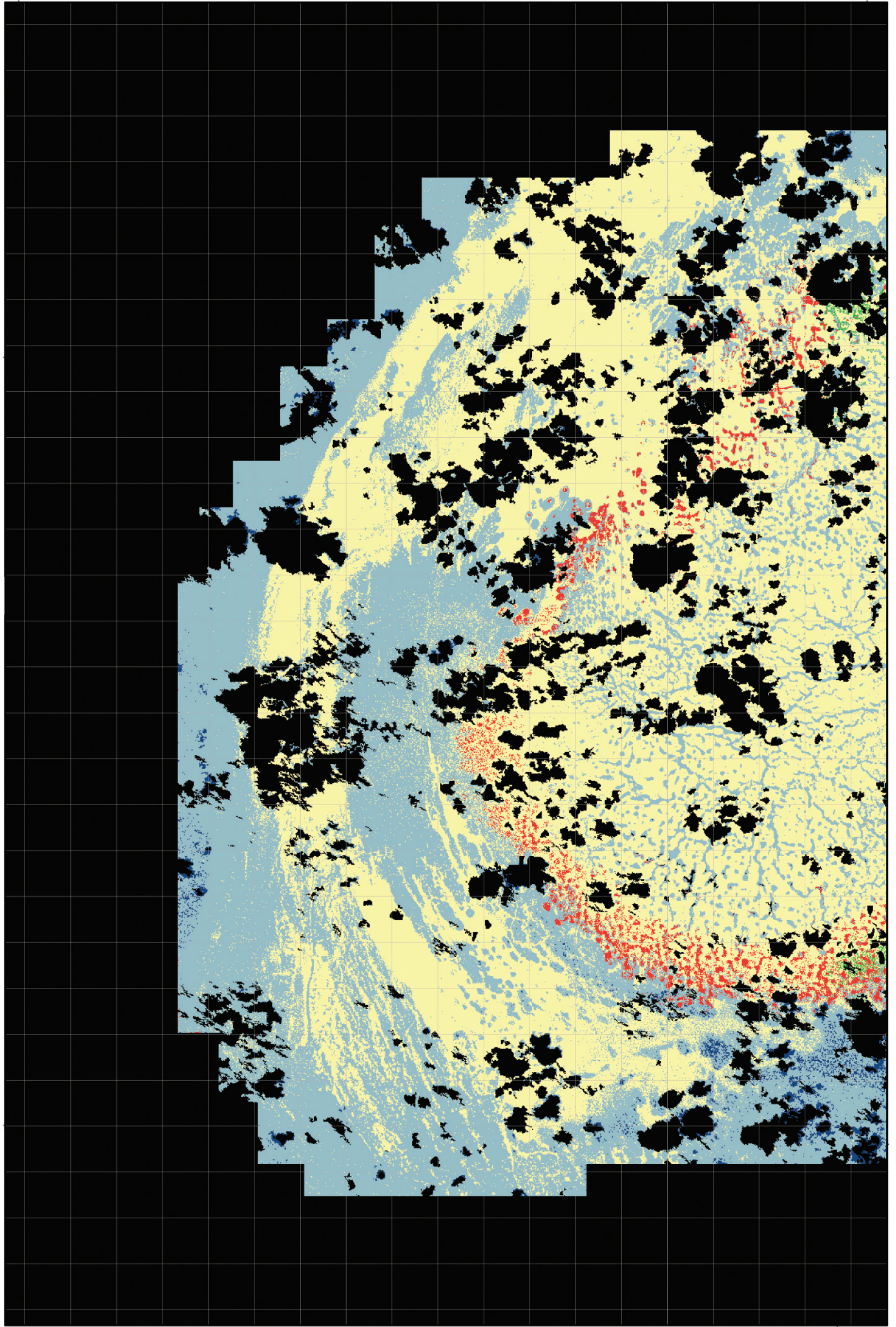
174°50'0"W

N

173°50'0"W

25°50'1"N

26°0'1"N



*Tile 16. A 1:80,000 scale aggregated cover map of the southern portion Lisianski Island, Northwestern Hawaiian Islands.*

