Coos Bay Study: An Interdisciplinary Study of Man and the Estuary

Conducted by

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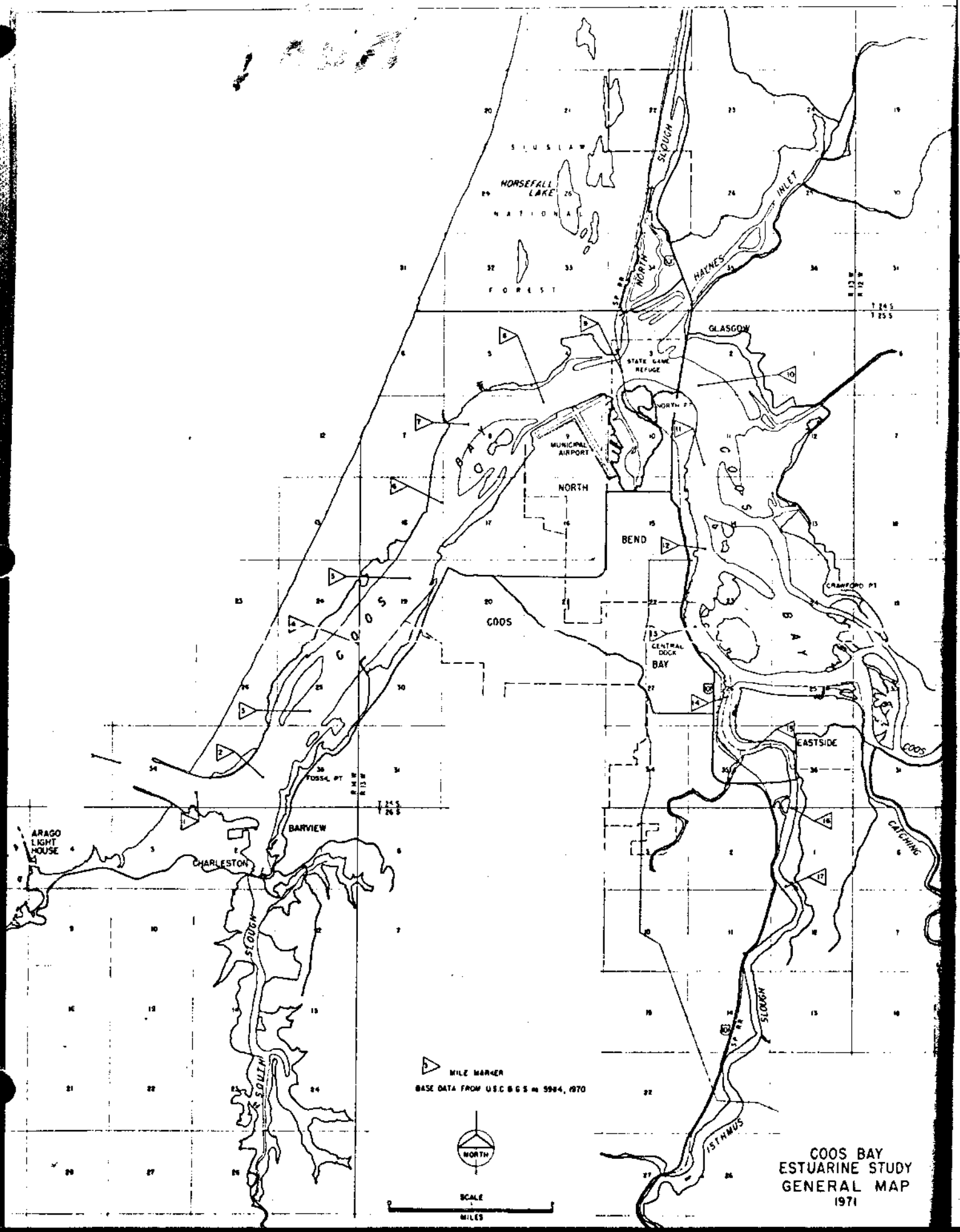

COOS BAY ESTUARINE STUDY GENERAL MAP 1971

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INTRODUCTION

This research project was initially inspired by the existence of a proposal by the Army Corps of Engineers to dredge the Coos Bay channel in order to facilitate navigation in the bay. The proposal includes plans to deepen the present channel by 5 feet and to enlarge turning basins 5 feet in depth and 50 feet in width. The Corps plan also calls for approximately 650 acres of the upper bay, across from the major industries and docks of Coos Bay and North Bend, to be diked to retain spoil. These proposed modifications are justified by the Corps of Engineers on what it considers to be the project's economic merits. However, benefits are computed only under the main headings of petroleum products and forest products.

