Smithsonian Environmental Research Center

# iTunicate Newsletter

March 2015


**"Plate monitoring was not only educational, but fun!" N. Davis Ketchikan High school (see article on page 6)**

## Inside this issue:



**Special points of interest:**

- *D. vex* update
- Climate change and Invasive species

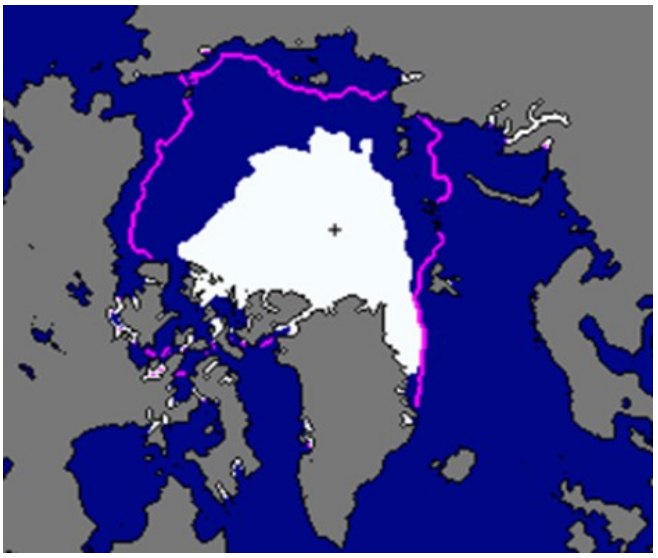
## *Rock Vomit in Alaska—What can we do about it?*

Rock vomit, (*Didemnum vexillum* or simply *D. vex*) is a non-native tunicate recently found in Whiting Harbor, outside of Sitka, Alaska. It is a fast growing, colonial tunicate, believed to be native to Japan, but now found world wide. Capable of forming large monocultures on the sea floor and overgrowing many organisms and substrates, it can cause dramatic changes to fouling communities and interfere with aquaculture. In 2011, Smithsonian scientist ran preliminary trials in Whiting to determine what treatments might kill the tunicate. A scaled up version of the most successful treatments is planned for this summer (2015). Treatments included immersion in freshwater, brine, hypoxia (limited or no oxygen), acetic acid, and bleach. The results of this aquarium sized experiment showed that continuous immersion in a brine solution with at least twice the salinity of ambient seawater produced 100% mortality after 24 hours. This summer, we'll use enclosures that extend to the sea floor to treat the bottom in small patches. Treatments will include salt, chlorine, cement dust, and combinations of these, to determine which has the greatest effect on *D. vex* survivorship. This work will be done in collaboration with Alaska Department of Fish and Game, the Bureau of Land Management, Alaska Department of Environmental Conservation, and of course, the people and city of Sitka. Stay tuned for results of this exciting work!

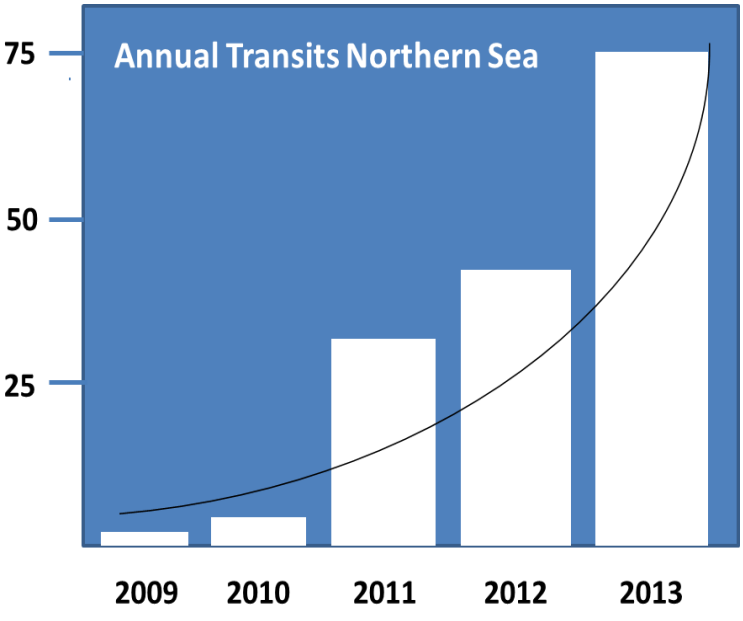
*D. vex* in Whiting Harbor including 2011 treatments. Top: Heather Meuret-Woody. Middle and bottom: SERC staff.

