Wiyot Tribe Natural Resources Department's FY13 Newsletter Articles

Japanese Marine Debris Reaches West Coast

By Stephen Kullmann

Japanese floating dock that washed ashore in Washington in December 2012. AP Photo/Washington Dept. of Fish & Wildlife

A large floating dock that washed ashore in Washington's Olympic Nation Park last December has been confirmed to be from the March 2011 Japanese tsunami. On January 15, a fisherman retrieved a 24-foot boat that was also suspected of being washed away during the tsunami. Other smaller debris have recently washed up along the shores of Hawaii and the West Coast. The Japanese government estimated that approximately 5 million tons of wreckage was washed to sea after the tsunami, but about 70% of it sunk offshore. Many people have expressed concern about potential radioactive contamination from the Fukushima power plant, but experts agree that this is highly unlikely for two reasons: 1) The debris came from a long stretch of shoreline, mostly many miles away from the power plant; and 2) no radiation was released from the plant until several days after the tsunami and the debris was washed away. Scientists are actually much more concerned with potential invasive plant and animal species that may be attached to floating items.

The National Oceanic and Atmospheric Administration (NOAA) has been tackling the difficult task of trying to track and model where debris will end up. Predicting where debris will drift to is complicated by ever-changing ocean currents and weather and the wide variety of types of debris. Currently, the models predict that we will continue to see more debris on the West Coast in 2013, with much of it remaining off-shore and circling back to Hawaii in 2014 to 2016. Much of it will also likely get caught up in the Great Pacific Garbage Patch. Because of the amount of garbage and debris that is generally in our oceans, it is difficult to positively confirm that debris originated from the tsunami and not from some other source.

The concern of the Japanese Marine Debris highlights another, more lingering problem--marine debris and garbage in general. Plastic garbage in the Pacific Ocean, much of it from single use drinking bottles and bags, has formed the Great Pacific Garbage Patch. The plastic breaks down in smaller polymers that can end up harming bird and sea creatures when ingested. Some of it has been washing ashore on the beaches of Hawaii; at some places accumulating up to three feet deep into the sand. While there is not much we can do to prevent debris from a natural disaster such as a tsunami, there is a lot we can do to address the concern of garbage in the ocean. Recycling, reusable shopping bags and water bottles, and properly disposing of trash into tightly sealed receptacles are all a start to reducing the amount of waste that ends up in our oceans. Help protect our waters and make even a small effort to reduce the amount of waste you generate. The Wiyot Tribe Environmental Department, in conjunction with the Humboldt Bay Harbor District and Humboldt Baykeeper, has also applied for NOAA funding to begin cleaning up some of the larger marine debris in *Wigi*, Humboldt Bay.

At Kamilo Point on the Big Island of Hawaii, plastic fragments penetrate up to three feet into the sand.

If you do encounter any suspected Tsunami debris along our coastline, make note of the exact location and nature of the debris and contact NOAA at DisaterDebris@noaa.gov, or the Wiyot Tribe Environmental Department at 707-733-5055. An interagency Japanese Tsunami Marine Debris website is available at: http://disasterdebris.wordpress.com/. There is also a mobile App for iPhone and Android: *Marine Debris Tracker,* available in Google Play or iTunes.

The Recycling Debate

By Tim Nelson

For many of us, recycling is a normal part of our daily routine. We were taught that by recycling materials, we can remanufacture a similar bottle, can, glass, etc. Metals like aluminum can be crushed, glass can be broken and melted, and paper can be pulped and reshaped to form another functional container/box for our everyday use. The processes involved may be easier said than done and the long lasting debate has been whether or not the costs of the process outweigh the benefits for society. Everything from jobs, energy, pollution discharge, and inevitably money are involved. The great debate: Is recycling economically efficient?

Economic analysis of recycling include decreased air pollution and greenhouse gases from incineration, reduced hazardous waste leaching from landfills, reduced energy consumption, and reduced waste and resource consumption which leads to a reduction in environmentally damaging mining and timber activity. Proponents for recycling will argue that recycling saves energy, reduces pollutant discharges caused by production of new material, reduces landfill accumulation, lowers incidences of hazardous waste spills, and creates jobs. Opponents to recycling argue that the amount of money saved depends on how the recycling facility functions and the size of a community in relation to landfill fees. Also, they argue that timber companies plant more trees post-harvest than the amount that existed pre-harvest, thus saving trees. Lastly, opponents will argue that the amount of energy being saved depends on the material that is being recycled.

Though opponents provide some interesting counters to the benefits of recycling, much data can be found to support the idea that recycling is very economically efficient. In terms of energy savings, recycling an aluminum can has a 95% energy savings, glass (5-30%), paper (40%), cardboard (24%), plastics (70%), and steel (60%). In terms of air pollution savings, recycling an aluminum can has a 95% air pollution savings, glass (20%), and paper (73%). In terms of landfill accumulation and emissions leading to global warming, the Environmental Protection Agency stated that in 2005 the U.S. efforts of recycling reduced CO_2 emissions by 49 metric tons while the United Kingdom's recycling efforts successfully reduce CO_2 emissions by 10-15 metric tons/year! Due to the removal of hazardous substances from our landfills, pollution of groundwater near landfill sites has been reduced dramatically thus saving on expensive pollution remediation efforts, cleanups, or drinking water treatment.

All in all, the debate between the economic efficiency of recycling will continue as scientific data becomes more available. So far, data shows that recycling proves to be worth the effort

for an economy in many different aspects whether they are economical, health, or environmental issues. Do your part and please recycle!

For more information on recycling, hazardous waste, or non-point source pollution, please call or visit the Environmental department.

Chemical and Biological Assessment of the Tribe's Wetlands

By Tim Nelson

In October 2012, the Environmental department assessed the Tribe's water resources for chemical and biological constituents during the annual "First Flush" event. During the spring/summer months, the amount of pollution generated will most often collect on our streets and roadways. It isn't until a heavy rain storm (usually over 1") transports this pollution off our streets, down roads and/or storm drains, and eventually into one of our waterways nearby. Similarly, the department conducted biological surveys (plant and avian) to assess the basic habitat of the Tribe's wetlands. Birds and plants can be important metrics to study habitat quality as the presence or absence of specific genera and/or species can be an indicator to the overall health of the wetland.

Assessment from the annual First Flush event showed results within acceptable ranges for all parameters that were measured. Total coliform levels were elevated with fecal coliform present but not at high levels. Since the wetland wells are not a source of drinking water, the presence of coliforms is not a concern and the levels at which they were detected are to be expected in a natural system. Fecal coliform most often originates from the waste of warm-blooded animals (i.e. mammals) and a main concern for human health is the presence of *E. coli* which can lead to severe gastrointestinal problems and can be fatal to the young and elderly. Nitrite, ammonia, and total Kjeldahl nitrogen were undetected during the monitoring period but nitrate and phosphorus were detected in low levels. The concern of elevated nutrient (i.e. nitrogen and phosphorus) levels in the wetland has to do with algal growth. As algae utilize the excess nutrient loads, they deplete the oxygen levels in the wetland leading to anoxic (low oxygen) environments. This is turn can have an effect on the vegetation present and lead to significant changes in biodiversity in the wetland. By having native wetland vegetation such as willows and alders, the plants can survive in these environments and act as buffers by filtering out pollutants and nutrients. In drinking water, the presence of nitrite and nitrate levels in excess limits can lead to a respiratory illness in infants called "blue-baby syndrome." Testing for metals was conducted and chromium, zinc, nickel, and copper were found to present. The presence of chromium was expected since it is naturally occurring in the soil while the elevated levels of zinc, copper, and nickel were within normal limits. The presence of elevated metals can affect the following systems:

- Dermis (skin)
    - *Arsenic*: Skin damage
    - *Chromium*: Allergic dermatitis
    - *Selenium*: Hair or fingernail loss