We think that the proposed dredging and spoil disposal plans are likely to alter the ecological balance in a portion of the upper bay. Assuming that perturbations operating on one element of the estuarine ecosystem may affect other elements of that ecosystem, and realizing that man may be considered a part of that ecosystem, we think it is important to consider other factors in addition to the economic ones. Our study has attempted to combine the disciplines of biology, psychology, political science, economics and urban planning to examine the relationship between man and his estuary.

Briefly, the biologists have attempted to **assess** the validity of the assumption that filling part of the upper bay will affect other aspects of the estuarine ecosystem. This required studying the productivity of that portion of the bay in relation to the entire estuary and the possible effects dredge spoiling might have on ecological balance within the bay.

We expect that alterations on an estuary such as Coos Bay will influence, directly or indirectly, the people living near it. The psychologists have endeavored to discover some of the relationships between the human community and its surrounding natural environment. Specifically, they have examined economic, occupational, and recreational relationships and presented respondents' opinions concerning important local issues.

In an effort to help elucidate the steps involved in making decisions concerning the estuary, the political scientist has investigated many of the legislative bodies and political organizations which may influence these decisions. She studied origin of the Corps proposal, estuarine ownership and control, and city planning.

The economist has characterized aspects of the economic environment in Coos County. He also pointed out factors besides savings accruing to petroleum and forest product shipments which should be considered with reference to the A.C.E. dredging proposal.

Finally, the urban planners have traced the historical development patterns of the Coos Bay area. They have then presented current uses of the estuary-land interface and have attempted to assess these uses in relation to the surrounding natural and man-made environments.

We had originally hoped to conclude our study by suggesting an integrated land and water use plan for the Coos Bay estuary based on results from the various disciplines. Although each research group has attained, at least in part, its initial goals, individual results have not lent themselves to integration into such a plan. However, we think that our findings are both interesting and important, and should be considered in future plans for estuarine development.

BIOLOGY

INTRODUCTION: The harvest of marine and estuarine animals is quite important to the economy of the Coos Bay area, so the welfare of these species is not merely an academic question The actual degree of dependence of this harvest on the estuary is much harder to estimate than might be imagined, owing largely to the particular biology of the animals involved and the lack of research in this area. But our a priori assumption that the estuary is important is based upon studies which have shown estuaries to be among the biologically richest places on earth (5, 17, 24, 25, 33) and the fact that most of the important food species of Coos Bay spend at least part of their life cycles in the estuary.

This project was designed to investigate some of the biological resources of the upper Coos estuary. While most of the information in this report comes from original research done during the summer of 1971, discussion of the importance of the bay is largely derived from studies described in the biological literature. The best available general discussion of the biology of the Coos estuary is probably the special report issued by the Department of the Interior in 1971 (37).