# *Melting Arctic Ice Means More Than New Shipping Routes*

In 2013, the first bulk carrier made the journey through the Northwest Passage – a route connecting the Pacific and Atlantic Oceans above Canada. The Nordic Orion, a commercial carrier much bigger than those currently traversing the Panama Canal, made the passage in just ten days. Another Arctic milestone happened in 2014, with the first cargo ship to sail through without an escort from ice breakers. All of this translates to big savings for the shipping companies, but it also could mean big impacts to relatively pristine Arctic environments these vessels will travel through. This shortcut was not possible decades ago, but warming temperatures have caused a reduction in Arctic sea-ice coverage in recent years, allowing ships to navigate a route that was previously inaccessible. The news of the crossing comes just as a UN-assembled panel of scientists issued a report concluding that human activity 'has been the dominant cause of the observed warming since the mid-20th century." Unfortunately, cargo isn't the only thing being transported through these northern passages. Marine biologists are worried that animals may be hitching a ride in and on ships, which could bring invasive species to areas previously relatively untouched by human impacts. Ballast water (ocean water used to weigh down a ship and lower its center of gravity to provide stability) and fouling of ship's hulls are the most common ways that animals get moved around in aquatic ecosystems. Movement through shipping pathways is responsible for 69 percent of species



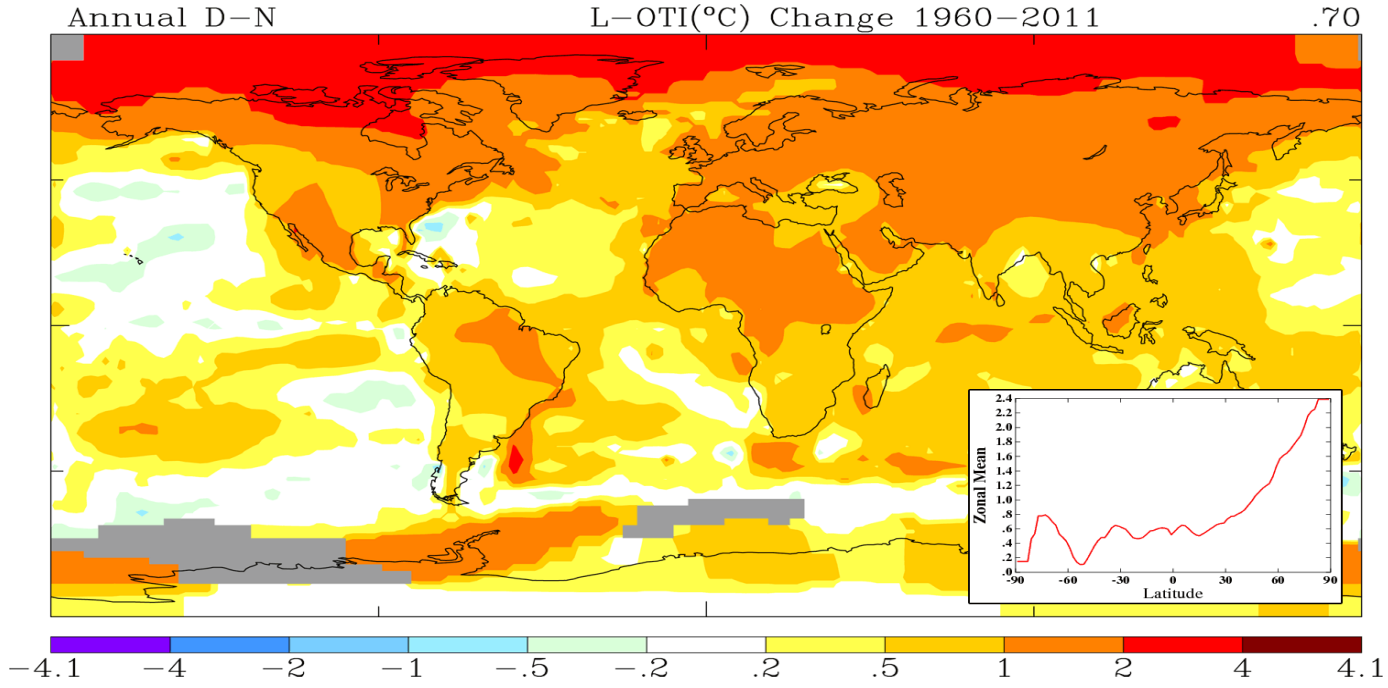
Arctic sea ice extent (white) for September 2012 was 3.61 million square kilometers (1.39 million square miles). The magenta line shows the 1979 to 2000 median extent for September and the black cross indicates the geographic North Pole. September marks the end of the summer melt season.—Credit: *National Snow and Ice Data Center*. Bottom left: Annual transits of the Northern Sea Route during 2009-2013. This number is expected to increase by approximately 20% per year. Adapted from Miller and Ruiz 2014. Bottom right: As Arctic ice melts, new routs are connecting the Atlantic and Northern Pacific oceans for the first time in two million years, bringing with it new species.




