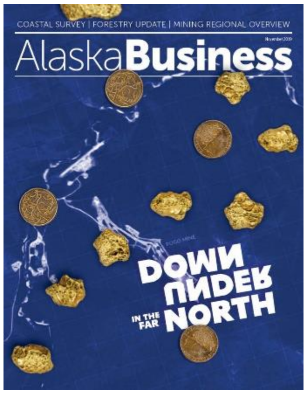

Imaging Alaska Coast to Coast

From oil spill response to climate change, Alaska ShoreZone provides essential insights

Alaska Business Monthly, November 2019

A single high-resolution, attribute-rich dataset created from Alaska's coastline has become much bigger than its original purpose to support oil spill response efforts. In addition to helping with such environmental crises, Alaska ShoreZone data is also assisting with fisheries research, providing reconnaissance for recreation, establishing a base point for climate change, inspiring artists, and even helping calibrate drone software for NASA.

The estimated shoreline of the Last Frontier measures more than 46,600 miles, far more than the entire combined coastline of the Lower 48. To map and classify such an enormous, remote swath of land seems nearly impossible, yet the value in the geomorphic and biological data that can be derived from doing so has driven scientists, GIS specialists, web specialists, nonprofit organizations, and government agencies to work together to create the Alaska ShoreZone project.

"The imagery can be extremely useful for anybody who may need to make decisions about accessing shorelines—for grounded vessels, oil spill response, and search-and-rescue operations," explains Susan Saupe, the Cook Inlet Regional Citizens Advisory Council director of science and research. "If a ship goes aground and you have its location, before responders even head out, they can see whether a helicopter could land nearby, what the substrate is like, whether a landing craft could get into shore, and whether there are sensitive shorelines nearby."

ShoreZone photos and beach habitat descriptions have been some of the first pieces of information used by incident commanders during several high profile events—including when the drilling rig Kulluk went aground near Kodiak. New uses for ShoreZone data have continued to crop up since the project was first launched in Alaska in 2001, says Saupe.

"Since then we've had other ships run aground, had other events that ShoreZone has helped with, many we never imagined it could help with," explains NOAA Fisheries Research Biologist Mandy Lindeberg, who has been part of the project since its early beginnings in Alaska.

Mapping Alaska's Coast

When Saupe first approached Dr. John Harper, founder of Coastal and Ocean Resources Inc., about bringing the ShoreZone project up from British Columbia to Alaska, he wanted to know what her long-term goals were.

"Knowing that we had more coastline than the rest of the country combined, it was a half-joke when I told him I wanted to see all of Alaska completed," Saupe says.

About eighteen years later, nearly 94 percent has been imaged, mapped, and is available online through an interactive website to the public.

Saupe's interest in the ShoreZone system stemmed from how it could be used by Cook Inlet Regional Citizens Advisory Council to tackle some of the tasks outlined by the Oil Pollution Act of 1990, which was put in place following the Exxon Valdez oil spill. Most notably was the program's ability to create high-quality shoreline information to better understand Cook Inlet's environments and its most sensitive habitats.

"We found that existing information was sparse, of low quality, and was often collected at higher tides, missing much of the intertidal habitat… areas at risk from any oil spill that reaches the coast," Saupe says. "We found that ShoreZone survey and mapping methods would be relatively low cost for how much area can be covered in a survey—and ShoreZone produces so much information about the shoreline: landforms, substrates, coastal processes, and biota."

Shooting from helicopters, researchers collect oblique aerial images of the coastline at low tide. The images are then used to map and classify the geomorphic and biological features.

The goal is to capture images of the entire area where the land meets the sea—from terrestrial, through the intertidal, and into the subtidal environment, Saupe says.

"It's important to include those terrestrial features as they provide information about the beach below and whether it's an eroding or depositional environment, whether there is riparian overhang" Saupe says. "It was also key to include the entire intertidal habitat, including habitat exposed at minus tides, so that we capture the entire shoreline's habitat."

Mapping biota from images taken from a helicopter can include recognizing species, as eelgrass, bull kelp, and even blue mussels can be identified from the imagery.

"But for the most part, the biota maps are what we call biobands and their assemblages of species… different assemblages occur at different tide heights… so they're mapped as these color bands," Saupe explains.

Such tidal windows to capture the details exposed during negative tides only exist for about five to seven days centered around new and full moons each month. Weather conditions and seasons further limit when researchers can collect data.

