

PRINCE WILLIAM SOUND
SCIENCE CENTER
CORDOVA, ALASKA

the Breakwater

Spring 2011

300 Breakwater Avenue
PO Box 705 Cordova, AK 99574

Ocean Science & Leadership Expedition

The **Ocean Science and Leadership Expedition (OSLE)** is a 10 day summer intensive learning experience for high school students that will take place July 14-23, 2011. Working with local marine scientists and educators, students will learn about, and experience firsthand, oceanographic principles and issues such as oil spills and climate change.

The course includes an overnight **sea kayaking expedition** to Shoup Glacier in Prince William Sound, where students will camp on remote beaches and learn Leave-No-Trace backcountry skills and ethics. While studying the science of climate change and effects of melting glaciers on ocean circulation, students will also have the opportunity to hike on Worthington Glacier near Valdez.

In Valdez, students will meet with experts at the Prince William Sound Regional Citizens' Advisory Council to learn about the *Exxon Valdez* oil spill, and see what is being done to prevent future spills. To culminate the case study, students will engage in a simulated oil spill scenario where they will learn the decision-making process of responding to environmental emergencies and experience the challenges of cleaning up oil in the marine environment.



Trekking atop Worthington Glacier near Valdez. Photo courtesy of Pangaea Adventures guide.

Space is still available in this exciting course, but enrollment is limited to 10 students. Participants will be active in all aspects of the small group learning and living environment. Tuition is \$1,100, and scholarships are available. The deadline for scholarship applications is April 1; encourage a high school student to apply today!

For more info, contact Alice at 907-424-5800 x 237 or visit the website: pwssc.org/blog/summer-programs/ocean-science-and-leadership-expedition

Exploring the Sound for Juvenile Herring

It's spring and that means herring are to be found! PWS Science Center researchers and Cordova District Fishermen United (CDFU) fishermen are headed into Prince William Sound in early March to assess the population and sample multiple bays to determine rearing locations of juvenile herring.



This is the second year CDFU's members have helped look for juvenile herring. Using their local knowledge and experience, they are covering more territory than researchers have previously sampled. You can read about their surveys and see maps of where they went by visiting "PWS Juvenile Herring Research" on Facebook.

The goal of the current research is to investigate key bottlenecks in the herring life cycle. Until 1993, PWS herring supported a productive roe, reduction and bait fishery. The cause of their population collapse is still debated with some scientists linking it to the *Exxon Valdez* oil spill.

The focus of current research is to understand why herring have not rebounded almost 20 years later. We know they are an integral source of energy for many species of the ecosystem as well as a valuable resource to local communities.

Issues potentially limiting herring survival include: herring eggs being eaten by birds or fish, or being in an environment where they are exposed to air at low tide; herring larvae being swept away from nursery areas by currents to areas of low food or high predation; competition by juvenile herring with other fish, affecting their growth and ability to store energy for winter; juvenile herring being eaten by birds or other fish; and susceptibility to diseases.

A meeting to review results to date is being scheduled in early May and will be open to the public. This project is funded by the Exxon Valdez Oil Spill Trustee Council. For more details, visit www.pwssc.org/herringsurvey.

Summer Surface Water Circulation

by Mark Halverson, Ph.D.



In July 2009, a team of researchers from Alaska and as far away as Maine and Texas came together to study the water circulation and biological productivity of Prince William Sound. PWSSC oceanographer Dr. Mark Halverson also took part by providing and operating a variety of instruments designed to track ocean currents and measure water properties such as temperature and salinity. This major field experiment was called “Sound Predictions 2009” and one of its primary purposes was to better understand where oil might travel in the event of a spill.

Surface currents were mapped with instruments set up and operated by collaborators at the University of Alaska Fairbanks. These radar units work by bouncing high-frequency radio waves off of the sea surface. Two separate units viewing the same area are needed to measure the surface currents; one was installed in Knowles Bay, while the other was installed in Shelter Bay. During the experiment—which ran from July 24–August 9—these instruments recorded a significant change in the currents in the central region of Prince William Sound.