174°50'0"W

N

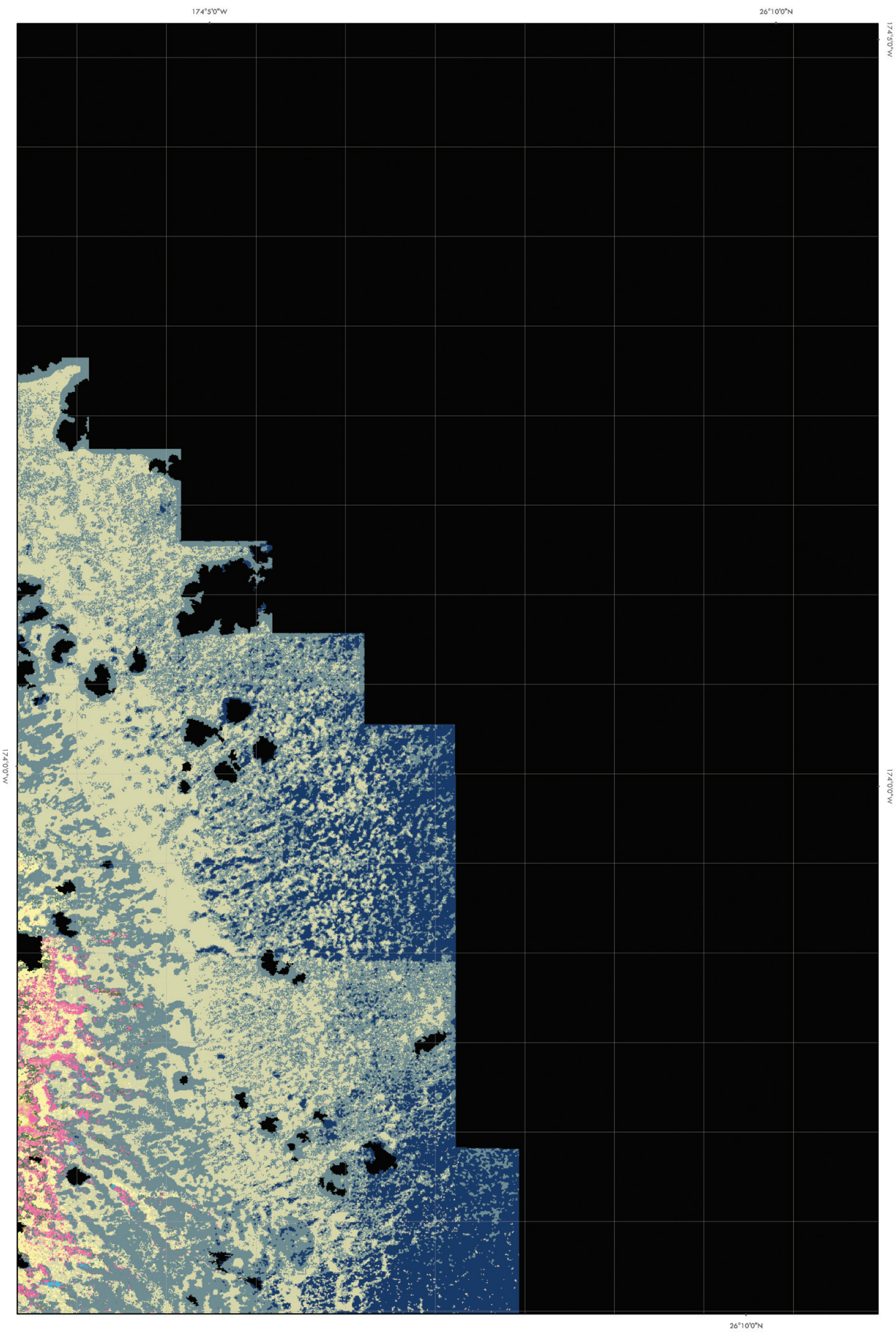
173°50'0"W

174°50'0"W

173°50'0"W

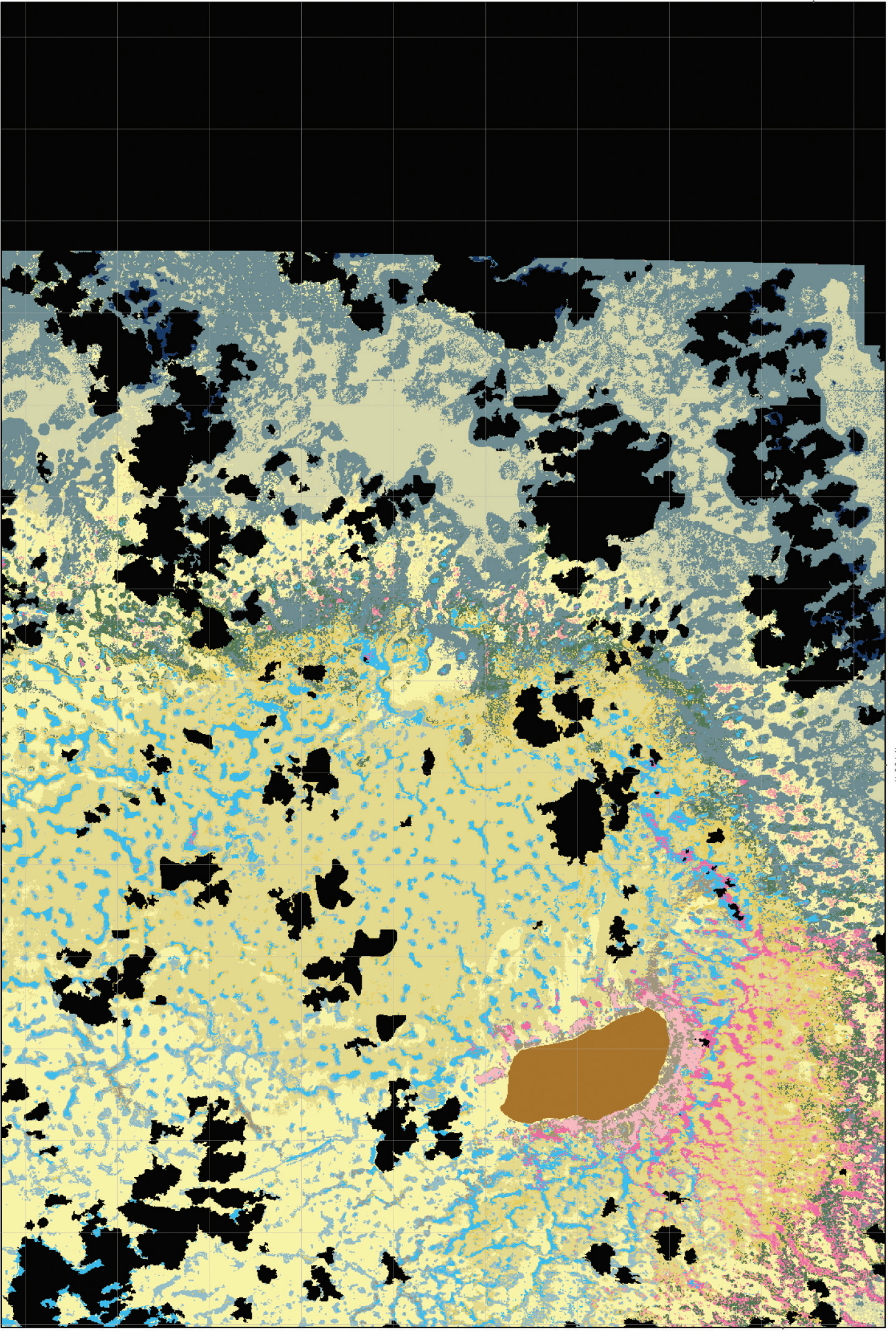
26°0'1"N

*Title 17. A 1:40,000 scale detailed benthic habitat map of the northwest portion of Lisianski Island, Northwestern Hawaiian Islands.*





26°5'0"N



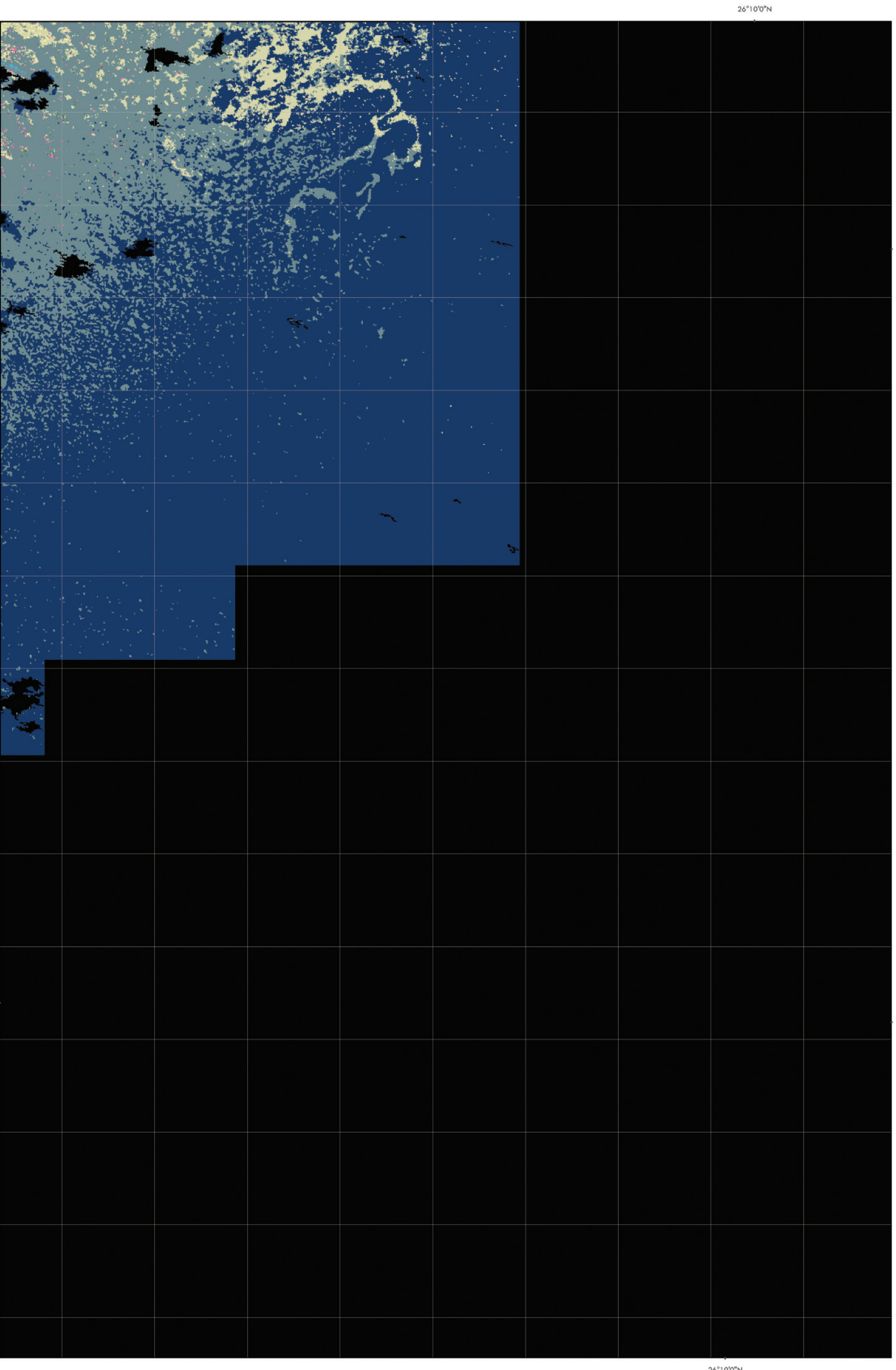
174°0'0"W

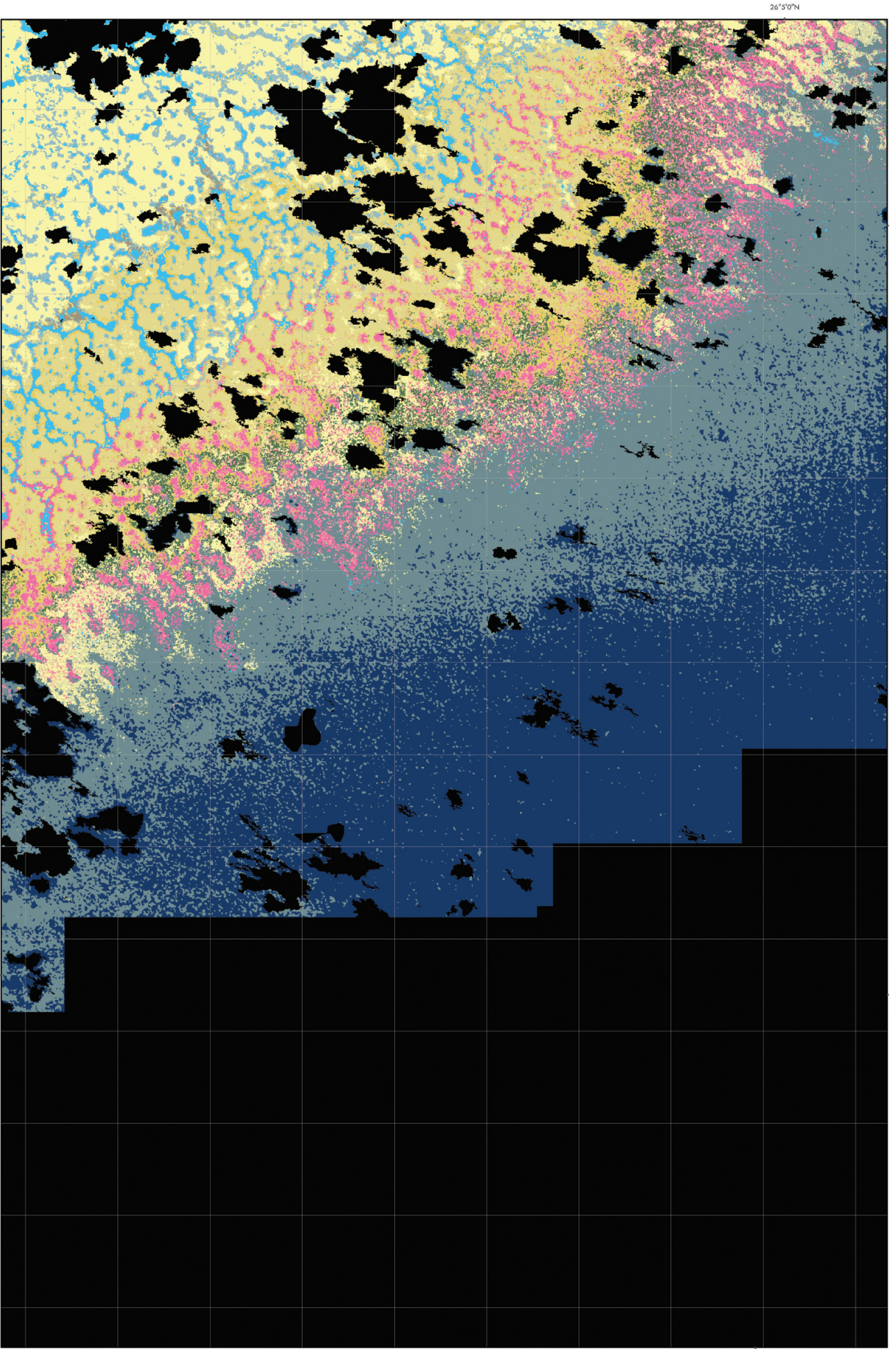
174°0'0"W

26°5'0"N

*Tile 18. A 1:40,000 scale detailed benthic habitat map of the west central portion of Lisianski Island, Northwestern Hawaiian Islands.*

*Tile 19. A 1:40,000 scale detailed benthic habitat map of the northeast portion of Lisianski Island, Northwestern Hawaiian Islands.*

