COASTLINES
Information About Estuaries and Near Coastal Waters

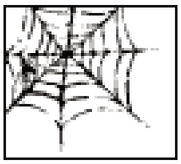
Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Information About Estuaries and Near Coastal Waters
Spring 1998, Volume 8, Number 2

Table of Contents

COASTLINES

Information About Estuaries and Near Coastal Waters



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

United States Environmental Protection Agency | Office of Water | EPA842-F-98-003L

Rock Barbs Enhance Fish Habitat and Water Quality in Oregon's Tillamook Bay Watershed

Demonstrating Practical Tools for Watershed Management Through the National Estuary Program

Tillamook Bay, Oregon

Characteristics:

- The watershed for Oregon's Tillamook Bay extends over 570 square miles and is drained by five rivers.
- The watershed supports several resource-based economic activities, including logging, fishing, shellfishing, and dairy and crop agriculture, which are vital to the region's economy.

The Problem:

- The intensive nature of resource-dependent economic activities over the past 150 years has altered the system's natural processes and contributed to an array of environmental problems in the Tillamook Bay estuary and watershed.

- Priority concerns of local residents include bacterial contamination, erosion within the watershed and resultant sedimentation within the bay, and degradation of habitat for salmonid spawning and rearing.

- Both sedimentation and loss of salmonid habitat can be traced, in part, to excessive stream bank erosion, lack of stream type diversity, and limited riparian vegetation.

The Project:

- The Biotechnical Barb Structure and Gravel Bar Stabilization Project was designed to be a low-cost, easily implemented, fish-friendly method of stream restoration which lessens erosion and sedimentation while improving fish habitat.

The National Estuary Program

Estuaries and other coastal and marine waters are national resources that are increasingly threatened by pollution, habitat loss, coastal development, and resource conflicts. Congress established the National Estuary Program (NEP) in 1987 to provide a greater focus for coastal protection and to demonstrate practical, innovative approaches for protecting estuaries and their living resources.

As part of the demonstration role, the NEP offers funding for member estuaries to design and implement Action Plan Demonstration Projects that demonstrate innovative approaches to address priority problem areas, show improvements that can be achieved on a small scale, and help determine the time and resources needed to apply similar approaches basin-wide. The NEP is managed by the U.S. Environmental Protection Agency (EPA). It currently includes 28 estuaries: Albemarle-Pamlico Sounds, NC; Barataria-Terrebonne Estuarine Complex, LA; Barnegat Bay, NJ; Buzzards Bay, MA; Casco Bay, ME; Charlotte Harbor, FL; Columbia River, OR and WA; Corpus Christi Bay, TX; Delaware Estuary, DE, NJ, and PA; Delaware Inland Bays, DE; Galveston Bay, TX; Indian River Lagoon, FL; Long Island Sound, CT and NY; Maryland Coastal Bays, MD; Massachusetts Bays, MA; Mobile Bay, AL; Morro Bay, CA; Narragansett Bay, RI; New Hampshire Estuaries, NH; New York-New Jersey Harbor, NY and NJ; Peconic Bay, NY; Puget Sound, WA; San Francisco Bay-Delta Estuary, CA; San Juan Bay, PR; Santa Monica Bay, CA; Sarasota Bay, FL; Tampa Bay, FL; and Tillamook Bay, OR.

Introduction to Tillamook Bay

Representative of the estuaries nestled between the Northwest Coast Range and Pacific Ocean, Tillamook Bay and its surrounding watershed provide critical habitat for countless plant and animal species. Since the area's settlement in the 1850s, these resources have supported the growth of the region; many of the industries which developed over a century ago still exist today.

Forestland accounts for roughly 50% of the upper watershed. Virtually all of the private forestlands have been harvested at least once this century, while public lands, having suffered a series of fires, will again be ready for harvest in the near future. In the lower watershed, 20,000 cattle produce much of the milk for the state's largest creamery.

The 13-square mile estuary produces a rich harvest of shellfish. Although commercial salmon fishing in the bay was closed in 1962, sport fishing remains important to the local economy. Over the past quarter century, however, Tillamook Bay has witnessed dramatically reduced fish runs and repeated closures to shellfishing.

Only 80 miles from the Metro-Portland area, the watershed is a very popular tourist destination and second home and retirement site for the region's 1.5 million residents.

Overview of The Biotechnical Barb Structure and Gravel Bar Stabilization Project

As the environmental impacts of the watershed's resource-based economy became more evident, concerned citizens petitioned the US EPA to establish the Tillamook Bay National Estuary Project as a means to address the bay's declining health and productivity particularly pathogenic contamination, erosion in the watershed and sedimentation in the bay, and salmonid habitat degradation.

To help address the latter two issues, the Estuary Project supports the Biotechnical Barb Structure and Gravel Bar Stabilization Project. Now completing its second year, this effort is showing significant returns from a relatively minor investment.

By strategically pointing rock structures known as barbs into the stream channel and following up with tree planting, this effort fosters channel structure diversity and increased riparian vegetation. The stabilization project provides a low-cost, fish-friendly means of addressing sediment loading and degraded salmonid habitat.

Project Objectives:
Through strategic in-stream placement of rock barbs, followed by riparian plantings, the project aims to improve salmonid habitat by achieving the following objectives:

- stabilizing stream banks,
- improving stream channel structural diversity, and
- improving or establishing riparian vegetation.

Implementing the Project:
The concept is simple; rocks are placed in the stream to alter flow and create new habitats. Specifically, a barb is constructed pointing into the stream, diverting the stream's thalweg (area of highest velocity flow) away from eroded streambanks, and creating slack water on the barb side of the stream. Sediment collects behind the barb while scouring occurs off its point. As sediment continues to fall out in the slack water, a bar forms which is then stabilized by willow plantings.

The engineering of the barb depends on the nature of the river segment. The velocity of the stream determines the size of the rock used, while channel morphology determines the angle of the barb. Once the composition and shape of the barb are established, the rocks are built into the channel bed and stream bank to avoid destabilization and a layer of riprap is placed on the bank upstream and downstream from the barb.

After the barb and riprap are in place, the streambank is graded and vegetated. The upper bank is planted with willow posts and the top with conifers. When enough sediment has collected behind the barb, the newly-formed bar and lower bank are planted with willow posts or other flood-tolerant species. Willow posts range in size from two to four inches in diameter and four to five feet in length.

Success Stories:
Stream restoration practices are often criticized for incurring high costs, while producing negligible returns. Planting trees to stabilize banks without first altering stream flow is generally not successful in areas of high velocity flows. Stream bank stabilization using riprap is costly and does not add to the diversity of the stream. The barb project succeeded in meeting both of these concerns. The cost of the barbs varied, depending on a number of factors, but generally ran between $2,000 - $3,000 per structure.