During the first 13 days of fieldwork, the flow was predominantly northward (Fig. 1). During the last few days, the flow transitioned to a counter-clockwise “re-circulation” pattern (Fig. 2). The transition occurred in about a day, and it coincided with a change in the wind direction from mostly easterly to westerly. When a re-circulation pattern sets up, surface water and anything else floating on it, such as oil, are temporarily trapped in PWS, which can be a boon or a curse depending on the circumstances. Radar surface current mapping research was supported by OSRI and AOOs. See more at www.pws-osri.org

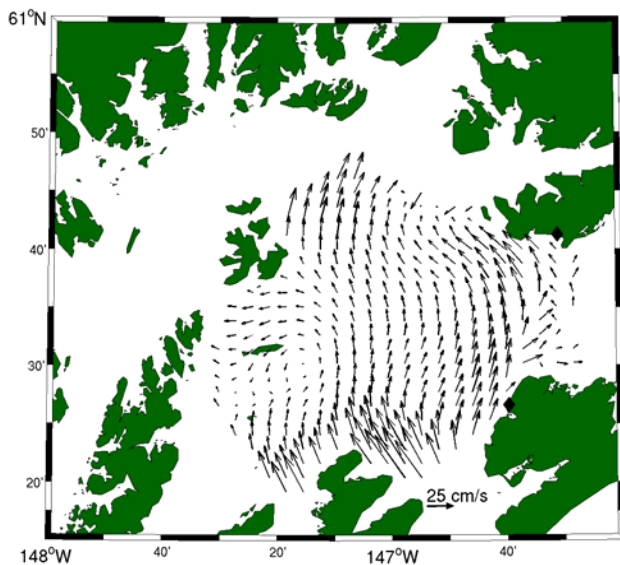


Figure 1: Predominantly northward flow

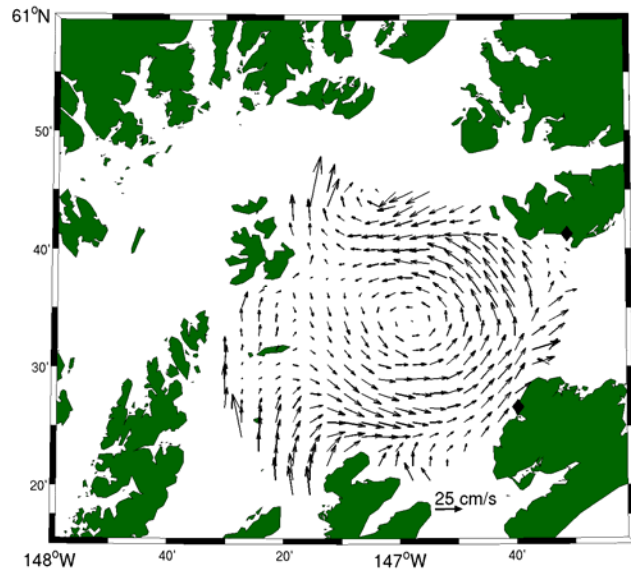


Figure 2: Flow changed dramatically to a recirculation pattern



OSRI Research Program Manager Scott Pegau with the new OSRI exhibit banner. Photo M. Buckhorn

PWSSC and OSRI staff contribute to 2011 AMSS

PWS Science Center researchers and educators were big contributors to the 2011 Alaska Marine Science Symposium. Held in Anchorage the third week of January each year, this year’s conference had record attendance, with more than one thousand people gathering to hear and see research results from throughout Alaska’s coastal regions.

Mark Halverson and Mary-Anne Bishop were among the 100 chosen to make presentations. They spoke, respectively, on PWS oceanography and tracking lingcod using the acoustic arrays in Port

Gravina that are part of the Pacific Ocean Shelf Tracking (POST) system. Tom Kline and Rob Campbell gave poster presentation. Scott Pegau led a herring program research workshop to which almost all PWSSC researchers contributed. Michele Buckhorn and Campbell served as moderators during the symposium.

