RESTORATION OF TILLAMOOK BAY: PROJECT PLANNING

A MARINE RESOURCE MANAGEMENT PROJECT REPORT

Submitted in Partial Fulfillment
of the Requirements for the
Master of Science Degree in Oceanography
Marine Resource Management Program
Oregon State University

WILLIAM A. HEVLIN

DECEMBER 2, 1988

RESTORATION OF TILLAMOOK BAY:

PROJECT PLANNNING

ABSTRACT:

The objective of this project is the production of a Tillamook Bay restoration plan which is designed to revitalize the bay's biological productivity and thereby stimulate economic opportunity in the region. A selected planning team will assess the cumulative impacts on the bay from accelerated sedimentation. The team will develop estuary-wide restoration goals which address these impacts and assure long term net-gains in productivity. Through consultation with engineers familiar with estuarine restoration the team will design a feasible and cost effective approach for the achievement of these goals. A draft plan will be evaluated by both a local advisory group and a technical committee. The final plan will be reviewed and commented upon by the public. The plan will contain an implementation strategy for a demonstration project.

This project addresses the problems caused by accelerated sedimentation in Tillamook Bay. Man's activities over the past century, which have altered the bay's watershed and shoreline, have contributed to the advanced filling of the bay with river-borne sediment and marine sand. Several technical reports assert that these conditions which restrict navigation, flood flows, and circulation, have also contributed to noted declines in the aquatic productivity of the bay.

Major impacts on productivity caused by accelerated sedimentation have been documented in other estuaries. Estuarine restoration has proven to be an effective approach to re-establishing productivity in several of these degraded areas.

The economic benefits derived from the recreational and commercial use of Tillamook Bay's resources have taken on renewed importance with recent downturns in the wood products industry. However, if past declines in aquatic productivity continue, the future economic attractiveness of the bay will be limited. The development of a restoration plan is the first step toward insuring the future of these resources and re-establishing the past productivity of the bay.

TABLE OF CONTENTS

I. THE PROBLEM

I. THE PROBLEM

A. GEOGRAPHY OF TILLAMOOK BAY

Tillamook Bay is located on the Northern Oregon Coast in northwest Tillamook County, 48 miles south of the Columbia River mouth and 75 miles west of the City of Portland. The Bay is the third largest estuary in the state, exceeded in size by the Columbia River and Coos Bay estuaries. Tillamook Bay is six miles long north to south, with a maximum width of three miles. (Bella et al.1974) It covers about 14 square miles at highwater and about 7 square miles at low tide. The bay is shallow having an average depth of 6 feet at high tide. At extreme low tide the bay water is confined mostly to narrow channels. (Glendening and Jackson 1981)

B. BATHYMETRY OF THE BAY

The bathymetry of Tillamook Bay can be divided into two zones: (1) tidal channels and subtidal basins under water and (2) tidal and grass flats that are exposed at low tide. The major portion of the bay (over 70%) is in the latter classification. (Avolio 1973) A study of navigation bathymetric charts published since 1867 by the U.S. Coast and Geodetic Survey reveals that both erosion and deposition have been taking place in the bay, with deposition being the dominant process. Figure one shows

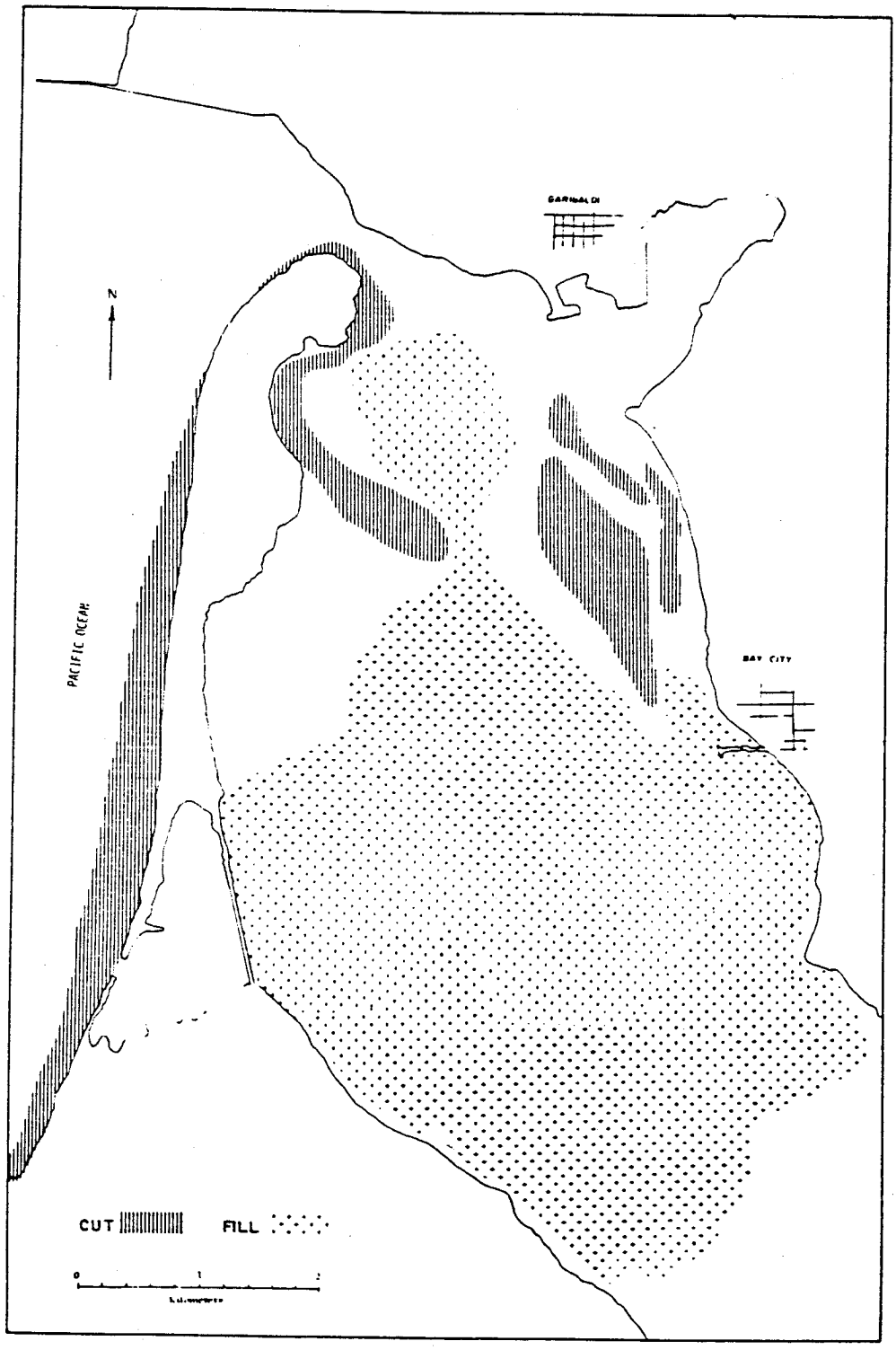


Figure 1. Cut and fill areas in Tillamook Bay.

areas of cut (erosion) and fill (deposition) since 1928. (Avolio 1973) Fill areas as shown in figure one are shallower on the contemporary chart than on the 1928 chart. The general trend seems to be that the bay is filling from south to north.

C. SEDIMENTATION IN THE BAY

The filling of estuaries with river-borne and marine sediment is a natural process which occurs over geologic periods of time. Although most estuarine sedimentation rates are low, man's activities have greatly accelerated those rates in some estuaries and thereby shortened their geological lifetimes. Coastal geologists contend that the increased influxes of sediments have degraded some estuaries to the extent that their useful biological and recreational lifetimes are drastically shortened. (Schubel and Meade 1977) (Tuttle and Dickert 1987)

Man's activities in the Tillamook Bay area over the past century have caused significant alteration of the bay's watershed and shoreline. (USDA 1978) These alterations have accelerated the influx of sediments to the bay over and above natural influx levels. The supposition that accelerated sedimentation has degraded particular resource values of the bay is substantiated in the following abstracts of articles describing the bay:

a) A development report prepared for Tillamook County and the Ports of Bay City and Tillamook Bay in 1972 specifies river sediment deposits as the basic problem in the bay and further

states that these deposits restrict navigation and flood flows and degrade the biological resources of the bay. (Murray 1972) Figure two, from this report, shows the sediment fill in the bay.

b) A comprehensive planning study prepared for the Tillamook Bay Task Force and Tillamook County Commissioners in 1976 claims that rates of erosion in the estuary drainage basin and consequent rates of sedimentation in the estuary have been greatly accelerated since man's settlement in the Tillamook area. (Oster 1976)

c) A study undertaken for the purpose of proposing methods of reducing sediment entering the bay contends that sediment deposition in the bay has caused adverse effects on shipping and navigation, commercial and sports fishing, oyster production and clamming, and on environmental and aesthetic qualities of the basin. (USDA 1978)

d) A newspaper article, "Nearby Townspeople Upset as Tillamook Bay Becomes Body of Mud", (reprinted in figure three) taken from the Oregonian, April 27, 1975, expresses the concerns of Tillamook Bay residents regarding the rapid filling of the bay with sediment.

D. THE SOURCE OF THE SEDIMENT

Extensive farming and logging accompanying the settlement of estuarine drainage basins by man have accelerated rates of sediment supply to estuaries. (Schubel and Meade 1977) In

frontispiece

N

Tillamook Bay, Oregon, at low tide (0.5') August 24, 1971. Bayocean Peninsula at left; partially completed south jetty at entrance; city of Garibaldi north; Bay City right center; and city of Tillamook at lower right. Photograph by Western Aerial Contractors, Inc., Eugene, Ore.

PCB

Tillamook Bay, Ore.

Nearby townspeople upset as Tillamook Bay becomes body of mud

By DAVID BAILEY
Special Writer, The Oregonian

Bays are supposed to be, among other things, large bodies of water. Unfortunately, Tillamook Bay is fast becoming a large body of mud.

As recently as World War II tugs motored to the far end of the bay, up the Wilson River and Hoquarton Slough into the center of Tillamook City. That no longer can be done.