The Tillamook County Soil and Water Conservation District began the Barb Project in the spring of 1996 by constructing seven barbs in the Kilchis river. After the first two years, which included several significant winter flood events, the barbs produced noticeable benefits. In addition to reducing sediment loads from eroded banks, the barbs protected vegetation introduced on the bar and in the riparian zone. As the vegetation becomes more established, it will contribute to a more natural stream channel and further dissipate the energy of the system. This system uses the natural flows and recruitment of the stream to establish the channel.

The barbs trapped sediments, which increased the size and elevation of the bar and created a deeper, narrower stream channel at low flows than had previously existed. The increase in depth and reduction in water surface area at low flows resulted in maintained stream temperatures. For summer- and fall-run (as well as local) fish, these deep, lower-temperature areas offer refuge. At higher flows, when the bar was flooded or overtopped, the plantings served as refuge for fry.

Finally, the barbs returned stream morphology and channel diversity to a more natural state. Increased meander and newly-created scour areas increased salmonid habitat while reviving some of the Kilchis' natural sinuosity. Spring and Fall Chinook now take refuge in the deep scour pools off the tip of the barb as well as the eddies which form behind it. The barbs trapped a great deal of organic material, which is good for river channel complexity and, when plantings take hold, the area will receive increased organic matter. This increase will, in turn, create more habitat. In addition to the increased supply of coarse woody debris, riparian vegetation will also provide canopy cover which will maintain low stream temperatures.

In sum, the barbs have begun to achieve their stated goals of stabilizing stream banks, improving stream channel structure, and adding salmonid habitat. Riparian plantings withstood high water levels due to the barb's flow diversion and are expected to flourish in newly-stabilized banks. Adult Chinook salmon were seen using the newly-created scour pools for refuge while smolts used the slack water behind the barb for cover. Over time, the barbs and vegetative plantings will continue to produce the following benefits:

- re-establishment of meander geometry and scour pools,
- diversion of flows from high erosion areas resulting in reduced sediment loading,
- reduced water surface area at low flows resulting in maintained water temperatures and deeper pools,
- increased stream structural diversity through reintroduction of gravel bars and loadings of coarse woody debris,
- increased aquatic refugia at high and low flows,
- increased stream shading/cover, and
- increased natural nutrient input.

Lessons Learned

Of the twelve barbs constructed as part of the demonstration project, all but one held entirely in place. The one failure yielded an important lesson. Depending on the condition of the bank, the flow rate, and angle of the current, it is critical to use large enough rocks and "key" the barb far enough into the bank. Experience helps in recognizing the size and amount of rock needed in any given location and there is no formula for what is appropriate. As a rule of thumb however, at least 10% of the barb's total length should be build it into the bank. Another useful rule is, when placing riprap upstream, bring it to a point even with the upper end of the barb. This will ensure that the bank doesn't erode and displace the riprap or barb.

For further information, contact:
For additional information on the Biotechnical Barb Structure and Gravel Bar Stabilization Project, contact Randy Stinson, Soil & Water Conservation District Hydrologist, 6415 Signal Street, Tillamook, OR 97141; phone: (503) 842-2240 ext. 108; fax (503) 842-2760.

Previous Publications in the Demonstration Projects Series

Report Title	National Estuary Program	Date Publication #
Biological Nutrients Removal Project	Long Island Sound, CT/NY	1995 EPA842-F-95-0001A

Buttermilk Bay Coliform Control Project	Buzzards Bay, MA	1995 EPA842-F-95-0001B
Georgetown Stormwater Management Project	Delaware Inland Bays, DE	1995 EPA842-F-95-0001C
Texas Coastal Preserves Project	Galveston Bays, TX	1995 EPA842-F-95-0001D
Shell Creek Stormwater Diversion Project	Puget Sound, WA	1995 EPA842-F-95-0001E
City Island Habitat Restoration Project	Sarasota Bay, FL	1995 EPA842-F-95-0001F
Buzzards Bay "Sep Track" Initiative	Buzzards Bay, MA	1997 EPA842-F-97-0002G
New Options for Dredging in Barataria-Terrebonne	Barataria-Terrebonne Basin, LA	1997 EPA842-F-97-0002H
Coquina Bay Walk at Leffis Key	Sarasota Bay, FL	1997 EPA842-F-97-0002I
"Pilot Project Goes Airborne"	Narragansett Bay, RI	1997 EPA842-F-97-0002J
The National Estuary Program: A Ten-Year Perspective	General NEP Discussion	1998 EPA842-F-98-0003K

For Copies of any of these publications contact:
National Clearinghouse for Environmental Publications
Telephone: (513) 489-8190
Facsimile: (513) 489-8695

COASTLINES
Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

International Black Brant Monitoring Project: Education that Spans a Flyway

The wind is howling, drawing all of the warmth from our fingers as we struggle to keep our binoculars focused on a small flock of Pacific Brant. "Are you counting? Remember count individuals, don't just guess," I exclaim, eager to get them counting before the Brant disappear out on the choppy water. Their flight is fast as they change direction and the wind catches their wings. "Wow, check that out, that's sooo cool, I could see the white ring around their necks that time!" shouts one of the 8th grade students from Bayview school in Mount Vernon, Washington.

The International Black Brant Goose Monitoring Project is a unique program that brings school kids out into the field to monitor the movements and activities of the Pacific Black Brant (Branta bernicla nigricans). Students connect their lives to this small elusive sea goose and to other students up and down the Pacific flyway while gaining an understanding of the life cycle and ecology of the Brant. They see first hand that estuarine ecosystems throughout the flyway are integrated through the movements of migratory geese.

Black Brant begin their lives in the Arctic Circle of Northern Canada, Alaska, and Siberia. When they are fledged and the Arctic winter nears, they fly with their family group to Izembek lagoon, on the Aleutian

Peninsula. Here Brant from all over congregate to feed on eelgrass and build up reserves for a long, nonstop flight to their wintering habitat. In late October or early November, they leave Izembek, arriving in their wintering waters 3,000 miles away in as few as 60 hours! That's a pretty impressive average speed of up to 50 mph. Their primary wintering habitat is on the coast of Baja, California, in Mexico. However, there are many smaller populations that winter at other sites along the Pacific coast which support their primary food source, eelgrass (Zostera marina).

When February rolls around, the Brant begin their gradual movement back to their breeding grounds in the Arctic. During this migration, the Brant move up the coast slowly, stopping in various estuaries along the way. Throughout this annual cycle, students involved with the project monitor their movements and activities. Data, stories, and experiences are shared among all the participants via e-mail, as well as a constantly-updated web site.