introductions in marine areas, including one of the most notorious introductions, the zebra mussel. Introduced to the Great Lakes from Western European ports more than 20 years ago, the species fouls power plants and water intake facilities, has driven native bivalves to near extinction, and has completely altered planktonic communities in the Great Lakes. This is just one example of how non-native species can directly or indirectly modify local communities, altering the way ecosystems function, and the services humans receive from them (fishing, water power, tourism, etc.). In the United States alone, estimates are that it costs over 120 billion dollars to manage invasive species every year. Zebra mussel management alone costs one billion dollars annually, largely in the maintenance of hydroelectric facilities.

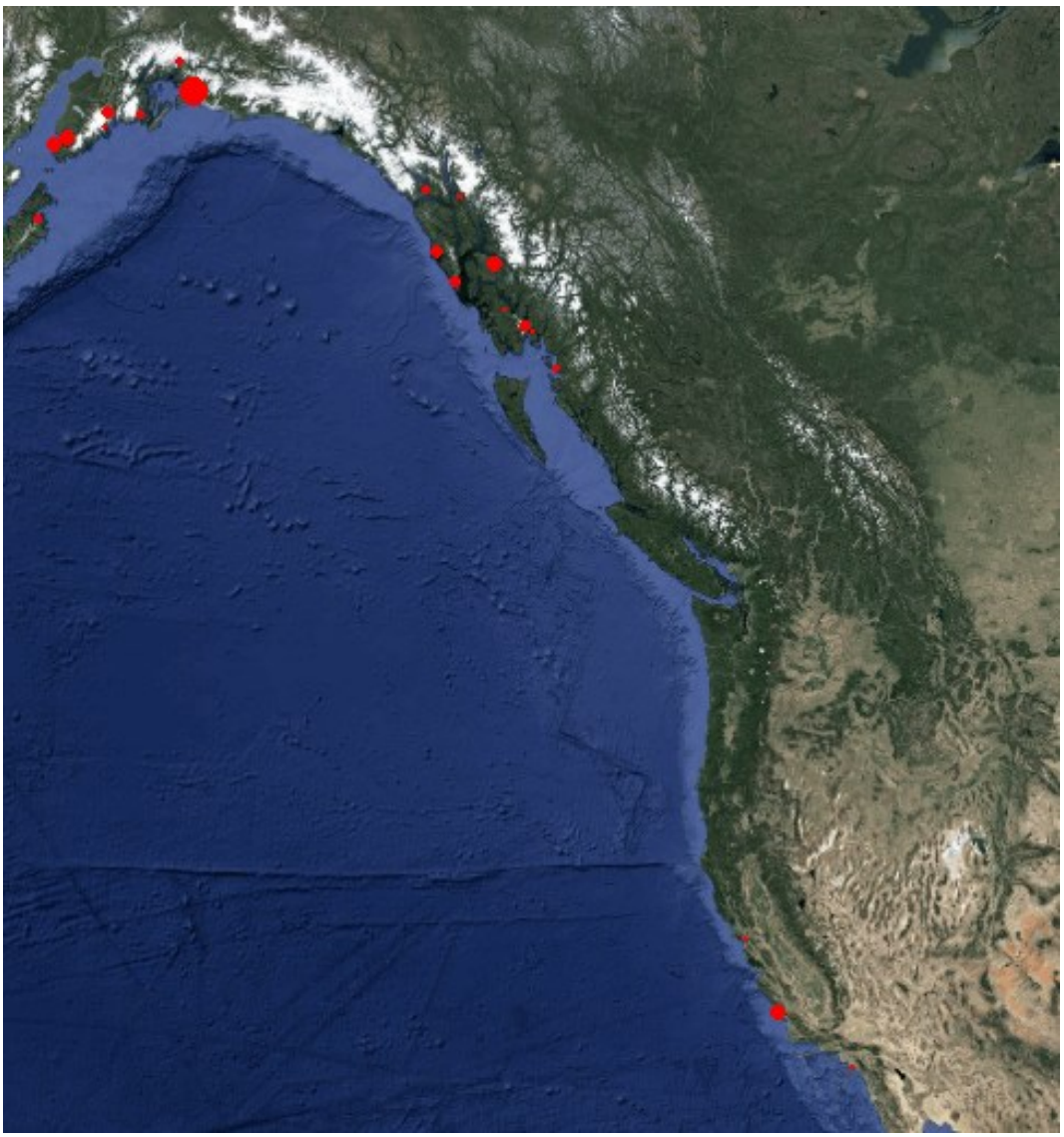
Intentional or accidental transport of new species is also one of the leading causes of alteration to global biodiversity and invasive species have contributed directly to the decline of 42% of threatened and endangered species in the United States. Shipping through the Arctic could make these statistics even worse. Currently, ships from northern regions wishing to move goods from ocean to ocean, are forced to transit through more tropical regions, through the Panama or Suez Canal. With the opening of the Northern Passage there won't be the temperature and salinity 'filters' organisms experience going through these existing canal routes. Organisms adapted to live in the cold waters of the northern, commercial port cities of North America, Russia and Northern Europe may be well suited to survival in the cool Arctic waters and visa versa. Also of concern is the fact that the journey through the Northern Passage is much shorter than through the canal routes, and thus invasive animals like crabs, barnacles, and mussels that may have perished on long journeys, are more likely to survive the crossing. But what does all this mean for Alaska and Plate Watch? As oceans warm with climate change and sea ice melts, we will see not only an increase in shipping but also likely an increase in non-native species. Shipping will increase the number of species that arrive to areas that were once remote, and many of these species will be adapted to cold water, making them likely to survive in Alaskan waters. These species threaten the balance of local coastal ecosystems and the local people who depend on these coasts for food, their economies, and their general well-being.

The best defense is a good offense. The old adage is good for more than just football teams! By monitoring for non-native species, we can help scientists and managers get up to date information about what species are currently living in Alaskan coastal waters and which new ones have appeared. While the management of invasive species can be extremely costly, early detection and eradication can save millions if not billions of dollars.