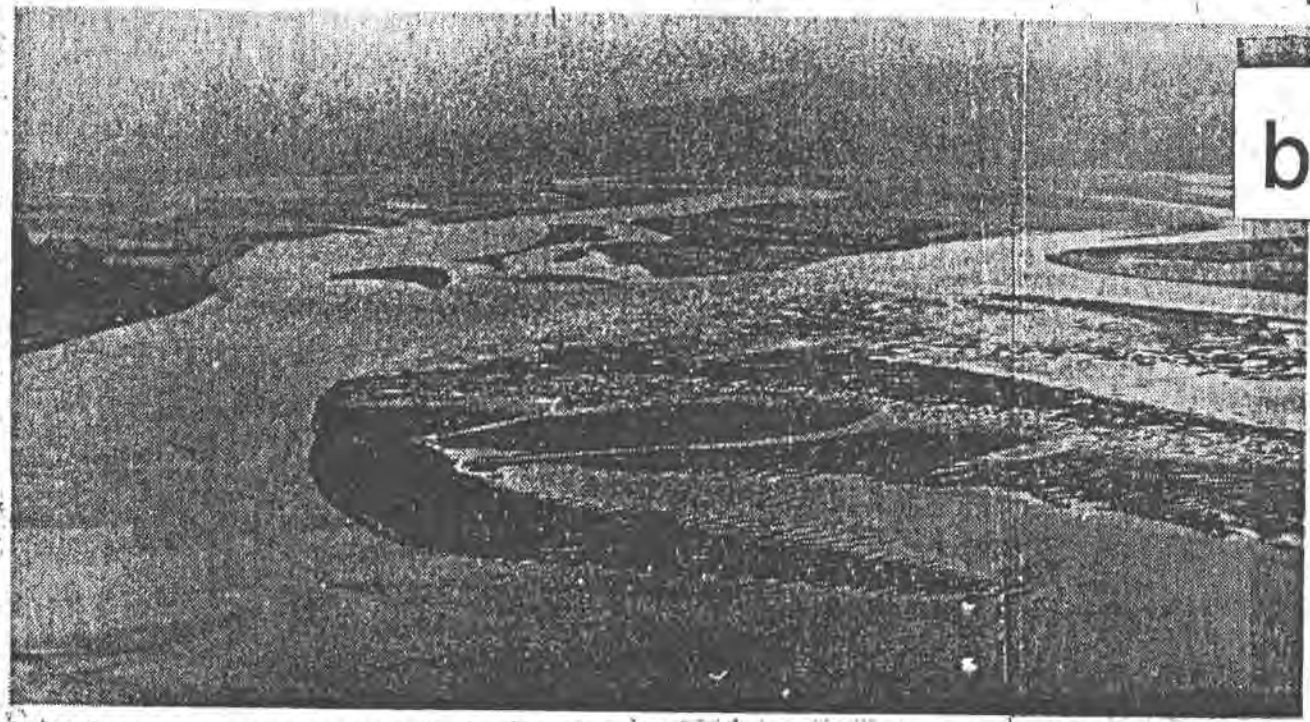
F.J. Vermilyea, president of the Port of Bay City, says, "I mowed hay last year where in 1930 there was a foot of water. That land is covered by five feet of silt now."

Nor can ships now safely reach Bay City, a small community located on the bay itself. Too much mud is in the way.

Garibaldi, the port closest to the mouth of the bay, is not much better off. County commissioner Jeff Brennan says the dock area there was dredged two years ago and now it's full again.

Garibaldi fishermen also complain of shallow bar conditions that make it difficult to leave the bay for the ocean except under extremely calm conditions. Some fishermen are not fishing at all now and Ted Cornett, president of the Port of Tillamook Bay, says: "I know of several fishermen who will lose every cent they've got if this bar isn't dredged."

Some Oregon congressmen have become concerned about the condition of the bay. Rep. Les AuCoin, D-Ore., sent a member of his staff, Carol Swope, to view the bay from the air recently. Both AuCoin and Sen. Bob Packwood have recently had representatives in Tillamook to talk to local officials about possible congressional help.



SANDY HARBOR — Tillamook Bay, once lively with boat traffic, is fast becoming a large body of mud.

Bay important

One reason the congressmen are interested in the bay is its importance to the rest of the state. Tillamook Bay is the second largest estuary in Oregon supporting major sport and commercial fishing. In addition, more than 90 per cent of the recreational boaters who use the bay are from outside Tillamook County, most coming from Multnomah and Washington counties, according to a 1971 survey by the Oregon State Marine Board.

The prevailing theory among coast officials as to why so much silt has settled in the bay blames a combination of natural and manmade causes. According to this generally held theory, the problem began in 1933 with the first of three fires that created the Tillamook Burn, and destroyed 233,000 acres of natural watershed. These fires cleared the way for massive erosion of the mountains through which course the five rivers that serve Tillamook Bay.

In 1952 the Bayocean Peninsula, which forms the western border of the bay, was breached by the ocean during a severe storm. Sand and water flowed into the bay, adding to the sedimentation. In 1954 the breach was closed by a dike, but the damage had been done.

More recent flooding has washed immeasurable amounts of sediment into the bay. In 1964 and 1972 major flooding of the Tillamook area resulted in it being declared a natural disaster area by the president. The Army Corps of Engineers estimated the damage from flooding in each of those years amounted to nearly $3 million. In addition, a Bay City oyster producer, Sam Hayes, estimated in 1972 that $250,000 damage was done to the oyster beds in Tillamook Bay.

Man-caused reasons for deterioration of the bay may include poor logging practices and incomplete jetty projects. Cornett says logging methods no longer practiced, like indiscriminate clear-cutting and poor road-building methods, may have contributed to erosion and therefore sedimentation of the bay.

Two parallel jetties form the entrance to Tillamook Bay but the south jetty is incomplete. The north jetty was completed in 1917. No south jetty was built at the time, and many coast residents feel the breach of the Bayocean Peninsula and destruction of the town of Bayocean were results

In 1965 construction of the south jetty was begun with the idea it eventually would reach as far into the ocean as the north jetty. In September of last year funds appropriated by Congress to build the jetty ran out and construction stopped 1,600 feet short of the goal.

The result, according to Garibaldi sport-fisherman Jim

Power

Lore, is that sand easily can build up a bar along the entrance to the bay. Lore says the tide and waves flow in from the northwest during the winter and from the southwest during the summer. He says this changing of directions creates a scouring action which keeps the mouth of the bay clear. With the north jetty reaching 1,600 feet farther into the ocean than the south jetty, the mouth of the bay faces southwest. Lore says because of this situation the winter tides cannot scour the mouth and that is why so much sand has built up there.

Commissioner Brennan says studies have shown that with jetties of equal length, more sediment would flow out of the bay. Brennan says half the weight of a bucket of seawater coming into the bay is sand weight. He says it is easier under present conditions for sand to be washed into the bay than to be washed out. With jetties that reach equal distances into the ocean, Brennan says a swifter flow would result and sand would not be deposited in the bay.

At a recent public hearing before the Corps of Engineers in Tillamook, Col. Clarence D. Gilkey told area residents the south jetty should not be extended until it's proven necessary. Said Gilkey, "Let's give it time. It would be foolish to extend the south jetty if physically it won't do more than the existing south jetty will do."

One audience member asked Gilkey if there had ever "been an unequal jetty system on the Oregon Coast that you people (the Corps) haven't had tremendous dredging problems with?"

Gilkey replied, "There is some truth to what you say."

Main purpose of the hearing was not to discuss the jetty problems but to hear testimony on a proposed rehabilitation project for the interior of the bay. But most of the fishermen at the hearing were mainly concerned with the condition of the mouth. Gilkey told them the mouth would be dredged some time this summer.

addition, construction of jetties to facilitate maritime navigation at estuary mouths has resulted in shoreline erosion. (Komar and Terich 1976) The next section is an account of how man's activities in the Tillamook Bay area have led to major alteration of the watershed and shoreline and caused accelerated filling of the bay with sediment.

Five major coastal rivers drain precipitation from 533 square miles of rugged coastal mountains and low-lying farm land into Tillamook Bay. This watershed was devastated by extensive forest fires in the 1930's and 1940's and subsequent heavy logging. Considerable erosion occurred in the head waters region as a result of the exposed soils. The velocity of the gorged rivers carried the eroded sediment down to the standing waters of the bay, filling its channels and tidal flats. One report estimates that erosion can increase up to twenty times more than normal during the first year following a watershed burn. (Ferrell 1959) Using this figure, an approximation of the sediment deposited in the estuary immediately following the Tillamook Burn can be computed. The USDA Soil Conservation Service estimated in 1978 (after reforestation) that the annual rate of sediment supply to the estuary was 61,000 tons. (USDA 1978) By multiplying this 1978 figure by 20, the estimated sediment supplied annually to the Bay in the 1940's was 1,220,000 tons.

The erosion and final breach of the Bay Ocean Spit in 1952 caused major changes in the southwest shoreline of the bay. Approximately 1,500,000 cubic meters of sand was deposited into

the central bay as a result of the breach. (Komar and Terich 1976) The initial action which began erosion of the spit was the construction of the single north jetty in 1917. The jetty interfered with the natural movement of sand thereby causing extensive erosion of the spit's ocean side. The eventual breach widened to over a mile and became the main channel into the bay. Finally in 1956 the Army Corps of Engineers constructed a dike to close the opening. (Army Corps of Engineers 1978)

The shoreline of the bay has also been altered by marsh expansion from sedimentation in the river delta areas and subsequent diking and tideland fills. Marsh expansion into the bay was estimated at a rate of 9 feet per year in the period between 1939 to 1969. (Army Corps of Engineers 1978) Settlement and diking of these newly created marshlands has moved the shoreline approximately one-third of a mile into the bay's tideflats. (Oster 1975) In addition, a total of 102 acres of tidelands have been filled since 1920 and put to other uses. (Oster 1975) Diking and filling of estuary marshland limit the area available for sediment deposition during peak precipitation periods. Consequently, most of the river-borne sediment is carried directly to the bay's river deltas for deposition rather than spreading thinly over a large flood plain.

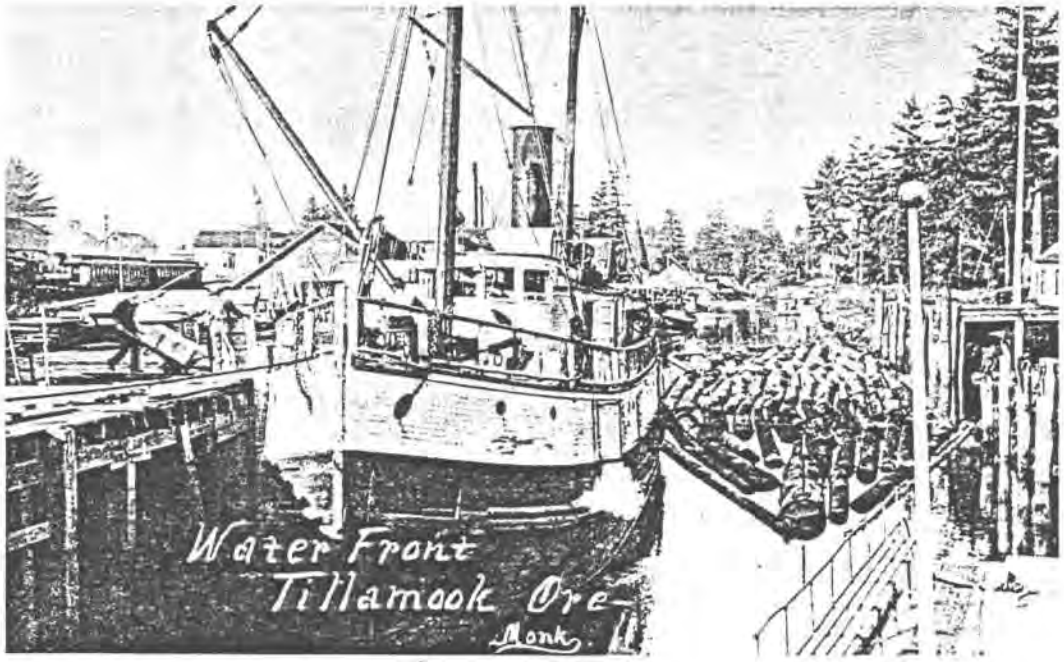
E. CUMULATIVE IMPACTS OF SEDIMENTATION

Accelerated sedimentation has reportedly degraded a number of physical and biological resources of Tillamook Bay. These impacts include: restricted navigation and flood flows, damaged shellfish habitats and eelgrass beds, declines in the abundance of sport and commercial fish, reduction of the tidal prism, decreased salt water intrusion, and diminished bay flushing. The ensuing review of literature and anecdotal accounts will help to substantiate that accelerated sedimentation has adversely impacted these resources. However, as will be mentioned, further study is necessary in several instances to firmly link sedimentation with particular impacts.