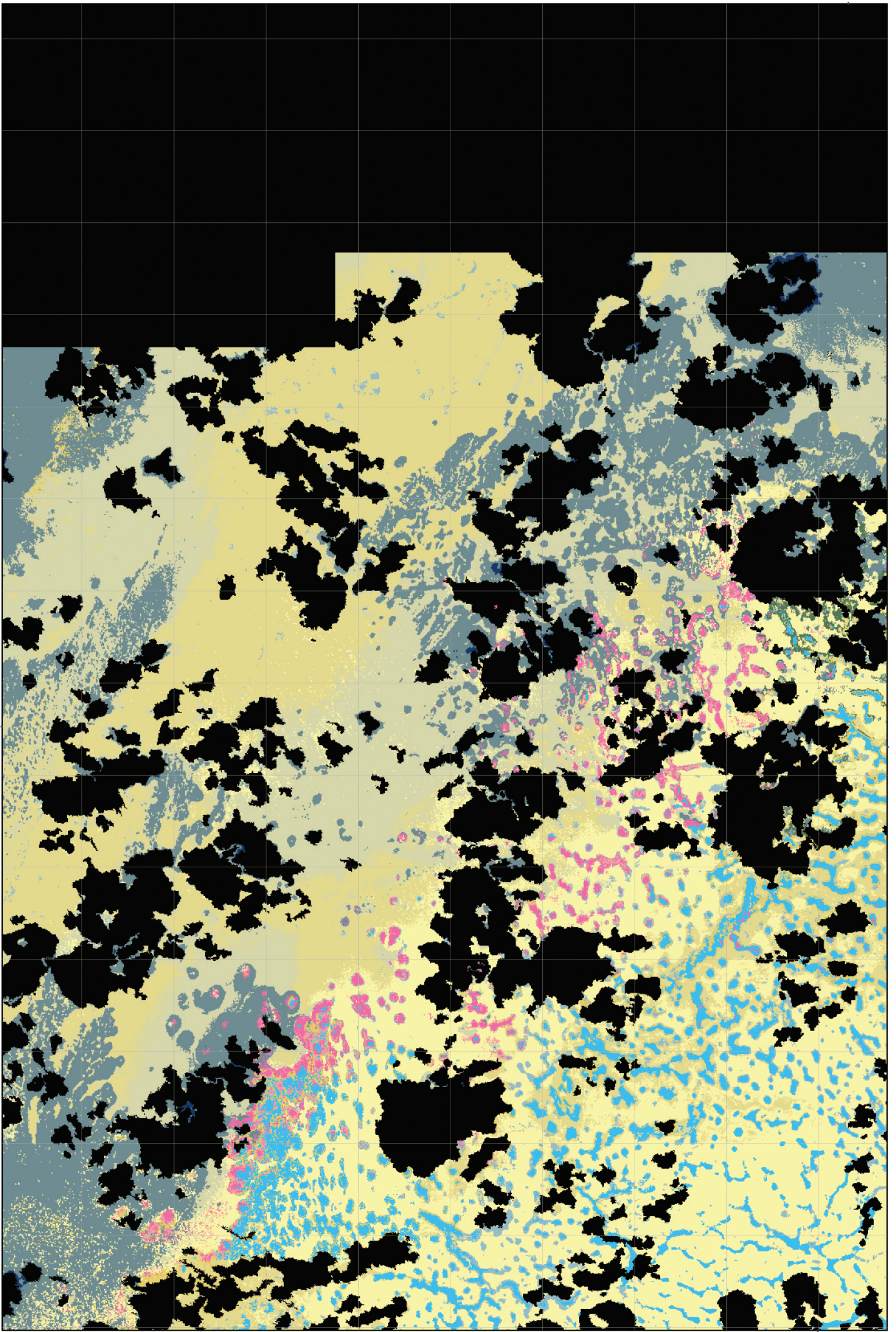




*Title 20. A 1:40,000 scale detailed benthic habitat map of the northeast central portion of Lisianski Island, Northwestern Hawaiian Islands.*

26°60'0"N

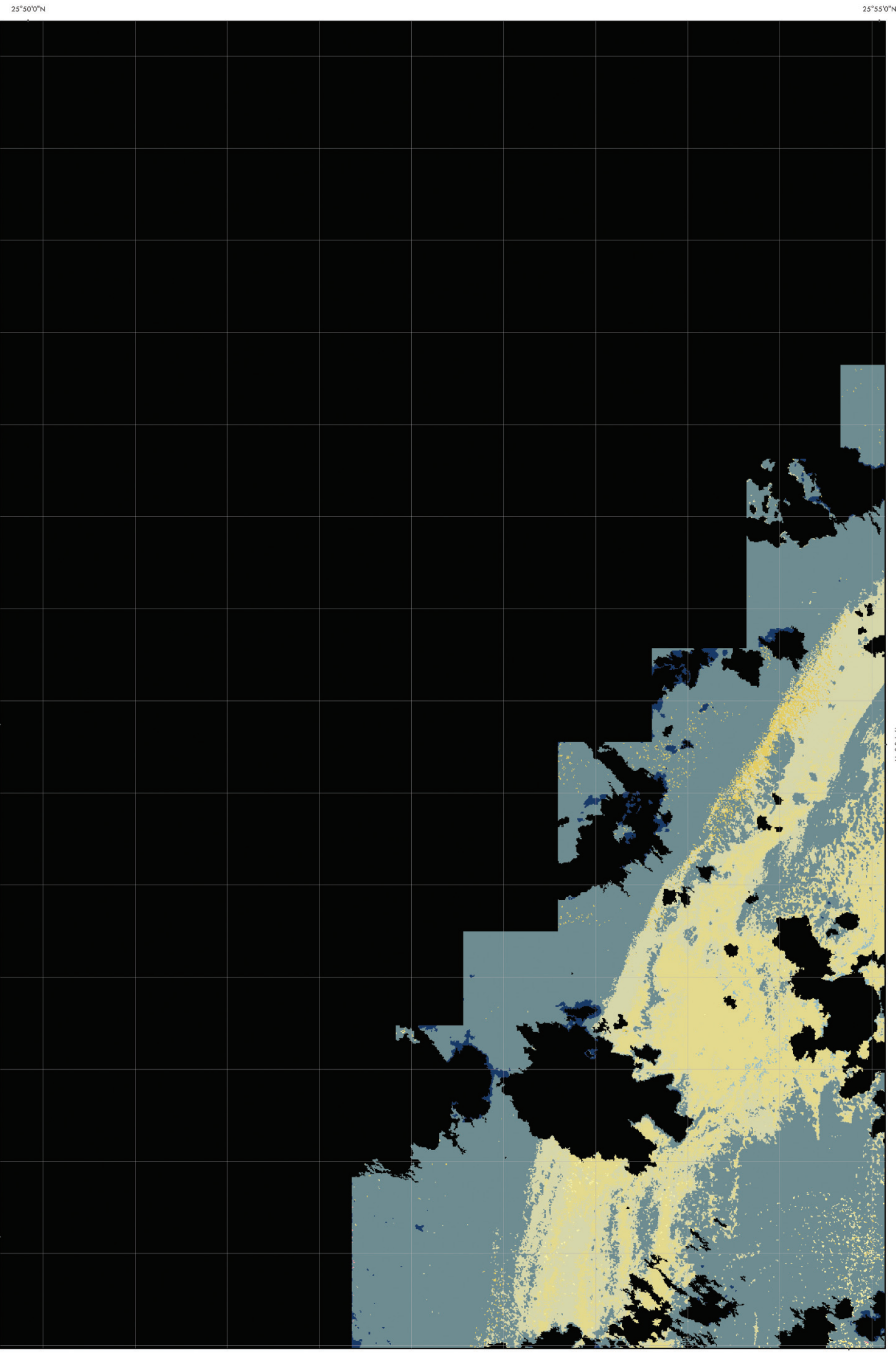
*Title 21. A 1:40,000 scale detailed benthic habitat map of the southwest central Lisianski Island, Northwestern Hawaiian Islands.*