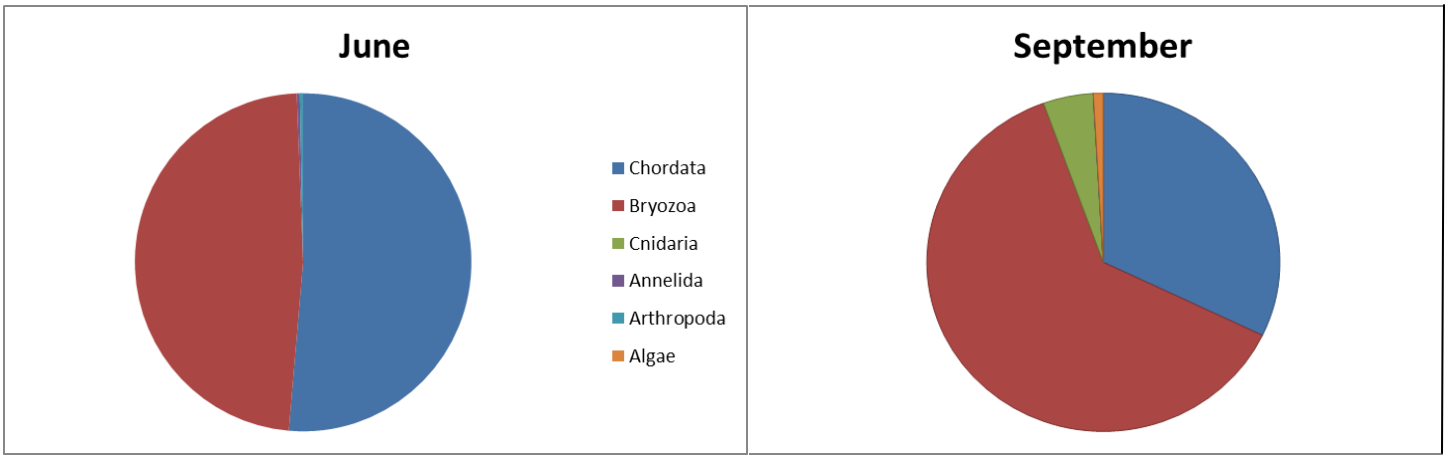

Changes to the mean surface air temperature 1960-2011. The Arctic has warmed more than any other region of the planet, increasing 2C (3.6F) during this 50 year time period. Credit: GGIS NASA

# *Plate Watch—Nine Years of Monitoring for Invasive Species on the West Coast*



Left: Sites sampled throughout Plate Watch history. Circles are areas where monitoring has occurred and the size shows the relative number of plates sampled from each site based on data posted on the website, i.e. the larger the dot the more plates have been sampled. Below: Photo of a plate that was uploaded to the webpage. Bottom: Whiting Harbor, Sitka Alaska derelict aquaculture facility. Aquaculture is one way invasive species can spread, making these harbors important monitoring sites.