Senior citizens of Tillamook County recall when steamers and sailing vessels tied up at docks on Hoquartum Slough in Tillamook City. Figure four shows a coastal freighter at dock in Tillamook in 1913. (Murray 1972) Channels to Tillamook are no longer navigable even for small craft. (Oster 1975) Small boat operators in the South Bay are cautioned to stay within the narrow channels during high tides or risk a mud flat stranding as the tide recedes. (USDA 1978)

Data obtained from a physical hydraulic model of Tillamook Bay constructed and operated at the U.S. Army Corps of Engineers' Waterways Experiment Station in Vicksburg, Mississippi, indicates that the shallow depths in the south bay region retard ebb and flood tidal flows and contribute to backwater effects on the

The photograph below shows a coastal freighter at the dock on Hoquarten Slough where the City Marine Park is now located immediately west of the U.S. Highway 101 bridge crossing Hoquarten Slough.



Coastal freighter at dock on Hoquarten Slough in downtown Tillamook, March, 1913. Photo courtesy of Ruby Walker, Garibaldi, Oregon.

rivers entering the upper end of the bay. (Army Corps of Engineers 1972) These backwater effects (due to sedimentation in the bay's river channels) contributed to the serious floods in 1972 by restricting flood flows. The physical damage caused during the 1972 floods was assessed at $2,816,000. (Army Corps of Engineers 1978) Commercial oyster farmers, whose oyster beds were covered with sediment during the flood, reported an additional $250,000 loss. Eelgrass beds in the bay, which provide important habitat to clams, crab, and fish larvae, were also damaged from excessive sedimentation. (Army Corps of Engineers 1978)

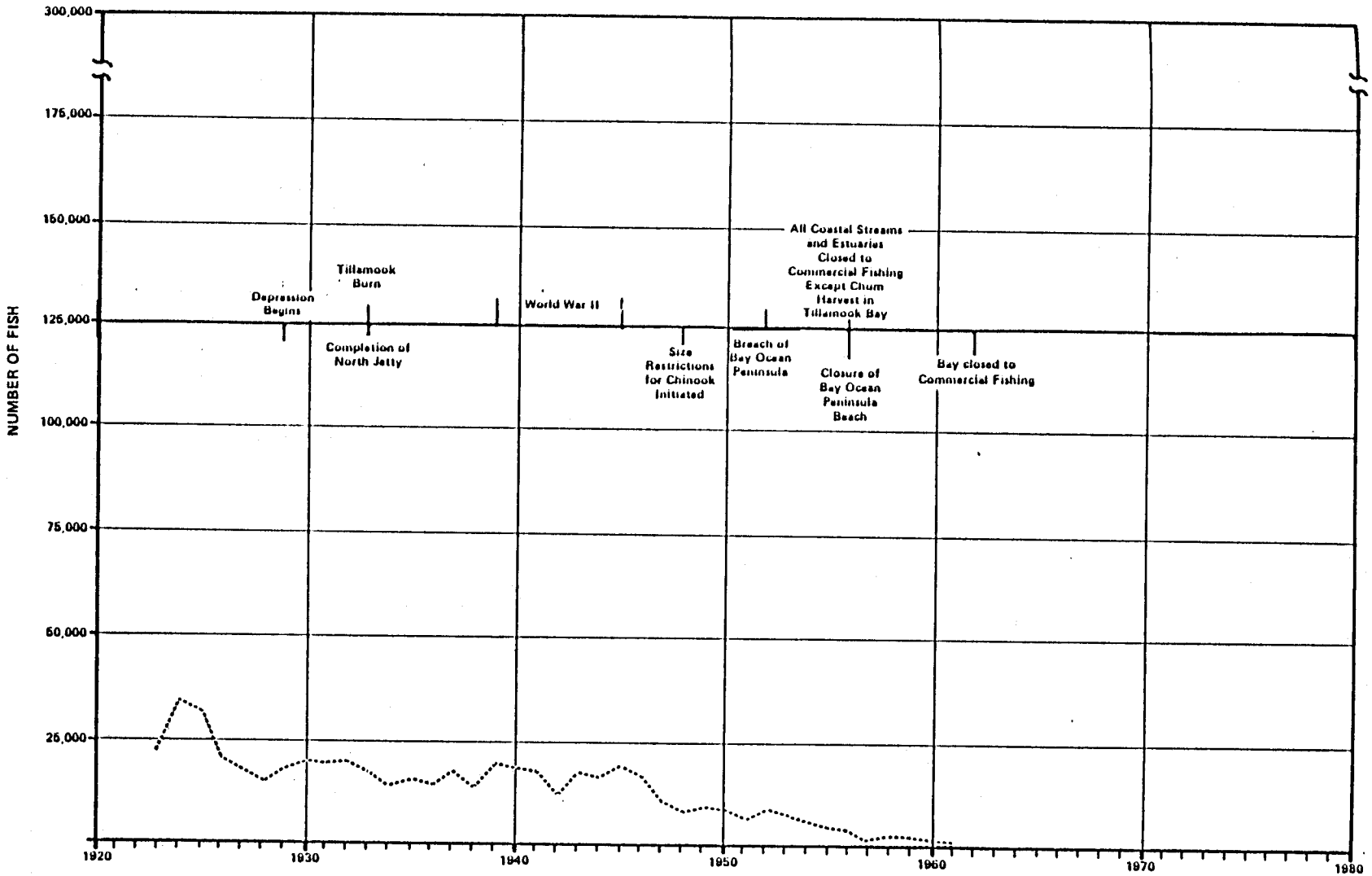
The marine sand carried in during the breach in the Bay Ocean spit in 1952 buried an estimated 1,000 acres of prime oyster and clam habitat. Marine sand combined with river-borne sediment is considered partially responsible for decreasing the usable acreage for oyster production from 2,800 acres to a present estimated 1,000 acres. (Army Corps of Engineers 1975) (Hayes per.com.1988)

Although the bay once produced enough clams to support a commercial industry, recent reports and testimony of long-time local clam diggers indicate major decreases in production and locations where clams can be found. A recent survey by the Oregon State Department of Fish and Wildlife of an area known for clam production in the past produced only one harvestable clam. (Demory 1986, appendix)

A study completed for the Crown Zellerbach Corporation in 1978 by the firm of Kramer, Chin, and Mayo, Inc. was undertaken to assess the Salmonid carrying capacity of Tillamook Bay. (Kramer et al.1978) Utilizing historical records of fish caught in the bay, the study found a definite decline in numbers of fish available. Figures five, six, and seven display the declines in annual harvests of Chinook, Coho, and Chum salmon from 1923 through 1960. The USDA Soils Conservation Service study of 1978 concurs with the results of the Kramer report and proposes that the reason for the decline is primarily due to heavy sedimentation in the bay: "While there may be other factors contributing to this reduction (in salmon), the most significant one noted has been that of heavy sediment loads. A strong correlation is evident between the increase in sediment yield from Tillamook Bay tributaries and the decline in Chum salmon. Catch and escapement records show the average 10-year catch took a 63% drop from the 1937-46 catch to the 1947-56 catch and a 78% drop from there to the 1957 to 1962 period." (USDA 1978 p.VIII)

Biological productivity in estuaries is largely due to particular environmental conditions which foster productive habitats. These habitats depend on specific water depths, salinites, and sufficient circulation. Several reports speculate that advanced sedimentation has altered these hydrological and bathymetric characteristics of Tillamook Bay. (Murray 1972) (Wick 1972) To substantiate these speculations technical studies need

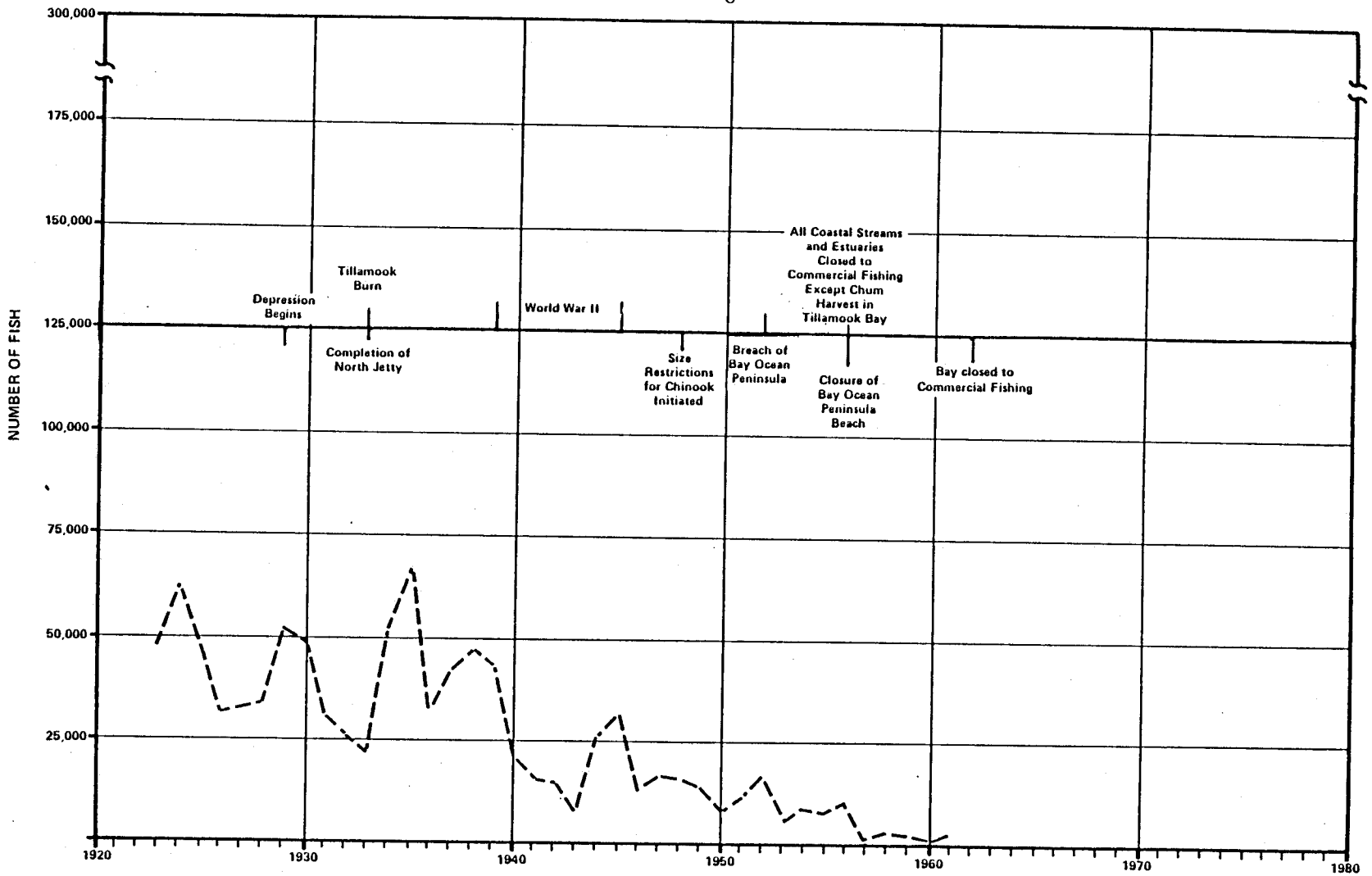
FIGURE 5



ESTIMATED ANNUAL HARVEST OF CHINOOK SALMON IN TILLAMOOK BAY

NOTE: Harvest Data reflect commercial landings only.
All fish caught after the 1956 closure were incidental.

