NOAA REPORT

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NOAA Unveils New U.S. Climate Reference Network

—By John Leslie

On Jan. 13, NOAA unveiled the U.S. Climate Reference Network, a high-tech system designed to track the nation's climate and precipitation trends.

In an era where any news story related to climate or global warming grabs its share of headlines and controversy, the network aims to pinpoint the shifts in America's changing, often unpredictable, climate—and make sense of it all.

The new network will "inject [into the climate debate] as much concrete data as possible about what the climate is doing now and how it will be impacted in the future," said Tom Karl, who heads NOAA's National Climatic Data Center in Asheville, N.C. Karl, one of the world's leading experts on climate change and global warming, said part of the goal is to give decision-makers the right tools to make smarter policies.

"Anytime climate observations are uncertain, or inconsistent in their quality, it's difficult to gauge what's really happening. The climate reference network will help eliminate doubts," Karl said.

There are 46 monitoring stations in the network currently operating in 28 states, logging real-time measurements of surface temperature, precipitation, wind speed and solar radiation. NOAA's Geostationary Operational Environmental

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NOAA Helps Coho Salmon Return to California Streams

—By Jim Milbury

On Jan. 12, state fisheries biologists, working with NOAA Fisheries, slogged through mud and rain with an ice chest full of mature coho salmon from Lagunitas Creek, a central California stream which has a self-sustaining salmon population, and released the fish into nearby Walker Creek, where the fish once thrived but are now absent.

The release of the fish, the first of three planned annual plantings, is just the latest example of federal and state efforts to use everything from elbow grease to DNA analysis to restore healthy populations of Pacific coast salmon.

Federal, state and local salmon recovery programs have helped produce recent record salmon returns of the fish from offshore waters to coastal streams of the Pacific Northwest where they spawn. But coho salmon on California's central coast have not fared as well.

One of five salmon species found in California, coho were once prevalent, drawing significant commercial and recreational fishing. Since the 1940s, the number of coho salmon decreased

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Joe Pisciotto/Calif. DFG

Biologists from the California Department of Fish and Game release coho salmon into Walker Creek, part of a program with NOAA Fisheries to re-establish coho salmon into several central California waterways where they are currently extinct.

Coho Salmon

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significantly, with only six to 15 percent remaining. By 1993, commercial and recreational fishing was closed in California to protect the species.

Their populations have been listed as threatened under the Endangered Species Act since 1996 when coho were no longer "running," or returning, to their native creeks and streams to spawn. Since then, NOAA Fisheries scientists believe the situation may have become even worse in some locations.

The life cycle of coho salmon in California lasts three years. The fish hatch in freshwater streams from egg nests called "redds" from March through May. They grow to maturity in their native stream for more than a year before beginning their migration to the ocean, where they remain for another year and a half. In November through February, these salmon return to the streams where they were born to establish redds of their own and then die.

The planting of coho salmon in Walter Creek resulted from a surprising discovery and a problem turned into an opportunity.

"A little over three years ago we realized that coho salmon were declining, particularly in the Russian River Basin," said Patrick Rutten, central California supervisor for the Protected Resources Division of NOAA Fisheries' Southwest Region. "From what we knew, there was only one stream [in the Russian River Basin] that had a marginal self-sustaining run of coho salmon."

That stream, Green Valley Creek, is a relatively small waterway with less than two miles of suitable salmon habitat. The creek struggles to maintain a run of less than a 100 salmon returning from the ocean to spawn each year.

Coho salmon are identified by the year they are born, or "year class." Since they have a three-year life cycle, a year class of 2004 would be expected to return as a run in the stream it was born in 2007. A population is considered self-sustaining if it has a run for each year of the three-year cycle.

"Historically, coho salmon were present in several tributaries to the Russian River. Currently, however, Green Valley Creek is the only tributary in the Russian River that has three year classes of coho salmon," said Dan Logan, a scientist in NOAA Fisheries' Santa Rosa office.

In 2000, a salmon recovery team composed of representatives from NOAA Fisheries, the National Park Service, the California Department of Fish and Game, water agencies, commercial fishermen, universities and local organizations designed a plan to save existing runs of salmon in the Russian River Basin and re-establish coho salmon in streams and rivers where they were once prevalent.