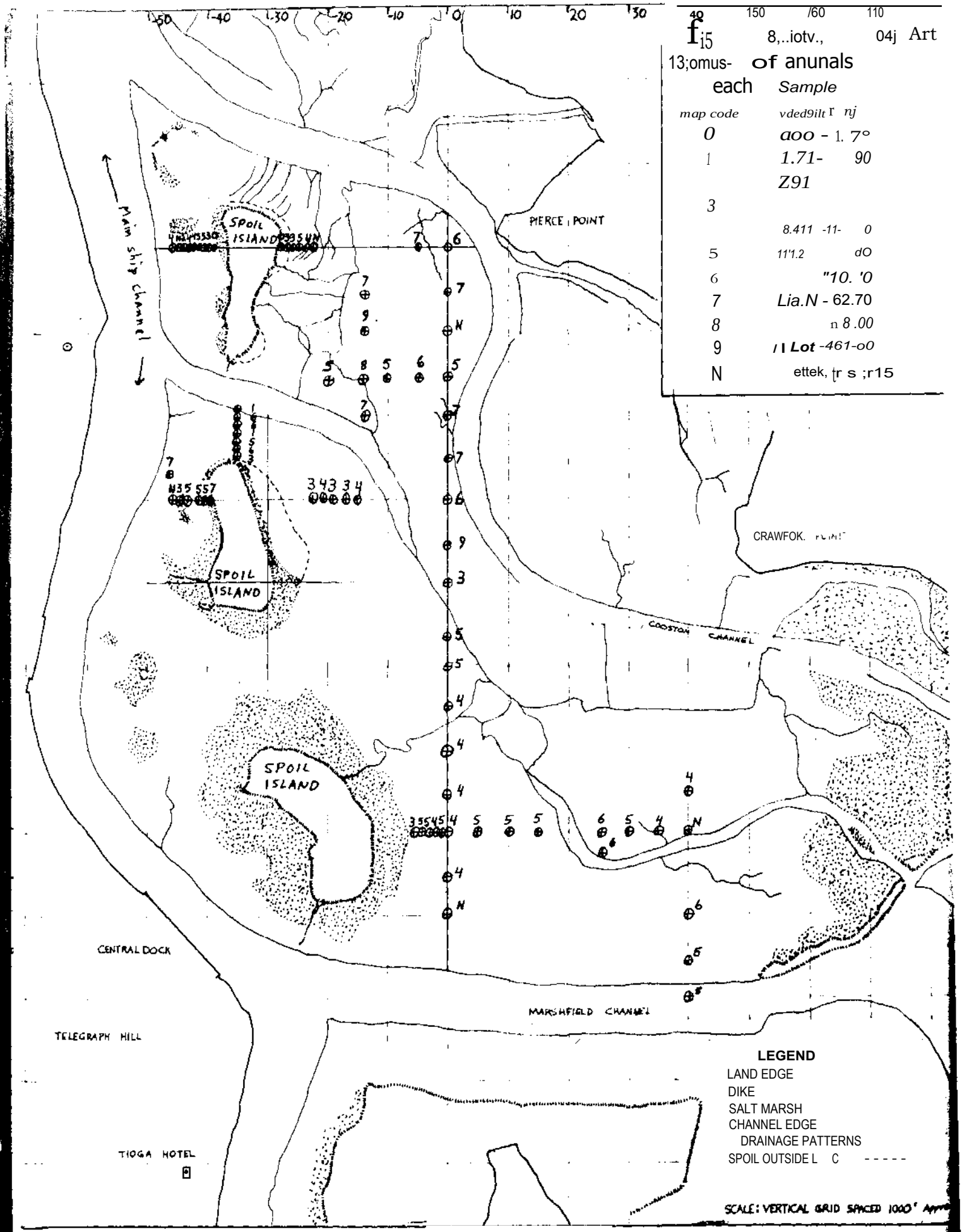
The biological study area (see Figures 1 and 2) compri approximately 1000 acres of tideland plus surrounding channels located roughly east of the cities of Coos Bay and North Bend. Ships, high spoil islands, and logs appear to dwarf the low tideflats, but in fact these mudflats occupy over two-thirds of the upper bay. Three major spoil islands and several



Figure 1. Aerial panorana of the upper estuary.

Above: Looking westward across the estuary toward the Pacific Ocean, which is visible at the top of the picture. Below: Looking eastward across the biology study area, we can see that the estuary is being filled in. The three large spoil islands are the result of channel dredging.





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smaller spoil deposits lie within the study area. These islands are the result of hydraulic channel dredging and rise over twenty feet above the **mean water level.** Although the islands were diked when being formed, neglected breaks in the dikes have combined with the wash-off of fine sediments during spoiling and later erosion by wind, wave, and rain to produce large areas of sandy deposits near the islands. Marsh often fringes the spoil islands and is also found on older spoil deposits not completely above tidal range. These marshes stabilize the spoil, and eventually result in meadow formation (5, 17, 25). Large marsh-meadow systems surround the southernmost island and are extensive toward the Coos River to the southeast. Detritus from the marshes may be an important energy source for the estuarine food chain (5, 17, 25, 33). Current plans calling for a continuation of dredge spoil disposal on the tidalflats will result in ecological changes in this area, and our study attempted to find out what some of these changes might entail.