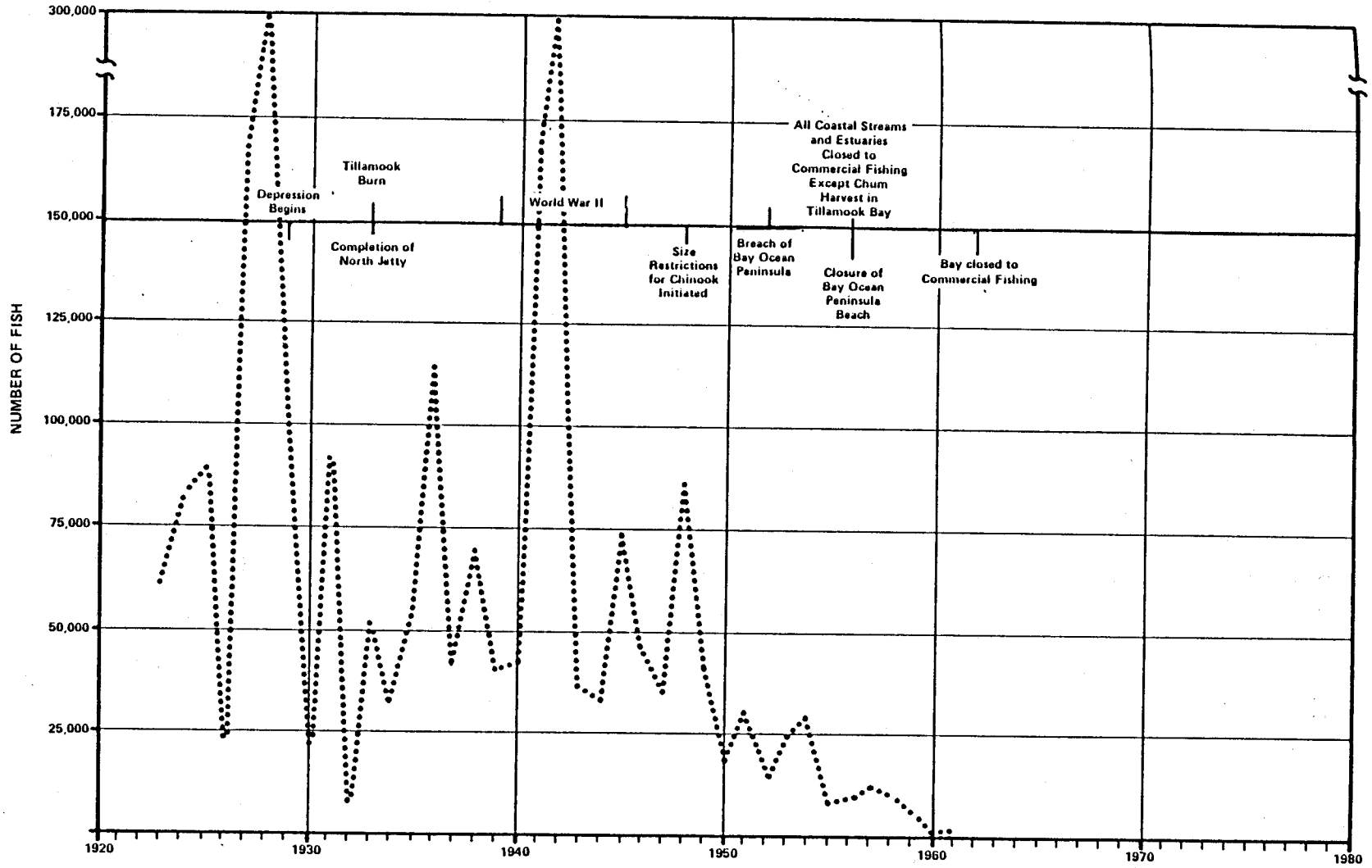
FIGURE 6



ESTIMATED ANNUAL HARVEST OF COHO SALMON IN TILLAMOOK BAY

NOTE: Harvest Data reflect commerical landings only.
All fish caught after the 1956 closure were incidental.

FIGURE 7



ESTIMATED ANNUAL HARVEST CHUM OF SALMON IN TILLAMOOK BAY

NOTE: Harvest Data reflect commercial landings only.

to be undertaken which accurately assess the extent of these alterations.

F. SEDIMENTATION IN OTHER ESTUARIES

Ever since the first European settlers landed, man has influenced the amount of sediment in streams draining North America. This is especially well documented in the Chesapeake Bay region, where clearing of forests and wasteful farming practices contributed enormous loads of sediment to the rivers. Clear streams became muddy and once relatively deep harbors were filled with sediment. Similar impacts can be seen in the Potomac Estuary near Washington D.C. A comparison of the 1792 and 1947 shorelines of the upper Potomac shows large areas which have been filled. The Lincoln and Jefferson Memorials now stand on what was described in 1711 as a harbor suitable for great merchant vessels. (Schubel and Meade 1977) On the West Coast, San Francisco Bay's tidal prism and flushing regime have been significantly altered due to the deposition of nearly a billion cubic meters of sediment from the Sierra Nevada mining activity in the 1900's. (Schubel and Meade 1977)

Accelerated sedimentation has been cited as an important contributor to the decline of many of California's wetlands including Humbolt, Tomales, Pescadero, and Morro Bays, upper Newport Bay, Goleta Slough, and several wetlands in Southern California. (Tuttle and Dickert 1987) Los Penasquites Lagoon,

Buena Visa Lagoon, and the San Dieguito River are representative of Southern California coastal wetlands which are threatened by increased rates of sedimentation associated with the urbanization of their watersheds. (McCreary and Zentner 1983)

G. ALLEVIATION OF THESE SEDIMENTATION PROBLEMS

Dredging has been the traditional means of alleviating accelerated sedimentation. Concern over the environmental impacts of dredging and dredge spoil deposition in the early 1970's led the U.S. Army Corps of Engineers to begin their Dredged Material Research Program (DMRP). An objective of the DMRP was to develop environmentally compatible dredging and disposal alternatives, and to initiate activities which utilize dredged material as a manageable resource. (Army Corps of Engineers 1977) As a result of this program, dredge spoil, which was once dumped wastefully back into the estuary, is now utilized to create or restore intertidal fish and wildlife habitats.

The need for dredging can be reduced by controlling erosion in the watershed. Soil conservation practices followed in watershed activities such as forestry, agriculture, urbanization, and road construction result in decreased sediment input into the estuary. (Schuble and Meade 1977)

While estuarine dredging for maritime navigation purposes is customary throughout the United States, estuarine restoration projects which involve dredging are relatively new. Estuarine

restoration is defined as remedial measures designed to revitalize or re-establish the functional characteristics of an estuary which have been diminished or lost by past alterations and activities. (Williams 1986) Recent innovative and successful examples of restoration projects can be found in California. The California Legislature, in a response to the severe degradation of coastal wetlands, declared in the 1976 Coastal Act that wetlands would be restored wherever feasible. As a result of this mandate, by 1982 sixteen coastal restoration projects which involved both dike breaching and substrate alteration (dredge spoil disposal, earthmoving) were completed or in process. (Josselyn and Buchholz 1982) In addition, eight more projects which involved dredging for sediment removal were in the planning stages. (Gates 1982) The objectives of these projects varied, but in summary included: wildlife and fisheries habitat creation and enhancement, improvement of water quality, flood control, flushing and circulation, increasing the tidal prism and salt water intrusion, sewage treatment, aquaculture, public access, and research. (Josselyn and Buchholz 1982)

An assessment by Zentner in 1988 evaluated the success of several of these restoration projects. The evaluations were based on whether or not a project accomplished its specific goals. The restoration goals for the Los Penasquitos Lagoon, near San Diego, were to reduce the lagoon's extreme variability in salinity, dissolved oxygen levels, and increase habitat values. These goals were to be accomplished by increasing the

frequency of tidal and freshwater flows. This lagoon, once described as deep in early Spanish records, had been so severely affected by sedimentation that one scientist calculated that it would be completely filled in fourty years. (Zentner 1988) (Gates 1982) The restoration plan recommended dredging at the ocean mouth, properly timed to maximize the force of ocean flushing. The results indicate success after one year of operation. Salinity, dissolved oxygen levels, and other parameters have become relatively stable and wildlife use has increased substantially. (Zentner 1988)

Sediment eroded into the San Dieguito Lagoon, also in Southern California, completely blocked tidal circulation and contributed to the frequent closure of the lagoon mouth. The restoration plan called for large scale dredging to create a tidal prism sufficient to keep an open ocean outlet and create subtidal habitat and mudflats. This project has been deemed a success because the ocean mouth now remains open much of the time and eighteen species of fish now inhabit the lagoon compared to seven prior to the project. (Zentner 1988)

Zentner's above evaluation found that successful restoration projects had two elements in common: construction managers with at least some environmental enhancement experience and goals which were based upon accurate engineering analysis. In addition, success depended upon proper monitoring after project completion to correct any problems which developed.