"The fact that the bird has to have adequate habitat in Alaska, British Columbia, Washington, Oregon, California, and Baja makes it difficult for individuals in various places to become adequate stewards. Use of the Internet has allowed us to dissolve these geographic barriers and has created an intimate community that crosses cultural and international boundaries. From a stewardship perspective, that is very empowering to individuals," commented Glen Alexander, Washington Regional Coordinator for the project. "Building a network of people, up and down the coast, who are knowledgeable about and sensitive to the needs of Brant is one of our goals. It takes the entire flyway to sustain a goose."

This fall begins the second field season with the Brant Project. The "Teach About Geese" curriculum created by the US Fish and Wildlife Service in Anchorage, AK, sparked the idea for the project. Funding was provided by the National Oceanic and Atmospheric Administration, the Lannan Foundation, and the National Fish & Wildlife Foundation. Amy Bohnenstiehl at the South Slough National Estuarine Research Reserve in Coos Bay, Oregon, developed a curriculum. The project now has partners in Alaska, British Columbia, Washington, Oregon, California, and Baja.

During this field season, students in the participating classes have been recording observations of Brant in their local habitat. This field experience is coupled with in-class activities that teach important concepts of Brant ecology and natural history, many of which are outlined in the Brant Project Curriculum. At all sites, students and educators have enlisted the support of local wildlife biologists who instruct the students about Brant biology, monitoring techniques, and local management issues.

This project has appropriately aligned itself with a species currently in need of attention. Brant populations have declined and migration patterns have changed in recent decades due to many pressures, especially continued loss of coastal wetland and estuarine habitat and human recreational activities in these coastal areas. Before 1958, Brant wintering populations were more evenly distributed with 50% wintering in Baja, 35% in California, and 15% in Washington and Oregon. Since 1980, 91% of Black Brant have wintered in Mexico. Development along the California coast has drastically reduced the populations of Brant wintering there, while Baja's winter populations rose dramatically. These changes probably indicate both general population decline and migration pattern changes. With development pressure along the Pacific coast increasing, it is urgent that humans begin to examine how we use our common habitat. Researchers have begun to take on this challenge and the Brant Project is one means of connecting the public with the researchers' efforts. It allows students to see how another species lives and, through that lens, they can examine their own lives and have more tools for making good decisions in their futures.

For more information about this project, contact Glen Alexander, Padilla Bay National Estuarine Research Reserve, 1043 Bayview-Edison Rd., Mount Vernon, WA 98273; phone: (360) 428-1558; E-mail: alex@padillabay.gov, or check our website.

COASTLINES
Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

On-Farm Research into Reducing Nutrient Loss in the Maritimes

Contamination of ground and surface water from nutrients is a common problem in agricultural areas, often leading to eutrophication and excessive algal growth in lakes, estuaries, and near-shore coastal waters. When fertilizer, in either synthetic or organic form, is applied in excess of crop demand, nutrients can leach from the soil into ground water. Common practices of leaving the soil bare between fall harvest and spring planting and applying manure to the bare soil contribute to both erosion and nutrient run-off to surface waters. In the Maritime Provinces of Canada, heavy spring and fall rains, occurring when the soil is bare, can exacerbate the problem. The lack of a constant snow cover, and frequent freeze-thaw cycles in the winter allow for nutrient loss during that season as well. In saturated soils or when organic fertilizers are left on the soil surface, nutrients such as nitrogen can be lost to the air.

For farmers, the loss of nutrients can represent a loss of an investment of time and money and more fertilizer is needed to replace nutrients that have leached away. Fortunately, techniques such as planting of catch crops, crop rotation, and manure management can reduce nutrient loss and protect the investment of farmers.

In general, losses from cropland occur when nutrient supply exceeds crop demands. The potential for leaching and run-off is greatest when the soil is saturated with water and is bare, sandy, and low in organic matter. Farmers can control the rate of nutrient loss by using slow-release organic fertilizers and by adjusting application rates to the crop needs. Losses are also reduced by maintaining ground cover (particularly during times of heavy rains and snow-melt), increasing the level of organic matter in the soil, and using cover crops to take up excess nutrients after a crop is harvested.

Catch crops are cover crops planted after cash crops are harvested or after legume ploughdowns. Frequently, an abundance of nutrients is available in the fall from either applications of manure during that season or "left-over" nutrients from spring or summer applications. Catch crops take up available nutrients at a faster rate than other crops. Not only can they scavenge leftover nutrients from the previous crop, but they can also use nutrients from direct applications of compost or liquid manure. The catch crops take up and hold the nutrients in their tissues, preventing leaching from the soil. As the catch crop decomposes the following spring, the nutrients are released at a time when the cash crops can use soluble nutrients.

Typically planted in the fall, catch crops provide ground cover until the land is ploughed the following spring. While they are growing in the fall, they take up rainwater, and thereby reduce the amount of water that can cause leaching.

To be a useful catch crop, plants must be fast growing, highly competitive against weeds, and be able to quickly take up substantial amounts of nitrogen. Common types include brassicas (e.g., oilseed radish, white mustard), spring grains (e.g., oats, barley), winter grains (e.g., winter wheat, fall rye), grasses (e.g., annual ryegrass), and herbs (e.g., buckwheat, phacelia).

The time of planting defines the choice of cover crops. Buckwheat is killed by light frosts and can only be planted in the summer. Phacelia is killed by moderate frosts. Brassicas and spring grains are all killed during the winter. The brassicas, grains, and grasses can all be planted in late summer to early fall. This will give them time to grow enough to take up nutrients, but not enough time to set seed. Fall rye can be planted late into the autumn.

In 1996, the Nova Scotia Organic Growers Association began a two-year project, funded by Environment Canada's Action 21, to encourage farmers to try using catch crops. During the project, the Growers Association recorded farmers' observations and evaluations of cover crops. In 1997, the Gulf of Maine Council on the Marine Environment funded an educational outreach program and field research to compare the efficacy of various cover crops to take up residual nitrogen.

Trial plots were established on twelve organic farms in Nova Scotia. The farmers (members of the Growers Association) volunteered their land and labour; they helped plant and monitor the crops. The efficacy of fall rye, oats, oilradish, and ryegrass to provide ground cover and reduce nutrient loss were evaluated. The treatments were compared to bare soil controls.

Several farmers initially showed interest in the project, however the scope of the research was limited by the weather. A lack of rainfall in July and August left the soil too dry to be ploughed and made the grain harvest later than usual. An early frost came just after the harvest. It was then too late to plant catch crops, except for fall rye.

Some of the catch crop plots failed due to the drought. On farms where dry land was disked in August and the cover crops planted, they suffered poor germination, establishment, and growth. The most successful cover crops were grown in areas that had been previously mulched. Low moisture levels may prove to be a problem for cover crops planted in July or August, however, in typical years, soil moisture levels are likely sufficient for fall-planted catch crops.