26°60'0"N

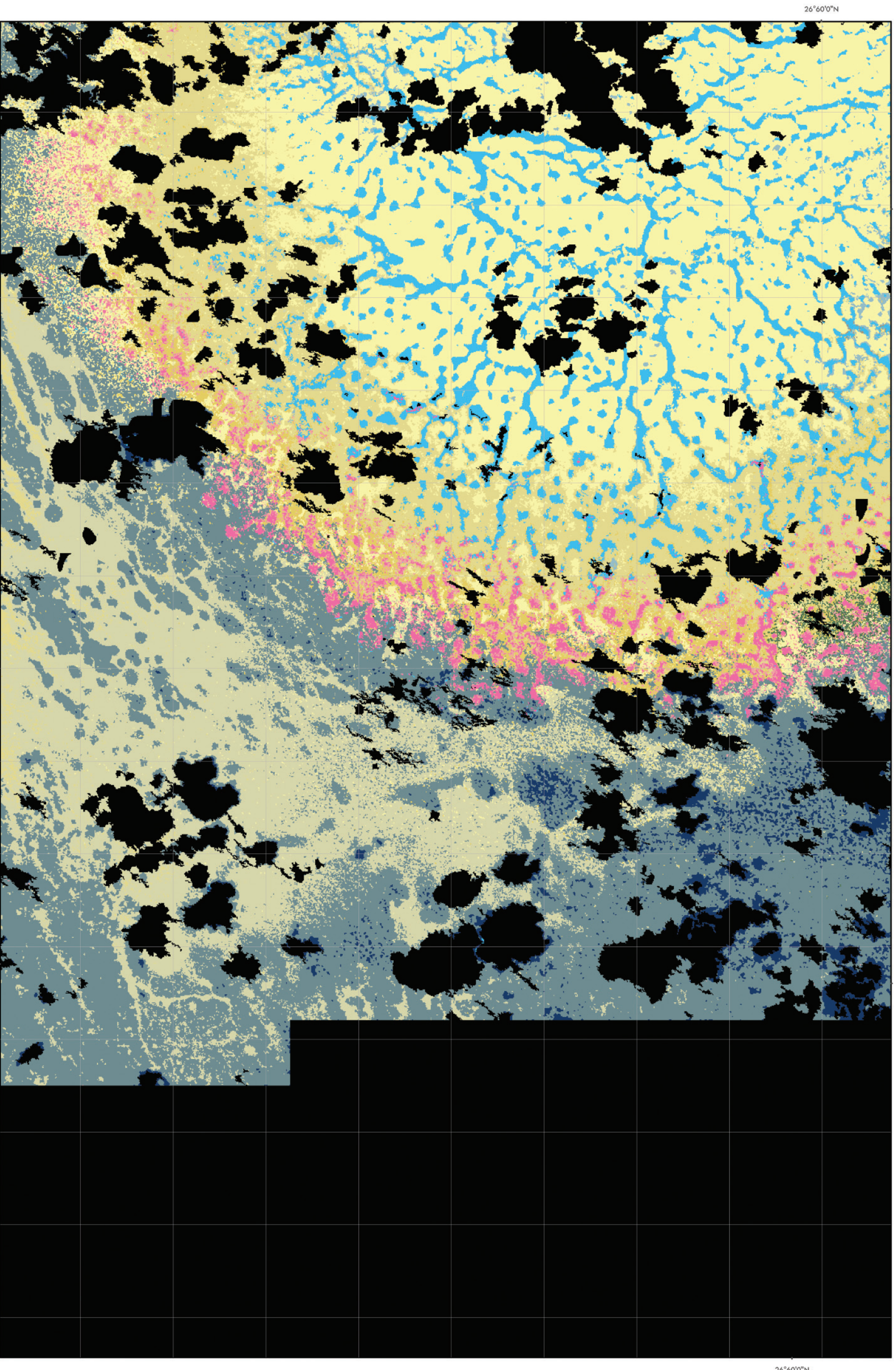
174°00'W

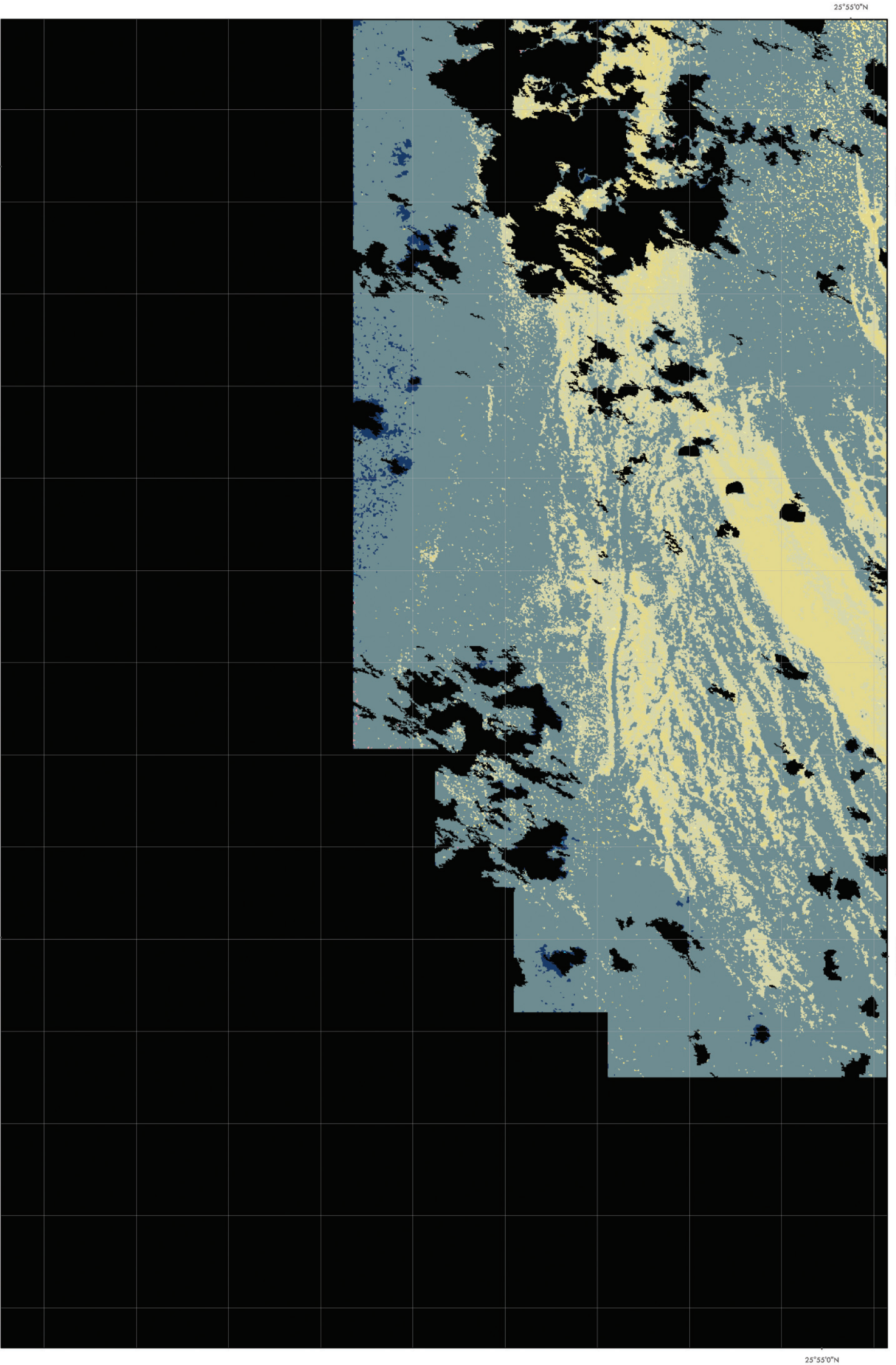
174°00'W



*Tile 22. A 1:40,000 scale detailed benthic habitat map of the southwest corner of Lisianski Island, Northwestern Hawaiian Islands.*

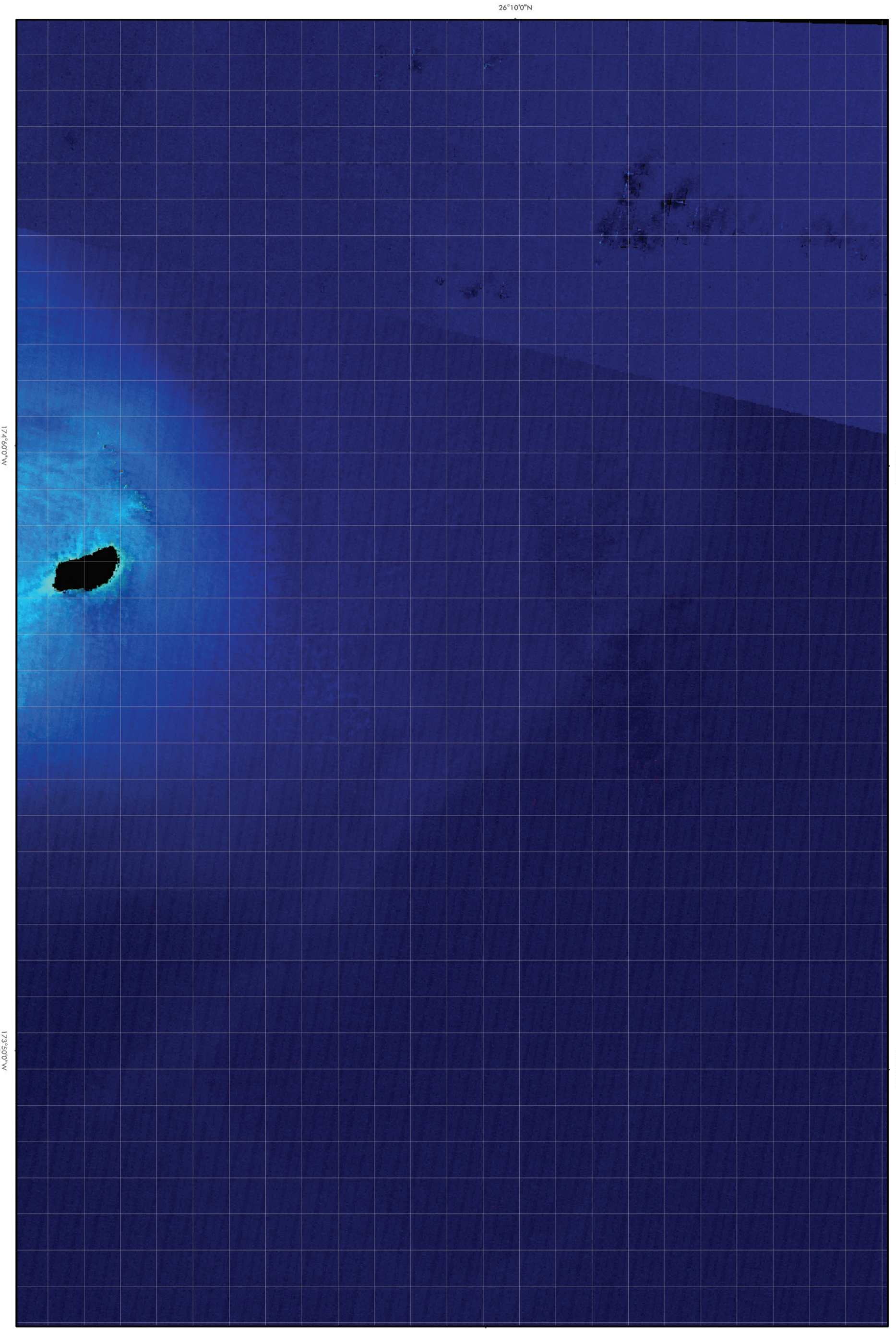
*Title 23. A 1:40,000 scale detailed benthic habitat map of the southeast central portion of Lisianski Island, Northwestern Hawaiian Islands.*