Restoration projects, such as these in California, require extensive engineering, careful biological considerations, and large budgets. The documentation required on these projects is extensive and includes feasibility studies, impact statements, permit recommendations, and technical reports on specific aspects. (Josselyn and Buchholz 1982)

H. EFFORTS TO ALLEVIATE SEDIMENTATION IN TILLAMOOK BAY

The earliest available documented recommendations for dealing with the sedimentation problem are found in the Murray study published in 1972. Dredging of a multipurpose channel system was recommended in order to facilitate the flood run-off and thus reduce flood levels. This study theorized that a channel system would increase the tidal prism of the bay, enhance flushing ability, increase the intrusion of salt water, and rejuvenate ecological zones. This recommendation and proposed benefits were substantiated by the results of experiments at the Army Engineer Waterways Experiment Station. The station constructed a small scale fixed bed hydraulic model of Tillamook Bay to explore the interrelationship of jetty spacing, tidal prism, and salinity intrusion. The findings were: "An extension of a navigation channel from Garibaldi to Tillamook would result in rather drastic salinity increases throughout the bay, an increase in the upstream extent of saltwater intrusion, and

appreciable increases in tidal ranges in the central and upper portions of the bay." (Fisackerly 1974 p.22)

Six months after Murray's development study, the Army Corps of Engineers released a report on the devastating floods of 1972. (Army Corps of Engineers 1972) Following these floods, the Corps of Engineers removed sediment and debris "plugs" at the mouths of the Wilson and Trask Rivers in order to increase the fresh and tide water flows and facilitate the passage of future flood waters. The positive results of these dredging efforts were immediately experienced by bay fishermen who could now navigate freely throughout the entire reach of the two rivers. Before the channel restoration the river mouths could be entered only at high tide, and then only with extreme caution. (Army Corps of Engineers 1972)

Tillamook County has been active in land use planning since 1945 when the third of the big fires led to State planning for reforestation and protection of the Tillamook Burn. Efforts again intensified in the 1970's with a state wide project to develop sound environmental guidelines for coastal development. Due to local concern about the problems of the bay, the Tillamook Bay Task Force was formed to express and deal with these issues. The following excerpt from a development planning document expresses these concerns and the Task Force's interest in bay restoration: "without an explicit plan for restoration the bay will continue to fill and its value to mankind as an estuary diminish until it becomes nonexistent." (Oster 1975 p.2-9)

The Tillamook Bay Task Force requested the Army Corps of engineers in 1978 to formulate a plan for the restoration of the bay. This proposal emphasized that the following benefits were achievable through restoration: reduction in flood levels, increased saltwater intrusion, increased channel scouring, bay wide navigation, enhancement of aquatic habitats, establishment and expansion of mariculture and aquacultural enterprises, and research. Though the request was not granted, the conviction remained that the long-term economic gains from bay restoration more than justified the costs involved. (Steiger 1975)

The Task Force and the Oregon Water Resources Institute instigated the 1978 U.S. Department of Agriculture's Soil Conservation Service study of watershed erosion and sediment deposition in Tillamook Bay. This report praised the past reforestation efforts and recommended soil conservation practices to further reduce erosion. In addressing the problem of sediment accumulations already in the bay this report proposed the following alternatives be given future consideration:

1) Construction of a floodgate and channel to the ocean at the upper end of the bay. The floodgate could then be opened and closed alternately with the tides ebb and flood events to change the flow pattern of the bay and to provide a surge-flush action on the upper bay sediments.

2) Increase funds for a one to five year period and dredge the bay and channels to a desirable depth.

3) Do nothing and allow the estuary to continue to fill with sediment and convert to new uses such as additional pasture.

4) Accelerate sedimentation in selected portions of the bay by a series of dikes and dredge-fill operations. This would result in a smaller, deeper bay.

The research and planning efforts of the 1970's firmly established the need for action regarding the sedimentation problem in the bay. While not producing a restoration plan, these efforts did contribute to the assembly of Tillamook County's Comprehensive Land Use Plan, acknowledged in 1981 by the Oregon State Land Conservation and Development Commission. In this plan, under Goal 16: Estuarine Resources, a description of the development standards for estuarine restoration and enhancement is found. (appendix)

In conclusion, while the original factors which caused the advanced filling of the bay have been attended to, such as extensive reforestation of the watershed and diking of the breach in the Bay Ocean Spit, the enormous deposit of sediment still rests in the bay. With each passing year the bay continues to slowly fill.

I. THE IMPORTANCE OF BAY RESTORATION

As in many other coastal areas, employment in the lumber industry has fallen in Tillamook County. Between 1980 and 1986 available jobs in the lumber industry declined 53%. Despite recent upturns, the economy still feels the effects of several mill closures and decreased operations. The unemployment rate in 1986 was 9%, which was several points above the national average at that time. In 1984, the per capita income in the County was $10,132, approximately $2400 less than the national average. (Northwest Economic Associates 1988)

Due to these recent downturns in the wood products industry, the jobs and dollars generated through tourism and recreation have become ever more important to Tillamook County's economy. The bay provides diversity in water related activities and visual experiences which draw people from outside the county. For instance, a review of the Oregon State Department of Fish and Wildlife catch records found the following statistics: in 1980, 18,375 angler days were spent on the bay to catch 2,827 salmon (Glendening and Jackson 1981); in 1972, 18,000 digger days harvested 540,000 clams (Lauman et al.1972); and in 1971, 93,456 pounds of dungeness crab were taken from the bay. (Gaumer 1971) The estimates of dollars generated by recreation and tourism range from $47,000,000 (about 35% of the county's economy) (Hempel 1975) to $12,000,000 (9% of the economy). (Oregon State University 1977)

Commercial Oyster farm operations on the bay produce approximately 80 percent of Oregon's annual crop. In 1975, 142,144 lbs. of oysters were harvested worth approximately $280,180. (Forsberg et al.1975)

The biological and recreational resource values of the bay are important to the present and future economy of the Tillamook area. However, as the bay shallows from continued filling these values will degrade further. Constructive action can revitalize this resource base.

Estuarine restoration has proven to be an effective intervention in coastal areas with similar problems. A restoration project for Tillamook Bay would help to insure that the important qualities of the bay survive into the future. For Tillamook County, whose future economy is uncertain, a restoration program could help to provide optimism and vision which are vitally important for economic development.

II. THE SOLUTION

II. THE SOLUTION

A. TILLAMOOK BAY RESTORATION PROJECT

The proposed Tillamook Bay restoration project is intended to become a foundation for the revitalization of the estuary and the small communities which surround it. The project will unite the enhancement of aquatic habitats with the economic rejuvenation of the region. Aquatic habitat improvements will increase the abundance of aquatic resources including sport and commercial fish, shellfish, and wildlife. Growth in aquatic resources combined with improved small craft navigation and public access will encourage greater recreational use of the bay. New jobs and improved economic conditions will result from increased recreational opportunities for tourists. Restoration will improve flushing in the upper bay thereby facilitating flood flows and abating pollution. In addition, commercial aquaculture opportunities will expand due to improved aquatic habitat conditions.

In-process documentation, post project monitoring and evaluation will be integral parts of the restoration project. This will insure that the experience gained and research data generated will be accessible and transferable to other estuarine restoration efforts.

The restoration project will be accomplished in three phases. Eighteen months is alloted for the development of a restoration plan, the goal of Phase I. A demonstration project, planned in Phase I, will be implemented in Phase II. After a complete evaluation of the success of the demonstration project, Phase III, continuing restoration work, will begin. The degree and timing for implementation of Phase III will depend on the success of Phase II and the available funds.

This proposal is designed to gain the funding necessary to implement Phase I: Plan Development. The plan developed will provide the long-term direction and guidance necessary to achieve the overall project goals of environmental restoration and economic revitalization. Estuary-wide planning, utilized in the Columbia River Estuary Mitigation Plan (Smith 1983), and the Coos Bay Estuary Management Plan (Coos County 1982), is advocated due to the region-wide outlook this approach offers. Through this type of planning cumulative impacts can be assessed and restoration goals formulated. In addition, future regional economic development must be considered in conjunction with bay-wide restoration objectives so that progress in both endeavors is insured.

B. EXPECTED OUTCOMES OF PHASE I: PLAN DEVELOPMENT

Phase I will produce a plan which will provide the long term guidance necessary to achieve the overall project goals of

environmental restoration and economic revitalization. This plan will be founded on sound environmental and economic principles. Community and state interest groups will be involved in the planning process thereby building local and regional support for the project. Public education and interpretation will be emphasized during planning to foster continued project advancement. Project outcomes will be carefully monitored and documented to insure that the research data generated will be available for similar projects. The final planning document will include the following:

a) A list of specific project objectives and a detailed approach and schedule for attainment of those objectives.

b) An assessment of the environmental values enhanced by these objectives and likewise the costs incurred in the process.

c) A demonstration project to be implemented in Phase II.

d) Historical, present, and post restoration descriptions of the bay and its resources.

e) Confirmation of public involvement in the planning process.

f) Post project monitoring plans and a project evaluation process.

C. PLANNING METHODOLOGY

The following planning methodology has been developed through a review of planning processes used in a number of

successful estuarine restoration projects. Those procedures which were consistently employed and which proved applicable were adopted. Reports on these projects are cited in the reference section.

1. Assembly of the Planning Team

The Oregon Coastal Zone Management Association Director will enlist the services of a private planning agency or individuals who demonstrate they possess the expertise necessary to produce the plan.

2. Definition of the Area to be Included in the Plan

3a. Agency and Project Coordination

The planning team will establish contact with the organizations which are responsible for managing the land, water, and biological resources within the planning area. All current and future projects which impact the area will be noted for project coordination.

3b. Formation of the Local Advisory Committee

The planning team will initiate the formation of the Tillamook Bay Restoration Advisory Committee which will include a representative from the following local interest groups:

* Board of Tillamook County Commissioners
* Port of Bay City
* Port of Tillamook Bay
* Aquaculture Industry
* Sport Fisheries
* Environmental Council
* Oregon State Department of Fish and Wildlife
* Tillamook County Community Development
* Oregon Economic Development Department

3c. Formation of the Technical Review Committee

The planning team will establish a technical review committee which consists of specialists in coastal oceanography and engineering, estuarine restoration and ecology, bay fisheries and wildlife, and resource and development economics.

4a. Data Collection

Utilizing available literature, interviews, charts, maps, and photographs the planning team will collect the data necessary to identify and compare historical and present biological and physical charateristics of the estuary. Data collected should allow for an adequate assessment of cumulative impacts on the estuary and an understanding of the dynamics of the problem.

4b. Resource Base Maps

Utilizing the data collected, resource base maps will be developed which specify the location of aquatic habitats and human activities in the estuary.

4c. Technical Studies

Technical studies may be necessary if sufficient data is lacking to adequately assess the impacts. The planning team may elicit the service of research scientists or engineers for these studies.

5. Design Project Objectives

The planning team will design a set of project objectives to be achieved by the restoration project. The specified habitat enhancement objectives will be based on a long term net-gain principle. The objectives will clearly support the following plan components and enable monitoring and project evaluation.

6. Identification of Alternative Approaches

Through consultation with engineers familiar with estuarine restoration, the planning team will identify several alternative approaches for achieving the project objectives listed in Step 5.

7. Assessment of Each Approach

The planning team will investigate the technical feasibility, anticipated benefits, and long and short term environmental impacts of each approach.