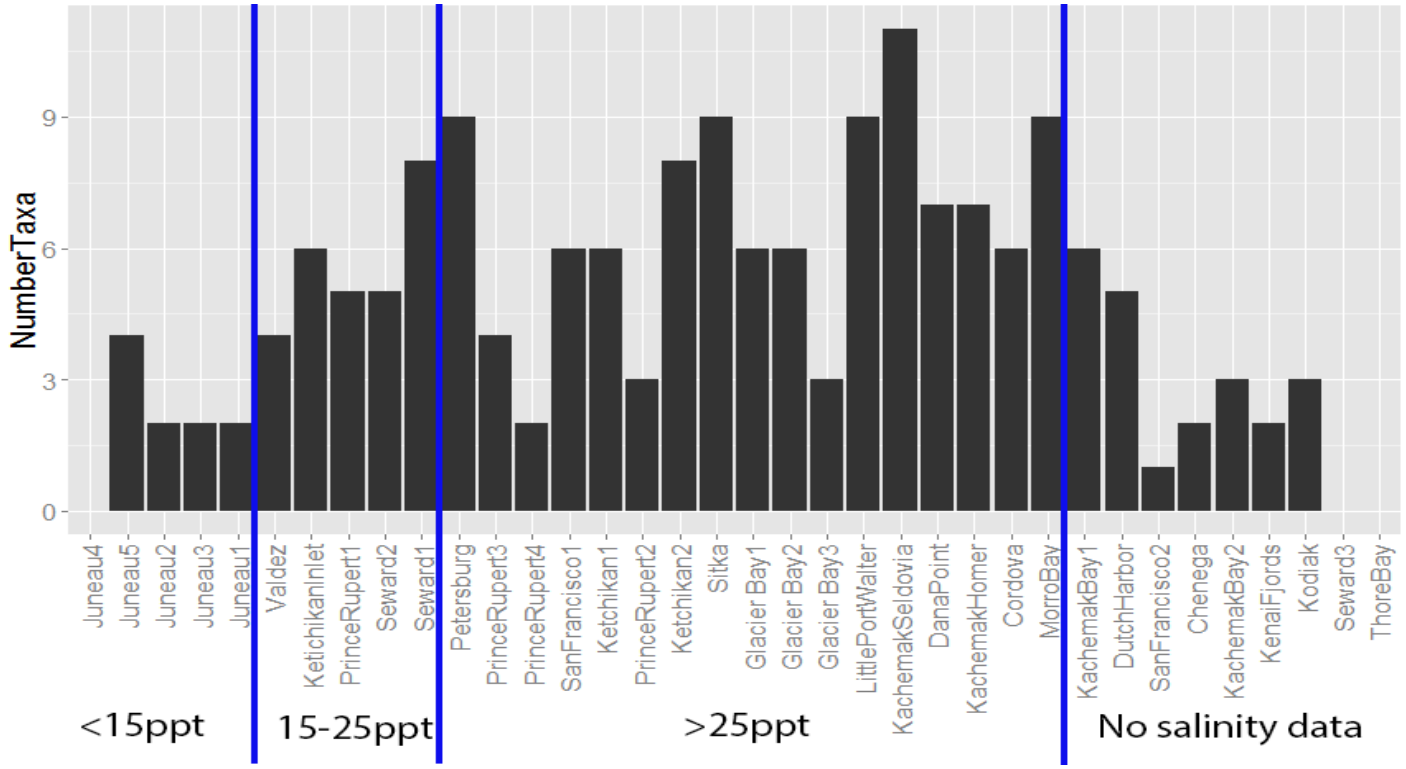
The Plate Watch monitoring program was established in 2007 by the Smithsonian Environmental Research Center to serve as an early detection system for marine invasive species and to gather baseline data on marine fouling invertebrates in coastal areas on the west coast of North America. Since Alaska has had few invasions in the past and is home to several important fisheries that might be impacted by invasive species, the main focus has been on this state. Invasions are detected through photographs and samples from pvc settlement plates deployed in near shore areas. Data is uploaded to the https:\\platewatch.nisbase.org website for analysis. Monitors have posted data on 1786 plates since the programs inception. Many sites have put plates in the water for 5 or more years (see map above). Monitors have recorded the presence or absence of 11 broad taxonomic groups of invertebrates and algae (see figures page 5). Their efforts have helped track the introduction and spread of *Botryllus schlosseri* and *Botrylloides violaceous,* two non-native colonial tunicates that have invaded elsewhere in North America. Monitors are also collecting temperature and salinity data that could be important in documenting climate change and resulting changes in species distributions. Beyond the detection of non native species, the data can be used to tell us much about existing fouling communities.




Ketchikan Bar Harbor Marina Percent Cover Data. These graphs show the average percent cover of each phyla present in June and September from 2007-2011.