Many species of importance to man can be observed in the study area. Resident and migratory birds, the edible Dungeness crab, and fish including salmon, shad, striped bass, and many others are of direct use to man. In addition, the plants and invertebrates of the tidalflats, the marshes, the smaller fish, and the microscopic floating plankton are all important food sources necessary for the maintenance of the larger animals. Some species spend all or most of their lives in the estuary, some visit it during breeding or migration,

and still others wander in from the ocean or the rivers to take advantage of the abundant foods.

It is very difficult to anticipate effects of estuarine landfill on any given species because of the many complexities in the life cycles of most estuarine species and a lack of fundamental knowledge as to what inhabits the estuary. Therefore a census of larger benthic organisms was an important part of the biology study. Food requirements of fishes and invertebrates were researched through laboratory and library work. But still the population sizes of many organisms and the rates of food consumption and energy flow through the food pyramid are not adequately known, so estimates of the productivity or resource value are of a very speculative nature.

It must be said that field studies of the type conducted here are sometimes criticized as inexact, vague, and uncontrolled. But all to frequently "laws" or "rules" arrived at in the laboratory fail inexplicably in the field, hence we feel that although our study cannot say precisely why things are the way they are, it nevertheless describes what is in the upper estuary, an accomplishment not possible by laboratory studies alone. We have chosen to present our data in two sections, the first concerned with a quantitative sury of the tidalflat organisms and the second with plankton and fish associated with the mudflat. A discussion of the ecology of the estuary and the possible impact of continued dredging completes our report.

A QUANTITATIVE SURVEY OF THE MUDFLATS

METHODS: Benthic populations of plants and animals were sampled by the following procedure: A large map of the study area was drawn and a grid system of lines spaced at every degree of latitude and longitude (about 73 feet east-west by 101 feet north-south) was placed on this map (Figure 2). In this report every tenth line is shown. Based on field observations and qualitative work done during the summer of 1970, several transect lines were chosen for sampling so that major subsystems would be sampled. A special effort was made to investigate the effects of spoil islands on nearby animal populations.

Sample stations were located and marked in the field using a compass and chain-at first, and later stadia. Industrial smoke stacks and channel markers were used as reference points. The procedure proved to be very time-consuming, but did produce a series of easily located pre-determined sampling stations.

An estimate of biomass was made for each station using two independent samples designed to obtain data on animals of different size ranges. A "large core" sampler (a sheet metal cylinder.25 m^2 in area and about 22 cm deep) was sunk into the mud. The enclosed surface vegetation was removed and stored in plastic bags. Mud was dug out and sieved through a coarse 1/8 inch mesh sieve in water. The animals and plants retained in the sieve were collected in bags. Wood chips

were also kept to give a crude indication of wood chip content of the substrate. A depth of 22 cm was usually sufficient to catch all animals except some Mya arenaria and Callianassa; the mud below this depth was felt by hand to see if either of these animals remained. A "small core" sample (0.0115 m2 defined by a sheet metal cylinder 30 cm deep) was then collect and stored, unsieved, in a bag. Interstitial water seeping into the resulting hole was collected in a bottle. The samplers then wrote a description of the area, noting substrat topography, and some of the organisms in the area.