8. Committee Review

Twelve months after the commencement of Phase I, the planning team will present copies of a draft plan to the Tillamook Bay Restoration Advisory Committee and the Technical Review Committee for their review and comment. The draft will include: resource base maps, project objectives, results of technical studies performed, descriptions of the alternative approaches identified, and a feasibility and cost/benefit analysis of each approach. Utilizing the committee's comments, the planners will choose a particular approach or combination.

9. Demonstration Project Plan

A demonstration project plan, to be implemented in Phase II, will be developed.

10. Implementation Strategy

An implementation strategy will be outlined which delineates the roles particular institutions will play in the implementation of the project. It will also specify an anticipated budget and likely funding sources. In addition, the strategy will detail

the steps required to achieve necessary permits and indicate if local or state legislation may be necessary for implementation.

11. Project Monitoring and Evaluation

A post project monitoring and evaluation process will be designed to evaluate project success and insure that any problems which develop are corrected. The research data generated in monitoring and evaluation will be documented to guarantee its accessibility to other projects.

12. Public Review and Comment

The developed plan will be submitted for a public review and comment process. The suggestions generated will be appraised and the plan re-assessed.

13. Completion of the Final Plan

Eighteen months after the commencement of planning the final restoration plan will be submitted to the Oregon Coastal Zone Management Association Director.

D. BUDGET FOR PLAN DEVELOPMENT (EIGHTEEN MONTHS):

Salaries and Wages (OPE Included)		
Program manager	$ 38,000.00	
Assistants	50,000.00	
Consultation Fees	15,000.00	
Technical Research	5,000.00	
Secretarial Support	9,000.00	
Services	5,500.00	
Materials and Supplies	1,500.00	
Travel	2,000.00	
Total Direct Costs	126,000.00	
Indirect Costs	20,000.00	
Total		$146,000.00

E. FUNDING SOURCES

F. ADMINISTRATIVE QUALIFICATIONS

G. KEY WORDS

Restoration, Enhancement, Wetlands, Estuary, Sedimentation, Watershed

III. REFFERENCES

III. REFERENCES

Avolio, G. W., 1973. "Granulometric Analysis of Recent Sediments of Tillamook Bay, Oregon": Department of Earth Science, Portland State University, Portland, Oregon., M.S. Thesis

Bella, David A. and others. 1974. "Oregon's Estuaries; Sea Grant College Program, Oregon State University, Corvallis, Or.

Demory, D., 1986. Memorandum, Oregon State Department of Fish and Wildlife. Subject: Creasy/Mercer Oyster Plats.

Ferrell, W.R.,et al. 1959. Report on Debris Reduction Studies for Mountain Watersheds, in "Coastal Zone '83". proceeding of a conference. p.2317. American Society of Engineers.

Fisackerly, G.M. 1974. "Tillamook Bay Model Study", Technical Report H-74-11, Final Report. U.S. Army Engineer Waterways Experiment Station, Vicksbury, Mississippi.

Forsberg, B.D.,and others. 1975. "Identification, Distribution, and Notes on Food Habits of Fish and Shellfish in Tillamook Bay, Oregon." Oregon Fish Commission, Portland, Or.

Gates, S. 1982. An Inventory of California Coastal Wetlands with Potential for Restoration and Enhancement, in "Wetland Restoration and Enhancement in California", proceedings of a conference; Feb.1982.

Gaumer, T., and others. 1971. "Tillamook Bay Resource Use Study." Fish Commission of Oregon, Division of Management and Research.

Glendening E.A., and J.E. Jackson, 1981. "Proposed Criteria for the Temporary Closure of Tillamook Bay to Shellfish Harvest." Tillamook Bay Drainage Basin WAter Quality, Oregon Department of Environmental Quality, Portland, Or.

Hempel, L., 1975. "The Recreation Environment of Tillamook County, Oregon." Western Interstate Commission for Higher Education. Boulder, Colorado.

Josselyn, M.N. and J.W. Buchholz, 1982. Summary of Past Wetland Restoration Projects in California. in "Wetland Restoration and Enhancement in California," proceeding of a conference; Feb.1982.

Kramer, Chin, and Mayo, Inc. 1978. "Estimates of Salmonid Carrying Capacity of Tillamook Bay, Oregon." Prepared for Crown Zellerbach Corporation.

Komar, P.D. and Terich, T.A., 1976, "Changes Due to Jetties at Tillamook Bay, Oregon" in Coastal Engineering Conference 15th, Honolulu, Hawaii, 1976, Proceedings, p. 1791-1811.

Lauman, J.,and others. 1972. "Supplement to the Fish and Wildlife Resources of the North Coast Basin, Oregon, and Their Water Requirements." Oregon State Game Commission, Portland, Or.

McCreary S. and J. Zentner. 1983. Innovative Estuarine Restoration and Management, in "Coastal Zone '83", proceedings of a conference. p.2527. American Society of Civil Engineers.

Murray, T.J. and Associates. 1972. "Development Program for Tillamook Bay, Oregon." Portland, Oregon.

Northwest Economic Associates, Vancouver, Wash. 1988. "Economic Analysis of Benefits for Coastal Projects Authorized for Commercial Fishing Purposes." Prepared for the U.S. Army Corps of Engineers, Portland, Or.

Oregon State University, 1977. "Tillamook County Economy: A Working Model for Evaluating Economic Change." Special Report 478, OSU Extension Service. Corvallis, Or.

Oster, D. 1975. "Land and Water Use Guidelines for Development of the Tillamook Bay Estuary." Prepared for the Tillamook Bay Task Force and the Tillamook County Board of Commissioners.

Personal Communication with Sam Hayes, August 10, 1988, long time local resident and commercial oyster grower and processor, Hayes Oyster Company, Bay City, Oregon.

Smith, S.E. 1983. "A Mitigation Plan for the Columbia Estuary." Astoria, Or: Columbia River Estuary Study Taskforce.

Schubel, J. R. and R. H. Meade, 1977, Man's impact on Estuarine Sedimentation in "Estuarine Pollution Control and Assessment" U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C., V.1, p.193-209.

Steiger, L.D., and Associates. 1975. "Proposed Modification of the Tillamook Bay and Bar Project, Tillamook, Oregon." Prepared for the Tillamook Bay Task Force and presented to the U.S. Army Corps of Engineers, Portland, Or.

Tuttle A.E. and T.G. Dickert 1987. Assessing Cumulative Impacts in Wetland Watersheds, in "Coastal Zone '87" proceedings of a conference p.1760, American Society of Civil Engineers.

U.S. Department of Agriculture - Soil Conservation Service, 1978. "Tillamook Bay Drainage Basin Erosion and Sediment Study Oregon, Main Report". Portland, Oregon.

U.S. Army Corps of Engineers, Portland District. 1972. "Postflood Report: Floods of January 1972, Tillamook County, Oregon.

U.S. Army Corps of Engineers, Portland District. 1975. "Operation and Maintenance of Jetties and Dredging Projects in Tillamook EStuary, Oregon. Final Environmental Impact Statement".

U.S. Army Corps of Engineers, Portland District. 1978. "Extension of Tillamook South Jetty, Tillamook Bay, Or., Final Environmental Impact Statement."

U.S. Army Engineer Waterways Experiment Station 1977. "Dredged Material Research Program."

Wick, W. Q., 1972. "Biological Considerations in Assessing Flood Damage of January, 1972, to the Tillamook Bay Area, Oregon." Cooperative Extension Service, Oregon State University.

Williams, G.L. 1986. "Study of Habitat Restoration Opportunities in the Bear River Estuary." Prepared for Fisheries and Oceans Canada by Hatfield Consultants, Limited, West Vancouver, B.C., Canada.

Zentner, J. 1988. Wetland Projects of the California State Coastal Conservancy: An Assessment, in "Coastal Management" journal vol 16,no.1. Hershman, M. editor.

EXAMPLES OF ESTUARINE RESTORATION PROJECTS:

Allen, G.H. and D. Hull, 1987. Restoring of Butcher's Slough Estuary - A Case Study, in "Coastal Zone '87", p.3675, a conference proceedings, May 1987. American Society of Civil Engineers.

Brownlee, M.J., and others, 1984. "The Campbell River Estuary: A Report on the Design, Construction, and Preliminary Follow-up Study Findings of Intertidal Marsh Island Created for Purposes of Estuarine Rehabilitation." Canadian Manuscript Report of Fisheries and Aquatic Sciences No.1789, Fisheries and Oceans, Canada.

California State Coastal Conservancy, 1979. "San Dieguito Lagoon Resource Enhancement Program."

Hofstra, T.D. and J.A. Sacklin, 1987. Restoring the Redwood Creek Estuary, in "Coastal Zone '87", p.813, a conference proceedings, May 1978. American Society of Civil Engineers.

Marcus, L. 1987. Wetland Restoration and Port Development: The Batiquitos Lagoon Case, in "Coastal Zone '87" p.4152. proceedings of a conference, May 1987. American Society of Civil Engineers.

Ryall, R. and C.D. Levings, 1987. "Juvenile Salmon Utilization of Rejuvenated Tidal Channels in the Squamish Estuary, British Columbia." Canadian Manuscript Report of Fisheries and Aquatic Sciences no.1904, Fisheries and Oceans, Canada.

Tutty, B.D. and others, 1983. "Estuarine Restoration and Salmonid Utilization of a Previously Dyked Slough in the Englishman River Estuary, Vancouver Island, British Columbia." Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1689. Fisheries and Oceans, Canada.

IV. APPENDIX

ADDENDUM TO SECTION II-C "PLANNING METHODOLOGY"

PRELIMINARY CONSIDERATIONS FOR DESIGNING RESTORATION PROJECT OBJECTIVES AND PLANS

* INTRODUCTION

The Planning Methodology section of this proposal was intended to be a general overview of the important tasks in the planning process. The means of achieving specific tasks were left to the professional planning team. Since completion of the proposal I have decided to write an addendum focusing on the important preliminary considerations which a planning team must face when designing restoration objectives and plans. Probably the most significant and difficult task the elected planning team must face is determining objectives and plans which are both implementable and cost effective. Thus, my goal is to give the planning team a head start on this task. I have examined the process of designing restoration objectives and plans on the basis of three questions: (1) What needs to be restored? (2) What can feasibly be restored? and, (3) What is worth restoring? The methods I suggest to address these questions are illustrated with information concerning restoration opportunities in Tillamook Bay.

* WHAT NEEDS TO BE RESTORED IN TILLAMOOK BAY?

Webster's Dictionary defines restoration as "a return of something to a former, original, normal, or unimpaired condition". Thus, when deciding whether "something" needs to be restored, one compares present state with original or former condition to determine if there is some degree of loss or impairment. For instance, when determining what needs to be restored in Tillamook Bay, the planning team will be identifying estuarine features which have been altered by past activities or natural events. This investigation requires data collection on the past and present status of these features for purposes of comparison, and to determine degree of change. While much of the present status data can be found in resource agency publications, technical studies may need to be undertaken to fill gaps in the data base. Historical data, though sparse, can be gained from reports, surveys, charts, photographs, and personal interviews. For example, by comparing the present state of Tillamook Bay's North Jetty with the original condition (Report to the Secretary of War 1903) the extent of deterioration can be assessed.