- *Thallium*: Hair loss

- Blood
  - *Antimony*: Increase in blood cholesterol/decrease in blood sugar
  - *Arsenic*: Circulatory problems
  - *Barium*: Increase in blood pressure
  - *Copper*: Liver problems (long-term exposure)
  - *Lead*: High blood pressure in adults
  - *Selenium*: Circulatory problems
  - *Thallium*: Changes in blood; liver problems
- Digestive
  - *Asbestos*: Intestinal polyps
  - *Beryllium*: Intestinal lesions
  - *Copper*: Gastrointestinal distress (short-term exposure)
  - *Thallium*: Intestinal problems
- Excretory
  - *Cadmium*: Kidney damage
  - *Copper*: Kidney problems (long-term exposure)
  - *Lead*: Kidney problems in adults
  - *Mercury*: Kidney damage
  - *Thallium*: Kidney problems
- Nervous
  - *Cyanide*: Nerve damage or thyroid problems
  - *Lead*: Delays in physical or mental development in kids
  - *Selenium*: Numbness in fingers and toes

Since 2007, biological assessments of the Tribe's wetland have shown a more favorable biodiversity of native plants and avian species utilizing the habitat. For botanical species, the proportional abundance of the three most common species occurring in the Tribe's wetland has stayed consistent since 2008 as coast willow (*Salix hookeriana*), water parsley (*Oenothera sarmentosa*), and buttercup (*Ranunculus repens*) were the most noted. Native species were recorded at an occurrence rate of 54-65% with perennial species comprising 81-91% of those recorded. For avian surveys, there has been an increase in the amount of birds recorded in each sequential year. To date, more than 3,250 individual birds of 75 known species have been recorded and characterized according to metrics used to assess wetland habitat health.

For more information on water quality issues or the Tribe's water resources, please call or visit the Environmental department.

The Importance of Riparian Zones

By Eddie Koch

Riparian zones are the areas that surround bodies of water and are composed of moist soil, water loving plant species, and the ecosystems that are associated with them. Riparian zones can be found around lakes, streams, estuaries, and rivers and consist of complex interactions between water, soil, microorganisms, plants, and animals. Our focus will be on the interaction between fish (primarily salmonids) and plants with an emphasis on a local example, the Salmon Creek Unit on the Humboldt Bay National Wildlife Refuge (HBNWR).

Scientists have long recognized the value that riparian areas provide for fish and wildlife. Unfortunately, a number of riparian areas in California have been in a constant state of degradation since the arrival of settlers. Lack of proper vegetation in riparian areas leads to inadequate shade cover that is essential to salmonid rearing habitat and allows excess sediment to build up which, in turn, profoundly affects the productivity of a salmon or trout stream. All around Humboldt Bay, including the lower Salmon Creek Unit, dikes were constructed to keep the incoming tides from flooding the land. As a result, 90% of the salt marshes of Humboldt Bay have been eradicated (9000 acres to our current amount of 900 acres) and riparian zones were essentially depleted as a result of denuded vegetation from increased agricultural practices.

The effects of sedimentation on salmonids are high stress or fatality, especially in the early egg and alevin stage. Survival of eggs is dependent on a continuous supply of well oxygenated water through the streambed gravels. Suspended sediment can cause reduced water flow as well as smother eggs, alevins, or emergent fry. In later life stages, fish secrete mucous to clean their gills which help in winter months when flows are high and sediment concentrations naturally increase. As sediment begins to accumulate in the gill filaments, fish excessively open and close their gills to expunge the silt. Protective mucous secretions are inadequate during the summer months, when natural sediment levels are low in a stream system. Consequently, sediment introduction at this time may increase the vulnerability of fish to stress and disease. Lack of natural vegetation in riparian zones can lead to high nutrient loads resulting in increased algae growth depleting much needed oxygen. When waste from cattle and agricultural runoff enter a stream, the associated nitrogen and phosphorus changes pH as well as increases algae growth. In turn, these changes deplete oxygen during respiration which creates a high stress environment that allows for numerous diseases to occur within fish populations. Willows and other riparian vegetation act as natural filters, removing and storing nutrients and toxins. Riparian vegetation also provides shade helping to maintain water temperatures desirable to salmonid productivity.

The Keystone XL Pipeline

By Tim Nelson

A decision will be made soon concerning the future of America's ongoing dependence of oil. The issue, currently awaiting the response from the President, involves the approval or denial of the expansion of the controversial Keystone XL pipeline, the main transport of tar sands oil from Canada to the United States. Opponents to the pipeline argue that the extraction process of oil from tar sands uses vast amounts of energy and water, destroys sensitive cultural and environmental areas, causes pollution, and is a step backwards in regards to America's vision on climate change. In addition, the economic impact of the pipeline will only worsen as the pipeline would serve as a transport of domestic oil from northern reaches (i.e. Montana) to southern reaches (i.e. Texas) for export thus, potentially leading to an increase in the price of gas in the United States. Proponents argue that the pipeline is a safer means of conveyance as opposed to conventional modes of transportation (i.e. tanker, rail) that result in higher greenhouse emissions and put the environment at a higher risk. Also, proponents argue that the Keystone XL pipeline will create 20,000 new jobs and up to $7 billion in revenue for the U.S. economy.

Currently, the Keystone XL pipeline, operated and owned by TransCanada Corporation, connects Canada's tar sands to the United States via pipelines running from Hardesty, Alberta to Steele City, Nebraska where it is routed east to Wood River and Patoka, Illinois (online 2010) and south to Cushings, Oklahoma (online February 2011) (Figure 1). Phase 3 of the proposed pipeline extension would continue from Cushings, Oklahoma where it will terminate in Nederland and Port Arthur, Texas. An additional extension, Phase 4, will enter the U.S. at Morgan, Montana and travel to Steele City, Nebraska. Most environmental opposition has been voiced over this extension due in part to the area in which it will traverse. One of these regions would be over the Ogallala Aquifer in Nebraska. The Ogallala Aquifer is one of the largest sources of freshwater in the world, spans 8 states, supplies water to nearly 200 million people, and supports a $20 billion agricultural industry. A major leak in this region would contaminate water resources thus, posing health problems and resulting in the endangerment of agricultural food supply.

Figure 1. Keystone XL pipeline (current and proposed lines). Photo: Wikipedia

In addition to our dependence to this non-renewable resource, there are a slew of issues that surround the production, shipment, and use of petroleum based products. Some of these

examples include, but are not limited to, pollution, climate change, habitat destruction, and much more. Tar sand, or bituminous oil, is referred to as unconventional oil since it is unlike hydrocarbons produced from a more traditional oil well. Tar sands, according to Canadian authorities are referred to as "petroleum that exists in the semi-solid to solid phase in natural deposits. Bitumen is a thick, sticky form of hydrocarbon, so heavy and viscous (thick) that it will not flow unless heated or diluted with lighter hydrocarbons. At room temperature, it is much like cold *molasses.*" For this reason, bitumen must be heated or mixed with other hydrocarbon sources for transportation. Additional steam injections and refining result in a 12% increase in greenhouse gas emissions per barrel for this oil source.