In 2001, the group began an annual program of capturing juvenile coho salmon in Green Valley Creek to raise in a hatchery as brood stock. The fish would be raised to adulthood and used to propagate their offspring for introduction back into the streams within the Russian River Basin.

Coho salmon from Green Valley Creek would also be bred with salmon caught in Lagunitas Creek, a nearby waterway with a relatively strong run of coho salmon, but in a watershed that empties into Tomales Bay instead of the Russian River Basin. It was thought that such a cross-breeding program would expand the gene pool of the salmon and increase their potential for surviving in the wild, an idea soon found to be potentially

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Climate Network

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Satellites relay the data from these ground-based stations to NCDC, which posts the observations online.

The new climate network marks the first time that surface and satellite measurements have been integrated, enabling more verification of the observations.

The plan is to deploy more stations in other states at a rate of 27 each year. By 2006, when it is fully operational, the network will be a sprawling link of 100 stations.

Each station costs about $50,000, from surveying the ideal site to loading the monitoring instruments.

During the early 1970s, the nation's climate-monitoring network consisted of only 23 stations around the country. Over time, these stations, along with the quality of the data they captured, slowly degraded, Karl said, because of a lack of budget support.

"We also didn't have the necessary number of people going to the stations to check for data and maintaining the stations." At best, Karl said, the stations just produced benchmarks of data, "not the bigger, clearer picture we see now, and will see."

During the 1980s, the Department of Energy chipped in to help fund a climate database, which later became the U.S. Historical Climate Network. While the quality of the data improved, Karl said government climate observers ran into other problems.

"Most of these stations were based at universities, which replaced them with parking lots," Karl said.

So in the 1990s, a determined Karl set out to build a better climate-monitoring system that would have its own budget stream

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Bev Schuetz/NOAA

Thomas Beaver.

Thomas Beaver Is the Team Member of the Month

—By Dane Konop

To hear his supervisor and NOAA clients tell it, February Team Member of the Month Thomas Beaver, a facilities project manager for QSS Group, Inc., at the Central Administrative Support Center in Kansas City, Mo., seems to be one of those people who is in exactly the right job. But because of a facilities funding gap three years ago, Beaver almost found himself out of a job for the first time in over thirty years, including eight at NOAA.

In June of 1970, fresh out of Grove City (Pa.) College with a degree in mathematics, Beaver was commissioned a second lieutenant in the Air Force. After first considering cartography, Beaver spent a year studying meteorology at the University of Texas, a fateful decision that would set his path over two careers.

"I started out as a forecaster and eventually worked my way up through the ranks," Beaver said.

When Beaver retired from the Air Force as a lieutenant colonel in June 1993, he went to work for Raytheon on the National Weather Service modernization.

The National Weather Service was upgrading technology, consolidating forecast offices, building new offices and closing others.

"We were in charge of putting together the information to support office closures," Beaver recalled. "We had to prove to the Secretary of Commerce that there would be no degradation of [weather] services if we closed these offices."

By late 2000, Beaver and his group in Silver Spring were shepherding the last of the closings.

Coincidentally, Beaver's oldest daughter and his son's wife both were expecting babies, his first grandchildren. With his daughter living in Kansas City and his son in Denver, Beaver said his wife told him, "We're not being long-distance grandparents. Find a way to get closer to them."

That he did.

We had this position open in Kansas City," Beaver said, "and I started putting in my bids for it."

The job involved managing facilities contracts in Alaska for the Central Administrative Support Center.

In January 2001, Beaver interviewed with Weather Service and center officials. "They thought they needed an engineer. They thought I was overqualified," Beaver said. "I'm a meteorologist by trade. I'm not an engineer. But I understand the building process."

He told them what he could bring to the table—oversee the building processes and put together time schedules and statements of work to make sure the work was getting done. Although Beaver was told he was not exactly what they were looking, they were impressed by his resume. He got the job and moved to Kansas City in March.

