Is It Warm Enough????

Shellfish Spawning Data Scavenger Hunt

If you are a shellfish (oyster) grower, it is important to determine where shellfish will reliably grow, and understand the conditions in which they will spawn.
In this data scavenger hunt, you will be exploring the marine conditions in Puget Sound to determine a good place to locate the host tribe mega-shellfish feed on the beach for the upcoming canoe journey.

Where and when is it warm enough for oyster to spawn?

SUMMARY
Oyster Facts

Biology
When conditions are favorable the female Pacific oyster may spawn up to 200 million eggs in a season, broadcasting them into the water where they are fertilized by sperm from the male. The fertilized eggs develop into shelled larvae and spend 3-4 weeks drifting freely as plankton with the tide before settling on some surface to attach and grow.
The Pacific oyster shell may reach 4 inches in size by the age of two years, whereas the slower growing Olympia oyster shell may only reach 1.5 inches in four years.

During summers, water conditions which best for the natural spawn from Pacific oysters may account for as much as two-thirds of the supply of oyster larva used to support the local shellfish industry. Best spawning conditions for the Pacific oyster occur at water temperatures above 65 degrees. Failure of the nearshore marine water to attain that warmth has a direct effect on the success of the spawning season.
Major sources of oyster larva are found in Hood Canal, Willapa Bay (coastal WA) and Pendrell Sound (Canada).

The Role of Nutrients
Nutrients in the water are also in indication of where oysters grow best. Oysters are famous for their nutritional qualities: they are rich in proteins, vitamins and such trace elements as iron, iodine, copper, phosphorous, cobalt, and manganese, which individually or in combination are essential contributors to a healthy human body.

Nutrients in the form of nitrates and phosphates occur naturally in Puget Sound and are supplied largely from coastal and local upwelling processes which bring nutrients from depth to the surface. Upwelled nutrients combined with sunlight feed the phytoplankton communities which in turn support the zooplankton communities, shellfish in the nearshore, and the more pelagic forage fish.

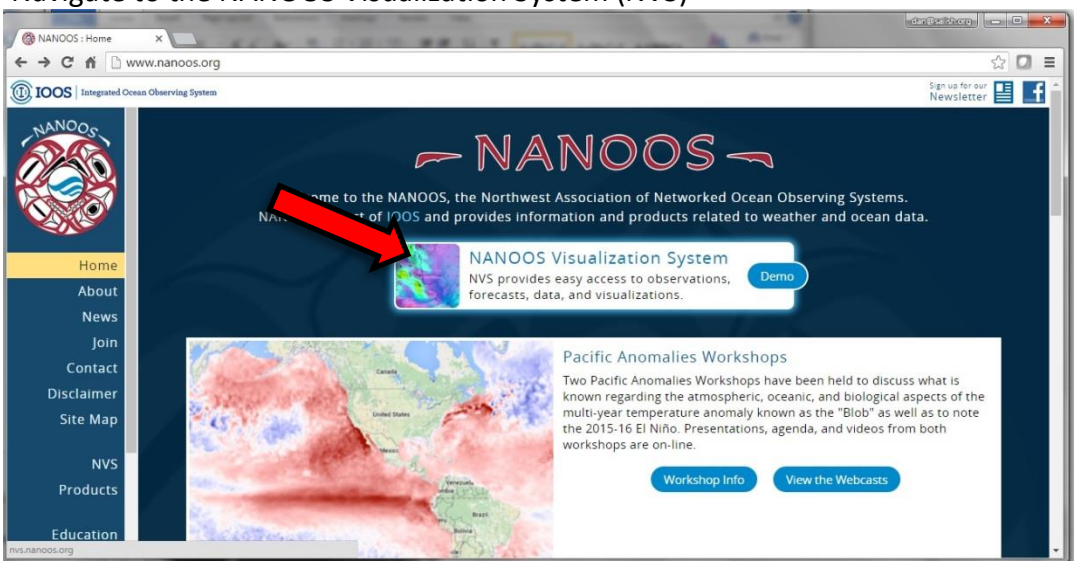
Nutrients that enter the marine water from the watershed also feed plankton, although excessive amounts of nutrients discharged through waterways (streams, shorelines, etc.) can disrupt the balance and have adverse effects.