Environmental threats surrounding the production of oil from tar sands are greater than conventional means of pumping oil from wells. Due to the viscosity of the resource, bitumen is heavily concentrated in metals and is further contaminated by the extraction process. Since up to 90% of Canada's bitumen is below ground, open pit mining is not a viable option. Instead, injection of steam and other solvents to liquidize the product increases the likelihood of contamination of water resources and results in higher carbon emissions. Water contamination by these extraction processes has been linked to abnormalities in fish eggs and tumors and other deformities in fish from Lake Athabasca and its tributaries. Similarly, human and wildlife health concerns have been linked to the extraction of oil from the tar sands since the products of hydrocarbons (i.e. benzene, toluene, ethyl benzene, and xylene) are known carcinogens. Migratory birds and other wildlife (i.e. moose) utilizing the fragile, nearby boreal forests are at risk of contamination and threat of habitat loss. In addition, cultural resources such as clean water sources, loss of gathering grounds, and destruction of sacred places and artifacts are at risk near the source of bitumen extraction at tar sand mines and all along areas where the pipeline exists or is proposed to run. Currently, the existing Keystone XL Pipeline is located within 30 miles of over 150 Indigenous communities in Canada, and TransCanada Corporation has facilities on a dozen First Nation reserves. Over 100 miles of the pipeline pass through Native American reservations, and numerous Native American communities are within few miles of TransCanada departments.

The future of America's climate change policy can easily be determined by the decision the President will soon make in regards to the expansion of the Keystone XL pipeline. If we desire to free ourselves from the quickly fading grip of oil, it would be desirable to make decisions, policies, and direct funding to sources that are renewable and worthwhile. The change will not happen overnight and it will take a gradual change to prove the worthwhile investment from nonrenewable to renewable energy. Current projections for near depletion of petroleum resources are near the year 2050! A decision by the President to halt the installation of pipe to

haul more nonrenewable resources will be a step in the right direction to making our country less dependent on petroleum based products.

For more information on hydrocarbons, non-point source pollution, and ways you can help to prevent pollution, please call, email, or visit the Environmental Department.

Environmental Department's Educational Program

By Tim Nelson

This year is sure to be a blast as the Environmental Department is gearing up for another summer of fun, exciting, and helpful community projects!!! Some of the activities and field trips that are being planned include, but are not limited to, the following:

- Surf Day
- Watershed Model
- Fish Identification Workshop
- Pollution Prevention activities at TBR
- Marine Laboratory in Trinidad
- River Day (kayaking, swimming, etc.)
- Hike the Headwaters Forest Reserve
- Calculate the Stream Flow of Elk River
- Bird & Plant Exploration at the Humboldt Bay National Wildlife Refuge
- Beach Clean-up at South Spit Beach
- Tree Planting on TBR
- Camping Trip(s)
- Fishing Trip(s)

Come out and enjoy the summer with us! For more information on summer activities, please call, email, or visit the Environmental Department. Also, the Environmental Department's Facebook page has recently been modified to include all departments of the Wiyot Tribe. Become our "Friend" and/or "Like" our page to get updates on upcoming environmental education dates/times, current projects, or to contact us.

Your Trash & Global Warming

By Tim Nelson

It may be a surprise to you when you hear that what you throw away can play a huge factor in the warming of our planet. It has been told to us that the input of carbon dioxide (CO_2) into our environment either by burning fossil fuels or other means is the foremost reason as to why our glaciers are melting and our seas are rising. You may be surprised to hear that methane (CH_4), a product from the decomposition of landfill waste, is twenty three times more effective at trapping heat in our atmosphere than carbon dioxide! Solid waste landfills are the single largest man-made source of methane gas in the United States. So, the next time you throw something away, ask yourself two simple questions:

- **Can I recycle or compost this?**
- **What can I do to reduce the amount of garbage that I am depositing into landfills?**

Can I recycle or compost this?

Most often than not, the answer will be yes. Your local waste facility will take just about every item whether recyclable, hazardous, electronic, etc. for free or a minimal fee. Currently, Californians throw away millions of tons of recyclable material every year. According to the California Integrated Waste Management Board (CIWMB), up to 60% of landfill material can be recycled or composted. Unfortunately, once this solid waste is deposited into landfills and soiled, much of it is unable to be recycled. Similarly, it would be too time/resource consuming to filter through trash piles recycling plastics, metal, etc. Therefore, it is the individuals' responsibilities to make sure that items are being recycled and composted correctly. This really is a case where individual responsibility is the sole driver to overall success. More information about composting is listed below:

Composting - Structures

Composting is the controlled decomposition of organic material such as leaves, twigs, grass clippings, and vegetable food waste. In nature, organic material falls to the ground where it is either consumed by organisms or naturally decomposes and returns valuable nutrients back to the soil. These valuable nutrients aid in the growth of successive plants that in turn are either consumed or decompose and the cycle goes on. These processes will happen whether you want them to or not so it is the best option to take advantage of these available resources. The nutrients in our yard and kitchen scraps help to grow a beautiful, productive garden and can be left out of our garbage where they will eventually end up in our landfills.

One can very well begin to compost by simply starting a pile or heap in their backyard but there are disadvantages to this method. Rodents and odor can be the two major nuisances to your backyard "heap." Rats, raccoons, mice, etc. enjoy your kitchen scraps and the ever-present wet weather on the North Coast can soak your compost pile and create a smelly, nitrogen enriched environment. For these two reasons alone, it is important to create a structure that will keep rodents at bay and shelter your pile from the elements so you can produce nutrient rich compost.

Important aspects to think about when creating your own composting structure include placement, size, shelter from rain, wind, and wildlife, air flow, and easy access when properly maintaining your pile. Usually, the placement of a compost structure will be tailored to the amount of space available but if this is not the case, an ideal spot would be away from any window in your house where odor may be a potential problem. Next, the size of your compost bin should be large enough to hold no more than a 3' X 3' pile of a green/brown material mix. As mentioned earlier, be sure to shelter your pile from wind, rain and wildlife as most troubleshooting dilemmas involve these problems. Air flow is very important in a compost pile because the bacteria and fungus alive in your compost pile need oxygen to survive. By providing a constant air flow through your structure (i.e. drilling holes) and by turning your pile every two weeks or so, you are ensuring that the survival of the beneficial bacteria and you are not delaying adequate decomposition. Lastly, you want to make sure that when you are building a compost structure that it will be easy to maintain your pile without any hassle. Make sure that you can "turn" your pile and not have to worry about any potential harm you can inflict upon yourself or the structure.

Composting – The Pile

Whether you have leaves from a tree, grass clippings from your lawn, and/or kitchen scraps from dinner, these valuable nutrients can aid in the growth of a home/community garden or to simply decrease the amount of one's weekly trash since 30% of all household waste can be composted. By doing your part to compost on a regular basis, you ensure that nutrients are returned to the soil rather than trucked to a landfill while improving the soil fertility, structure, aeration, and moisture retention. It is easy to do and this article is designed to help you begin, maintain, and use valuable compost.

A well balanced compost pile only requires the ingredients that nature supplies. These include *nitrogen-rich green material* (i.e. kitchen scraps, tea bags-NO STAPLES-, coffee grounds, grass clippings, etc.) which is needed to heat the pile and *carbon-rich brown material* (i.e. twigs no larger than a pencil, leaves, straw, dried grass) needed to feed the pile. As previously stated in

part 1, air and water must be balanced as well because a pile that is too wet or dry will not decompose adequately. To avoid problems, DO NOT ADD meat, bones, dairy products (rodents and odor) or dog and cat manure (disease-risk) to your compost pile. NOTE: You may add lime, manure, soil, and blood meal to your compost pile while maintaining the proper wetness/dryness in order to speed up decomposition.

Now that we know the proper ingredients of an adequate compost pile, we must now build our working pile. Like layers on a cake, we want to build a balanced pile that will have the right amount of "wet" and "dry" material. Begin by laying down a layer of brown material no larger than 4-8 inches deep. Next, add a similar sized layer of green material on top and alternate until you have a pile no larger than 3' high X 3' wide. Maintain the pile by adding dry material when wet or by lightly watering the pile when dry. Once your pile is completed and a balanced environment is achieved, simply "turn" the pile (top layer is now the bottom, bottom is top) every two weeks. Continuous additions of material such as kitchen scraps is acceptable but must be maintained by digging the food into the pile or covering with brown material. Compost will eventually occur in a timeline of ~6 months if left alone but if turned every two weeks, a timeline of two weeks to four months is more likely.