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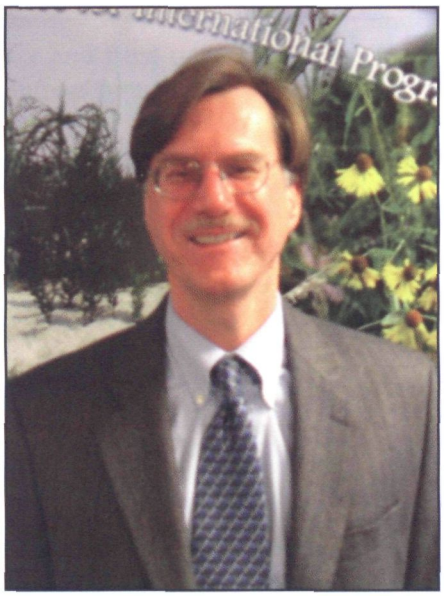

Sloane Strother/NOAA

Rick Schwabacher.

Rick Schwabacher Is the Employee of the Month

—By Glenda Powell

Employee of the Month Rick Schwabacher said, "I've always had a special longing to work for NOAA."

Little did Schwabacher know as he approached his one-year anniversary working for the organization that he wanted so much to be a part of that he would be selected as its Employee of the Month. As a policy analyst for the Communications and Education Division of the National Ocean Service's Management and Budget Office, Schwabacher's work is critical to the success of the organization.

A native of New Jersey, Schwabacher has a B.S. in geology and environmental science from the University of Michigan and a J.D. from Western New England College in Springfield, Mass., with a focus in environmental law. He said he has always had an interest in environmental initiatives and moved to Washington, D.C., to pursue those interests.

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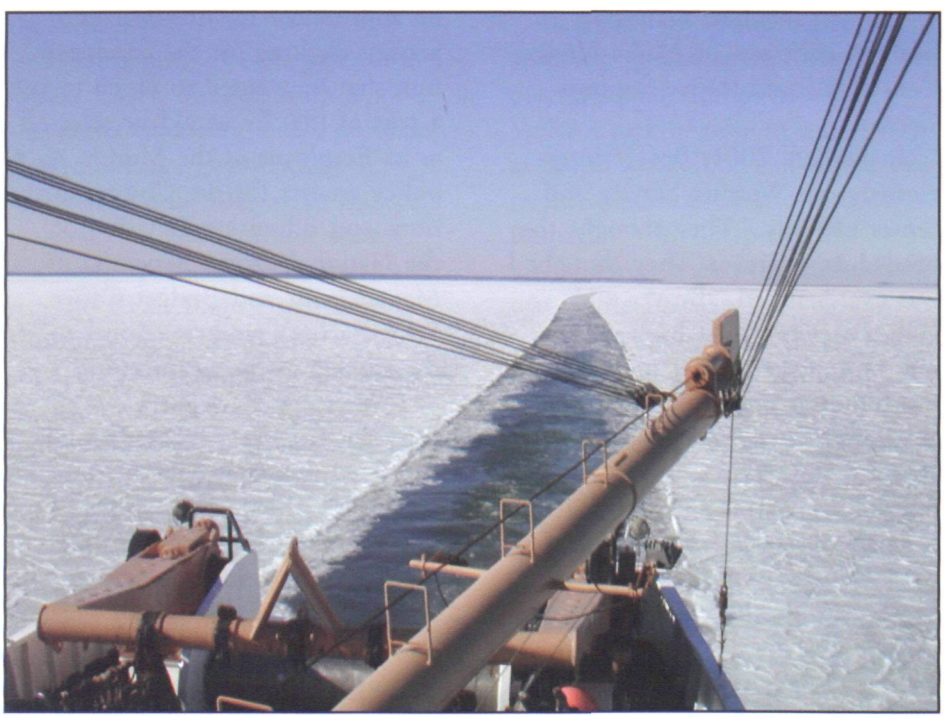
Focus On...

Ens. Erich Bohaboy/NOAA

The tug Jaguar breaks through the ice surrounding the NOAA Ship Albatross IV and its sister ship Delaware II (upper left) at the docks in Woods Hole, Mass.



Ens. Erich Bohaboy/NOAA

As seen from the stern, Albatross IV cuts a 25-mile-long path through frozen Nantucket Sound on its way to survey the ecosystem of the Gulf of Maine

Albatross IV Breaks Out of the Ice for a Winter Ecosystem Survey

—By Dane Konop

On a frigidly cold Saturday morning Jan. 24, the crew of *Albatross IV* awoke to find the NOAA ship surrounded by a thick sheet of ice at its dock in Woods Hole, Mass. But it would take more than the cold hand of Mother Nature to keep *Albatross IV* from carrying out its mission to survey the ecosystem of the Gulf of Maine.