Finally, several Board members (Riki Leberman and Jeff Welker) joined PWSSC staffers (Nancy Bird, Allen Marquette, Alice Dou-Wang and others) in hosting an exhibit table with new banners and informational materials.

National Ocean Sciences Bowl Competition in Seward

by Alice Dou-Wang

Nine Cordova High School students competed last month in the Alaska Tsunami Bowl, the regional competition of the National Ocean Sciences Bowl. Held annually in Seward, the competition brings together 20 high school teams from around the state to challenge students' knowledge of ocean sciences. The Tsunami Bowl has two portions: an ocean knowledge quiz bowl and a research project, which includes a 20-page research paper written before the competition and a 20-minute oral presentation given to judges and audience members. The results of the research and quiz competitions are combined to determine the overall winning team, which advances to compete against winners of other regions in the national finals.



The Auto-Eviscerators receive their 3rd place award.

Cordova's two teams were the Inglorious Dawgsharks, consisting of James Allen, Ben Americus,

Shannon Lindow, and Adam Zamudio; and the Auto-Eviscerators, consisting of Craig Bailer, Keegan Irving, Christina Morrisett, Sophia Myers, and Jessica Smyke. Both teams, coached by Alice Dou-Wang, have met outside of school for several hours a week throughout the school year to study all aspects of ocean sciences and work on their research projects.

For this year's research project, each team had to investigate a local human impact on the ocean and propose an ecosystem-based management plan to protect local marine resources. The Auto-Eviscerators' project, titled "Effects of Melting Glaciers on Nutrient Flux to the Gulf of Alaska", won second place in both the research paper and the overall research project. The project focused on iron input to the Gulf of Alaska from glaciers in the Copper River watershed. As glaciers recede due to climate change, the influx of iron to the Gulf will eventually decrease, reducing the phytoplankton

production and the salmon population. To manage the projected problem, the team proposed the placement of cannery waste back into tributary streams of the Copper River, supplementing the natural process of nutrient recycling from spawning salmon in order to slow the decrease in iron flux to the Gulf of Alaska.

The Inglorious Dawgsharks won third place in the research presentation with their research project, "Waste Not, Want Not: Find Alternate Uses for Cannery Waste." Their presentation, which proposed ways to reduce the waste stream from seafood processing, drew the attention of Charles McEldowney, manager of the Iccle Seafoods fishmeal plant in Seward. McEldowney gave both teams a personal tour of the Iccle facilities and encouraged them to combine the biological sciences with engineering to come up with innovative ways to use and process seafood waste.

Both teams performed well in the quiz bowl, which required students to demonstrate knowledge of ocean sciences by answering questions both individually and as a team. There were several close matches, including a few that were decided by the last question of a tiebreaker round. The Auto-Eviscerators placed 5th in the quiz bowl and 3rd overall in the Tsunami Bowl, and the Inglorious Dawgsharks placed 12th in the quiz bowl and 11th overall.

The three-day competition weekend also included educational activities for all participating teams. Students toured the Alaska SeaLife Center and the lab facilities and crab hatchery at the Seward Marine Center, and heard from guest speakers who exposed them to new topics and career opportunities in marine science.

The Inglorious Dawgsharks deliver their research presentation to judges at Seward High School. All NOSB photos courtesy of Christina Morrisett.



The Tsunami Bowl is hosted by the UAF School of Fisheries and Ocean Sciences and the Alaska Sea Grant College Program. Cordova's teams are also supported by the Oil Spill Recovery Institute, Harborside Pizza, and community donations.

Support our **Summer Education Programs** and enter to win a once-in-a-lifetime cruise experience in Prince William Sound!

Summer Education Raffle

Grand Prize: 6-day cruise for two on **Discovery Voyages!**

A retail value of \$8,000! Visit www.DiscoveryVoyages.com

Drawing will be held at the Copper River Nouveau dinner event on June 11, 2011. Need not be present to win. \$50 each or 3 for \$125. Call 907-424-5800 x 221 for more info and to purchase tickets today!