Composting – Troubleshooting

Problems arise when composting but the solutions are easy to manage. Some common hardships usually involve odor, infestation, and/or decomposition rate. If your pile smells or has flies then your pile is too "wet" or fresh material is being exposed. The easy solution is to either mix the fresh material into the pile or mix "dry" brown material into pile. Similarly, if you notice that your compost pile is not breaking down fast enough, try lightly sprinkling your pile and turning the pile. Rule of thumb is to keep your compost pile as moist as a wrung-out sponge. Lastly, rodent infestation can be a nuisance to your compost pile as last night's leftovers can end up strung about your yard and soon you will be sheltering animals like rats, raccoons, skunks, etc. In order to avoid becoming an animal shelter, make sure that you cover or enclose your compost pile and deter potential pests by properly maintaining the pile (i.e. decrease odor).

To learn more about composting, to pick up some very useful brochures, or to simply ask questions, call or visit the Environmental Department or visit these helpful web sites below:
www.epa.gov/compost
www.howtocompost.org
www.compostguide.com
www.recyclenow.org/r_composting_trouble.html

Besides, recycling and composting, what can I do to reduce the amount of garbage that I am depositing into landfills?

In order to deposit waste into a landfill, the item(s) must be generated first. Therefore, in order to reduce your deposit, choose items in bulk rather than individual packages. Also, reuse containers for lunches rather than using plastic bags. Another tip is to avoid individual silverware, plates, and cups by using washable items. More information about the ease and benefits of going paperless is listed below:

Going Paperless!

Paper has been in use since 105 A.D. as the Egyptians and Chinese used the product to make records and inscriptions. As you read this article hopefully you will take a minute to think about how the pieces of paper that you hold in your hand came to be. If you're reading this article via email, then you will be happy to hear how much you are benefiting the world by simply going paperless. It's everywhere now! Your bills, company newsletters, books, magazines, and now the Wiyot tribal newsletter, are asking you to conserve paper and get your information via email. Simple changes on an individual basis can be viewed as small and minute but if more people joined to help the cause, the impacts would be great.

Going paperless is one of the easiest ways for an individual to go "green." You are simply taking the stacks of paper out of your life and replacing them with information that can be viewed on a computer screen. If only one in five households switched to electronic bills, statements and payments, the collective impact would save **151 million pounds of paper, avoid filling 8.6 million garbage bags and eliminate 2 million tons of greenhouse gas emissions**. Now imaging if 2 or 3 households began to make this switch? We would collectively save 300-400 millions tons of paper, avoid filling 17-26 million garbage bags to be dumped in landfills, and eliminate 4-6 million tons of greenhouse gas emissions from paper manufacturing processes and conserve forests for carbon sequestration. It's amazing that something as easy as a couple clicks of a mouse button can help to clean up our planet!

Accompanying the pros to going paperless, "inconveniences," rather than cons, can deter individuals. Individuals may not be able to make this switch due to the fact that they do not have access to a computer, they are not computer savvy enough to make the switch, or they are concerned to place too much information online for fear of theft. These are all reasonable excuses as to why an individual may have difficulty making the switch, but they should not be reasons to completely ignore the important reason we all should do so. I do admit that access

to a computer makes going paperless very difficult but not entirely impossible. Other than this reason alone, individuals should not have any reason to continue receiving information via paper because the process is VERY simple. Information such as your bank statements (that are most often wrong when you eventually receive it 4-5 days later) to your bills and newsletter, can all be changed over to information that can be sent to your email account. This gives you the opportunity to print at your leisure and conserve a large amount of paper that you would otherwise throw in the trash or shred. If you're concerned about theft, companies, such as banks, offer zero-liability policies that exempt you if theft occurs.

If you haven't already done so, take the hassle of large stacks of papers, misplaced information and consequential late payments and fees out of your life and go paperless! You'll save millions of trees, keep millions of tons of garbage out of our landfill, and help to clean up our air by keeping carbon sequestered in the one place where paper comes from, our forests. If you do use paper, please remember to use recycled paper in order to reduce continued logging of forests, cut down emissions used in the pulp and paper manufacturing process, and reduce waste.

Coastal Cleanup Day 2013!!!

By Tim Nelson

This year's Coastal Cleanup Day on September 21st is quickly approaching. International Coastal Cleanup Day began as a local program of the Northcoast Environmental Center (NEC) in 1978, and has since grown into the largest volunteer event in care of the marine environment in California and across the world. The success of Coastal Cleanup Day is owed to the support and participation of our hundreds of volunteers. Last year, over 500 Humboldt County volunteers came out in support of their communities and environment and succeeded in the cleanup of over 5 tons of trash and recyclables!

The Wiyot Tribe's Natural Resources Department is committed to cleaning up not only our marine environments but all others as well. This year the Department will be assisting and/or leading a group of committed volunteers in cleaning up a marine site within Wiyot Ancestral Territory. The site will be determined in August and more information will be posted to the Natural Resources Department website @ http://www.wiyot.us/natural-resources. Thank you for helping to keep our oceans and beaches clean from marine debris and other harmful pollutants.

Youth Environmental Education Program Continues During the Summer!

By Tim Nelson

The Natural Resources Department has created a curriculum full of fun and exciting field trips and activities for the Wiyot youth. With the assistance of the Social Services Department's Youth Activity Program, the education program has gotten off to a great start! So far, the program has included surf day at Moonstone Beach, a watershed demonstration, a fish identification workshop, a polluted runoff demonstration, a TBR wetland field trip with a Wiyot language lesson by Language Program Manager Lynnika Butler, a trip to Indian Island, and a trip to the Elk River Headwaters Forest Reserve and estuary with a language lesson as well. Other field trips that are planned include a river floating trip on the Eel River with a visit to Cock Robin Island, a plant and wildlife exploration field trip to U.S. Fish and Wildlife Service's Humboldt Bay National Wildlife Refuge, a beach day focusing on marine debris cleanup, and a tree planting day on TBR. If you're interested and would like more information on the summer program, please feel free to contact the Natural Resources Department via phone, email, or visit the Tribe's Facebook page.

Tuluwat, Indian Island Restoration Project Nearly Complete!

By Tim Nelson

We are approaching an exciting time in the Wiyot Tribe's Tuluwat Restoration Project, and we expect the cleanup phase of the project to be essentially complete this summer!

Tuluwat Village is located on the northeastern tip of Indian Island in ***Wigi*** (Humboldt Bay). The village was the site of the annual Wiyot World Renewal Ceremony until its violent interruption in February 1860. After the massacre, the sacred site was used as a drydock for about 100 years, where boats were hauled ashore, repaired, and treated with chemical preservatives. When the Wiyot Tribe purchased its land back in 2000, we were left to remediate the toxic legacy. After over 12 years, countless hours of work by staff and volunteers, and millions of dollars of donations and grant funding, the cleanup is nearly complete. Most of the soil contamination, including dioxins, PCBs and PCPs, and heavy metals, has been treated, including an innovative *in-situ* peroxide based treatment that helped neutralize dioxin without harming the midden or any cultural artifacts or remains contained within. The final phase of the cleanup plan is a semi-permeable cap and soil fill. This will make the site safe for the general public and especially for the completion and continuation of the 1860 World Renewal Ceremony. The work on this phase will begin in July 2013 and be completed in August. This work is being completely funded by the United States Environmental Protection Agency (USEPA) Emergency Taskforce of the Superfund Division, at no cost to the Wiyot Tribe. The Wiyot Natural Resources Department has also secured funding through NOAA's Community Based Marine Debris Removal program to address remaining debris in the tidal mudflats surrounding the

Tuluwat midden. Future work will include removal of invasive plant species from the wetlands, and planning and construction of a traditional ceremonial area.