All material collected was taken back to the laboratory and stored in a refrigerator until it was analyzed. Surface vegetation and wood debris were washed and dried to apparent dryness, then weighed. Interstitial salinity was measured with a refractometer. Large core animals were separated, counted, identified, measured, dried (clams without shells), and weighed individually or in groups, depending on size. Small core samples were first picked through for worms, then sieved through a series of graded Tyler screens with water on a mud shaker. All animals unable to pass through a 1 mm mesh screen ("macrofauna") were treated similarly to large core animals. Weight-length and weight-volume relationships were established for clam and worm species respectively to facilitate estimation of dry organic mass of the samples **(See Appendix "D").** Biomass estimates were made using clam and large annelid data from the large core and amphipod and small worm data from the small core, plus

data on other animals from whichever sample they were found

Blomassing proved to be physically exhausting especially when equipment, samples, and mud had to be carried long distances through deep mud. Low tides were usually early in the morning so sampling was done as rapidly as possible between the time when it was light enough to see and when the tide covered the area. Laboratory analysis required long, tedious hours of searching for, identifying, and processing animals and plants. The entire process required from five to ten man hours per sample, depending on where the sample was from and what was in it.

RESULTS: Figure 2 shows the biological study area and the biomass at each sample location. It is evident from the map that although generalizations can be made concerning the distribution of biomass, it is hard to predict what might be found in any particular area. Reasons for this will be discussed later. As biomass is not broken down into component parts on this map it should be pointed out that the relative composition of the sample is not constant. Therefore the biomass of any one species is not necessarily proportional to the total biomass. Larger, sporadically occurring animals introduce some fluctuation into the total biomass count, but elimination of such animals from the total did not change the overall picture of biomass distribution. The scale of Figure 2 is logarithmic, thus the weight ranges are not of equal size.

Figures 4 and 5 illustrate animal biomasses along transects through the spoil islands. A succession is suggeste by most of the transects, but it is also apparent that the trends are not inviolate. As animal populations can fluctuate greatly within a small area, it is not likely that a firm trend can be established by a few samples. In addition, few transects actually show a strict transition from high to low elevation going away from the spoil islands because of gradual irregular elevational changes, the presence of small marshes, and substrate changes.

A greatly simplified idealized transect might be as follows: sandy, layered substrate is found near the spoil islands with marsh plants abundant at higher levels but givin way to Ruppia (aquatic grass) at lower levels. Some large Mya are in these areas. Cumaceans and the amphipod Anisogamm may be found in the algae mats sometimes present on the slopes of the islands. Farther down, Callianassa-Cryptomya associations occur where the substrate is sandy. Otherwise there is a gradation into muddy substrate with Neries, Tellin Macoma, and other mud dwellers. Eelgrass forms large, dense beds in some places of low to intermediate elevation, especia near channels, and usually has rich and diverse associations of animals.

For the purpose of comparative analysis, the study was divided into four environmental subsystems incorporating the differences between areas as they appeared to us. The resulting division of the study area is shown in Figure 6.

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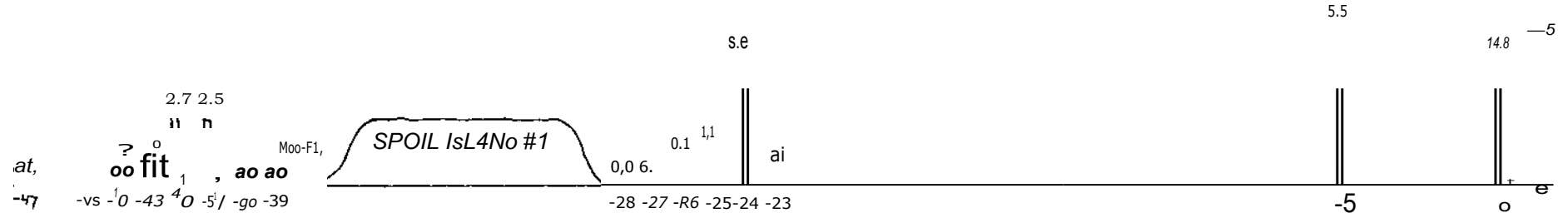