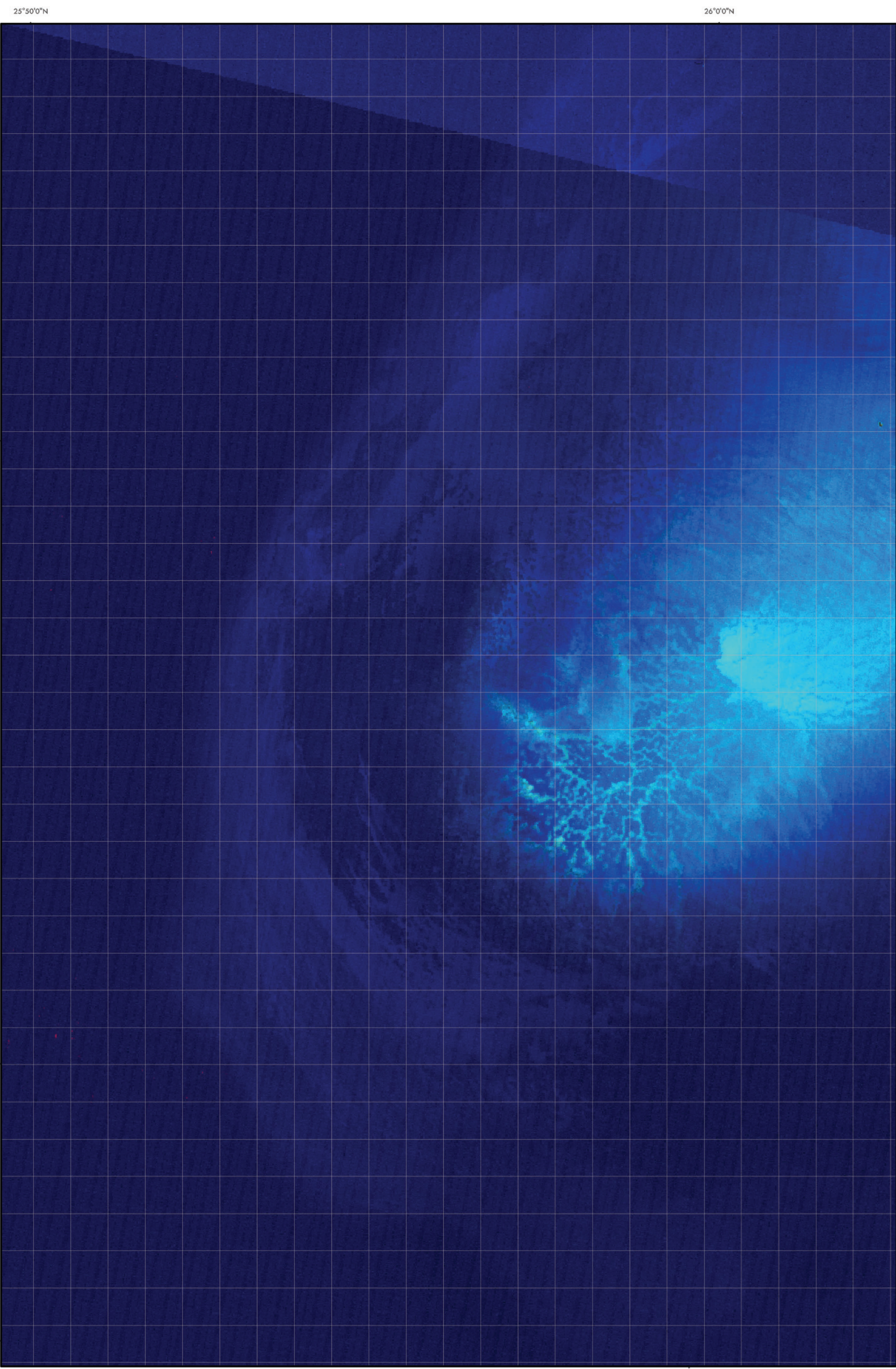


*Title 24. A 1:40,000 scale detailed benthic habitat map of the southeast portion of Lisianski Island, Northwestern Hawaiian Islands.*

*Tile 25. A 1:80,000 scale map of the northern "bank" area associated with Lisianski Island.*







*Title 26. A 1:80,000 scale map of the southern "bank" area associated with Lisianski Island.*

## Laysan Island

Approximately 1300 km WNW from Kaua'i and 900 kilometers ESE from Midway lies Laysan Island at longitude 171 degrees 45 minutes W and latitude 25 degrees 46 minutes N. Laysan Island is about 3.7 sq. km in size, which makes it the largest island in the NWHI. Laysan Island is surrounded by a vast 4,530 sq. km shallow-water coral reef ecosystem.

Laysan Island and its surrounding shallow-water coral reefs were formed approximately 17 million years ago when the underlying shield volcano and a portion of the associated coral reef bank were lifted above sea level.

Of all the Northwestern Hawaiian Islands, Laysan and Midway are the islands that have seen the most extensive alterations to their ecosystems as a result of human habitation. The ecology of Laysan has been extensively modified by humans. Although it was first discovered in 1828, it was not until the 1890s that Laysan began to suffer. Guano mining, the introduction of rabbits, and the harvesting of bird feathers and wings devastated the island and its fauna. By 1923, Laysan was essentially a wasteland.

After 1923, conditions on Laysan slowly improved. Laysan finches and ducks survived the destruction. Native plants slowly began to return. Visitors introduced other plants. In 1961, it is believed that, while establishing an astronomical monument, the military introduced sandbur, an invasive plant from Central America, to Laysan. By the end of the 1980s, sandbur had expanded considerably, but it does not provide a suitable habitat for the thousands of burrowing seabirds that nest on Laysan. Starting in 1991, the FWS began a sandbur eradication effort that successfully removed the weed from the island. However, constant vigilance is required, and every visitor is subject to a quarantine procedure. Before stepping foot on Laysan, every visitor must put on brand new clothes that have been held in a freezer for at least 48 hours. Special quarantine procedures exist for every island in the NWHI.

A hypersaline lake (0.7 sq. km) lies in the middle of Laysan Island. The island is home to an estimated 2 million birds, including thousands of boobies, frigatebirds, terns, shearwaters, and Laysan Ducks.

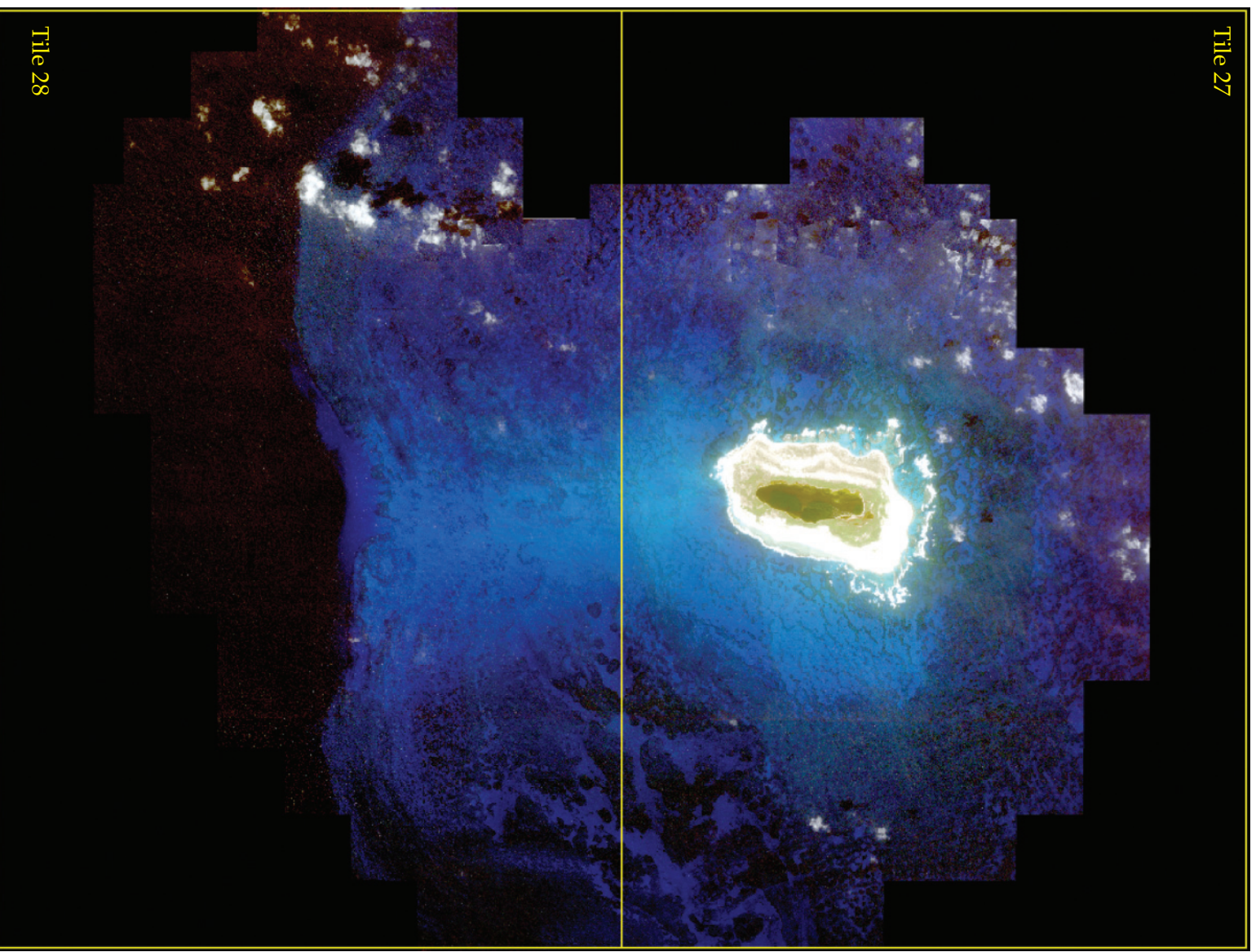
Due to its size, two map tiles are required to depict the 1:40,000 scale detailed benthic habitats of Laysan Island. One 1:80,000 scale map is included to depict the estimated bathymetry and aggregated cover derived from IKONOS. Two 1:80,000 scale map tiles are included to depict the extensive shallow-water bank area around Laysan Island. A one-square-kilometer grid is included with all maps of Laysan Island.

The area in square kilometers of aggregated benthic habitat cover types found at Laysan Island, Northwestern Hawaiian Islands.

Hardbottom with >10% live coral	5.8
Hardbottom with >10% crustose coralline algae	0.5
Hardbottom (uncolonized)	2.9
Hardbottom with >10% macroalgae	0.1
Hardbottom with indeterminate cover	81.7
Unconsolidated with 10% or less macroalgae or seagrass	36.2
Unconsolidated with >10% macroalgae or seagrass	-
Total Habitat Area Classified	127.2

The area in square kilometers of benthic habitats found at Laysan Island, Northwestern Hawaiian Islands.