Tuluwat Village and remnants of abandoned drydock in 1998, shortly before being purchased by the Wiyot Tribe (left); site visit with USEPA Project Officer Damian Willson in 2013 (right). Note reconstructed drydock, erosion control sheetpile, and cleared debris

Funding for this project has come from (in no specific order): Wiyot Tribe Sacred Sites Fund, USEPA, California Cultural and Historic Endowment, Humboldt County Economic Development Division, Headwaters Fund, California Integrated Waste Management Board, California Conservation Corps, Tribal Conservation Corps, Sierra Service Project, Coast Seafoods, National Park Service, California Sea Grant, Coastal Conservancy, Seventh Generation Fund, Humboldt Area Foundation, McLean Foundation, National Oceanic and Atmospheric Administration, and numerous volunteers.

Swap Out Your Lead Based Ammunition for Free!

By Tim Nelson

The Natural Resources Department is assisting the Yurok Tribe's Wildlife Program in getting the word out to all parties interested in swapping out lead based ammunition for non-lead based ammunition. The ammunition can be old, cheap, corroded, hand-loaded, and/or unusable, it doesn't matter! The Yurok Tribe will then give you a box of premium factory-loaded non-lead ammo in the matching caliber for free!

The problems associated with lead based ammunition can have a devastating effect on the environment, wildlife, and even humans. Residual lead can degrade water quality that can have an effect on aquatic species, wildlife can ingest the lead pellets while foraging, scavenger species (i.e. vultures and condors) can ingest the lead after wildlife have been shot and not taken, and humans can ingest pieces of lead-based shot in game or meat that has absorbed the lead shot. The dangers of lead

can include lead poisoning leading to kidney problems, high blood pressure in adults, and delays in physical or mental development in kids.

If you are interested in swapping out your ammunition (REMEMBER: can be old, corroded, and/or unusable!), please give the Natural Resources Department a call at 707-733-5055 or contact us via Facebook (Wiyot Tribe). A booth will also be set up at Wiyot Day, September 7, 2013 to swap out old lead based ammunition for new, non-lead based ammunition.

The Challenges of the *Gou'daw* (Pacific Lamprey)

By Tim Nelson

Recently, the Natural Resources Department has been conducting passage assessments within the Eel River/Van Duzen watersheds to determine barriers to ***gou'daw***, Pacific lamprey (*Entosphenus tridentatus*), migration. Our work has been primarily focused on culverts (especially along roads) but has not been limited to other barriers such as railroad crossings, bridges, dams, etc. So far our work has taken us to the Lower Eel, Van Duzen, South Fork Eel, and Middle Main Eel sub-basins with future work to occur in the North Fork Eel, Middle Fork Eel, and Upper Main Eel.

The life history of lamprey (specifically Pacific lamprey) is unlike the life history of other culturally important and more closely studied species such as salmonids (i.e. steelhead, Chinook/Coho salmon). Lamprey begin their journeys by spending 5-7 years buried in fine substrate (i.e. silt and/or sand) filter feeding. After this period, the ammocoete (eyeless, jawless lamprey) emerges from the substrate grows an eye and small mouth (technically referred to as a macropthalmia at this stage) and begins to "feed" on a host species. Pacific lamprey are considered a parasitic fish since their method of feeding consists of latching on to a host species (trout, salmon, etc.), boring a hole with their three teeth ("*tridentatus*" meaning "three teeth"), and sucking their blood. Once the macropthalmia reaches a large enough size, it begins its migration to the ocean where it will spend 1-2 years attached to another host (i.e. salmon, tuna, etc.) growing even larger before making its way back into the river system where it will find a suitable spot to make a redd. The premier location for a lamprey redd is usually situated above a riffle with suitable substrates comprised of cobbles. Larger substrate is difficult for a lamprey to move around and smaller substrate does not provide the necessary size and protection. Unlike salmonids, lamprey do not return to their natal stream but rather select river systems based on pheromones secreted from ammocoetes upstream.

During the years that pass from the ammocoete to the spawning stage of the Pacific lamprey life cycle, there are numerous threats to the survival of an individual lamprey. For instance, ammocoetes require little for survival since the majority of their lives are spent in the substrate. These necessary requirements would be water (for oxygenation), suitable sediments (for protection), and food. If these three requirements exist, the survival rate for the ammocoete is high since predator species are less likely to "dig" for their prey. But, if these requirements are absent and/or depleting, the ammocoete is required to leave the sediment and search for a more suitable location. This makes the small, eyeless,

jawless creature prey to any larger predator in the area. Also, if the area in which the ammocoete is located has been cut off from the river, it runs the risk of dying from either low oxygen levels as water temperatures heat up or suffocation from the pool drying up before rains can reconnect the river system.

So what are the real challenges to lamprey success? The big, glaring problem (especially on the Eel and Van Duzen River) has to do with water quantity. This year in particular has been an awful summer in regards to precipitation. Combine this with the existing legal diversion to Sonoma County along with hundreds to thousands of illegal diversions, most often for marijuana cultivation, and there is little water remaining. Of the water that is remaining, hot temperatures (especially in low flow areas) in combination with high nutrient loads cause blue-green algae blooms that can lead to human and wildlife sickness as well massive fish kills when the algae dies, taking up large stocks of oxygen.

Besides water quantity and quality, lamprey also have to deal with predation from large, non-native fish called Sacramento pikeminnow (aka squawfish). Pikeminnow can grow as large as 1 meter in length and are considered a piscivorous cyprinid known to compete with trout and also prey upon young salmonids and lamprey. Pikeminnow were introduced for sport fishery purposes and quickly populated the Eel River system. Once established, the pikeminnow further depleted an already crippled salmonid and lamprey population thus slowing restoration efforts.

Barriers to lamprey migration (i.e. road culverts, railroad crossings, etc.) can have an impact due to the fact that lamprey lack the ability to jump like salmonids. Rather, lamprey have to attach to substrate or other structures using their suction disk mouth and inch their way up over a barrier as long as some water flow exists. The problem with this type of maneuvering has to do with angles. If the lamprey suctions up a barrier and hits a 90° angle (i.e. concrete steps on culverts and fish ladders), they lose suction and cannot pass the barrier. If flows reach a point where lamprey can pass through without climbing, then the upper reaches are accessible as long as flow through the culvert is not too powerful for a lamprey to swim and/or attach and pass through.

So how do we fix these problems? A quick solution, that many believe is the root cause of all the problems, is to remove the Potter Valley Project dams that are situated on the Eel River. As much as these barriers have a huge impact on the migration of lamprey, there are some stretches, such as the South Fork of the Eel River, that are not impacted by the flows from the dams. Rather this stretch is mainly impacted by human use within these watersheds. Streams natural dry up or occur "intermittently" (water in stream for a certain distance, then dry for a certain distance due to underground flow, then flow above ground downstream) but illegal diversions of Eel River water are having a huge impact in that they are drying up important tributaries that lamprey would use for spawning and/or ammocoete habitat. More conscious approaches to water storage and/or use, especially on a river like the Eel that has existing water quantity issues, will be a primary reason for the success or failure to the migration of Pacific lamprey.

Organizations have been working hard to retrofit barriers to fish passage and we are glad to say that lamprey (specifically Pacific) are being considered in the same breath as salmonids when infrastructure such as road culverts, bridges, dams, fish ladders, etc. are constructed. The Mattole Restoration group has the Good Roads Clear Creeks program that has retrofitted nearly 36 culverts which have allowed fish access to more than 29 miles of upstream habitat! California's Department of Fish and Wildlife as well U.S. Fish and Wildlife Service are also working closely with California's Department of Transportation to remove and/or retrofit barriers to fish migration.