While details of the original condition of man-made structures such as the North Jetty are readily available, it is sometimes difficult to find information on "former" (pre-alteration) conditions in the bay. Historical descriptions are influenced by the interests of the party composing the report and

naturally will vary according to date. Therefore, to be sure historical data reliably depicts former conditions, it is advisable to refer to data from the earliest surveys. For example, when assessing the former features of the inner bay channel system, only data from surveys prior to the beginning of the Army Corps of Engineers' inner bay navigation projects should be utilized. (Report to the Secretary of War 1890)

To estimate the bay's former morphology, circulation, and ecology, United States Coastal Geodetic Society bathymetric charts, upland surveys, and notes can be used. (Oregon Cadastral Survey 1867) In addition, the Corps of Engineers original survey of the bay can be helpful in assessing pre-alteration conditions. (Report to the Secretary of War 1888) Past changes in surface area, tidal prism, channel volumes, and sedimentation rates can be gained by digitizing and mapping the bathymetic and shoreline values found in these charts. The historical currents, flushing and mixing rates, and salinity distributions can be estimated by applying historical hydrologic and tidal data to a numerical circulation model similar to that created by Hamilton (1984) for the Columbia River Estuary.

Ecological alteration in the bay can be investigated by comparing the past and present area and location of the bay's habitat types. In this instance habitat types denote particular combinations of estuarine parameters (salinity, depth, current,

substrate) which enable distinct biological communities to flourish. Estuary-wide changes in the location and surface area of these habitat types are an indication of the degree of ecological change in the bay. Researchers have quantified alterations in several estuaries by comparing the present and past surface areas of these distinct ecological regions or habitat types. (Krone 1979), (Atwater et al 1979), (Thomas 1983) One of these studies, "Changes in the Columbia River Estuary Habitat Types Over the Past Century" (Thomas 1983) exemplifies an investigative process which can be used to determine habitat change in Tillamook Bay. In this study the locations and total surface areas of five habitat types (deep water, medium deep water, shallows and flats, tidal marshes, and tidal swamps) were delineated from the original Columbia River survey of 1868. Resultant averages and locations were then compared to the present habitat features to determine quantitative changes. A similar habitat change analysis could be undertaken for Tillamook Bay due to the fact that a comparable survey was completed in 1867.

To complete this determination of restoration needs in Tillamook Bay the planners must assess the degree to which each of these changes or alterations have adversely affected particular estuarine values. In this case, values are defined as attributes of the estuary which provide some type of recognized utility or environmental service. To determine Tillamook Bay's

values the planners will need to survey local, regional, and national interests. To assist with this survey, lists of generalized estuarine values are available in recent literature on wetlands and estuaries. (Zentner 1982) (Kennedy 1980) (Alexander et al 1986) In order to estimate the degree of impact which alterations have had on particular values the planners must attempt to describe and quantify their relationship. Once the impacts are estimated, those changes which have adversely affected estuarine values most significantly can be identified and given preference for restoration.

To illustrate this point, consider the value placed on the populations of commercial and recreational fish and shellfish which inhabit Tillamook Bay during their life cycle. In my proposal I presented preliminary evidence that several of these populations have significantly declined in the past century. Studies suggest, (Healy 1982) (Simenstad et al 1982), that these declines are related to the degradation of particular habitats. If the results of a historical habitat analysis demonstrate habitat degradation and if specific species' population declines can be quantitatively related to these changes, then the importance of restoring certain habitats will have gained support.

* WHAT CAN FEASIBLY BE RESTORED?

The planners have now identified altered features of the estuary which have caused significant impacts on estuarine values. With the help of engineers familiar with estuarine restoration, the planners must now develop and detail alternative approaches to restoring these altered features. The feasibility of each alternative plan is subsequently assessed by the following two questions: (1) Is the restoration plan technically realistic? and (2) Is the plan permittable under state and federal regulations?

To determine the degree to which each plan is technically realistic the planners must assess the likelihood that the approach used will produce the desired environmental benefits. There is always a degree of risk that project outcomes may not be as expected. This is due to the relative youth of estuarine restoration as a science and the complex nature of estuaries. By reviewing the outcomes of completed restoration projects the planners can estimate risk factors involved with any particular approach. Those plans found to be relatively low risk can be considered the most technically realistic.

The second factor in assessing the feasibility of each alternative plan is to determine whether they are permittable under state and federal regulations. The planners must review

the process for gaining the proper permits and understand the conditions under which these permits are granted. The following discussion presents a general overview of the permit process. For greater detail the planners can refer to the publications cited or consult with permit agency personnel.

A restoration proposal for Tillamook Bay must receive a local land use permit from the Tillamook County Planning Department. The policies and standards which regulate this permit process are set forth in the county's comprehensive land use plan. In addition, if the proposed restoration project involves dredging or filling, a permit is required from the Oregon Division of State Lands (DSL) and/or the U.S. Army Corps of Engineers.

The policies and standards regarding estuarine restoration enumerated in Tillamook County's Plan were adopted from goal sixteen, "Estuarine Resources", contained in Oregon's Statewide Planning Program. In goal sixteen estuarine restoration is defined as: "to revitalize or reestablish functional characteristics and processes of the estuary diminished or lost by past alterations, activities, or catastrophic events. A restored area must be a shallow subtidal or an intertidal or marsh area after alteration work is performed, and may not have been a functioning part of the estuarine system when alteration work began". (Oregon's Statewide Planning Goals 1985) The conditions set forth in this definition comprise the standards by

which a proposed project is evaluated in the permit process. In addition, the proposal must contain evidence that restoration activities are consistent with the resource capabilities of the area and the purposes of the management unit in which the restoration site is located. If the site is located in an estuarine natural management unit and dredging or filling is required, the applicant must apply for a conditional use permit. Under these conditions, the final permit determination is made by the Tillamook County Planning Commission, utilizing information concerning resource impact assessment provided by all applicable state and federal resource agencies. If the site is located within an estuarine conservation or development unit the proposal is reviewed administratively within the planning department and can be granted outright. (Tillamook County Comprehensive Plan) The designated locations of all management units for the bay can be viewed on Tillamook Bay's management plan map available in the county planning office.

Under most circumstances the Division of State Lands (DSL) requires mitigation as a condition of any permit for filling or removal of material from estuarine lands. However, the director may waive mitigation when dredging or filling is required as part of an estuarine restoration project. While mitigation may not apply, the planners will benefit by reviewing the DSL document "Estuarine Mitigation The Oregon Process" (1983). This document defines estuarine restoration (consistent with the definition

cited earlier in goal sixteen) and lists examples of areas and features considered suitable for restoration activities. (Division of State Lands 1984, p.19). On this note, goal sixteen, section eight under sub-heading "Implementation Requirements" also mentions degraded estuarine features which are considered appropriate for restoration. (Oregon's Statewide Planning Goals 1985)

* WHAT IS WORTH RESTORING?

The planners have determined what needs to be restored, developed alternative approaches for restoration, and assessed the feasibility of each plan. The final step consists of analyzing and comparing the economic and environmental impacts of the most feasible restoration options.

Two accounts are proposed for the evaluation of each plan. One, a benefit-cost analysis, enables an assessment of the relative economic efficiency of each plan by placing monetary values on the economic benefits derivable and costs incurred. The other, an environmental impact assessment, shows the beneficial and adverse effects of each plan on the ecological, cultural, and aesthetic attributes of the estuary which cannot be measured in monetary terms. (Shabman and Batie 1980) (Mitsch and Gosselink 1986) Guidelines which can be followed in the formulation of these accounts are found in the U.S. Water

Resources Council publication "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (1983).

This evaluation allows a comparison of the economic efficiency and environmental impact of each feasible restoration approach. While providing important information for the decision making process this should not be the sole criteria for plan selection. The social impacts of each restoration option also need to be addressed. (Freeman 1979) Estuarine restoration will most significantly impact those who benefit from and those who pay for it. To insure that these impacts are equitable, a plan which maximizes the distribution of both benefits and costs across society is most attractive. The "public good" nature of many of the environmental services derivable from restoration will insure that benefits are available to whomever can appreciate them. Likewise, costs can be evenly distributed though a state-wide means of public funding. This appears justifiable upon assessment of the significant economic benefits which the state has gained over the past century from the two economic interests whose activities presumably altered the estuary the most: logging and shipping.

REFERENCES:

Alexander, C.E. and others 1986, "An Inventory of Coastal Wetlands of the USA". National Oceanic and Atmospheric Administration, US Dept. of Commerce, Wash. D.C.

Atwater, B.F. and Others 1979. History, Landforms, and Vegetation of the Estuary's Tidal Marshes. Conomos, T.J. ed. "San Francisco Bay: the Urbanized Estuary", San Francisco: California Academy of Sciences.

Freeman, A. M. 1979. "The Benefits of Environmental Improvement - Theory and Practice". Resources for the Future, Johns Hopkins University Press.

Healey, M.C. 1982. Juvenile Pacific Salmon in Estuaries: The Life Support System. in: "Estuarine Comparisions" ed. by V.S. Kennedy. Academic Press.

Krone, R.B. 1979. Sedimentation in the San Francisco Bay System. Conomos, T.J. ed. "San Francisco Bay: the Urbanized Estuary", San Francisco: California Academy of Sciences.

Mitsch, W.J. and J.G. Gosselink 1986. "Wetlands" Van Nostrand Reinhold Company.

Oregon Cadastral Survey, Field Notes, and Plat Sheets 1867. Bureau of Land Management Office, Portland.

Oregon Department of Land Conservation and Development 1985, "Statewide Planning Goals".

Oregon Division of State Lands 1983, "Estuarine Mitigation The Oregon Process"

Reports of the Secretary of War. Reports of the Chief of Engineers. 1888-1915. In: House Executive Documents, sessions of Congress. U.S. Government Printing Office, Washington, D.C.

Shabman, L.A. and S.S. Batie 1980, Estimating the Economic Value of Coastal Wetlands: Conceptual Issues and Research Needs, in: "Estuarine Perspectives", ed. Kennedy, V.S. Academic Press.

Simenstad, C.A. and Others 1982. The Role of Puget Sound and Washington Coastal Estuaries in the Life History of Pacific Salmon: An Unaprpreciated Function. in: "Estuarine Comparisions" ed. by V.S. Kennedy. Academic Press.

Tillamook County Comprehensive Land Use Plan, Acknowledged 1981, Revised 1987.

Thomas, D.W. 1983. "Changes in Columbia River Estuary Habitat Types Over the Past Century". Columbia River Estuary Data Development Program.

U.S. Water Resources Council 1983, "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies".

Zentner, J. 1982. Development of Regional Wetland Restoration Goals: Coastal Wetlands. in: "Wetland Restoration and Enhancement in California" ed by M. Josselyn.