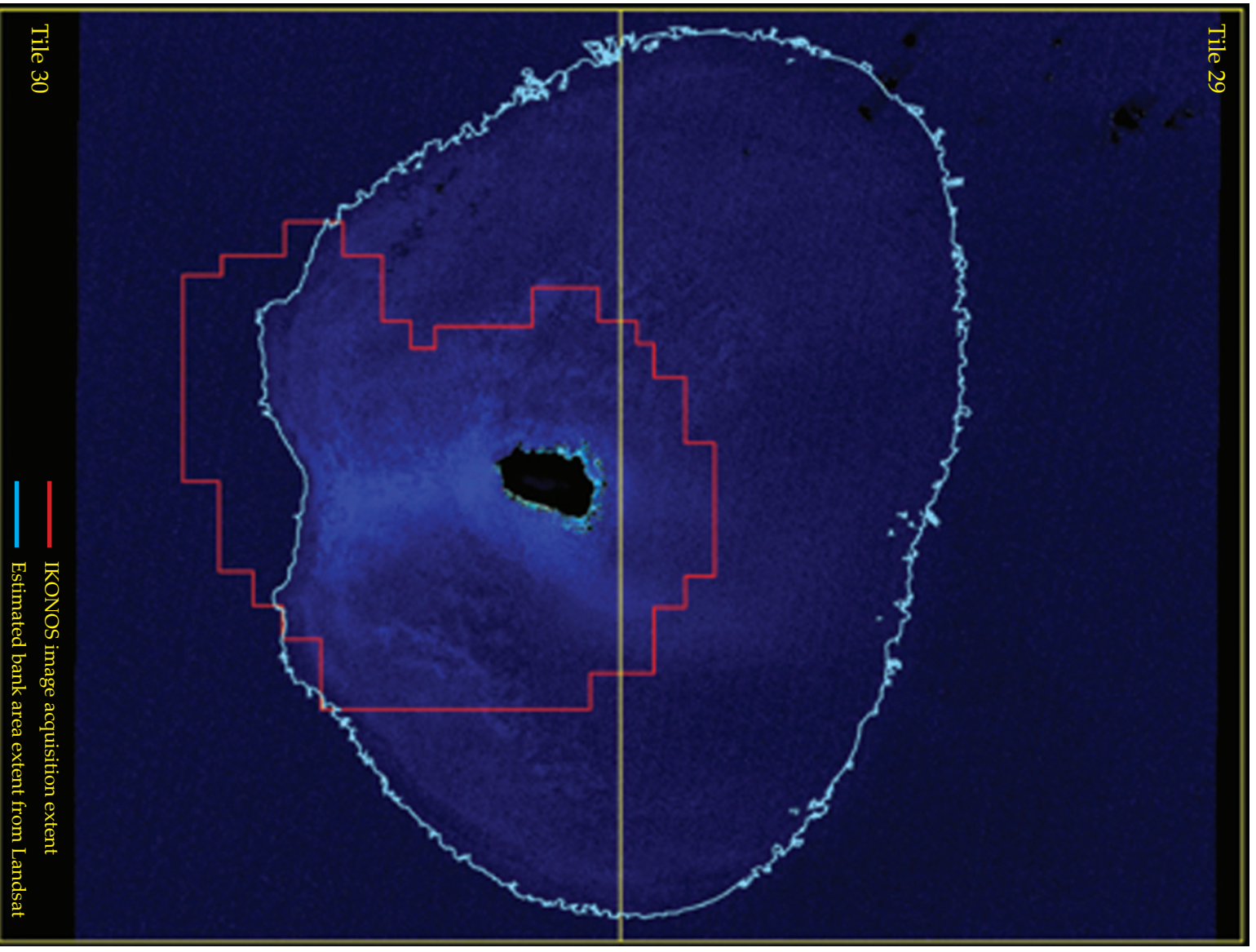
Unconsolidated (1000, refer to classification scheme for habitat description)	-
Sand (1100)	35.0
Sand with macroalgae (1120)	-
Sand with patchy (10-50% cover) macroalgae (1121)	-
Dense (>50%) macroalgae on sand (1122)	-
Unconsolidated Rubble (1300)	1.1
Unconsolidated Rubble with sparse (10-50% cover) algae (1301)	-
Unconsolidated Rubble with dense (>50% cover) algae (1302)	-
Sand and Rubble (1400)	-
Groove (1500)	-
Hardbottom (2000)	81.7
Hardbottom with sparse (10-50% cover) algae (2001)	-
Hardbottom with live coral (>10% cover) (2010)	-
Hardbottom, uncolonized (2020)	-
Hardbottom with crustose coralline algae (<10% cover) (2030)	0.5
Linear Reef (2100)	-
Linear Reef with live coral (>10% cover) (2110)	-
Linear Reef, uncolonized (2120)	-
Linear Reef, uncolonized with sparse (10-50% cover) algae (2121)	-
Linear Reef with crustose coralline algae (<10% cover) (2130)	-
Aggregated Coral Heads with live coral (>10% cover) (2210)	-
Spur and Groove (2300)	-
Patch Reef (2400)	-
Patch Reef with live coral (>10% cover) (2410)	0.4
Patch Reef, uncolonized (2420)	-
Patch Reef, uncolonized with sparse (10-50% cover) algae (2421)	-
Patch Reef with crustose coralline algae (>10% cover) (2430)	-
Aggregated Patch Reef (2500)	-
Aggregated Patch Reef with live coral (>10% cover) (2510)	-
Scattered Coral/Rock in Sand with live coral (>10% cover) (2610)	-
Pavement (2700)	-
Pavement with sparse (10-50% cover) algae (2701)	0.1
Pavement with dense (>50% cover) algae (2702)	<0.1
Pavement with live coral (>10% cover) (2710)	5.4
Pavement with live coral (<10% cover) and dense (>50% cover) algae (2712)	-
Pavement, uncolonized (2720)	2.9
Pavement, uncolonized with dense (>50% cover) algae (2722)	-
Pavement with crustose coralline algae (<10% cover) (2730)	-
Pavement with sand channels (2800)	-
Pavement with sand channels and live coral (>10% cover) (2810)	-
Pavement with sand channels, uncolonized (2820)	-
Volcanic Rock (2900)	-
Volcanic Rock with dense (>50% cover) algae (2902)	-
Volcanic Rock with live coral (>10% cover) (2910)	-
Volcanic Rock, uncolonized (2920)	-
Hypersaline Lake (3000)	0.7
Deep water (3010)	33.0
Reef crest (3020)	-
Dredged channel (3030)	-
Land (3100)	3.5
Cloud, Shadow, Surf, and No image data (3210, 3220, 3230, and 4000)	7.6
Unclassified (3300)	0.2
Total Habitat Area Classified	127.2
TOTAL Area in IKONOS image	172.2



Tile 27

Tile 28

Index of 1:40,000 tiles



Tile 29

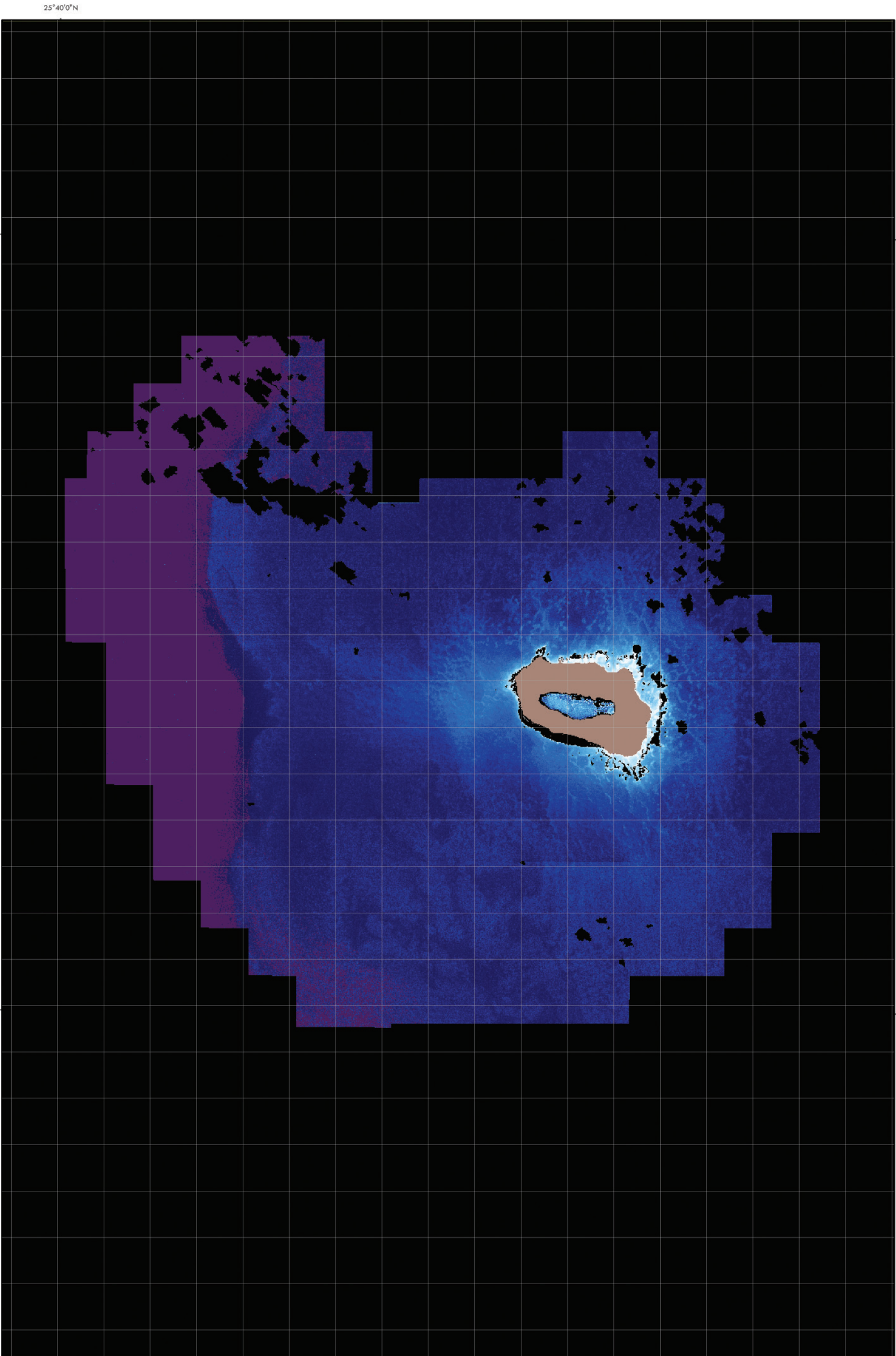
Tile 30

— IKONOS image acquisition extent  
— Estimated bank area extent from Landsat

Index of 1:80,000 tiles (bank maps only)

Index maps indicating the locations of map tiles for the 1:40,000 scale detailed habitat maps and the 1:80,000 scale bank of Laysan Island, Northwestern Hawaiian Islands.