The Growers Association Catch Crop study demonstrated that fall catch crops can reduce soil nitrate levels by about 33%. This translates to a retention of approximately 150 kg/ha of nitrogen. The study was conducted at organic farms on fields where slow-release forms of nitrogen, such as composted manure, were used. The potential for greater retention of nitrogen is likely where raw manure or synthetic fertilizers are utilized.

For further information, contact Janet Wallace, Nova Scotia Organic Growers Association RR #1, Margaretsville, NS BOS 1 NO; phone: (902) 825-6834; fax: (902) 825-3139; E-mail: jwallace@istar.ca.

COASTLINES
Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Pinning Down Sources of Coliform Bacteria

Waterways compromised by elevated levels of fecal coliform bacteria from nonpoint sources continue to be one of the major issues faced by water quality managers. Tracking down and verifying nonpoint sources is a very difficult sometimes seemingly impossible task. Recently, researchers on opposite sides of the continent teamed up to focus some modern-day molecular biology on a site-specific fecal coliform problem. Their results offer considerable promise for those seeking the source of a fecal coliform problem in their coastal water body.

During the fall of 1997, a partnership including Mr. Chris Gonaver of the San Diego (CA) County Department of Environmental Health, the City of San Diego, and Dr. George M. Simmons, Jr. of the Biology Department at Virginia Tech in Blacksburg, VA initiated studies to investigate potential sources of fecal coliform contamination to Children's Pool in La Jolla, California. Based on observations by the Department of Environmental Health, the source of contamination was believed to be from seals which frequented the beach after feeding offshore. Staff from the Department collected water samples from offshore monitoring sites, as well as seal scat. Ten colonies of the fecal coliform bacterium, Escherichia coli (E. coli) were isolated from 10 water samples and 18 seal scat samples. These isolates were sent to Virginia Tech in December 1997, to determine how many of the E. coli from the water samples could be matched with the E. coli in the seal scat using modern molecular biology techniques.

The chromosomal DNA from each E. coli isolate was cut with a Not I restriction enzyme, and the resulting chromosome segments were separated by pulsed field gel electrophoresis to create restriction endonuclease digestion profiles (DNA fingerprints) for each isolate. The fingerprints could then be used for comparative purposes. There were two levels of investigation in this project. One was to compare the E. coli strains from the water with those from the seal scat. On a second level, the investigators wanted to compare the E. coli strains from the water in Children's Pool with those in the Virginia Tech library from known animals, including humans, from the southern Chesapeake Bay area. At this stage of the research, Dr. Simmons quickly admits his uncertainty about how useful, or valid, the DNA fingerprints are in the library in trying to identify E. coli strains from the west coast.

The Matching Process

If all DNA bands in the profile matched each other, then it would be concluded that there was a 100% similarity of banding patterns between two strains. However, in most cases of comparison in this type of research, there is not an exact 100% match. If there has been a mutation in one of two identical strains being compared, three bands will not match. In clinical studies, it is generally accepted that if two strains match within three bands of each other, they are substrains of an original strain. In a comparison starting with two original strains with 15 bands in each strain and a 100% similarity, if a mutation in one of the strains should occur, then all bands would match except three, which would result in a 90% similarity (28/31). It seems reasonable to assume that if a mutation could occur in one strain over a given time period, there are equal chances of a mutation in the second strain. Therefore, within the same time period with a mutation in each strain, there is the potential for six bands not to match. Given the example above of each strain having 15 bands, with six non-matching bands, there would be a similarity of 81% (26/32). Therefore, in these analyses if there was an 80% similarity, or greater, between a given water isolate and a strain from a known source, it was concluded that there was a high probability that the strain from the water could be related to that animal source. In some cases, there was a suggestion of more than one possible source. In this situation, environmental scientists familiar with the problem would have to make a judgment, based on the ecology of the area, about the more likely candidate for the source.

Of the 100 water isolates received by the Virginia Tech laboratory, 17 could not be printed because the restriction enzyme produced only two bands. That left 83 isolates which did produce an acceptable banding profile. Of those 83 isolates from water, 72 could be matched with a seal isolate at an 80% similarity or better. In three cases the envelope of acceptability was extended to a 75% match because a seal isolate was the only one which showed any similarity. The three water isolates in this category were identified as "possibly" of seal origin. If they are included, then 75 of the 83 isolates (90%) could be matched with a strain from seal scat. Of the eight water isolates which did not have a similarity to a seal strain, seven could not be matched with anything in the Virginia Tech library. The one remaining isolate showed an 80% similarity with a raccoon strain, and only that strain the only match with any similarity. While raccoons are transcontinental in their distribution, Dr. Simmons again cautions that this type of research is highly experimental and nothing is yet known about similarity of E. coli strains in animals of the same species on different sides of the continent.

As noted above, a second objective was to evaluate how well isolates from the water would match with other E. coli strains from known animals in the Chesapeake Bay region. There were some very good matches with some of the animal strains in the Virginia Tech library. For example, in addition to matching with a seal strain at an 84% similarity, one water strain matched a beaver strain at a 90% similarity and a merganser strain at an 82% similarity. Ecologically speaking, a seal source would be suspected first and a waterfowl source second, unless beaver were known to exist in the area. In another example, one water strain matched an E. coli strain from a mallard duck with a 93% similarity and a seal strain at an 88% similarity. One would have to conclude that if the nonpoint source was not seal, then there would be a high probability that the nonpoint source was from waterfowl, such as ducks. And lastly, there was one strain which shared similarities with a human strain (87%), a beaver strain (84%), a merganser strain (82%), and a seal strain (77%). This E. coli strain (and its relatives) is probably a "garden-variety-type" that may have similarities to strains from many animals and would not provide very much information about a potential source, other than there were more non-human strains with a potential match than human strains. It is this type of analysis that has to compare and contrast statistical, biological, and ecological degrees of significance.

Dr. Simmons notes that the Virginia Tech DNA library and the dichotomous key used for identifications is based on approximately 300 distinct DNA fingerprints from known animal sources. Compared to the total number of possible E. coli strains in nature, the library is quite small. For example, the Virginia Tech researchers have yet to add strains from domestic animals and an extensive number of isolates from seabirds collected during the 1997 summer at barrier islands off Virginia's Eastern Shore. Therefore, it is difficult to list other potential sources for the fecal coliforms in Children's Pool when those strains do not now exist in the library for identification purposes, i.e., other potential sources cannot be denied. Also, because of the newness of this technology for ecological analyses, the understanding of strain fidelity with respect to specific animal groups across wide geographic areas is also limited.