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Mysteries of Young Lingcod Movements Revealed *by Brad Reynolds*

When we tagged our first lingcod with acoustic transmitters in 2008, my inner fisherman could not help but be disappointed by their small size. Apologetically, I would return to report that most of my lingcod were a measly 18 to 20 inches in length. If you have angled lingcod, then you understand my frustration. A desirable catch is typically larger than 36 inches and up to 52 inches!

Nonetheless, for two years we tracked the movements of these lingcod within the array of acoustic receivers installed in Port Gravina as part of the Pacific Ocean Shelf Tracking project. We didn't expect much excitement; however, as we analyzed the movement data, our disappointment quickly waned as novel patterns began to emerge.

We discovered that three and four year old lingcod disperse within a five week period during either winter or spring. We believe that winter departures may be related to sexually immature lingcod or newly-mature male lingcod being displaced when larger males establish territories prior to spawning. In Alaska, lingcod spawn from January through March, but males establish territories as early as November. Spring departures may be indicative of the onset of migratory behavior where lingcod move out into Prince William Sound and possibly the offshore waters of the Gulf of Alaska.

Our study was the first to document a pattern in the migration timing for this life stage in lingcod. While this phenomenon is assumed to occur for many species, confirmation has been difficult without the application of acoustic monitoring.

On subsequent tagging trips I have seen my original disappointment



Matt Ajemian, from the Univ. of South Alabama, displays one of the lingcod caught for tagging. Photo by B. Reynolds.

made manifest every time a new fisher reels a small lingcod to the surface. "It's okay", I say, patting them on the back, "this is great data!" However, even to the fisherman-scientist, conveying the excitement as to what this means in terms of knowledge is still a stretch.

The full findings of our research can be accessed online at www.plosone.org.

Brad Reynolds is a fish ecologist at the Prince William Sound Science Center. For more information on this project please contact Dr. Mary Anne Bishop at mbishop@pwssc.org or Dr. Sean Powers at spowers@usouthal.edu.

President's Corner *by Nancy Bird*

"Ensuring a sustainable future for the world's richest waters." In a nutshell, that's why the PWS Science Center exists. Our core purpose is to be a regional science center serving residents, resource managers and others with a stake in PWS. Our Board of Directors and staff are committed to conducting, promoting and widely sharing our investigations and findings.

This is a "lofty" endeavor and not achievable overnight. Over the years, I have had many conversations about how scientific research and information from environmental monitoring get transferred to applications and information for use by resource managers. It is not enough to just publish our results in a technical report or journal, though that's an important step in the scientific process. So, what would be different if PWSSC programs hadn't existed for the past 22 years?

- Over 15 years of oceanographic research documenting PWS currents; both at the surface and throughout the water column, would not be available. Understanding ocean currents is funda-

mental to understanding biological production, and managing for sustainability.

- There would be no peer reviewed scientific papers linking the herring population crash to the Exxon Valdez oil spill. Our herring research identified problems in the herring population model currently used by resource managers, a potential source of error that could affect management decisions.
- Oil spill response plans for the Copper River Delta would be absent. In 1997, state regulators debated the risks of an oil spill at Hinchinbrook Entrance to the Delta. PWSSC conducted a statistically valid study (based on interviews with 84 mariners) documenting the occasional, but strong westerly currents that could push spilled oil to the Delta. A drifter buoy released that summer confirmed the study and ended the debate; the buoy traveled across the Delta from west to east and back again, over an 8-week period.