*A 1:80,000 scale estimated bathymetry of Laysan Island, Northwestern Hawaiian Islands.*



25°40'0"N

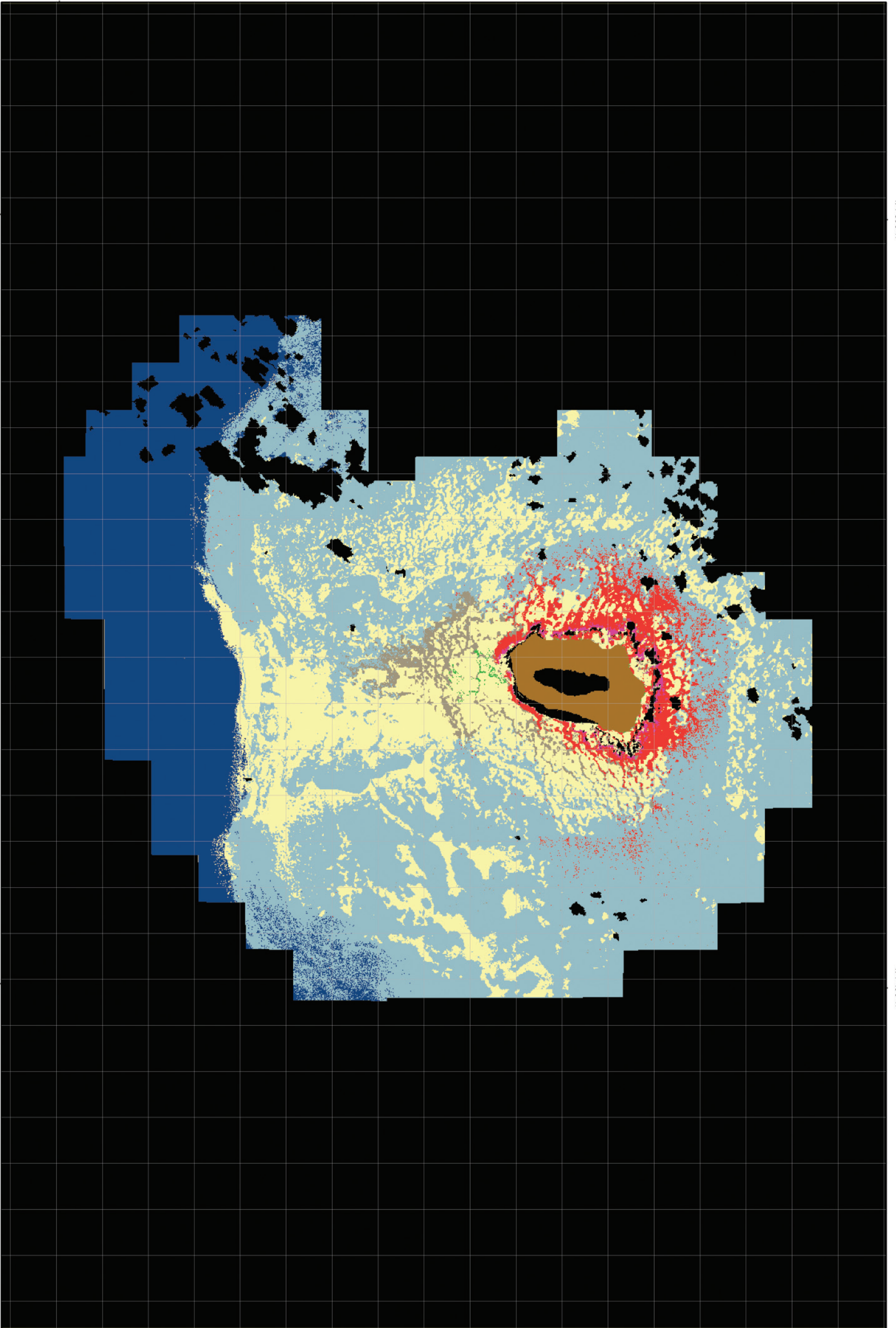
171°50'0"W

171°50'0"W

*A 1:80,000 scale aggregated cover map of Laysan Island, Northwestern Hawaiian Islands.*