"We did our standard procedures for getting the ship ready to depart. The scientists were aboard. Everybody was ready," said *Albatross IV* operations officer Lt. (j.g.) John Crofts. "It hadn't gotten above 20 degrees for a couple of weeks. But we didn't expect to be frozen in nearly as solidly as we were."

A strong, persistent wind had blown ice floating in Great Harbor up against the ship, encasing the 187-foot *Albatross IV* in a football field-size sheet of ice tight against the dock.

Although *Albatross IV* has a reinforced steel hull and was never in danger, the ship could not budge.

When a local ice-breaking tug determined the ice was too thick, a larger tug in New Bedford, Mass., three hours away, was called. But it could not come until the next morning.

The ship's 12-man crew, four officers and four visiting scientists settled in to wait.

Overnight, conditions worsened.

"It was really cold, and the ice was probably twice as thick and covered a greater distance—about

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100 yards out from the ship," Crofts said.

As soon as the ice-breaking tug *Jaguar* arrived, it began chipping away at the edge of the ice pack.

"Once he cut a path through the ice, he turned around and, rather than cut the next path, he used his wake to break up the ice," Crofts said. The wake would travel under the ice sheet, causing it to flex and crack.

"He must have spent at least an hour working his way from the outskirts where it was thinner to the ice around the ship, which was easily five inches thick," Crofts said. "The process took probably an hour and 15 minutes of steady work, like mowing the lawn."

Finally free, the ship headed for the open Atlantic, plowing its way through an iced over Nantucket Sound.

Inside the ship below the water line, the crew reported that the sound of the ice cracking was like claps of thunder.

"We took the precaution of navigating between areas of thinner ice and tried to move towards the infrequent small areas of open water, all the while keeping a close track of the numerous shoal hazards in our vicinity," said Cdr. Michael Abbott, *Albatross IV's* commanding officer. "At times we found ourselves surrounded by ice fields as far as the eye could see."

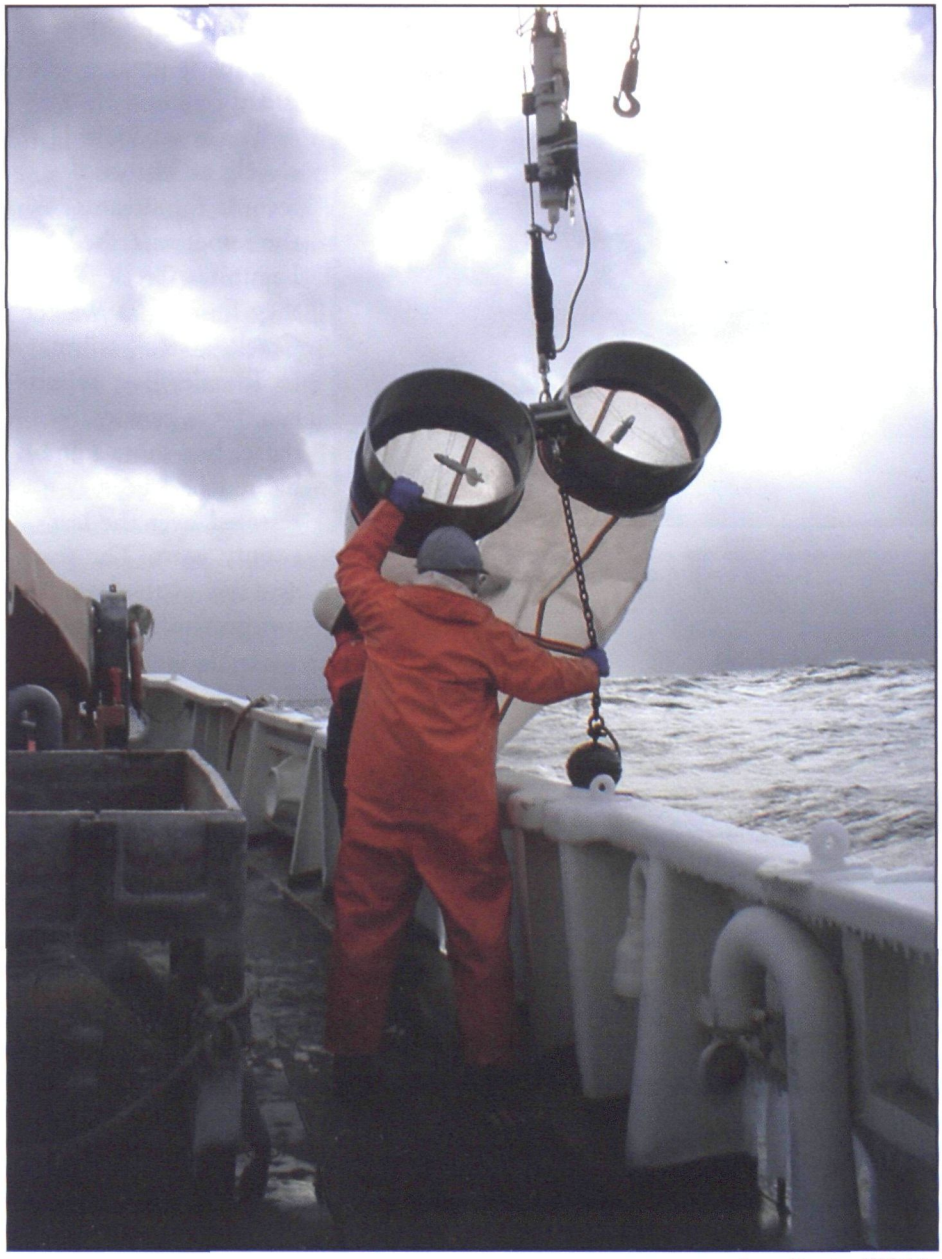
By mid-afternoon, the ship had reached the first of the planned sampling stations, or locations, chosen by NOAA Fisheries scientists. There the crew and scientists deployed bongo nets to collect samples of plankton—microscopic organisms that form the base of the marine food chain—and measured the temperature and chemistry of the surrounding sea water.