- Elementary and high school students in Cordova, Tattletale, Chenega Bay and Whittier have met with and learned from our scientists on a regular basis. We created opportunities for students to learn about and contribute to data collection. Without these "hands on" experiences fewer among them would pursue science-related careers and return to our communities to help manage our resources.
- We would not have oceanographic current and wave models for Prince William Sound that can be used in response planning in the event of another oil spill. These models are also proving to be invaluable in helping better understand factors influencing the survival of juvenile herring and recovery of herring populations.
- The City of Cordova would not have benefited from over \$22 million in wages and services contributed to the local economy, and other researchers and service providers would have missed the additional \$21 million contracted through the Science Center. This economic diversification is noteworthy for a small community almost solely dependent on commercial fishing.
- We would not have the long term (20-year) herring research program currently underway. We have partnered with local commercial fishermen in our effort to understand and address factors limiting the recovery of the depressed herring populations. Partnerships like this one are critical to our continued success as we strive to ensure a sustainable future for the world's richest waters.

Tribal Council Sends Students on Ocean Acidification Excursion *by Lindsay Butters*

On February 5, a spectacularly sunny Saturday, we had the good fortune of being in the company of 15 students from Anchorage's West and Bartlett High Schools. We love these kinds of students: polite, inquisitive, excited to be in Cordova ... but most of all because they love science! The students are participating in a science class (in addition to their regular high



school coursework) offered by the Cook Inlet Tribal Council (CITC). In order to earn the privilege to attend a weekend field trip to Cordova, these students put in the extra effort required to be at the top of their class. These are not just ordinary students!

And this was no ordinary field trip!

The CITC teachers and students received a grant to study Ocean Acidification (decreasing pH due to increased concentrations of atmospheric CO₂ being absorbed by the world's oceans). Ocean Acidification is likely to affect many marine organisms, particularly those, such as some plankton, corals and shellfish, who have calcareous shells. The students came to Cordova to measure pH and learn more about how an increasingly acidic ocean environment might affect the entire ocean food web.

The group started the day at the Alaska Department of Fish & Game where they learned how biologists use otoliths (fish ear bones) and scales to gather information about fish growth rates and freshwater/saltwater habitat utilization. They practiced locating and removing the incredibly tiny otoliths from a herring, then learned how the otoliths are ground and glued to a microscope slide. They also practiced aging herring by counting annual rings on the scales.

At PWSSC, they first met with Dr. Rob Campbell, who taught them about the various types of plankton, the important role plankton play in marine food webs, and other interesting facts. Did you know that pteropods use a mucus web to catch their prey? Cool!

After discussing which feeding strategy to use to eat their lunch (will it be stinging tentacles or a mucus web?), the students broke into three groups and commenced further exploration into the causes and effects of Ocean Acidification. In the lab, the students set up a variety of simple chemistry experiments to study pH. They simulated ocean acidification by "carbonating" tap water (H₂O) with a soda siphon-one crack of the CO₂ cartridge and poof-they created carbonic acid (H₂CO₃). They ground up oyster shells (CaCO₃), added a little hydrochloric acid (HCl) and poof-they created carbon dioxide and water (CO₂ and H₂O).

New Board member Mike Mahoney was on hand to help the students conduct a plankton tow from the PWSSC dock. After "fishing" for plankton, the students



brought their "catch" inside and looked at the plankton under microscopes. While the plankton weren't abundant, they were intriguing and the students identified 4 or 5 different types in the samples they collected.

At the final station, students collected data from ocean water samples with the help of volunteer Chris Verlinden, LTJG, who is currently stationed in Cordova on the U.S. Coast Guard Cutter Sycamore. Chris showed the students how to use a Hydrolab sensor to record ocean temperature, pH, salinity and dissolved oxygen. The students will be comparing the pH data they collected in Cordova to pH data collected by students in other regions, including the Aleutian Islands and Hawaii.

By the end of the day, everyone's brains were stretched and tired, but one thing is for certain: each student knew more about Ocean Acidification than they did that morning. Each could give an example of how their lives might be affected if our oceans continue to become more acidic, and steps we can all take to mitigate the risks of a changing climate. We sure are fortunate to have bright, compassionate young people like these students studying science, exploring the issues, and working to make a difference!