Funding the Surveying

"Ultimately, what drives how much shoreline is included is the funding available and logistics. We can only survey a fixed amount depending on the speed of the helicopter and the length of time we have to survey when the tide is below mean lower low water," Saupe says. "In Alaska, where much of the coastline is incredibly remote, logistics are key to minimize the amount of time spent flying back to a refueling location and to maximize the amount of shoreline surveyed before the tide comes back in."

As imaging technology rapidly advanced, so did the quality of the data being collected through ShoreZone Alaska.

“Our first surveys in Alaska still collected imagery with slide film and videotapes. At that time, digital cameras were too slow to focus and record the data to be of much use. But, by 2003, we transitioned to digital imagery,” Saupe says. “Each year it seems that the capabilities get better, and you can see that in the online imagery.”

Though about 6 percent of the Last Frontier’s shoreline remains unmapped, some areas are already being revisited. In 2009, Cook Inlet, which was the first area surveyed via the project, was reflown. Cook Inlet Regional Citizens Advisory Council was able to secure the necessary federal funding to re-image that section of shoreline because the quality of equipment and resulting data are significantly better.

The importance of re-imaging Cook Inlet came down to it being a relatively high-risk area for oil spills because of oil tanker and cruise ship traffic, as well as the oil production platforms in the Inlet. And, at the time, the region had the oldest and lowest resolution imagery, according to Saupe.

Saupe says that some questioned the choice to refly Cook Inlet when so much of the state’s shoreline had yet to be mapped. However, it came down to funding. The Alaska ShoreZone project has been funded through the years by nonprofit organizations and government agencies that are aware of the direct benefits of mapping specific sections of shoreline. So, priorities for imaging and mapping with Alaska often come down to who has funding.

So far, more than $11 million has been invested by more than forty ShoreZone partners, says Cindy Hartmann Moore, who coordinates the ShoreZone partnership and manages the NOAA Fisheries ShoreZone contract.

“Some of the contributions included the partner’s in-kind contributions and some of the contributions reflected just the amount spent for the contract imaging or mapping work,” Hartmann Moore says.

These contributions include everything from supplying bunkhouse space for researchers to direct funding for imaging surveys, mapping, and special projects.

The regions yet to be mapped—central and western Aleutians, Forrester Island, and the Bering Sea Islands—are some of the most remote and logistically intense areas to access. The additional obstacles presented in these regions have made it more difficult to find funding for imaging and mapping them.

“The rough estimate of the costs to complete imaging and mapping of the remaining ShoreZone gap areas in Alaska is approximately $1.2 million,” Hartmann Moore says. “This cost is high due to the expense of surveying this remote location.”

Despite the current fiscal climate in Alaska, Saupe is hopeful that the multi-agency steering committee that oversees ShoreZone Alaska will be able to reach new partners to help fill in those final missing sections of shoreline.

Among those potential new partners are shippers and insurance agencies that could benefit from having good habitat data and imagery for crisis management planning purposes, Saupe says.

"With the continual increase in traffic along great circle routes through the Aleutians, the remoteness of these areas highlights the value of having access to high-resolution imagery and an understanding of where the most sensitive shoreline habitats are when you are so limited in getting out to see them in person," Saupe says.

ShoreZone Alaska's success so far comes from how the data has been served up to the public, revealing remote sections of shoreline to specialists, as well as general users.

"Early on, we worked with our ShoreZone contractors at Coastal and Ocean Resources, Inc. to develop a tool to serve the imagery online to provide visual access to Alaska's remote shorelines," Saupe says. "I believe that the intense interest in the Alaska ShoreZone program was largely due to the online tool providing access to the coastal habitat data and allowing users to virtually 'fly' along the coast."

Storing and Sharing Data

Though that 2001 pilot project and the associated website was a success, according to Saupe, the team didn't realize how data-intensive, time consuming, and expensive it would be to save and share the data.

"We soon out-grew the capabilities of that first website and it became clear to us that aggregating the data and imagery from surveys sponsored by multiple organizations would require a more focused and dedicated effort," Saupe says. "Luckily, NOAA stepped up to that task and, through their efforts, dozens of funding partners have shared their data and imagery to the overall Alaska ShoreZone program to be served online together."

In 2004, NOAA's National Marine Fisheries Service (NMFS), Alaska Region funded imaging surveying and mapping, as well as hosted the data and presented it online.

"NMFS [Alaska Region] staff were instrumental in pulling together partner contributions needed for imaging surveys and mapping. This included funding from NMFS and from other organizations," Hartmann Moore says.