Because of the icy conditions, everyone had to work especially carefully deploying the bongo nets over the side of the ship. The freezing temperatures on deck made it impossible to wash the samples into collecting tubes at the bottom of the nets. Instead, as soon as the bongos came up, scientists rushed the nets into the relative warmth of the ship's wet lab to retrieve their plankton samples.

By Tuesday, *Albatross IV* had traveled over 150 miles out into the Atlantic and collected samples at twelve stations in the northeast corner of Georges Bank, a relatively shallow area of ocean that is the region's prime fishing grounds for cod, flounder and haddock.

But weather conditions were deteriorating. "We had winds blowing a steady 20 to 25 knots. We had snow constantly," Crofts said.

Finally, an approaching Nor'easter did what the ice and cold couldn't—ended *Albatross IV's* cruise with only about half its stations sampled. "We got in just in time to avoid the storm," Crofts said. As usual, Mother Nature held a trump card.



Jerry Prezioso/NOAA

NOAA Fisheries scientist Joseph Kane (foreground) and Albatross IV crew member Tharwat Saleh retrieve plankton samples in a bongo net.

Coho Salmon

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harmful to the project.

Every year since 2001, scientists from the California Department of Fish and Game and the National Park Service donned nets and buckets to catch juvenile coho salmon in Green Valley Creek and Lagunitas Creek in pools that were at high risk of drying up in the summer heat. The fish were then transported to the Don Clausen Fish Hatchery at Warm Springs Dam in northern California. Here they were isolated and placed in separate pens by stream and year class waiting until they reached sexual maturity for breeding purposes.

As a precaution, Carlos Garza, a geneticist at the NOAA Fisheries Laboratory in Santa Cruz, decided to take tissue samples from every fish captured for genetic analysis before allowing the breeding to take place. The outcome of that analysis was nothing that scientists had expected. The fish from the two creeks were very dissimilar, even though they were from the same species and from streams flowing relatively close to each other.

"We really had to do the [genetics] work to know," Garza said. "If we had assumed that because they [salmon from Green Valley Creek and Lagunitas Creek] were geographically proximate they would have been similar, we would have been wrong."

What Garza found was that the coho salmon from Green Valley Creek were very different genetically from those captured in Lagunitas Creek. At least some of these differences are believed to be related to specific traits necessary for their survival in that particular watershed. Had coho in the Russian River Basin been bred with salmon from Lagunitas Creek, a different watershed, many of these survival traits that had evolved over many years could have been lost and their ability to repopulate the Russian River Basin reduced or even nullified.