Thank you to everyone who helped make the CITC visit a success: Rich Brenner, Krysta Williams, Jane Allen, Rob Campbell, Mike Mahoney, Chris Verlinden, Joe Wilson and the science teachers at CITC, West and Bartlett High Schools. All photos courtesy of PWSSC Staff.

Declining Populations *by Allen Marquette*

Marbled Murrelets are one of the most abundant seabirds found in Prince William Sound during summer months. During winter as many as 10,000 of the small diving birds reside in the Sound. But their numbers over the last several years have been declining.

Studies show that between 1989 and 2005, the Marbled Murrelet population in PWS declined at a rate of over 6% per year. Although juvenile population numbers appear to be normal, the adult populations are on the decrease.

Because of the secretive behavior of these small birds, their nesting sites have been very difficult to find, let alone study. Early ornithologists offered rewards for finding the tiny bird's nests which we now know are generally located in coastal old-growth forests throughout their range from the Aleutians to California. The majority of the Marbled Murrelet population breeds in Alaska.

Marbled Murrelets are robin-sized seabirds that have a very short neck and tail and are brown above and light brown with gray marbled colors below in the summer. In the winter they are black above and white below with a white wing patch and collar.

During winter, Marbled Murrelets in Alaska are almost entirely confined to marine waters. This means facing extreme weather conditions, increased daily food requirements, reduced food abundance and shorter days for foraging.

Since the crash of the adult herring population stocks in PWS in 1993, many species of mammals and seabirds have been

Continues on Page 7

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 thank you for making a difference.**

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Who makes possible all that we do?

In this column, we highlight the experience and interests of some of our newer staff members.



Bobby Hsu M. S., joins our staff to assist Dr. Mary Anne Bishop with shorebird and seabird research projects in Prince William Sound and the Copper River Delta. Bobby graduated from the University of California, Davis with a B.S. in Environmental Biology and received his M.S. in Conservation Biology from the University of Hawaii at Hilo. His research experience spans ornithology and fresh water fisheries in the Pacific Northwest and Hawaii. You may reach him at 907-424-5800 x240 or bhsu@pwssc.org.



Jordan Watson, M. S., arrived in early March to work with Dr. Mary Anne Bishop on fish ecology projects including the Prince William Sound Herring survey and the Pacific Ocean Shelf Tracking Project. Jordan received a B.S. in Chemistry from the University of California, Santa Barbara and completed his M.S. in Aquatic and Fishery Sciences at the University of Washington. He just finished work at McMurdo Station in Antarctica. You may reach him at jwatson@pwssc.org.

Marbled Murrelets, Continued from page 5

affected. Juvenile herring are critical to the Marbled Murrelets' diet which may be one reason why the small seabird's numbers have been decreasing over the years.

Dr. Mary Anne Bishop, a Research Ecologist with the Prince William Sound Science Center, and Dr. Kathy Kuletz of the U.S. Fish and Wildlife Service, have been studying Marbled Murrelets with a grant from the North Pacific Research Board.

Previous work by Dr. Kuletz found the weights of Marbled Murrelets in PWS during summer have been declining suggesting that the Murrelets enter winter in less than optimal body condition and continue to decline. The goal of the project was to document Marbled Murrelet diet, body condition, and physiological stress levels during the winter months of October through March. However, documenting body condition and stress levels required capturing and handling the birds.

Marbled Murrelets are commonly observed throughout Prince William Sound during the daylight hours of winter. However, finding the Murrelets at night in Prince William Sound during winter proved difficult. During the wintertime surveys, a total of 280 hours were spent observing Murrelets during the day. More than 80 hours were spent on nocturnal surveys using boats equipped with large spotlights to search for the birds. Over 700 Marbled Murrelets were observed in PWS during the day, but only one Murrelet was discovered on the water during the nighttime surveys.

Apparently, Murrelets are leaving the bays at night and flying to more open waters such as the Gulf of Alaska. Interestingly, during the early morning hours before daylight, Murrelets were heard vocalizing as they circled forested areas by the water. Once again though, no birds were observed on the water until sometime after sunrise.