As an example, we use a site which has collected and posted data for many years—the Ketchikan, Bar Harbor site monitored by Gary Freitag. The pie chart shows changes in the diversity and make up of fouling invertebrates settling on plates retrieved in June and September, based on 3 years of collections (Figure above) for each season. On average there are more Chordata (Tunicates) covering the plates in summer, while in the fall there is a greater percent cover of Bryozoans. Details like these can help us better understand the patterns of species abundances and inform management decisions for invasive species. And we can do so much more, but……..

**We need your help.** Please post your data so that we can get the most out of your amazing efforts. We hope that this peak at the data will inspire you to update your data online, and to continue to help us monitor!




The number of taxa found at each site over all the years monitored for each site, based on the data submitted to the website. Sites are listed in order of increasing Salinity, with salinities lower than 15 psu to the far left, 15-25 psu in the middle and >25 psu to the right. We have no salinity data for the sites on the far right.

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## *Monitor Spotlight*

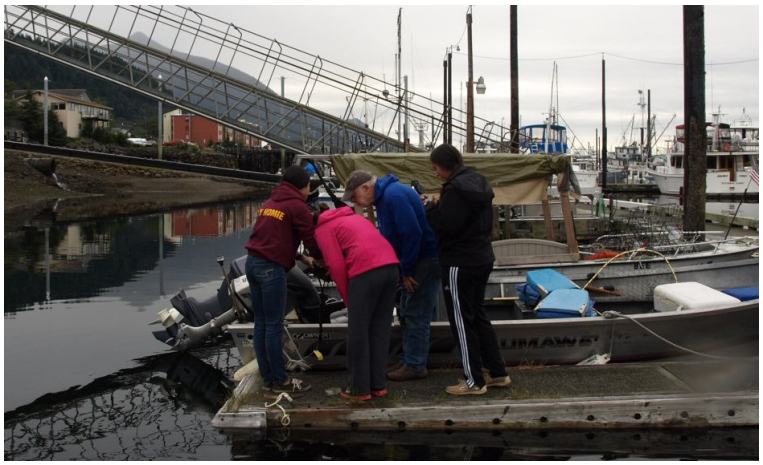
Volunteer monitors are the heart and soul of the Plate Watch program. Here we would like to take a moment to honor the people who make all of this effort and data possible.

In Bar Harbor Marina Ketchikan, Alaska, site of a recent tunicate introduction we now have expanded monitoring capabilities thanks to some high school students and their teacher, Julie Landwehr, from Ketchikan High School. This group of about 5 students from the Oceanography class, grades 10-12, began monitoring last year and had a blast collecting data and learning about invasive species. From our student monitors:

"I learned the effect that invasive species can actually have upon local species. Plate monitoring gives you a sense of what some areas of the ocean look like without going under water." - A. Davis

"I learned the impacts of invasive species. I thought they wouldn't harm the resident species that much. Seeing it with your own eyes makes you really aware and think about it." -A. Antonio

"Plate monitoring is really educational. We saw first hand how invasive tunicates come in and take over and how the resident species have no coping methods. I also got to see how scientists study tunicates and how to measure and track the area they inhabit." - G. Bonck

Top: Students Gabi, Autumn, and Nahoni pull up a Plate Watch settlement plate from Bar Harbor Marina in Ketchikan. Above: Seastar *Pisaster ochraceus* clings to a plate students pulled up to sample, the star could be eating animals on the plate or just using it as a place to rest. Left: Students on the dock examining samples. Photos by Gary Freitag.

Linda McCann and Michelle Marraffini
Smithsonian Environmental Research Center c/o
Romberg Tiburon Center
3152 Paradise Dr.
Tiburon Ca 94920

Phone: 415 435 3528
Fax: 415 435 7128
E-mail: mccannl@si.edu

Smithsonian Environmental Research Center

ROMBERG TIBURON CENTER FOR ENVIRONMENTAL STUDIES

**We're on the web at**

**http://platewatch.nisbase.org**