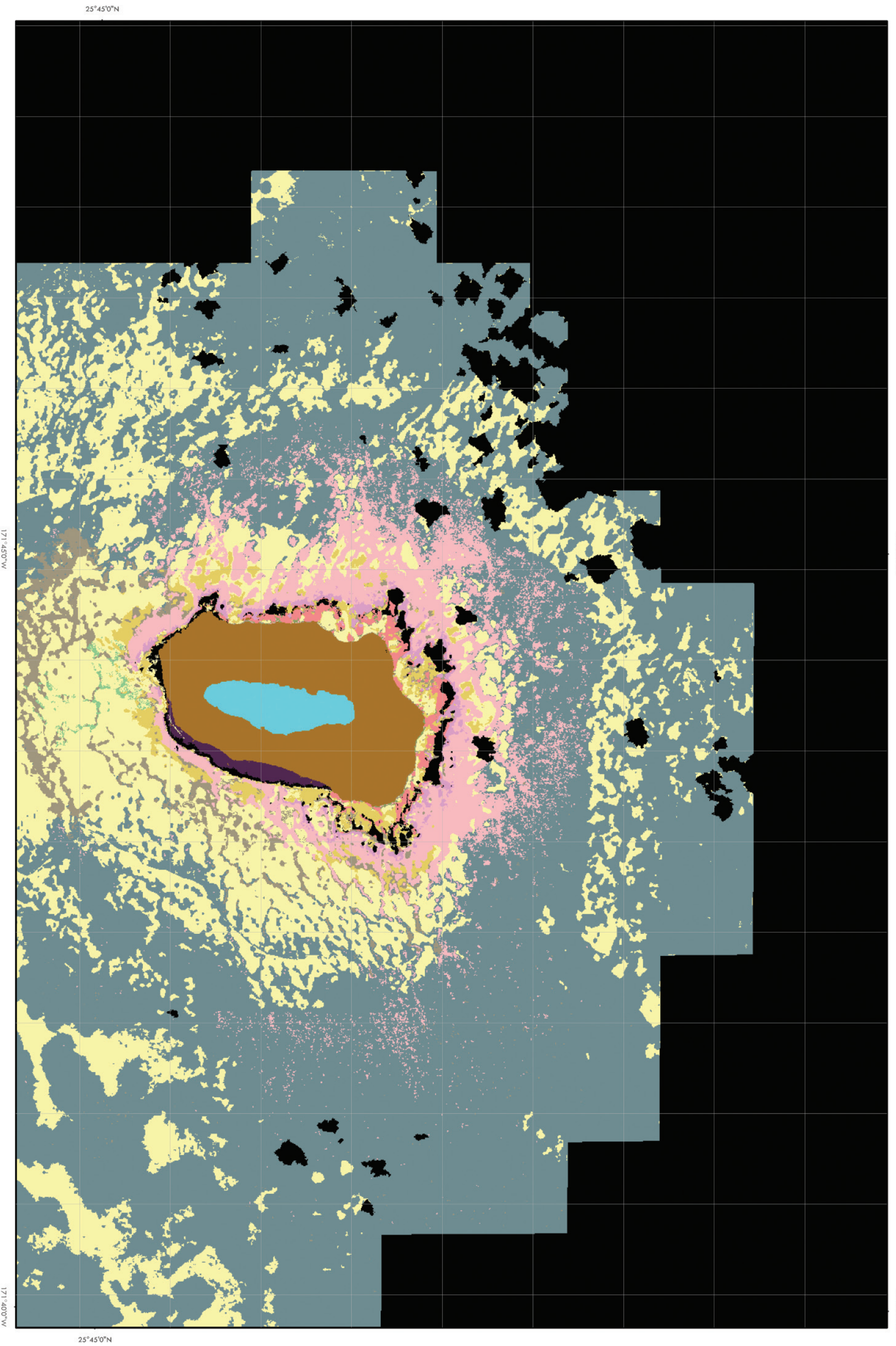
171°40'0"W

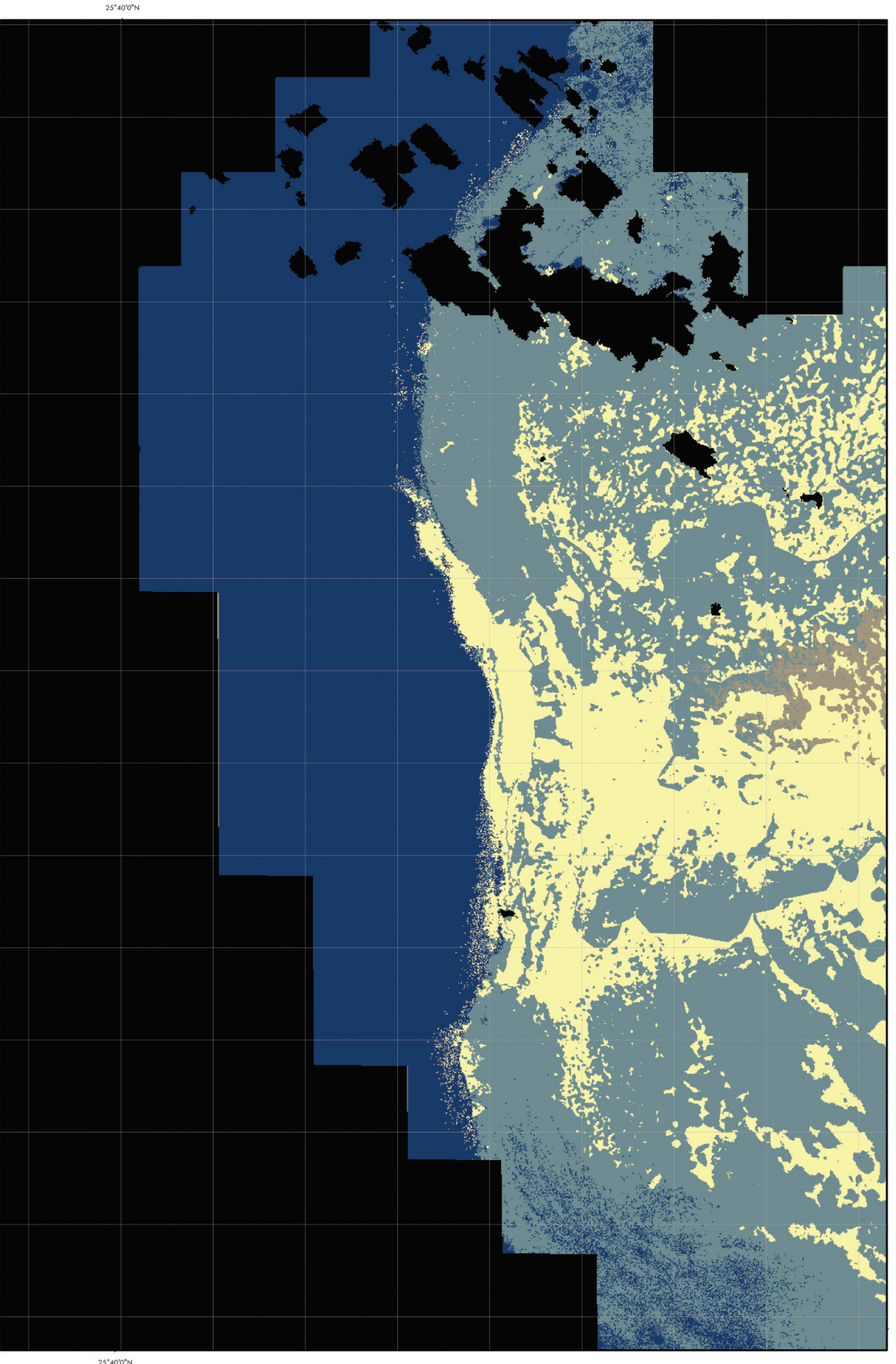
171°40'0"W



25°40'0"N

*Tile 27. A 1:40,000 scale detailed benthic habitat map of the northwest portion of Laysan Island, Northwestern Hawaiian Islands.*





25°40'0"N

171°45'0"W

171°40'0"W

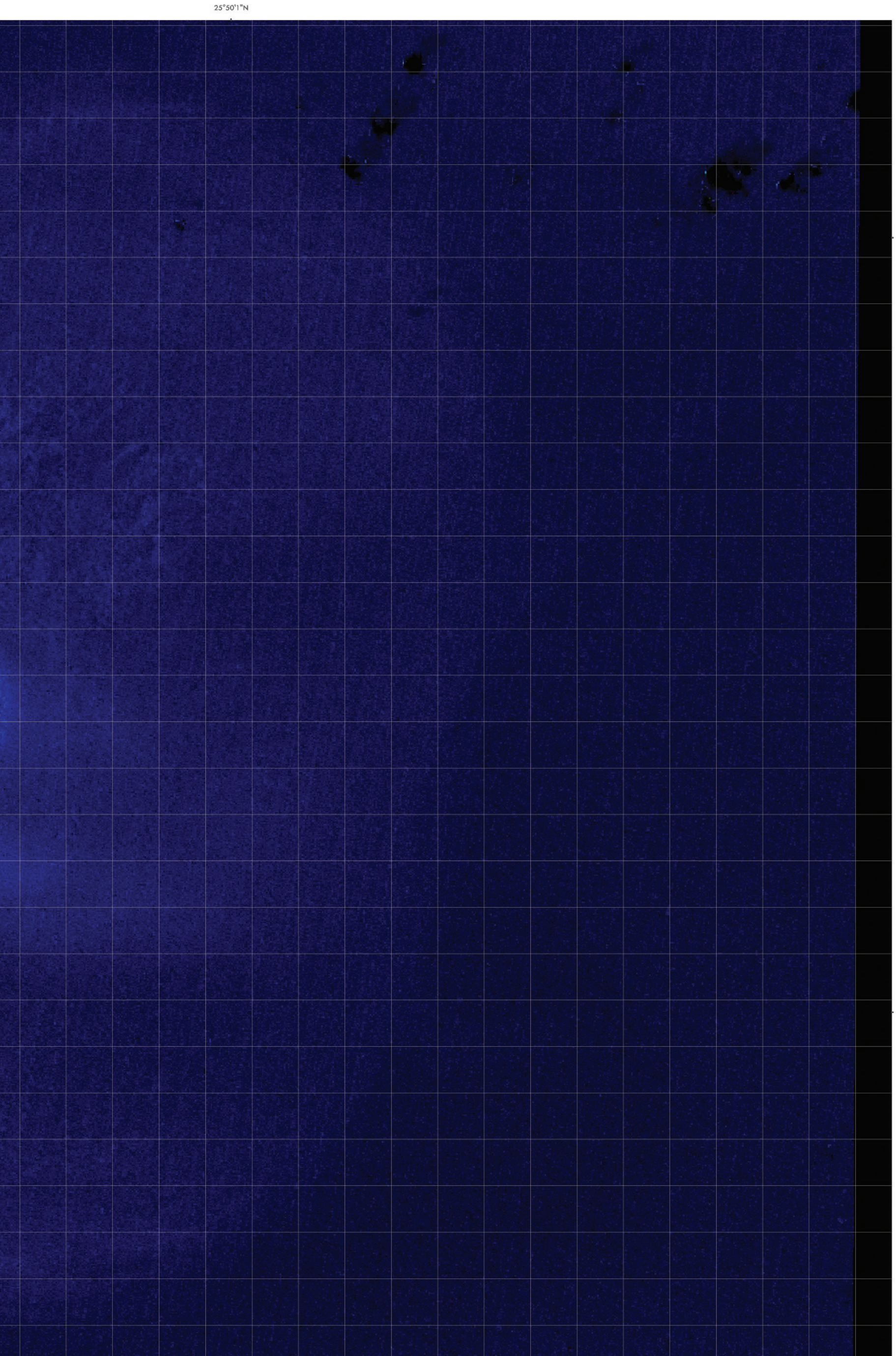
25°40'0"N

171°45'0"W

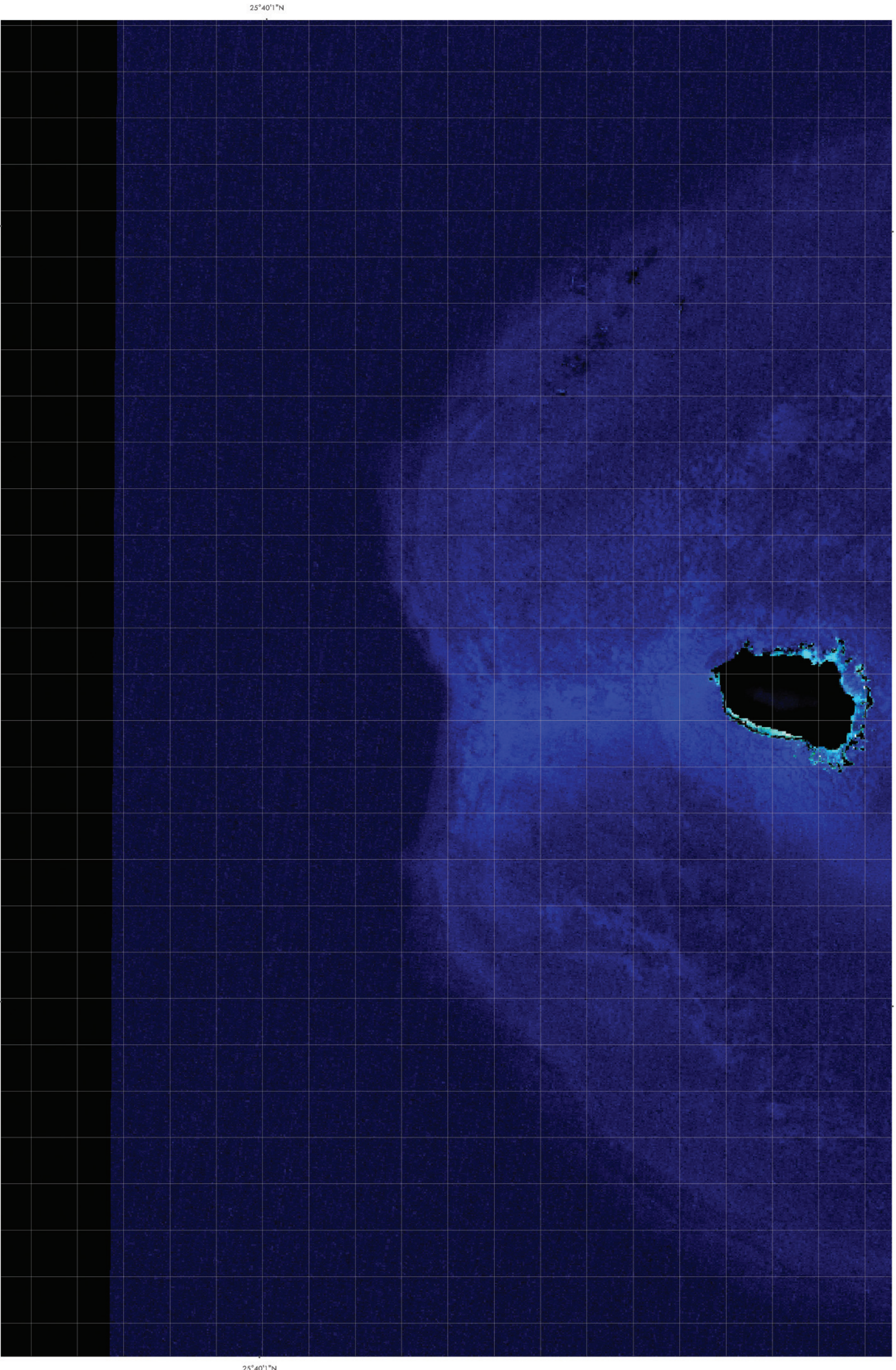
171°40'0"W

*Title 28. A 1:40,000 scale detailed benthic habitat map of the northeast portion of Laysan Island, Northwestern Hawaiian Islands.*

*Title 29. A 1:80,000 scale map of the northern "bank" area associated with Laysan Island, Northwestern Hawaiian Islands.*







*Title 30. A 1:80,000 scale map of the southern "bank" area associated with Laysan Island, Northwestern Hawaiian Islands.*