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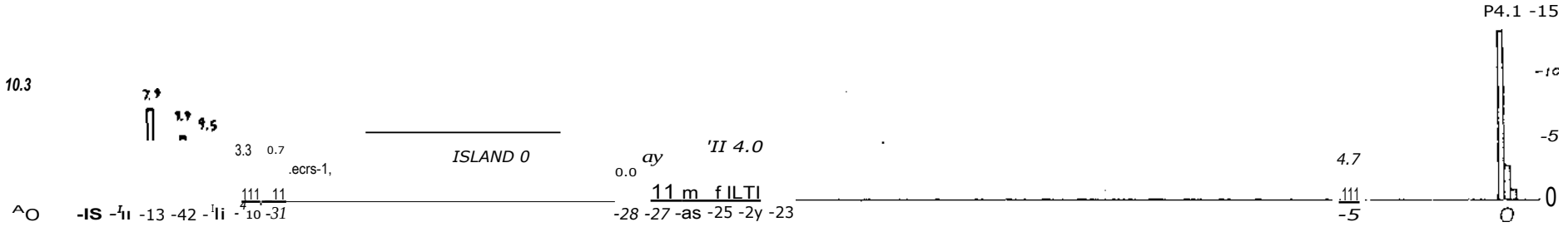

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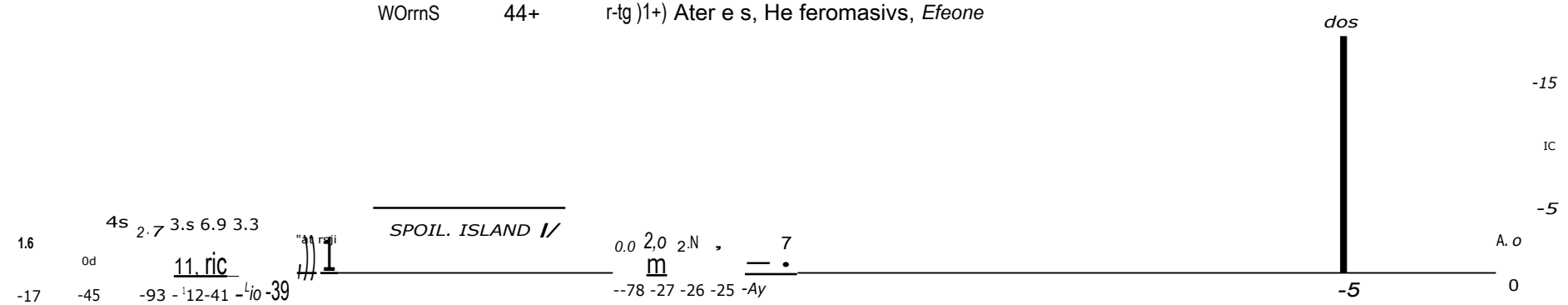