Conclusions

Based on the isolates that were collected and presented, the first objective of this project was quite clear. Eighty-seven percent of all water strains that could be printed showed an 80% similarity or greater with a seal strain. If three additional strains with a 77% similarity are included, then 90% of potential identifiable strains showed a seal signature. When human and seal E. coli are compared, there is a statistically significant difference in banding pattern. While strain fidelity over large geographic scales still remains to be determined, the data continue to suggest that, in general, this kind of molecular approach can be used to identify nonpoint fecal coliform sources for remediation purposes.

Of the water strains that could be identified from Children's Pool, all suggested a non-human origin, all but one suggested a seal origin, and that strain suggested a raccoon origin.

Work on this project was funded by the City of San Diego, CA, and the San Diego County Department of Environmental Health. For additional information, contact Dr. George Simmons, Biology Department, Virginia Tech; phone: (540) 231-6407; fax: (540) 231-9307; e-mail gesimmon@vt.edu or Mr. Chris Gonaver, County of San Diego, Department of Environmental Health, P.O. Box 129261, San Diego, CA

92112-9261; phone: (619) 338-2201; fax: (619) 338-2174; E-mail: cgonaveh@co.san-diego.ca.us

COASTLINES

Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

Who Lives on How Much Coastline?

Recently, we got an e-mail questioning which country has the most coastline, a request we passed on to the Urban Harbors Institute at the University of Massachusetts/Boston. Using information derived from published US Central Intelligence Agency documents, they responded with the following:

1.	Canada	243,791 km (152,369 miles)
2.	Russia	37,653 km (23,533 miles)
3.	Australia	25,760 km (16,100 miles)
4.	US	19,924 km (12,452 miles)

The figure for the U.S. is significantly different that than the 95,000 miles provided by NOAA. This difference is an artifact of the techniques used to make the measurements. The length provided for any coastline depends on the resolution of aerial photography, how many of the embayments and estuaries the measurements include, how far up rivers is considered "coastline", whether shorelines of all islands are included, etc. Coastlines has no wish to question the accuracy of the CIA or NOAA, and suggests that the relative standing provided by the CIA of "who has the longest coastline" should be considered accurate, but cautions that absolute length of coastline is a difficult topic.

In a somewhat related note, a study published in the journal Science estimates that approximately 37% of the global population, over 2 billion people, live within 100 km (60 miles) of a coastline, 44% live within 150 km (93 miles), and 49% within 200 km (120 miles). This updates, and revises significantly downward, previous estimates which held that 66% of the global population lived within 100 km of the coast.

COASTLINES
Information About Estuaries and Near Coastal Waters

Reducing Contamination in New York Harbor Sediments: Cleaning Up Our Act

Although the Clean Water Act has meant a substantially cleaner harbor than when Joseph Mitchell wrote his 1951 essay, New York Harbor sediments are still contaminated, and continue to cause both ecological and economic problems. The same contaminants PCBs, PAHs, dioxins, heavy metals, and pesticides that cause the states of New York and New Jersey to issue health warnings against consuming fish and shellfish caught in harbor waters, have also gummed up the works of the region's economic engine the Port of New York and New Jersey.

In order to remain clear for the ships that ply the harbor's waters from all over the globe, the channels of naturally shallow New York Harbor must be dredged up to 4 million cubic yards a year. Because some of these dredged sediments are contaminated, disposal options are limited. In September of 1997, when a White House-brokered agreement directed EPA to close the historical ocean disposal site for dredged materials six miles off Sandy Hook, New Jersey, disposal options became even more limited. Whereas moderately contaminated materials had been permitted to be disposed at that site, now only sediments suitable as "Remediation Material" are to be placed in what is now called the Historic Area Remediation Site. But this "clean" Remediation Material is only about 15% of the total amount to be dredged.

The US EPA and the Army Corps of Engineers require testing of sediment slated for dredging in order to determine if it is suitable for ocean placement. In 1993 and 1994, the EPA conducted a comprehensive survey of sediment quality (as well as benthic community structure) in the harbor system, called R-EMAP (Regional Environmental Monitoring and Assessment Program). Analyses and comparisons of these data highlight some consistent patterns. For example, they indicate that the area highest in most sediment contaminants is the Newark Bay/Arthur Kill complex. Further analyses of these data, accounting for grain size and organic carbon content of the sediments, indicate that there is a local, ongoing source of DDT in the Arthur Kill, and there may be one for PCBs as well. Concentrations of contaminants in American eel tissue are also highest in the Arthur Kill, perhaps because these fish are more sedentary than other species, and may reflect the contaminant environment to which they are exposed. Regulators, scientists, environmentalists, and others have been working on a variety of solutions to the dredging problem: decontaminating the sediment after it is dredged up, re-evaluating disposal options, and assessing options for port reconfiguration so channels and berths are relocated to naturally deeper parts of the harbor. However, there is wide agreement that the long-term solution to this problem the one that will best serve the economy and the environment is to reduce or eliminate the sources of contaminants to the sediments. To achieve this goal, the New York/New Jersey Harbor Estuary Program and the Dredged Material Forum (a regional entity charged with addressing pressing dredged material management issues) jointly established the Sediment Contamination Reduction Work Group in 1994, to address how best to achieve contaminant reduction in New York Harbor. Co-chaired by the Hudson River Foundation and the Port Authority of New York and New Jersey, the Work Group is comprised of representatives of federal, state, and local environmental agencies as well as scientists, environmentalists, port representatives, and others.

The Work Group developed a strategy which linked assessment tools with regulatory techniques in order to implement necessary reductions in loadings. One tool that has been developed by researchers at Manhattan College as part of this plan is a mathematical model of contaminant fate and bioaccumulation in the harbor system. Given data on the location and magnitude of loadings of contaminants to the harbor, this model will predict what the response will be in surface sediments and striped bass tissue throughout the harbor. Managers can then ask "what if" kinds of questions: what if we shut off PCB sources completely in the Newark Bay area? What if we dredge a channel and shut off sources? What if we do nothing? In any of these and other scenarios, the model will be able to predict how long it will be until only Remediation Materials are left in the harbor. With this information, appropriate long-term disposal options can be planned and implemented. The model can also predict when striped bass flesh will be safe for humans to eat and, therefore, when the striped bass fishery, closed since 1976, can be reopened.

Although many categories of contaminant sources to the harbor are recognized, there is no quantitative information about the magnitude of each source for each problematic contaminant. Without this information, the Manhattan College model could not be accurately calibrated. A series of workshops was held in 1996 to develop a comprehensive monitoring program that would quantify loadings of contaminants from every conceivable source: sewage treatment plants, industrial dischargers, landfills, atmospheric deposition, tributaries to the harbor, and others. This plan also called for synoptic measurements of levels of these contaminants in ambient water, sediments, and organism tissue from multiple levels of the food chain. Total cost for this monitoring program was estimated at $10 million.