Are the nearshore water temperatures warm enough to trigger a spawning event? Follow this scavenger hunt to see if you can find the clues and signs in the data of water temperature warm enough to trigger shellfish spawning!

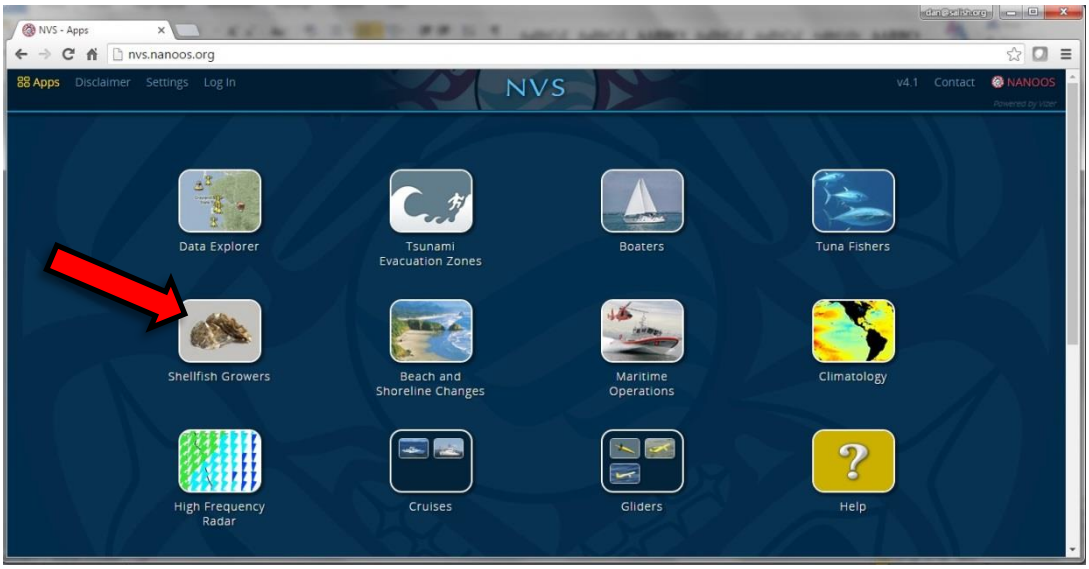
GET STARTED

1) Go to www.nanoos.org

2) Navigate to the NANOOS Visualization System (NVS)



3) The homepage of NVS will take you to a variety of APPS. For this exercise select the "Shellfish Growers" button.



4) You will see buoy and shore platform symbols that are colored and you may find symbols that are gray. The gray platforms are off-line for some reason. Monitoring in the marine waters is difficult for many reasons. Some symbols are active only seasonally and others may not be transmitting data. It is not an easy place for sensors to be! Scientists are constantly looking to see IF their sensor is collecting data even before they look at the data. Occasionally data may seem wrong, especially if the data changes dramatically. If a sensor is working incorrectly, it may be providing "bad" information.

FIND THE SIGNS – Where and When is the water warm enough?

Indicator #1: **Water Temperature**

Now your investigation begins.

- Select a number of platforms from throughout the Puget Sound region and review the water temperature from those locations over the last 60 days.

Record your findings in the table below.

Station location	Water Temp today	Depth	High temp last 60 days	Low temp last 60 days	Suitable location? (yes/no/possibly)

- Now select a number of platforms from throughout the coastal regions of Washington, Oregon and Northern California and review the water temperature from those locations over the last 60 days.