Garza also determined that the salmon from Green Valley Creek were from only a few distinct families and that many were as genetically related as brothers and sisters. In response, he developed a method to ensure genetically similar individuals were not bred with one another by using a plan of mating a salmon from one family with a salmon from another family.

"We used the genetic data to construct a breeding matrix," Garza said. "The matrix ensures individuals that are close kin are not mated together because that leads to inbreeding with a loss of genetic variation and deleterious traits. It is also designed to ensure that all of the families are represented in future generations."

Jonathan Mann/NOAA

NOAA Fisheries scientists test equipment to monitor the flow of Austin Creek in central California, where coho salmon habitat is being restored.

With the genetics and breeding patterns understood for the Green Valley Creek coho salmon, the question then became what to do with the coho salmon from Lagunitas Creek. They could not be bred with the other coho salmon and they could not be returned to their stream because of concerns over spreading disease from the hatchery back to the native population.

"To a certain extent we ended up in this situation where we had this problem," Garza said. "And we turned this problem into just a great opportunity."

The team looked closely at historical records for streams in the same watershed as Lagunitas Creek. What they found was Walker Creek, a small tributary to Tomales Bay. Salmon runs were now extinct there, but some salmon habitat had been restored over the last twenty years. The team saw this as the best prospect to revive a coho salmon population in a stream devoid of these fish for decades. The Jan. 12 planting followed.

The restoration team will continue to plant fish in Walker Creek in 2005 and 2006. If salmon runs return there in 2007, 2008 and 2009, plantings may continue.

Streams and creeks in the Russian River Basin will be stocked with fish from Green Valley Creek. The stream location and method of planting are still being determined.

But with a brood stock safe in the hatchery, scientists now have the option of releasing mature salmon to spawn, planting juveniles that will travel to the ocean and return, or planting artificially fertilized egg nests in the streams.

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and not be dependent on other influences that could derail its progress. He proposed ten best practices for climate monitoring, adopted by the powerful National Research Council, which would be the backbone of a new climate monitoring system.

He suggested having the new system quickly assess changes throughout the network and that the network provide extensive information on the status of each station's instruments and the local conditions surrounding the station.

"With populations expanding further from urban hubs into areas close to where we'd have these stations, it's important to watch how human influences would impact the observations," Karl said.

Also critical was providing other scientists and researchers the freedom to access the data and other supporting information, which is available on the Internet.

Bruce Baker, the climate reference network program manager who is overseeing the installation of the stations, has worked with Karl for years to develop the system. He had an up-close view of the problem uncertain data can bring.

"If the data is the least bit uncertain, then it's tough to apply it in a way that it helps answer questions about climatic data of the past," Baker said.

He also said part of the new network's strength is its ability to work with other observation systems—for example, the National Weather Service's Automated Surface Observing System based at airports—to capture redundant climate measurements.

"It's important to have the climate reference network integrate with other existing observation systems so that any open gaps in data collection can be closed, and that the data can be verified for accuracy," he said.

The system is drawing interest from other nations, including Germany and Canada. "They're interested in the redundancy and duplication of the system," Baker said. "In another five years, the climate reference network will be a global system."

In the U.S., Karl said the feedback from his science colleagues within and outside of NOAA has been positive. "I have yet to speak to one person who doesn't support [the network]."

"I'm a big proponent of the climate reference network because we badly need a benchmark of observations that we have faith in, that we can relate to other climate-data platforms," said Kelly Redmond, deputy director and regional climatologist at the Western Regional Climate Center, part of the Desert Research Institute in Reno, Nev.

The climate reference network will be a welcomed addition in the West, he said, home to the wettest, driest, coldest, hottest and snowiest places in the United States.

Redmond said the new network is also forcing climate experts to revisit the entire observation process. "It's pushing us to look at observations—and their importance to understanding the big picture—squarely in the eye, from how the equipment we use observes climate, right down to the actual changes [such as] urbanization around the stations."

Ken Hubbard, director of the High Plains Regional Climate Center at the University of Nebraska in Lincoln, said, "There are a lot of other observation networks out there, but this is the first time this nation has one set up just for monitoring the climate."

