THE PENGUIN CHASER

Matthew Oliver, right, and a fellow researcher in Antarctica with one of their Underwater Gliders
(Photo courtesy Matthew Oliver)

MARINE SCIENTIST MATTHEW OLIVER WINS MAJOR RESEARCH AWARD, THEN LAUNCHES A SATELLITE-BASED OCEAN ECOSYSTEM STUDY IN ANTARCTICA

BY TOM NUGENT

TWO MONTHS AFTER HE WON a coveted $300,000 research grant and shook President Barack Obama's hand, oceanographer Matthew Oliver (**B.S., Ecology and Systematic Biology, '99; M.S., Biology, '01**) decided it was time to pack up and get to work.

It would be a very long commute. The 35-year-old University of Delaware assistant professor traveled more than 7,000 miles to settle down in his new office – a laboratory at a National Science Foundation weather station on Antarctica's west coast.

With his trusty laptop computer and a couple of digital cameras, the former Mustangs football standout launched a three-year oceanographic project through the NASA Biodiversity research program.

His mission: Chase a crew of hungry penguins back and forth across the Antarctic waters and analyze the ecological implications of their movements with the help of environmental data from half a dozen orbiting U.S. satellites.

For Oliver, a cutting-edge oceanographer fresh off a prestigious Presidential Early Career Award for Scientists and Engineers (PECASE) in November, that meant spending January monitoring vast quantities of NASA satellite data from the heaving ocean waters surrounding his outpost.

By attempting to relate the information contained in his satellite data stream to the movements of several electronically tagged Adelie penguins as they foraged for food, Oliver hoped to gain a better understanding of how ecosystem factors (such as ocean temperature, color and changes in currents) affect the birds' foraging habits.

"In many ways, this kind of three-dimensional study of the penguin ocean habitat has never been attempted before," Oliver said from Antarctica's Palmer Station weather outpost. "We hope to open a window on how penguin habitats are affected by changes in things like temperature and salinity.

"By comparing the data stream from the satellites with information from the 'tagged' birds and also our fleet of Underwater Gliders (motorized micro-subs equipped with sensors), we can begin to better understand how all these complex relationships are at work in the penguin ecosystem."

BREAKING NEW GROUND

Headquartered at the NSF-operated Palmer Station on Anvers Island, Oliver's five-year project is also breaking new ground in the study of how climate change can affect marine ecosystems.

"The signs of climate change's impact can be seen everywhere in West Antarctica, as glaciers retreat and the loss of massive amounts of sea ice becomes increasingly evident," Oliver said. "One of the most exciting things about this project is that it seems likely to help give us a better understanding of how climate change actually affects these Antarctic ecosystems. That could prove to be very important, scientifically, because it could help us to better prepare for the impact of climate change on all the oceans."

The work presents a challenge, but one right in line with the passion that brought Oliver to Cal Poly in the first place: marine science.

"The challenge we face in studying these seascapes is that they aren't landscapes, and so they're always moving on you," said the Southern California native, who earned an oceanography doctorate at Rutgers University in 2006 after leaving Cal Poly. "To understand what that means, imagine trying to study a forest that drifts for miles each day, so that every time you look at it, the ecological dynamics have changed completely."

That means Oliver must carefully track the vast data streams that flood continuously from the satellites and underwater gliders into his computers.

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A group of the Adelie penguins Oliver and his group studied in Antarctica. *(Photo courtesy Matthew Oliver)*

"Because of all these variables, understanding the ecological factors at work is extremely challenging. As a result, almost every time we run an analysis of the data, we find something new," he said. "I don't think there's any doubt that these kinds of three-dimensional studies are going to help change the way we think about the world's oceans."

Oliver grew up in the Los Angeles area and then headed for San Luis Obispo to pursue his passion in marine science at Cal Poly. Under the guidance of "inspiring mentors" Tom Richards and Mark Moline (A 2001 PECASE winner now studying the Antarctic penguins with Oliver – see sidebar) Oliver said he was "hugely motivated" by a Cal Poly research voyage he took across the Pacific.

"Dr. Richards got me hooked up with the 'Golden Bear' training ship (now part of the Cal Poly at Sea program). We sailed from San Francisco to Hawaii and Australia and Japan," Oliver said. "I remember approaching Alaska on the way home, and our ship was getting crunched by these monster waves. I looked at them and thought: 'Man, I love this stuff! This is where I want to spend my career.'"

After nailing down his doctorate, Oliver launched a series of studies on ocean currents along the East Coast. Last fall, his highly regarded research landed him a visit to the White House – where Barack Obama shook his hand and urged him to use the PECASE award (the highest honor bestowed by the U.S. government on young professionals in the early stages of their independent research careers) to help improve the U.S. fishing industry, among other scientific goals. ☐

COLLABORATION

CAL POLY PROFESSOR MARK MOLINE ALSO STUDIES ANTARCTIC PENGUINS

MATTHEW OLIVER'S ANTARCTICA RESEARCH brings him back in direct contact with Cal Poly and in collaboration with one of his mentors, Cal Poly Biological Sciences Professor Mark Moline.

Moline received a two-year, $290,000 National Science Foundation grant in 2010 to research the foraging environment of Adelie penguins in the Antarctic Peninsula.

"We are collaborating, though with different agencies," Oliver said of his former professor. "My project is through NASA Biodiversity, while Mark's is through the NSF Office of Polar Programs. We joined our resources to enhance both projects."

Moline's work, like Oliver's, is addressing the impact of global warming and how it is affecting the penguins' foraging environment.

"The species is declining because of the increasing water temperature, which has warmed up by one to two degrees in the last 15 years," Moline said. "As a result, the ice is melting and their food sources are changing."

Moline and fellow researchers traveled to Antarctica in January with an Autonomous Underwater Vehicle (AUV) they used to conduct daily surveys of the penguins' foraging locations. The penguins were tagged, allowing the AUV to track them via satellite and transmit data to create a 3-D image of their foraging environment.

What's remarkable about the team's particular model of AUV – about 2 meters in length – is that it matches the penguins' abilities for diving and duration. "This research will truly demonstrate the feasibility of robotic vehicles in a cold water environment, with water temperatures averaging 34 degrees," Moline said.

The NSF grant was one of two Moline received last year. The other, a four-year, $500,000 grant, will support a collaborative effort with UC Santa Barbara to examine wind and water flows off California's Central Coast. That project also will use robotic submarines developed at Cal Poly. ☐