Bay watch
Penn State civil engineers help biologists unlock Glacier Bay’s mysteries

It was a chance meeting on kayaks in 2004 that spawned David Hill’s research in Glacier Bay, Alaska.

“I overheard some kayakers using some obscure engineering phrases, which caught my ear, so I interrupted and introduced myself,” recalls Hill, an associate professor of civil engineering. “It turns out they were U.S. Geological Survey biologists.”

Hill explains that the Glacier National Park and Preserve is a rather unique place that’s drawn the curiosity of numerous scientists and researchers.

“It possesses one of the highest densities of tidewater glaciers on the planet,” he explains. “It’s also been a place of remarkable change. The glaciers have retreated more than 50 miles in 200 years. As a result, the terrestrial and marine ecosystems are changing rapidly in response. Interestingly, the amount of water released by this glacier retreat has resulted in a one-meter sea level rise around the globe.”

The USGS biologists Hill met were trying to understand why they found certain species in some areas of the bay, but not in others.

The biologists suspected that it had something to do with the tidal flows in and out of the bay, but they didn’t have a physical scientist on hand to help prove it.

Hill, an expert in coastal engineering and tidal hydrodynamics, arranged to take his sabbatical to help study the issue. The work eventually led to a grant with the National Park Service, which oversees Glacier Bay National Park.

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“With our modeling work, we’ve been able to strongly correlate the distribution of crabs to tidal speed,” Hill states. “We’ve been able to show that high tidal speed is essentially preventing crabs from being found in that area—the high velocity just scour away the substrate.”

For the first time, scientists understood where the bay’s water came from and how different areas of the bay interact.

The model also gave biologists a much better idea of how animals interacted with the aquatic environment.

Hill continues, “When we start looking at and correlating the populations of various species with physical quantities, like tidal speed or tidal elevation, you can explore some of those linkages between the physical and the biological.”

For the Glacier Bay scientists, Hill and Ciavola’s model opens up some new avenues of exploration.

“They’re all very curious,” he says. “They all seem thirsty for this additional information.”

He added that the computational tools and data sets were developed in an open-source way and are available to any interested researcher through the project’s website.

—Curtis Chan

Dr. Hill can be reached at dfh4@psu.edu or at 814-863-7235. More on the work can be found online at www.ing.psu.edu/ciavola/ glba/default.htm.