Because the online world changes so rapidly, NOAA Fisheries regularly upgrades the platforms for ShoreZone, as well as adds new information.

"New imagery, video mapping information—those all have to be updated and our agency has taken the lead on this and serving it up," explains Lindeberg, who has flown and imaged much of Alaska's coastline as a lead biologist.

One of the most recent updates is adding the capability to develop digital elevation models for the shoreline, where 2D photographs can be merged into 3D images of the coast.

“In the future, these 3D images of the coastline might be a key component of ShoreZone information available online,” says Saupe.

Those capabilities far surpass those of the early website.

“When we first served the video imagery online, we had to serve one-second captures of the video. So, you’d see a somewhat ‘jerky’ video as you flew along the coast,” Saupe says. “Now, the servers and bandwidths available allow the full, higher-resolution video to be viewed by users. In addition to the NOAA website, we’ve also been able to integrate ShoreZone habitat data and imagery into other online tools, including data portals at the Alaska Ocean Observing System, or AOOS, that allow us to layer them with selections from hundreds of other data layers.”

Lindeberg, who uses ShoreZone for her research on coastal ecology and essential fish habitat, explains that NOAA is always looking for additional tools or features that users might want.

“We’re open to adding layers of data and pushing the technology,” Lindeberg says. “The Fisheries Alaska regional office in Juneau has done a wonderful job of supporting and keeping up the database and adding these layers—it couldn’t happen without those folks.”

One of the least expected ways that the imagery has been used is for artistic purposes. At the 2012 and 2014 Alaska Marine Science Symposium, ShoreZone images taken by Lindeberg and Mary Morris were used to create exhibits: “Coastal Impressions: A Photographic Journey along Alaska’s Gulf Coast” and “Arctic Impressions: A Photographic Journey along Alaska’s Arctic Coast,” respectively.

The impact of these images inspired several artists to reach out to ShoreZone in hopes of collaborating. From a selection of sixteen photographs, the artists were challenged to respond in an abstract, impressionistic, or realistic manner. Their work resulted in the 2016 exhibit: “Coastal and Arctic Impressions: Artists Paint Alaska’s ‘ShoreZone.’”

Both Lindeberg and Saupe say that they hope to see more artists and museums collaborate with ShoreZone to share the stunning landscape of the Last Frontier captured by the project.

Tracking Climate Change

Though art derived from ShoreZone images could play an important role in communicating the project’s work to a larger audience, enticing users to “fly” around on the interactive website, perhaps the most important role ShoreZone will play in the future is tied to climate change.

“The ShoreZone data set is a goldmine of information, as it’s a baseline from before some of these big changing events happened,” Lindeberg explains.

Coastal erosion, warming conditions, and marine heatwaves are changing Alaska's coastlines, forcing some communities, such as Newtok, to relocate.

"The ShoreZone imagery is really valuable because we can go back and look at it and say, 'Well, what did this beach look like ten years ago? What did it look like before we had these events?'" Lindeberg says.

With more than 94 percent of the baseline established, Lindeberg says it's easier for scientists to cost-effectively target specific areas to compare images.

"We don't have to go back and refly all of Alaska. We can go to these points of interest and assess those and do comparisons," Lindeberg says.

In British Columbia, scientists are already going back to earlier sets of data they gathered through ShoreZone to look at kelp forests and how their footprint has changed over time.

"They are seeing their distribution shift north or simply shrinking with warming water conditions," Lindeberg says.

Expanding Vision

While kelp forest footprints are changing, ShoreZone is working hard to expand its footprint outside of Alaska. Efforts are underway to upgrade older databases from British Columbia and Washington State, and, more recently, Oregon's coastline was mapped.

An exposed rocky shoreline with high rock cliffs and sea foam created by the dramatic high energy environment in the northern Gulf of Alaska.

“Many partners would also like to see ShoreZone imagery and mapping data for the coast of California,” Hartmann Moore says. “It would be great to have ShoreZone imagery and corresponding mapping data from where Alaska meets Canada in the Beaufort Sea to where California meets Mexico in the Pacific Ocean. ShoreZone could be done across the globe.”

Moving forward, ShoreZone is working on establishing new partnerships and identifying additional funding avenues to fill in the remaining gaps in remote areas of Alaska, Lindeberg says.

“We need to think creatively about how we’ll get funding for that work—maybe collaborating with industry to help,” Lindeberg says. “There are limited resources, limited things you can actually do in some of these remote locations without partnering. We’re definitely looking for partners and ways to finish off mapping Alaska.” AB

Back to Issue