DEPARTMENT FISH AND WILDLIFE

MEMORANDUM

DATE: September 5, 1986

TO: Bob Loeffel

FROM: Darrell Demory

SUBJECT: Creasy/Mercer Oyster Plats

To recap, Douglas Creasy and Robert Mercer filed for oyster plats in Tillamook Bay with the Department of Agriculture April 29, 1986. The plats are for 67 acres each located in the vicinity of the "borrow pit" at Bay Ocean (item 1). Our contacts to date have been with Jerry Creasy, Doug's father, and Bob Mercer, a Portland attorney.

Our original statement from Will Beidler to Ag. stated that ODFW could not support the oyster plat applications due to : 1) destruction (poor word) of eel grass, 2) reduced public access, and 3) adverse impact on clam habitat (item 2). Brent Forseberg and I met with Creasy/Mercer, and Bill Wright of Ag. on August 1, I agreed to resurvey the area in question and Ag. agreed to postpone issuing a letter of plat denial pending the outcome of our survey.

Our resurvey of the area was done on August 6, and 22, and duplicated the transects of our 1974 work (item 3). Mud and ghost shrimp are dense over most of the area thinning out somewhat on the eastern end of the area. Two commercial shrimpers were working the east end of transects 4 and 5. Eel grass and ulva are also dense over most of the area. The substrate is sand/mud and is generally very soft, firming some on the south side of the area. One cockle was found on transect 3 along with many macoma sp. Compared to the 1975 survey, shrimp and eel grass both have increased greatly. Harvestable clams are gone.

Our recent survey has verified that the clam flat east of the Bay Ocean borrow pit has been taken over by mud and ghost shrimp to the detriment of popular clams. Also, eel grass and ulva have become dense in the area. Although clam digging has ceased, commercial shrimp pumping has taken place on both east and west ends of the area, and the vegetation is important waterfowl habitat. It is also likely that at some future time clams will resettle the area.

Overall it appears that there are significent fish and wildlife values that would be adversely impacted by commercial oyster operations. In light of alternative areas for oyster culture, the shellfish staff feels that oyster culture should not be allowed.

DD:sr

cc Doug Taylor

(15) RESTORATION AND ENHANCEMENT: Restoration and enhancement projects in estuary zones, Water-Dependent Development (WDD) shoreland zones or other areas within the Shoreland Overlay zone shall be subject to the following standards:

(a) Restoration and enhancement policy requirements in the Tillamook County Comprehensive Plan shall be met.

(b) Proposals for restoration projects shall present evidence that:

(1) The restored area is a shallow subtidal or an intertidal or
tidal marsh area after alteration work is performed; and

(2) The restored area may not have been a functioning part of the estuarine system when alteration work begins; and

(3) The restored area is revitalizing, returning or replacing original attributes and amenities which have been diminished or lost by past alterations, activities or catastrophic events.

(c) Estuarine enhancement project proposals shall identify:

(1) The original conditions to be enhanced.

(2) The cause of the loss or degradation.

(3) The location and extent of actions necessary to achieve the enhancement objective.

(d) Estuarine enhancement project proposals shall present evidence that the project will result in an overall improvement in the cultural, historic, economic or navigation features of an estuary, which will outweigh any adverse impacts.

(e) When active restoration and enhancement projects are proposed in Estuary Natural (EN) or Estuary Conservation Aquaculture (ECA) Zones, evidence shall be provided by the applicant and findings made by the County that the project is consistent with the protection of significant fish and wildlife habitats, biological productivity, and scientific, research and educational needs.

(f) When active restoration or enhancement projects are proposed in Estuary Conservation 1(EC1) or Estuary Conservation-2(EC2) zones, evidence shall be provided by the applicant and findings made by the County that the proposed use is consistent with the resource capabilities of the area and the long-term use of renewable resources, and does not cause a major alteration of the estuary.

(g) When passive or active restoration or enhancement projects are proposed in Estuary Development (ED) zones, evidence shall be provided by the applicant and findings made by the County that the project will not interfere with the provision or maintenance of navigation and other needed public, commercial and industrial water-dependent uses, and will not interfere with the use of adjacent shorelands especially suited for water-dependent development.

(h) When active restoration projects are proposed in Water-Dependent Development (WDD) shoreland zones, evidence shall be provided by the applicant and findings made by the County that the proposed project does not preclude or conflict with existing or reasonable potential water-dependent use on the site or in the vicinity. Shoreland Development standards shall apply.

(i) Dredge, fill, shoreline stabilization, shoreland development, installation of energy facilities or utilities, dredged material disposal and other uses and activities proposed as part of [an active] a restoration or enhancement project shall be subject to the respective standards for these uses and activities.

(j) Restoration and enhancement projects in Water-Dependent Development (WDD) shoreland zones or other areas within the Shoreland Overlay zone shall be subject to Shoreland Development standards.

(16) SHALLOW DRAFT PORT FACILITIES AND MARINAS: Siting, design, construction and maintenance of shallow draft port facilities and marinas in estuary zones shall be subject to the following standards:

(a) Evidence shall be provided by the applicant and findings made by the County that:

(1) Facilities have been sited and designed to minimize initial and maintenance dredging.

(2) Dryland boat storage has been provided for, or is impracticable.

(3) Provision has been made for public access, viewpoints and recreation use, consistent with safety and security considerations.

FISHING RESOURCES OF TILLAMOOK.

Can Beat any Place in the Known World for all Sorts of Fish.

"I have lived," exclaimed the immortal Kipling, when he had taken a young salmon in the Clackamas river, but that pastmaster of the language must have failed to express his emotions, if instead of a 14lb. fish, he had made the pilgrimage to Tillamook, and instead of a grilse had captured a silverside weighing 25 or 30 pounds, or perhaps a royal chinook, such as I once saw, which tipped the beam at 49½ pounds, and took three boys in a small skiff a mile and a half in the hour's fight before they could bring him to the gaff.

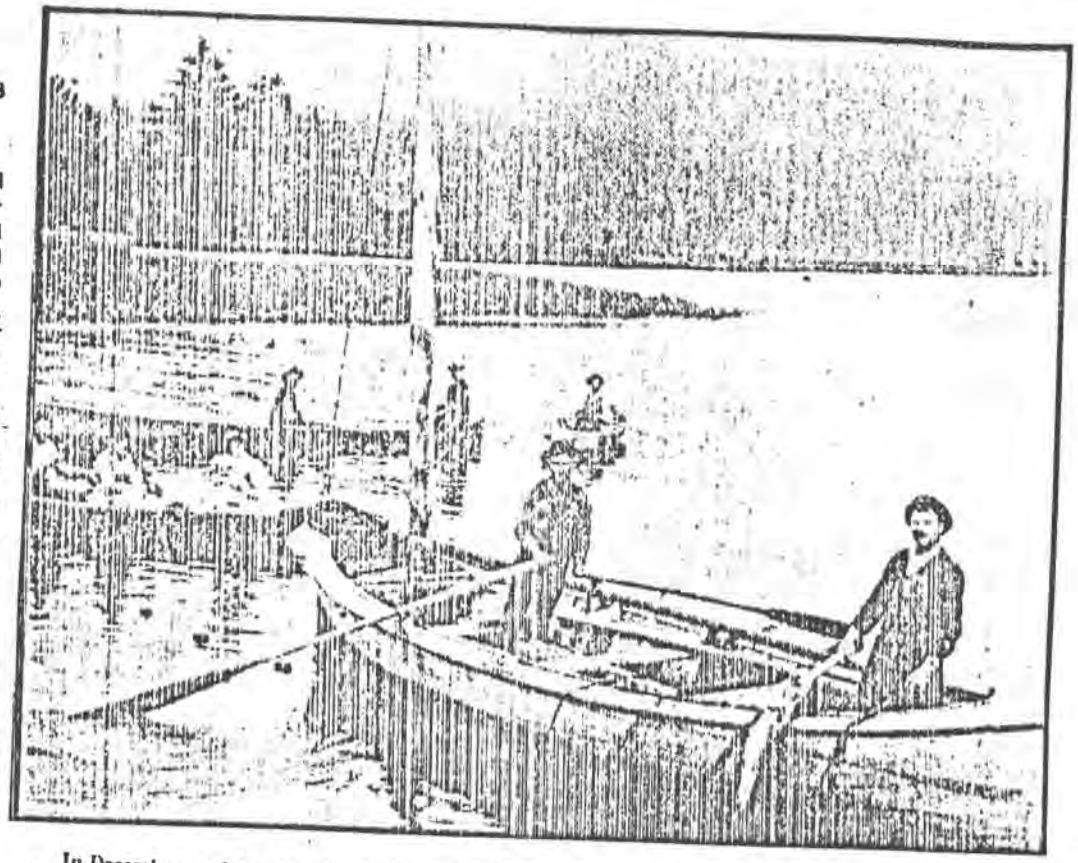
As a means of recreation, fishing is only less important than as a source of industry. No pursuit known to civilization combines all the qualities of rest for the overworked brain, exercise for the underworked muscle, development of the fagged appetite, and stirring up of the clogged digestion so requisite to the man of sedentary occupation, which can be enjoyed by the disciples of Izak Walton.

Considered economically, no calling affords so great a field for human industry as the fishery.

From both standpoints Tillamook is peculiarly favored by nature. Her commercial fish yield an unfailing annual harvest, while her game fish are a perennial joy to every lover of the gentle art.

First, always, is the Royal Chinook, royal par excellence, of all the finny tribes, both as a food fish, as the basis of a great industry, and as the gamest fish that ever took a fly. This fish variously classified by the few scientific men who have studied our coasts, but probably best named *salmar scouleri*, arrives in our waters late in June, and spends the time from then until about October in becoming acclimated to fresh water, and then starts for the spawning grounds up the small streams in the coast mountains. It weighs from 30 to 70 pounds, is not quite so oily as its brother in the Columbia River, but fat enough for any palate. During the month of July it can be taken with a fly or on a spoon, but the man who lands one always knows he has been fishing. From the middle of August to the middle of November it is taken in gill nets for canning purposes, furnishing with the Silversides, an annual output of from $125,000 to $200,000 from the waters of this county.

The Silversides (Oncorhnchus Chavicha) arrive a little later, and go through the same process. They are smaller than the Chinook, not so oily in their meat, and not so fierce in their resistance to the angler. Still they are an excellent fish, weighing from 15 to 35 pounds, beautifully scaled, with firm pink meat, take a fly or spoon greedily, and then fight for about a quarter of an hour. In addition to canning well, these fish are salted in brine for shipment and can be dried and smoked.



In December and at periods all through the winter come the Steelheads, sometimes called a salmon, but really the Rainbow Trout (Salmo Gairdneri), a good sound flesh fish specially adopted to salting and to ice-packing from the absence of oil. This fish weighs from 15 to 40 pounds It will sometimes take a fly, though as it is usually a fly cast for trout of reasonable dimensions, the results are hardly ever satisfactory to the fisherman. The big brute snaps up your No. 4 coachman or professor and starts off, the only question left for you is where will the tackle break and how much of it will be left for you and how much will the fish take away with him?

Tillamook Headlight, 1899