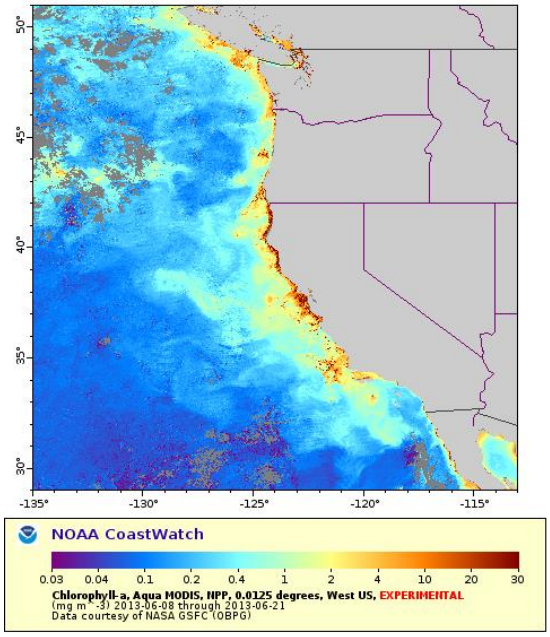
Record your findings in the table below.

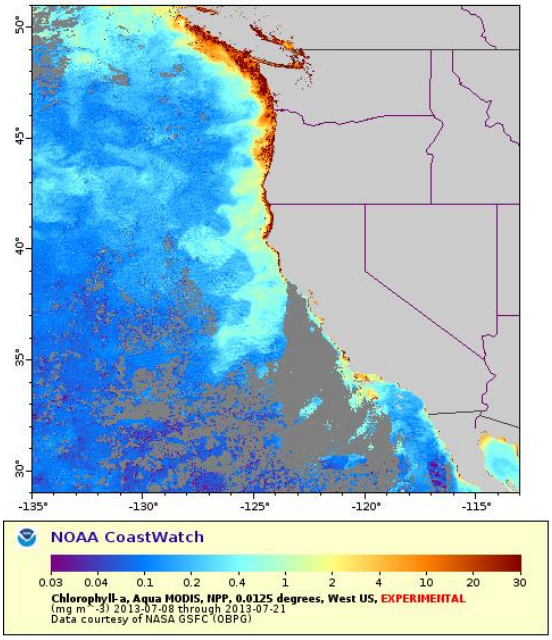
Station location	Water Temp today	Depth	High temp last 60 days	Low temp last 60 days	Suitable location? (yes/no/possibly)

Indicator #2: **Phytoplankton**

The abundance of phytoplankton, the base of the marine food web, is measured by **chlorophyll**, a photosynthesizing pigment in plant cells.

Here is an example of how the chlorophyll concentrations can change during upwelling off the coast – the first visualization is from Jun 8-21, 2013, when it was not upwelling, and the second satellite image is from July 8-21, 2013, when it had been upwelling for over a week.





- Investigate the Chlorophyll levels at different stations – some stations that are measuring for chlorophyll: the PtWilliams Bellingham Bay buoys near Seattle, and Hatfield Marine Science Center, South Slough NERR along the OR coast.

Cholorphyll is measured in units of milligrams/liter or µ/l

Chlorophyll measurements				
Station location	Depth(ft)	Today (µ/l)	Date/Max (µ/l)	Date/Min (µ/l)

Based on this information, you may now have a good sense for when the sun was shining and the nutrients were available in the surface waters.

PUTTING IT ALL TOGETHER

Now that you have sleuthed through the data for clues, your final task is to determine if you have enough information to determine whether you have identified a good location to announce at the next tribal council meeting for locating the canoe journey shellfish feed.

CONCLUSION/DISCUSSION:

Did you find a good place to grow oysters? Where is this place?

What time of year were the water temperatures high enough to trigger spawning?

What are the water temperature patterns at this place?

NOTE: Another important factor that shellfish growers must now consider is the pH levels of the water. The increasing level of carbon dioxide in the atmosphere is affecting the chemistry of the marine waters. Decreasing pH levels in the water is making it more difficult for shell-forming organism to produce their shells.

When selecting the type of oyster to grow you should note that oyster growers are finding the native Olympia oyster may be more resilient to the effects of lower pH levels.

To complete your investigation it would also be important to determine if pH levels are acceptable throughout the year.

http://www.nanoos.org/education/learning_tools/oa/ocean_acidification.php