The Department has collected data on approximately twenty (20) passage barriers in the Van Duzen and Eel River watershed and have photographed/visited approximately fifteen (15) other barriers. Throughout this field work, the team has garnered a further appreciation for lamprey due to the enormous challenges that they are consistently subjected to. So far it appears those Pacific lampreys are holding to stretches of river or tributaries that have adequate water supply and/or little human impact. There is a lot more work to do but as long as the species exists, the Wiyot Tribe's Natural Resources Department will continue to work towards reviving the run of Pacific lamprey on the Eel River.

On-Land Cleanup Phase of Tuluwat Restoration Project Complete! First World Renewal Ceremony in 154 Years being Planned!

by Stephen Kullmann, Wiyot Tribe Natural Resources Director

Figure 2. Indian Island in Humboldt Bay. The Tuluwat Village shell midden is at the northeastern tip (Photo courtesy of Thomas Dunklin)

According to Wiyot Councilwoman, Cheryl Seidner, the effort to restore Tuluwat Village, the site of the Wiyot Tribe's annual World Renewal Ceremony, began immediately after the tragic massacre of 1860 and the atrocities that continued throughout Wiyot Territory. The Wiyot people were prevented from accessing their sacred land for over 100 years while an industrial boat repair facility and drydock continued to indiscriminately dump toxins and contaminate the historic shell midden. The Tribe has worked tirelessly to reacquire its sacred land and remediate the environmental contamination so that it can once again hold its World Renewal Ceremony. The Wiyot Tribe, through generous donations to the Sacred Sites Fund, purchased 1.5 acres of the Tuluwat Village shell midden in 2000. In 2004, the City of Eureka returned an additional 60

acres, approximately 1/3 of the Island. After 14 years of hard work and millions of dollars spent, the Wiyot Tribe is planning to complete the World Renewal Ceremony that was brutally interrupted 154 years ago.

Tuluwat Village is located on the northeastern tip of Indian Island in ***Wigi*** (Humboldt Bay). The village was the site of the annual Wiyot World Renewal Ceremony until its violent interruption in February 1860. In the evening of February 26, 1860, after most of the men had departed back to their villages to gather food for the following day, a group of settlers rowed over from Eureka and murdered approximately 200 Wiyots and others, mostly women, children and elders. Although there was a national outcry about the atrocity, no one was every held accountable for the crime. Bret Harte, a young journalist who reported the story, was run out of town by an angry mob.

Days before the massacre, Robert Gunther purchased the deed to the Island, which was known as Gunther's Island for the coming years. In addition to leasing the village site for use as a drydock, he diked and drained the tidal wetlands to raise cattle and vegetables, and sold other parcels on the southern portion of the island for homes. The drydock operated for over 100 years under various ownership, hauling ships ashore on metal rails called “ways” and treating them with various chemical, paints, wood preservatives, and anti-fouling agents. With little or no oversight, chemicals were spilled freely onto the land and water, and lead acid marine batteries were even used as a homemade seawall. Amateur archeologists were allowed to dig in the shell midden, removing artifacts and human remains to be sold to museums.

Figure 2. The Tuluwat Village Site in 1998, shortly before purchased by the Wiyot Tribe.

In 1964, the site was designated a National Historic Landmark and in 1996 added to the National Register of Historic Places. In 1971, plans for a "Far West Indian Historical Center, Indian Island" were created, spearheaded by Albert and Beverly James and

others. Also in 1971 the Samoa Bridge was dedicated, and the Island was officially renamed Indian Island.

The Wiyot Tribe purchased 1.5 acres of the shell midden land "as-is" in 2000, through generous donations to the Sacred Sites Fund. Work on remediating the toxic legacy and protecting the site from ongoing erosion began immediately, initially through staff and volunteer efforts and subsequently through a series of federal, state, local, and private grants. Over the years, tons of metal debris, toxic substances, chemically treated wood, and dilapidated structures have been removed. A sheetpile revetment was installed around the east shore of the midden to protect against erosion and prevent toxic substance from leaching into Humboldt Bay, an important waterway supporting much of California's oyster industry and other fisheries. The goal was to disturb as little of the original midden as possible, but unfortunately after comprehensive assessments, a portion of the soil was found to be too contaminated to safely leave in place. Primary contaminants included dioxins, pentachlorophenyl (PCP), polychlorinated biphenyl (PCB), arsenic, and heavy metals. In 2009, archeologists specially trained to work with hazardous materials carefully removed approximately 23 cubic yards of material, which filled 87 55 gallon drums and needed to be barged offsite and transported to a certified landfill.

Figure 3. Tuluwat today, after completion of the geotextile cap and fill.

Other activities included removal of invasive plant species and transplanting native willows around the shoreline. Trespassers, thieves, and vandals were also a constant problem at the remote site. Because the project was highly visible, occurring on a National Historic Site within designated wetlands and a bay listed for dioxin and containing various endangered species, there was oversight required by various public agencies including the City of Eureka; California Coastal Commission; Humboldt Bay Harbor, Recreation, and Conservation District (HBHRCD); California Regional Air Quality District; California Regional Water Quality Board; California

Department of Fish and Wildlife; US Army Corp. of Engineers; US Fish and Wildlife Service; US Environmental Protection Agency (USEPA); and the Wiyot Tribe Historic Preservation Office. All of this added considerably to the time and cost requirements of the project.

All activities were further hindered by the lack of accessibility to the site. Although the Samoa Bridge crosses Indian Island, the shell midden is a nearly 1/4 mile walk across tidal marshland and sloughs and is only reachable on foot at low tides. The old dock and bulkhead facilities had been destroyed by neglect and Humboldt Bay's harsh conditions. In the beginning of 2011 the bulkhead was renovated, which required pumping concrete the 1/4 mile from the bridge, to a booster pump situated on a barge, to the forms. By the end of the year, the bulkhead was used to help complete an in-situ chemical oxidation treatment to reduce contaminates to an acceptable background level. The treatment was carefully selected to effectively break down dioxins, PCPs and PCBs without causing harm to the midden and potential artifacts.

The final cleanup phase was the installation of a permeable geotextile cap and approximately one foot of clean fill over the site to prevent contact with contaminated soil. The top layer of soil was mixed with oyster shell donated by a local seafood company to more closely match the native midden material. The entire area was then hydro-seeded with a native grass mixture specially formulated for the site.

Overall funding for the project to date has been estimated at $2.7 million, including federal, state, local, and private grants and untold volunteer and in-kind donations. Funders have included the Wiyot Tribe Sacred Sites Fund, USEPA (Performance Partnership Grants, Brownfields Grants, and Emergency Task Section), California Cultural and Historic Endowment, Humboldt County Economic Development Division, Headwaters Fund, California Integrated Waste Management Board, California Conservation Corps, Tribal Conservation Corps, Sierra Service, Coast Seafoods, National Park Service, California Sea Grant, Coastal Conservancy, Seventh Generation Fund, Humboldt Area Foundation, McLean Foundation, National Oceanic and Atmospheric Administration (NOAA), and numerous volunteers. The Wiyot Natural Resources Department (WNRD) has also secured

Figure 4. Debris in the surrounding mud and eelgrass beds will be removed through a NOAA-funded Marine Debris Removal Project.

funding through NOAA's Community Based Marine Debris Removal program to address remaining debris in the tidal mudflats surrounding the Tuluwat midden. Future work will include a wetlands management plan and removal of invasive plants, improving access through a new dock and temporary bridges, and planning and construction of a traditional ceremonial area.

This project is essential to promote healing after the unspeakable atrocity of the Indian Island massacre and subsequent environmental crimes, for both native and non-native communities. Furthermore, through the tireless work and fundraising of the Wiyot Tribe, millions of dollars have been funneled into the local community, the quality of Humboldt Bay has been improved, and as an unanticipated side benefit, the USEPA Emergency Task Force that completed the capping portion of the project is now working with the HBHRCD to help with the Samoa Pulp Mill cleanup. The WNRD has been continuing to partner with federal, state, and local agencies and groups to promote and effect environmental restoration within its ancestral territory and waters. The WNRD has an ongoing water quality monitoring project, is working with the HBHRCD on a Marine Debris Removal Program to remove old concrete floats, and Humboldt Baykeeper and the Ocean Conservancy on public outreach, collaborates on invasive species removal projects, and works on Eel and Mad River Restoration Projects. For more information, visit our website at http://wiyot.us/natural-resources

Figure 5. The Wiyot will dance again on their sacred land.