It became evident from this study that capturing Marbled Murrelets in PWS during winter time is very difficult. Discovering where Marbled Murrelets go during the nighttime in winter may help researchers understand why Marbled Murrelets are declining in PWS.

Two Boats, Nine Bays by James Thorne

Our annual Spring Herring Cruise involves two boats collecting data in nine bays; one does acoustic assessments and the other sampling or fishing. Preparing for these cruises keeps technicians busy as they ensure that the gear is ready for use.

For the "fishing" or sampling boat, that entails mending the two hanging gillnets and cast nets that may be needed. Supplies are ordered such as the 50 pounds of frozen squid used to bait the long line gear. Collection permits and other paperwork required is checked.

Some processing of samples takes place on board the vessels so measuring boards, scales, dissection tools, viral culturing tubes and storage bags all must be gathered.

On our cruises, the "acoustic boat" travels ahead of the

"fishing boat" into each bay to unobtrusively assess and quantify the fish, birds and marine mammals before the sampling vessel arrives. The acoustic boat uses underwater SONAR and infrared cameras. Getting this electronic gear ready means checking that all the various cables are connected to ensure that every box is powered

and working. Then each piece is repacked (with spares) and staged at our dockside storage area in preparation for loading.



Bobby Hsu tests the infrared camera prior to deployment. Photo by J. Thorne.



Delta Sound Connections is a unique educational publication distributed annually to residents of and visitors to Alaska. 16 pages of full color maps, photographs and graphics help illustrate short articles on the natural systems and cultural history of Prince William Sound and the Copper River Delta. Educational information on wild salmon, salmon aquaculture and commercial fishing is also included. Among our goals is a greater understanding and appreciation for our sustainable wild salmon fisheries; the backbone of the economy and lifestyle in the region.

These science news articles offer a unique opportunity for fellow organizations and businesses to help 'get the word out' and educate the public on fish and wildlife and the habitats that help maintain them.

The Prince William Sound Science Center plans to distribute over 20,000 copies of this publication (for free!) this year We will also be posting the upcoming edition online--

<http://www.pwssc.org/dsc/>. The 2011 edition will print in late April and we welcome additional outlets for its distribution. If you would like a copy or would like host a stand, please contact Kate Alexander at (907) 424-5433 or kate@pwssc.org.

Upcoming Events

- **Copper River Delta Science Symposium** March 22-24 at The Little Chapel in Cordova
- **22nd Anniversary of Exxon Valdez Oil Spill** March 24
- **Far North Film Festival** 7pm April 2 at Mt. Eccles Elementary in Cordova
- **OSRI Scientific & Technical Committee Mtg** April 7 in Anchorage
- **22nd Anniversary of PWSSC** April 22
- **Outreach Discovery trip to Yakutat** May 3-6
- **Annual Shorebird Festival** May 5-8 in Cordova
- **PWSSC Board of Directors meeting** June 10 in Cordova
- **OSRI Work Plan and STC Meeting** June in Cordova
- **Ocean Science & Leadership Expedition** July 14-23
- **Science Day Camp** August 8-12

Copper River Nouveau

June 11, 2011

Our annual benefit dinner and auction is held at Orca Adventure Lodge in Cordova with an Opening Reception and Fisheries Achievement Award at the PWSSC Deck.

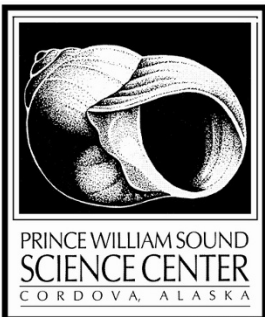
Join Honorary Host, *Senator Lisa Murkowski* for an evening of gourmet food and entertainment.

Chefs Van Hale and Jack Amon from Anchorage's

Marv Bros. Café will be in the kitchen.

Tickets are on sale now—\$125 per guest.

To purchase, call Linée at 907-424-5800 ext 221
or email lperkins@pwssc.org



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