Imagine the surprise of the work group when a funding source was actually identified and secured! The States of New York and New Jersey had completed a bi-state dredging plan, to be funded by the Port Authority of New York and New Jersey at a level of $65 million for each state, at the same time that the Work Group efforts were taking place. New York Governor George Pataki agreed that a worthwhile use of $10 million of New York's $65 million would be to collect the necessary data to calibrate the Manhattan College Model. These data, he realized, would also provide a much-needed baseline of the status of contamination in the harbor, against which future measurements could be compared in order to tell if environmental protection efforts are working. The $10 million grew to $13 million as a few other contaminant-related projects were added, and the New York State Department of Environmental Conservation, the initial recipient of the funds, prepared a more detailed work plan. Sampling is scheduled to begin this summer. New Jersey is in the process of developing a workplan compatible with New York's, also to be funded through their bi-state dredging budget.

Because funding has been located for many components of the Work Group's plan, those involved are hopeful that this contaminant reduction effort will result in real environmental and economic improvements in the harbor. As Dennis Suszkowski, with the Hudson River Foundation, and Andrew Willner, the Baykeeper for the harbor, wrote in an Op-Ed piece published in the Asbury Park Press (a New Jersey newspaper) recently, "We have a rare window of opportunity for business and industry, environmental organizations, the scientific community, and government to join together in order to reap the vast regional economic and environmental benefits of a clean harbor." We are all hoping to take full advantage of this opportunity and make Joseph Mitchell's description of "The Bottom of the Harbor" ancient history.

For further information, contact: Nancy Steinberg, Hudson River Foundation, Public Participation Coordinator, New York/New Jersey Harbor Estuary Program, 40th West 20th St. 9th Fl., New York, NY, 100111; phone: 212-924-8290; fax: 212-924-8325; E-mail: nancy@hudsonriver.org.

COASTLINES
Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

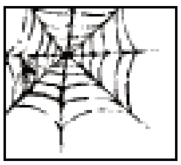
Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

Plastic Pollution in North Pacific Affects Seabirds

Surveys of seabirds caught as bycatch in the pelagic, or open-ocean, waters of the eastern North Pacific has underlined the existence of widespread plastic pollution in the ocean, and suggests that ingestion of plastic by seabirds is a serious problem. Writing in Marine Pollution Bulletin, researchers Louise Blight and Alan Burger note that plastic particles were found in the stomachs of 8 of 11 seabird species studied. Plastic was found in every single surface-feeding bird (from two storm-petrels, one albatross, one petrel, and one fulmar species) and in 75% of shearwaters. Blight and Burger note: "Increasing plastic production since the 1960s and a corresponding rise in the amount of plastic debris in the oceans correlate with an increase in the consumption of plastic in seabirds. The uncertainty over the long-term, cumulative effects of this pollution on seabirds makes it important to monitor plastic ingestion worldwide. Our results confirm the high frequency of plastic particles in surface-feeding birds, as well as in some pursuit-divers, from the eastern North Pacific. This provides further evidence of widespread pollution of the pelagic ocean by both user and industrial plastic."

URL: http://www.epa.gov/owow/estuaries/coastlines/spring98/plastic.html
Revised May 19, 1998

COASTLINES
Information About Estuaries and Near Coastal Waters



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

Refugio Wetland Demonstration Project; Techniques to Reduce Nonpoint Source Pollution

More than 550,000 people presently live within the 12-county region, generally known as the Texas Coastal Bend, which makes up the study area for the Corpus Christi Bay National Estuary Program. By 2050, the population is expected to nearly double in size. Even at the current population, human-induced and natural stresses place the estuarine ecosystem of the Coastal Bend at risk. The study area includes over 12,500 square miles of land and water, 75 miles of Texas Gulf shoreline, and three of the seven major estuary systems in the state. Three major rivers, the Aransas, Mission, and Nueces, flow through this portion of the Gulf Coast and South Texas Plains. Natural vegetation is characterized as coastal prairie and mesquite chaparral savanna. A large portion of land conversion has occurred, primarily for rangeland (61%) and agricultural/pasture land uses (27%).

Little Creek, a tributary of the Mission River, is located in Refugio County in the northeast corner of the study area. The creek lies entirely within the limits of the Town of Refugio and has a watershed area of approximately 1,400 acres 507 acres in urban land use and the remaining utilized for native range. The confluence of Little Creek and the Mission River occurs within Lions/Shelly Park. Below the confluence, the river flows on to Copano Bay, part of the Aransas estuary system. A river barrier had been placed across Little Creek, resulting in a five-foot deep, two-acre retention pond. A number of nonpoint source pollution problems existed in the vicinity of the retention pond, primarily as a result of surface runoff from a state highway, residential streets, commercial parking lots, and residential property.

Using funding from the Corpus Christi Bay National Estuary Program, the Town of Refugio and a team of agency and academic partners embarked on a demonstration project designed to reduce the impacts of the nonpoint source pollution through the construction of shallow, vegetated wetlands at Lions/Shelly Park.

The first objective of this demonstration project was to increase the size of wetlands within the park and enhance their quality. The river barrier positively influenced adjacent upstream wetlands by increasing their hydroperiod (the seasonal level of water in a wetland). Shallow-water, emergent wetlands were expanded along the pond edge and in upstream creek meanders by constructing a shoreline terrace and planting 1,500 native wetland plants. An auxiliary water source was provided to ensure appropriate wetland hydroperiods during drought conditions, a climatic situation that occurs with some frequency in south Texas.

The second objective of the Refugio wetland demonstration project was to develop and implement a water-quality monitoring program to assess the role of wetlands as biofilters in the reduction of urban nonpoint source pollution. The water-quality monitoring plan included sites within the watershed and at Lions/Shelly Park. Certified monitors, trained through the Texas Natural Resource Conservation Commission's Texas Watch Volunteer training program, collected water-quality data within the creek, wetlands, and retention pond for a six-month period.

Samples were collected 11 times between May and October, 1997, at six locations and analyzed for five nonpoint source parameters: chlorine, detergents, ammonium nitrates, copper, and phenols. Detergent was detectable at low levels in all months; highest in June and lowest in October. Chlorine was detectable at low levels during the first nine sampling periods, exhibiting the highest level at the beginning of the study, decreasing thereafter (with the exception of a spike in July's measurement) until none could be noted in the last two samples. Copper, phenol, and ammonium nitrate were not detected at any station throughout the sampling period. At the beginning of the study, water levels were at maximum depth, but with negligible rainfall during July and August, water levels decreased from five to three feet in the deepest end of the pool. Several substantial rainfall events occurred in September and October. During this period of increased precipitation, detergent levels continued to decrease and no chlorine was documented. Although the wetland vegetation was planted in late June, the decrease in these pollutants was probably due to the increased flushing of the system. Continued monitoring will ensure the ability to detect levels of target pollutants if they are present. More monitors will be trained to continue the sampling process in the future and local teachers will use this opportunity to educate students on causes of nonpoint source pollution and methods to reduce or mitigate pollution in their community.