In Nebraska, Hubbard is using technology to transfer new climate reference network data into computerized programs that tell scientists what data collected 50 to 100 years ago would have shown. "Nothing like this has ever been done before, or has ever been possible," he said.

Brent French/NOAA

Stations in the new U.S. Climate Reference Network are located in pristine areas, away from future construction or development that could affect readings by the stations' instruments.

Beaver

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But at the end of the fiscal year, funding for Alaska construction virtually dried up. As a contractor, his job was in jeopardy.

"I actually got a pink slip that said in two weeks you're done," he said.

But he quickly got a reprieve.

"When he was at risk [of losing his job] a year and a half ago, we found work for him because of his talent and reputation," said Chris Moren, his supervisor at QSS.

Beaver ended up working half time for the Central Administrative Support Center on the Alaska region and half time for the Weather Service until Alaska funding was back on track.

Among other projects, he's now reviving the Alaska facilities program, with plans underway to renovate the Weather Service office on St. Paul Island in the Aleutian chain west of Anchorage.

"Tom's role is to coordinate [status] reports, keep up to date with the activities that are going on at the site and put them into a format that can be shared with our clients, our headquarters and with the engineers," said Frank G. Rabuse, chief of the Logistics and Facilities Division at CASC. "Religiously every month, he produces this huge volume of information on all our projects, probably 20 or 30 projects. If numbers don't jibe, he goes back to the guys and makes sure they get it right. He's on them like glue. It's amazing," he said.

"I've never seen anyone like this guy," Rabuse said. "The biggest thing is his pro-activeness. He comes into my office innumerable times and says, 'Frank, how can I help?' And if he sees a problem, he takes that problem away from me. He is just way ahead of the curve. I'd love to have 15 employees like him."

Schwabacher

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Schwabacher had many jobs before joining NOAA, including working for Congress and spending 12 years as the Washington representative of the Cousteau Society. During that time, he was instrumental in creating many environmental policies, including helping to phase out ocean dumping of municipal wastes—experiences that prepared him for the work that he performs daily for NOAA.

Schwabacher serves as a liaison, tying together the work that the Ocean Service does with the interests of its constituents.

"I was a NOAA constituent for a long time before becoming an employee. I understand the needs and the interests of our constituents," he said.

This understanding is what makes Schwabacher so good at his job.

Schwabacher works with program offices on special projects. Over the past several months he has worked on the Ocean Future Roundtables, a series of constituent meetings focusing on Ocean Service programs and initiatives.

The roundtables provide an opportunity to introduce NOAA Assistant Administrator Richard Spinrad to the Ocean Service's constituent community, provide a forum for Spinrad to speak on Ocean Service issues and above all provide the constituent community with a chance to voice their concerns and opinions. Participants include representatives from academia and non-governmental organizations, as well as NOAA Ocean Council members and Ocean Service program directors.

There are a total of seven roundtables, which began in December 2003 and will conclude in June 2004. Each roundtable addresses cross-cutting topics, including the Ocean Service's role in the NOAA strategic plan, ocean observation systems and modeling, and possible recommendations from the U.S. Commission on Ocean Policy.

So far, two roundtables have taken place: "Marine Transportation, Maritime Safety, Charting and Navigation" and "Advancing Our Understanding of the Oceans," with "Enhancing Ocean Value and Vitality" scheduled for Feb. 12 in Washington, D.C.

Each constituent roundtable takes considerable planning and effort—from creating background materials to organizing logistics.

Schwabacher does not take all of the credit for the success of the program, citing the contributions of his peers.

"Everyone has made significant contributions to the roundtables, from developing background information materials to supporting the Website," Schwabacher said. "This has truly been a team effort."

Tom Cox, director of the Communications and Education Division and Schwabacher's supervisor, gives special credit to Schwabacher's efforts. "With very little time, Rick created a constituent program that's moving forward with great gusto," Cox said.

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Address comments to:
Editor, *NOAA Report*
1315 East-West Highway
SSMC3, room 10853
Silver Spring, MD 20910
301-713-9042
Email: dane.konop@noaa.gov
***NOAA Report* Online:** *http://www.publicaffairs.noaa.gov/nr*
Jordan St. John, director, OPCIA
Dane Konop, editor

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