Youth Environmental Education Program A Success This Summer!

By Tim Nelson, Natural Resources Specialist

The Wiyot Tribe's Natural Resources Department (hereafter "Department") created a curriculum full of fun and exciting field trips and activities for the Wiyot youth. The main purpose of the Wiyot Tribe's environmental education program is to teach tribal youth about threats to the health of the ecosystem, how it can have an effect on the plants and animals associated within, and ways they can help to safeguard our environment for generations to come. That being said, it is the overall goal of the Department's environmental education program to incorporate both traditional environmental and institutional-based knowledge into a curriculum in order to ensure that the Wiyot youth have a strong desire to care for their environment. With the assistance of the Social Services Department's Youth Activity Program, the education program included surf day at Moonstone Beach, a watershed demonstration, a fish identification workshop, a polluted runoff demonstration, a TBR wetland field trip with a Wiyot language lesson by Language Program Manager Lynnika Butler, a trip to Indian Island, a field trip and language lesson at the Elk River Headwaters Forest Reserve and estuary, a river floating trip on the Eel River with a visit to Cock Robin Island, a plant and wildlife exploration field trip at the U.S. Fish and Wildlife Service's (USFWS) Humboldt Bay National Wildlife Refuge, and a beach day focusing on marine debris cleanup. If you're interested and would like more information on the summer program, please feel free to contact the Natural Resources Department via phone, email, or visit the Tribe's Facebook page.

Department Collaborates with Tribes and Agencies to Monitor Mad River Summer Steelhead

By Tim Nelson

In July, the Department worked with the Mad River Alliance on conducting summer steelhead counts on the Mad River just below Ruth Dam all the way down to the estuary. Working alongside Mad River Alliance member agencies such as USFWS, California Department of Fish and Wildlife Service (formerly California Department of Fish and Game), National Oceanic and Atmospheric Administration (NOAA), Blue Lake Rancheria, and many others, the Tribe surveyed a section of Mad River located approximately 15 miles upstream from the estuary. In total, 20-30 teams of 4-5 members from Tribes, government agencies, environmental NGO's, timber companies, and private consultants all participated in collecting highly valuable, scientifically defensible data on Mad River's summer steelhead population. This is a great example of how collaboration with different agencies and groups can provide valuable data than if all parties collected this data individually. The Department also collaborates with partners on the Eel River to collect salmonid data and will be participating in dives in October and November.

Wiyot Tribe Continues Study of Eel River *gou'daw*, Pacific Lamprey

By Stephen Kullmann & Tim Nelson

The Wiyot Tribe Natural Resources Department, funded through a U.S. Fish and Wildlife Service Tribal Wildlife Grant (USFWS TWG), has been conducting passage assessments and ammocoete surveys within the Eel River/Van Duzen watersheds to determine barriers to ***gou'daw***, Pacific lamprey (*Entosphenus tridentatus*), migration. Working with Stillwater Sciences, our work has been primarily focused on culverts (especially along roads) but we have also investigated other barriers such as railroad crossings, bridges, dams, old structures such as weirs and trash racks. Using the California Fish Passage Assessment Database (PAD), we prioritized a list of 60 potential lamprey barriers. To date we have assessed 32 and visited 26 others, taking us to all of the major Eel River sub basins except for the North Fork.

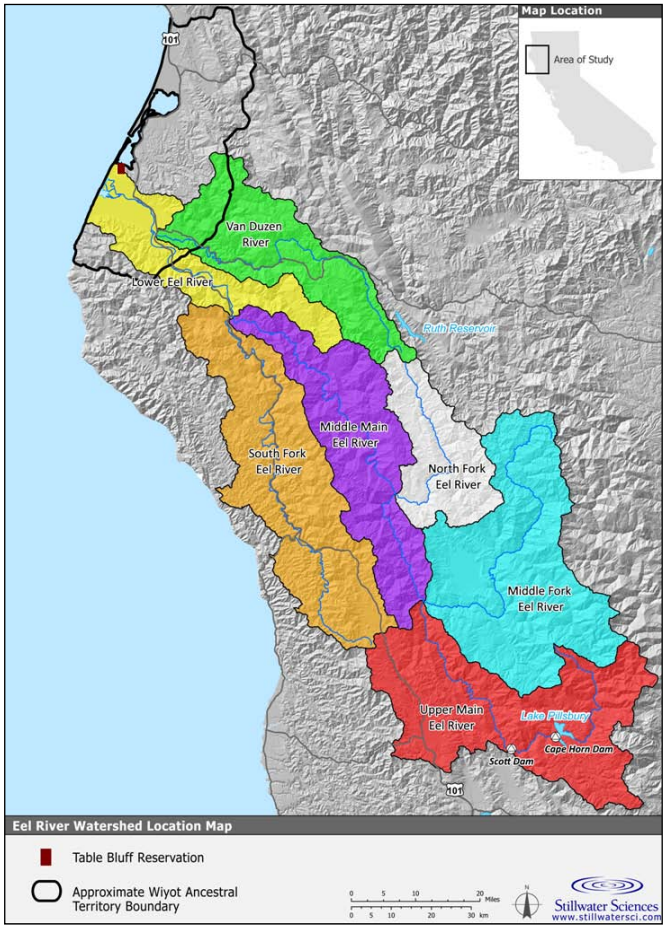

Figure 1. Sub-basins of the Eel River watershed (courtesy of Stillwater Sciences)

Depending on the conditions at the individual sites, an assessment can include a full longitudinal profile with survey equipment, which is later entered into the Fish Xing model, lamprey specific spawning and ammocoete habitat assessments, and electrofishing (e-fishing) to determine ammocoete presence/absence and identification. All sites are also carefully photo-documented. While we are still completing the data-collection phase of the project, some patterns are emerging and much is being learned about Pacific lamprey distribution throughout the system. Unfortunately, it is too early to draw any conclusions about major limiting factors to Pacific lamprey success in the Eel River.

Although there has been little or no previous concentrated study of Pacific lamprey on the Eel River, anecdotally there has been a steep population decline over the past decades. Once a staple for the various Native American Tribes dwelling along the river as well as a major food source for many species throughout the ecosystem, the gou'daw are becoming harder to find and even harder to harvest. Loss of traditional foods has had a major impact on the health of Native American peoples, and their traditional ecosystem management that kept the ecosystem healthy for thousands of years has been ignored. Migrating lamprey, which are higher in fats and caloric content

than other migrating fish, are a major food source for all river-based predators, including sea lions, bears, raptors, and more. It has been suggested that the species acts as a "buffer" to migrating salmonids, which are stronger swimmers (harder to catch) and provide fewer calories.

As this lamprey project is wrapping up, we will soon be starting a new USFWS TWG lamprey project focusing on the lower Eel River and Humboldt Bay tributaries. The goals of this project will be the development of preliminary long-term monitoring and management plans for Pacific lamprey, which will include a creel survey of "eelers" and identification of index reaches for lamprey monitoring. Furthermore, through a collaborative effort with CA Fish and Wildlife, we will conduct a PIT tag effort of Pacific lamprey in Freshwater Creek to study the species' unique.