The overall project goal was to increase citizen awareness about urban nonpoint source pollution and the values of wetlands in an urban landscape. Interactive field days with public schools and citizens were established and brochures, informing residents about ways to minimize nonpoint source pollution in creeks, rivers, and estuaries, were prepared and distributed. The location of Lions/Shelly Park adjacent to a major highway increases the education and exposure potential of the project. Interpretive trails and associated brochures extend the benefits of the project by highlighting the value of riparian corridors and wetlands to wildlife within an urban setting.

For more information, contact: Dr. Elizabeth H. Smith, Center for Coastal Studies, Natural Resource Center Suite 3212, 6300 Ocean Dr., Corpus Christi, Texas 78412; phone: (512) 994-6069, or Ms. Sandra Alvarado, Corpus Christi Bay National Estuary Program, Natural Resource Center, Suite 3300, 6300 Ocean Dr., Corpus Christi, Texas 78412; phone: (512) 980-3420; fax (512) 980-3437.

COASTLINES
Information About Estuaries and Near Coastal Waters

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

San Francisco Bay Area Wetlands Ecosystem Goals Project

Introduction

The San Francisco Bay Area Wetlands Ecosystem Goals Project grew out of discussions during the early 1990s among members of the San Francisco Estuary Project as an effort to answer the question "How much, of what kind, of wetlands do we need where and why?" The Goals Project subsequently evolved into a cooperative public-private partnership to develop wetland habitat goals goals representing a shared vision of the Bay Area's wetlands and associated habitats needed to insure a healthy bay ecosystem. The Goals Project systematically quantified wetland types, locations, and amounts to establish the baseline data needed to monitor the health of Bay Area wetlands and to restore fish and wildlife populations. Based on the scientific findings, the wetland habitat goals are intended to provide valuable data to decision-makers involved in land use planning and wetlands restoration and landowners wishing to improve their properties' wetlands.

Process and Participation

Establishing wetland ecosystem goals for the Bay Area's wetlands is a complex undertaking. Many levels of government and the public have strong interests in wetland issues. The Goals Project evolved based upon the advice and experience of its participants. The following are the steps which made up the process:

1. Selection of the species of baylands plants and animals that are the subject of the effort;
2. Identification of the habitat types that support the communities of the selected plant and animal species;
3. Review and documentation of existing information regarding the historical and modern distribution and abundance of the selected wetland habitats and species;
4. Formulation of narrative map recommendations for the amount and arrangement of habitats;
5. Integration of recommendations and guidelines for implementing projects to attain the goals into the draft ecosystem goals report;
6. Presentation of the draft report for public review and comment; and
7. Preparation of a final report based on the public input.

To include varying perspectives in each step, a rigorous system of peer review and public input was built into the Goals Project. Many of the participating agencies and non-governmental organizations contributed substantial human resources to advance the project; the Bay Area community provided about 20,000 hours of volunteer research time. Groups sharing primary responsibility for developing the wetlands ecosystem goals include:

- the Resource Managers Group, comprised of senior agency ecologists and biologists, which oversees all aspects of the project and will work with other project participants to produce the final wetlands ecosystem goals,
- focus teams which produce recommendations for the amount and arrangement of habitats needed to support the species that rely on the region's wetlands. (As with all other tentative decisions in the process, these are offered for public review and comment.),
- a Hydro-geomorphic Advisory Team which assures that water, land, and infrastructure constraints are adequately considered during the process,
- the Science Review Group, comprised of leading scientists with expertise in wetland ecosystem analysis, integrated resource planning, and conservation biology, which provides scientific peer review of the Goals Project's processes and products,
- the San Francisco Estuary Institute, a nonprofit organization, which assists in establishing the Goals Project's scientific process. The Institute also produced an "EcoAtlas," a Geographic Information System (GIS) about the historic and existing conditions of wetlands in the region, and
- an Administrative Core Team of agency representatives which provides administrative and public outreach support.

The general public plays a critical role in shaping and focusing the Goals Project. Because public participation is such an important aspect of establishing sound ecosystem goals, the public is invited to review all processes and products of Goals Project. All project meetings are open to the public and special workshops are held to share information and receive feedback.

Utilization

It is not the intention of the Goals Project to dictate wetlands policy or land use regulation. The goals will, however, provide a biological foundation to help guide and assist decision-makers involved in land use planning and wetlands protection. They also will be useful to private landowners seeking to improve wetlands on their properties; by local resource conservation, open space or park districts undertaking wetlands restoration or enhancement projects; by city and county planning departments wishing to protect wetlands through zoning or general plans; and by state and federal resource agencies planning to restore or enhance wetlands.

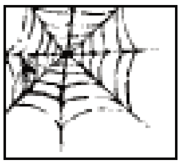
Progress Report

The draft wetland ecosystem goals report written descriptions and illustrative maps recommending a mosaic of wetlands and related habitats will be available for public review this spring. The completion of the final goals early this summer will mark the opportunity to begin active preparation of a regional wetlands management plan for the Bay Area.

For further information, contact Peggy Olofson, Administrative Manager, San Francisco Bay Regional Water Quality Control Board; phone: (510) 286-0427; fax (510) 873-6321; E-mail: PRO@rb2.swrcb.ca.gov.

COASTLINES

Information About Estuaries and Near Coastal Waters



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

The Historic Fishponds of Moloka'i, Hawaii

Nearly every culture has practiced aquaculture to some degree. However, the ancient Hawaiians and their extensive system of fishponds offer one of the premier examples of successful fish farming in the world. Prior to western contact in 1778, it is estimated that there were over 480 fishponds in the islands which now produce an estimated yield of almost 2 million pounds per year.

The ancient Hawaiian aquaculture systems included man-made and natural enclosures of water used for the cultivation of a variety of edible fish and seaweed. They were part of the complex, integrated farming system that ran within each land division, or ahupua'a, which divided the islands into self-sufficient wedge-shaped units (essentially watersheds) that extended from the mountains to the sea.

The genius of the Hawaiian aquacultural system was that they created their own estuaries and stocked them with fish species that would most efficiently grow in the conditions offered by the fishponds. The walled ponds were constructed between two points along the shore next to the mouth of a stream or near freshwater springs. The size of the ponds varied greatly, ranging from one acre to more than 523 acres. Construction of a walled fishpond was a highly labor-intensive undertaking; historical references note it took over 10,000 men to construct one.

The south shore of Moloka'i island is blessed with the greatest number of relatively intact ancient

Hawaiian fishponds in the state and perhaps the strongest advocates of fishpond preservation and restoration. Moloka'i is popularly referred to as the "Last Hawaiian Island." Within the total 1990 population of 6,717, 49% were Native Hawaiian, the largest percentage of Hawaiians of any of the six major islands. With that strong native basis, the community has developed a vision of a Moloka'i that includes a rural subsistence lifestyle which relies upon existing and potential resources of the land and the people to stimulate local employment opportunities.

The community envisions that the fishponds, which have slowly deteriorated and are under-utilized, will be restored and managed by residents primarily for subsistence use. Secondary considerations to restoring the fishponds may include using them as a teaching tool for various disciplines (Hawaiian culture and history, marine sciences, resource management, etc.), eco-tourism, recreation, and community-oriented economic development. However, beyond these proposals is the overriding wish of the community to save the historic structures from further destruction as they embody an important spiritual, cultural, and historic link with the past.

Unfortunately, community wishes to restore the historic ponds are running into the modern statutory and regulatory structure designed to protect Hawaii's present marine and coastal environment. At the moment, the restoration of coastal fishponds entails at least six major federal, state, and county permits. Costs to complete this process may range as high as $150,000. While these laws intend to balance the competing interests of protecting marine and coastal environments against its over-development and degradation, they also pose the latest, and some feel the greatest, impediment to attempts to restore the ancient Hawaiian fishponds. This level of cost to acquire permits unintentionally seems to favor projects that require substantial returns on investment, hence the trend for development within the coastal zone to favor major outside private interests rather than small, local community interests.

The regulatory process also, unfortunately, has had the effect of transforming the original community vision for fishpond restoration. As each permit is granted, it has come with a number of preconditions to be fulfilled before restoration can commence. Such preconditions are inadvertently rewriting the plans and strategies of fishpond restoration as to how, and for what purposes, the fishponds can be restored.

A number of techniques have evolved in an attempt to reduce delays, costs, and changes related to the regulatory process. These include:

Permit streamlining.
A Master Conservation District Use Application which incorporates 29 Moloka'i fishponds was created and offered a means to simplify the permit process. This meant only a single application and Environmental Assessment was needed for all 29 ponds, significantly reducing costs and time. Potential adverse environmental impacts associated with restoration activities were identified as mangrove removal, threats to endangered species and wetlands, changes to navigational features, removal of extensive silt deposits, reduction in public access and use, and the possibility of erosion or accretion on nearby shorelines.

The Corps of Engineers is in the process of completing its own master permit, (known as a General Permit) for its .404 permit. Again, the intent of the General Permit is to reduce the cost and time associated with permit processing for fishponds that have relatively few environmental constraints. At the moment the Corps has 13 Moloka'i fishponds on the General Permit.

Mediation.
The Interagency Initiative for Fishpond Restoration is an ongoing dialogue between the various agencies involved in regulating the coastal zone. These meetings are, in a sense, mediations among the conflicting positions and interests that these agencies are mandated to carry out.

Pollution prevention.
The assurance of mitigating possible environmental impacts associated with restoring the fishponds through the development of restoration plans and best management practices is the critical component in satisfying the regulatory requirements and securing the necessary environmental permits.

To the future.
In the very near future, the wall of Honouliwai fishponds on the southeast coast of Moloka'i will be complete. It took nearly three years to obtain the necessary permits and just under a year to compete the work. This state-sponsored demonstration project is a working model in developing restoration techniques as well determining if such activities do indeed require such a cautious approach to permit approval and compliance.

For many, it is hoped that the lessons learned from Honouliwai will pave the way to work on the other fishponds and provide a major step toward reviving the aquacultural legacy of Molokai's ancestors.

Joseph M. Farber is author of the book, *Ancient Hawaiian Fishponds: Can Restoration Succeed on Moloka'i?*, Neptune House (1997); phone: (808) 947-1827; E-mail:

COASTLINES
Information About Estuaries and Near Coastal Waters

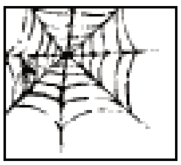
Estuary Plan Book Reaches the Web

The Oregon Estuary Plan Book is now available on-line at www.inforain.org/epb.htm.

Published (on paper) in 1987 by the Oregon Coastal Management Program, the *Estuary Plan Book* is the principal reference for estuary and shoreland planning in that state. The original book contains two maps for each of Oregon's 17 largest estuaries: one of estuarine habitats and the other of management planning units. These maps are also available at the Website via interactive mapping (Java-enabled browser required). In addition, the spatial (GIS) data contained in these maps are available for download for use on your own GIS system. The site will be updated as new data and descriptions become available.

For additional information or to comment on the site, contact chad.nelsen@state.or.us.

COASTLINES
Information About Estuaries and Near Coastal Waters



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

New Technology Under Development to Convert Nitrates to Nitrogen Gas

As Coastlines has noted many times, elevated levels of nitrogen-based materials, particularly nitrates, are a major factor in eutrophication of coastal waters. Unfortunately, there has been little available in the way of viable techniques to remove nitrates once they have been introduced into the ecosystem.

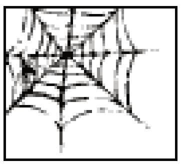
Los Alamos National Laboratory has recently demonstrated at bench scale a method for changing nitrates to nitrogen gas. Existing methods (e.g., reverse osmosis, evaporation, and thermal or biological destruction) have been used to break down nitrates in waste, but these techniques have generally proved to be energy-intensive and have left harmful residues. The new Los Alamos process is a non-thermal and non-biological technique which reportedly leaves only environmentally benign substances. The new method relies on transition metals and catalysts to reduce nitrate to nitrite.

Experiments have shown that this method works effectively on a wide range of nitrate concentrations, from natural bodies of water containing low levels of nitrates to radioactive waste water high in nitrates. Because the process operates at moderate temperatures and pressures, it is far less energy-intensive and, consequently, more cost-effective than current nitrate treatment methods. Los Alamos is seeking an industrial partner to complete the development and commercialization of this promising technology.

(Excerpted from a press release from Los Alamos National Laboratory.)

COASTLINES

Information About Estuaries and Near Coastal Waters



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not been updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

National Estuary Program "What's New" Web Site

A new and improved National Estuary Program Web site was recently released which includes a "What's New" page to highlight current activities, projects, meetings, announcements, conferences, job opeings, etc., relating to the National Estuary Program. To access the new page, click on "What's New" from the main menu on the NEP Web site. The page features the following sections, updated on the first of each month:

- News from EPA Headquarters
- News from the NEPs
- Calendar of Events
- Job Openings