Figure 2. Assessing Pacific lamprey habitat at Root Creek, tributary to the Van Duzen

Wiyot Tribe Fisheries Capacity Continue to Grow with New NOAA/NMFS Tribal Species Recovery Grant-Funded Eel River *Ba'm*, Green Sturgeon, Project

By Stephen Kullmann

The Wiyot Tribe is continuing to develop its capacity to renew its traditional role as stewards of its natural resources. We were recently awarded grant funds through the National Marine Fisheries Service (NMFS)/National Oceanic and Atmospheric Association (NOAA) Species Recovery Grant to Tribes to complete a three-year study of Eel River ***ba'm***, green sturgeon (*Acipenser medirostris*). The Wiyot Tribe, with technical assistance from Stillwater Sciences, is in the perfect position to successfully investigate green sturgeon in the Eel River and fill a critical data gap.

Figure 1. *Ba'm*, green sturgeon (Photo courtesy of Thomas Dunklin)

The goal of this project is to determine the current status and population of origin of North American green sturgeon in the Eel River. Green sturgeon in the Eel River comprise one of the most prominent data gaps for North American green sturgeon given that the Eel River is one of the larger rivers in California and had an apparently large and important historic spawning run. Ambiguity exists in terms of the current status of green sturgeon in the Eel River with official designations considering the spawning run lost and yet sightings still occurring annually.

According to NOAA's recovery planning document for southern Distinct Population Segment (DPS) green sturgeon, "In order to establish a recovery plan for the species, the current status of that species must be understood." This project will greatly improve that understanding by investigating one of the best potential unrecognized spawning runs. For whatever green sturgeon that still spawn in the Eel River, it is important to determine if they are northern DPS, as presumed without evidence, or if they are southern DPS, or a mix. All possible outcomes would be significant: 1) if they are northern DPS then this would add a third spawning river to that population besides the Klamath and Rouge rivers; 2) if they are southern DPS then that would add a vital second spawning population besides the Sacramento River, with important implications for resiliency; and, 3) if they are a mix, then it would be the first documented mixed spawning run.

In addition to determining the population of origin, it's important to document spawn timing and location, which can allow for a more accurate assessment of potential threats to successful reproduction and recovery in the Eel River. Another question to be answered is if the Eel River estuary, both the riverine and marine portions, are being used as rearing and feeding habitats for one or both DPSs of green sturgeon similar to nearby Humboldt Bay (mixed), or the Umpqua River estuary (northern DPS only), or the Klamath River (mixed in marine estuary, northern DPS only in riverine estuary).

The objectives of this project are to: 1) determine the presence, timing, and locations green sturgeon spawning and holding in the mainstem Eel River; 2) determine the population of origin (southern DPS vs. northern DPS) of these fish; and 3) determine the summer residence of green sturgeon in the Eel River estuary (riverine and marine). The project area will be from the confluence of the Middle Fork and mainstem at river mile 120 (Dos Rios) to the Pacific Ocean and the near shore marine portion of the estuary. It is important to conduct this study over a consecutive three year period to have an adequate baseline of data to meet the objectives given the spawning periodicity of green sturgeon.

Specific activities will include: 1) review of background scientific information and tribal oral histories and traditional ecological knowledge; 2) assess habitat availability and limitations by cataloguing pool depths and gathering available water temperature and flow data; 3) conduct a presence and enumeration survey on the mainstem Eel River using a mobile DIDSON sonar camera (192 river kilometers); 4) identify population(s) of origin using genetic analysis of any eggs collected with artificial substrate mats placed in likely spawning areas identified during the mobile DIDSON survey; 5) monitor for individuals tagged elsewhere by installing a sonic receiver detection network at strategic sites in the marine, estuarine, and riverine migration corridor; and, 6) report and disseminate findings in a manner that protects sensitive green sturgeon spawning and holding areas.

The Eel River Dams

By Eddie Koch, Natural Resources Technician

The first dam known to exist was constructed by the ancient Egyptians around 2950-2750 B.C.E. The dam was 37 ft tall, 348 ft wide, and was called Sadd el-Kafara, which in Arabic means "Dam of the Pagans." Since the time of the Egyptians, a large number of dams with different uses have been constructed worldwide. The federal government's involvement in dam construction in the United States started in the 1820s when the Army Corps of Engineers built wing dams on the Ohio River to improve navigation. In 1902, the Bureau of Reclamation was established and consequently the number of dams in this country increased dramatically. The primary purpose of dams is to store water, which is used to produce electricity or to supply water for human use such as agriculture or drinking water. Around the turn of the century it was commonplace to construct dams on major river systems based on anthropogenic needs seemingly without regard to environmental impact. While much public attention has been focused on issues surrounding the restoration of the Klamath River basin, including the Department of the Interiors recommendation to remove four hydroelectric dams, outcry on such a large scale concerning dams occupying the Eel River has gained little momentum.

The Eel River watershed is the third largest in California and at one time was the largest in salmon production. Two dams, Scott and Cape Horn, occupy the Eel River, effectively cutting off hundreds of miles of salmon as well as Pacific lamprey (eel) spawning habitat. The two dams are a part of the Potter Valley Project (PVP) which was conceived with the typical mind set at the time for creating a water diversion project without consideration to impacts on the local ecosystems. Cape Horn Dam was completed in 1907. It forms the Van Arsdale reservoir which is used to divert 190,000,000 m^3 of water annually through an aqueduct tunnel to a powerhouse in Potter Valley where it drives a turbine supplying electricity for the City of Ukiah and surrounding area. In 1921, Scott Dam was completed forming Lake Pillsbury in order to supplement the water supply for the PVP.

Fragmented rivers affect the migration of fish, disrupt the transport of sediments, cut off floodplains, threaten many species, and have a devastating effect on the people who depend on them. Opinions concerning the PVP occupy the entire spectrum from complete removal of dams on the Eel River in order to restore the ecosystem back to a natural state to uninterrupted use of the dams in order to provide water and electricity to the thousands of people who have come to depend on it. Where do the Wiyot people sit on the matter? Whatever your opinion, it is hard to argue that like numerous other Tribes that occupy traditional territory containing a valuable natural resource, the Wiyot are positioned somewhere in the middle and are affected more acutely yet have less say in the matter than most other parties involved.

It is unlikely that the dams constricting the Eel River will be removed in the foreseeable future, so what can be done to alleviate water quality and quantity problems associated with them? If we focus on just two aspects of water use, hydroelectric power and agriculture, we find that viable solutions exist. For example, using alternate sources such as solar or wind to generate electricity would alleviate the need for water diversion. Also, for current agriculture watering practices, a switch to drip irrigation from the widely used method of broadcast watering would ease the strain on the water supply immensely. This conversion for the entire state of California would save enough water to supply 10 Los Angeles sized cities! So why not do it? Simply put, it is not cost effective to do so. The cost of converting large scale agriculture operations to drip irrigation far outweighs the monetary benefits of doing so. Similarly, the savings in dollars of converting to solar or wind generated electricity, compared with the cost of doing so, would not be seen for so long that most energy companies are not willing to make the initial investment. Incentives are needed to move us toward sustainability in these areas. Unfortunately, less environmental impact is not enough of an incentive for those who wield power. Money talks, even when the voice of reason resonates much louder. Until then we can help by supporting programs designed to promote ecologically sound systems that supply our everyday needs.

Some tips to use less water and electricity are:

- Turn off your computer at night (it may go to sleep but it will still suck up energy)
- Repair leaky faucets
- Switch to Energy Star qualified products when upgrading appliances
- Clean your refrigerator coils (vacuum out the dust and wipe with a damp cloth)
- Cancel your newspaper subscription and read the news online
- Place a brick or small, weighted down, open container in old toilets (a large amount of water is displaced by the brick thus using less water or the container will "catch" water after each flush, thus saving water)
- Take shorter showers (or switch to low flow faucets)
- Run the dishwasher only when it is full
- Plant native or drought-tolerant plants

For more information on Eel River water quality issues, our fisheries projects, and/or some helpful tips on conserving water, please call or email the Natural Resources Department.