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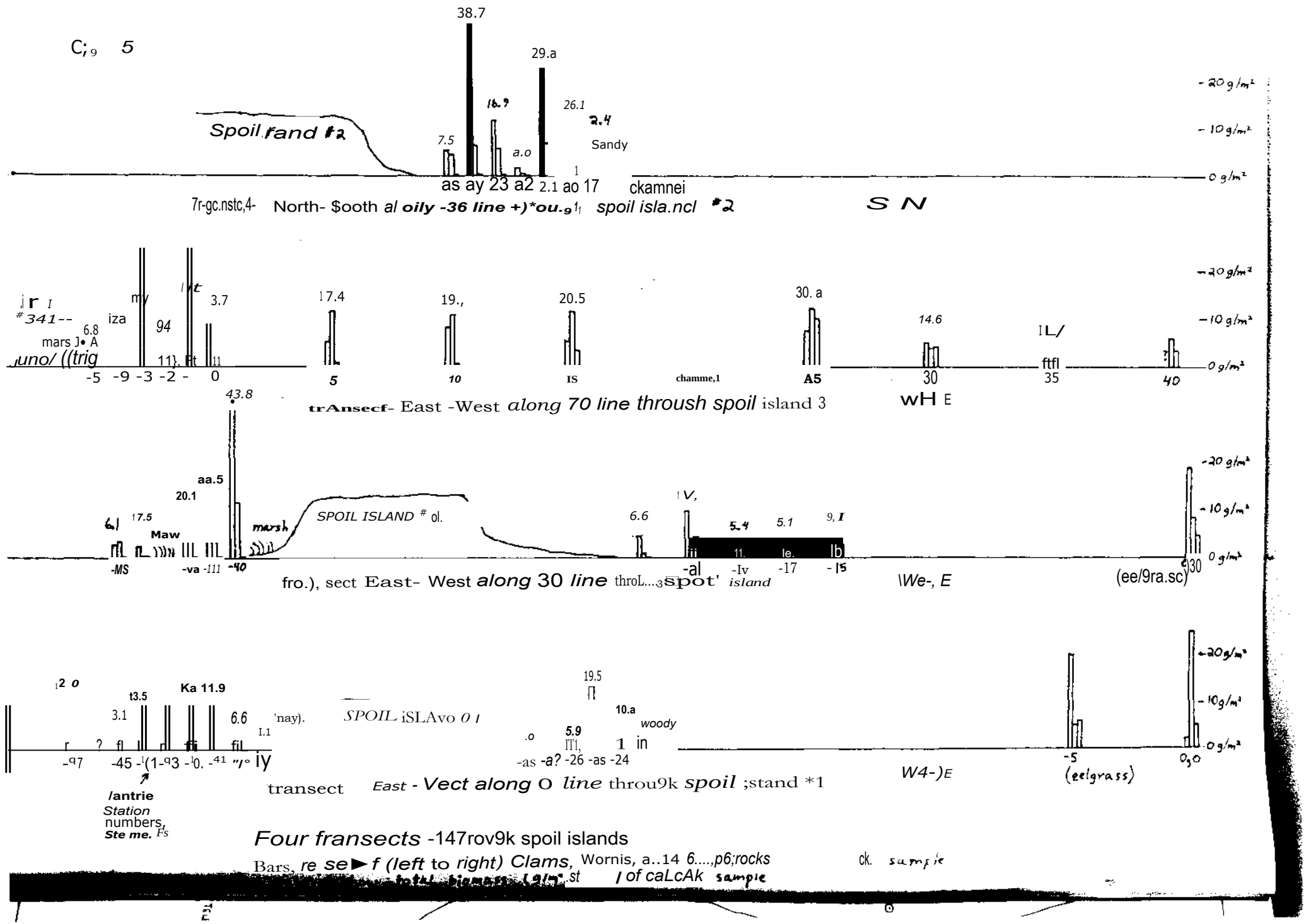
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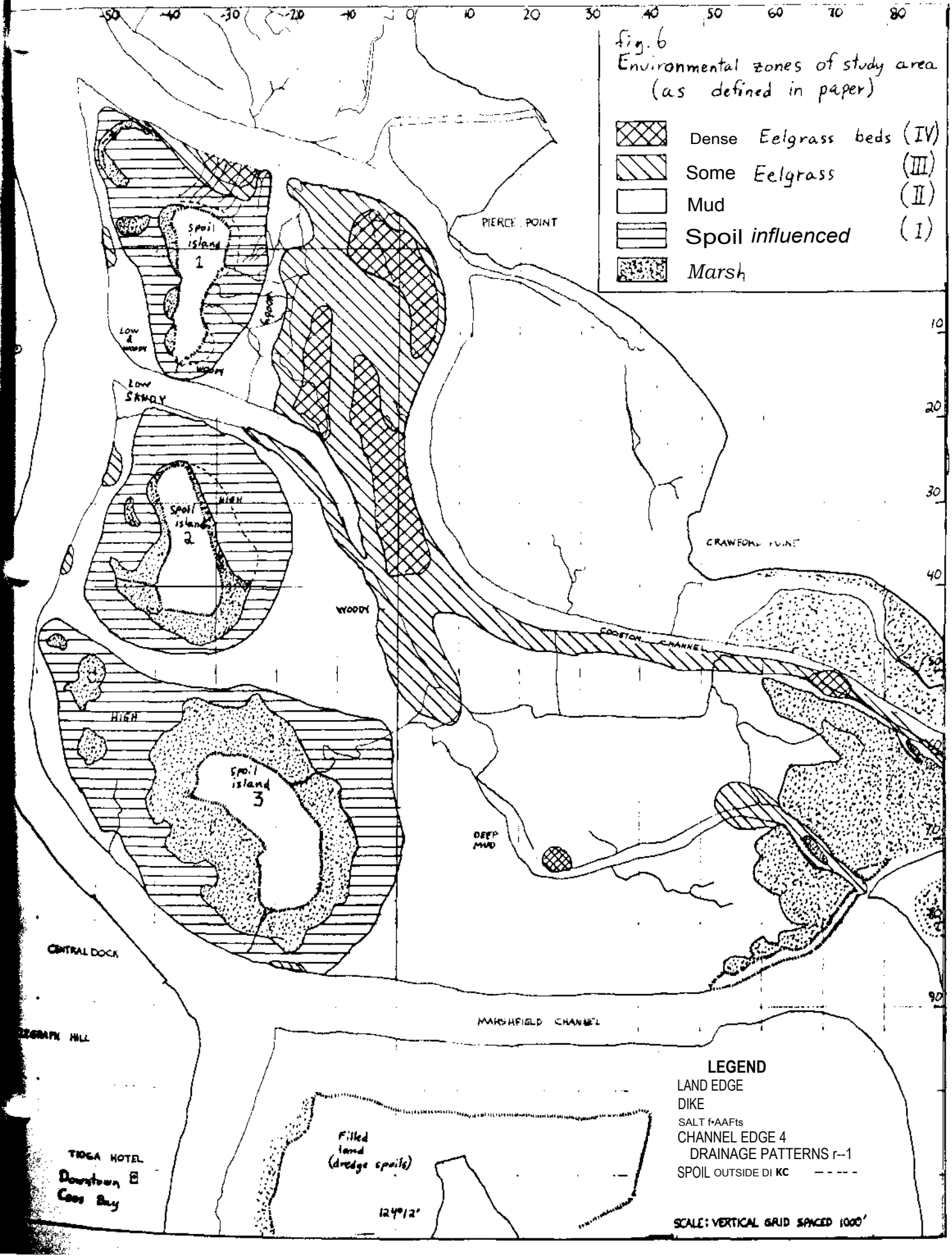
fig. 6
Environmental zones of study area
(as defined in paper)
Dense Eelgrass beds (IV)
Some Eelgrass (III)
Mud (II)
Spoil influenced (I)
Marsh
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
10
20
30
40
50
60
70
80
90
PIERCE POINT
Spoil Island 1
LOW & WOODY
LOW SANDY
WOODY
Spoil Island 2
HIGH
WOODY
CROSTON CHANNEL
HIGH
Spoil Island 3
DEEP MUD
CENTRAL DOCK
MARSHFIELD CHANNEL
Filled land (dredge spoils)
TIOGA HOTEL
Downtown Coos Bay
LEGEND
LAND EDGE
DIKE
SALT f•AAFts
CHANNEL EDGE 4
DRAINAGE PATTERNS r--1
SPOIL OUTSIDE DI KC
SCALE: VERTICAL GRID SPACED 1000'

The subsystems may be characterized as follows:

(I) Spoil influenced areas lie at high elevation on the slopes of the spoil islands. Substrate is often hard, consisting of alternating layers of sand, mud, and wood chips, and frequently a layer of blue-green algae or Enteromorpha lies on top. In areas of extensive spoil wash-off, few animals are present.

(II) Mud areas are usually poorly-defined, lower lying zones characterized by a fairly uniform silty substrate. Algae are sparse, and although worms and smaller clams appear happy here, Mya cannot tolerate the silty mud. Eelgrass-covered areas are excluded from this category.

(III) Sparse to medium density eelgrass areas often border the channels and form a transitional zone, both geographically and biologically, between the mud and dense eelgrass areas. Substrate varies from sand to gloppy mud.

(IV) Dense eelgrass areas include those having a large biomass of eelgrass (Zostera marina) or described as densely covered in the field notes. Usually eelgrass grows at low to medium elevation and often along the channels. A large variety of animals are found in and beneath the eelgrass, and are probably feeding on its epiphytes and the infauna, while protected somewhat from dessication and predators. At high tide fish and crabs are most abundant in the eelgrass beds.

The biomass data are graphically presented by subsystem in Figures 7-11. On these graphs all weights are cumulative and the total for the column, in g/m^2, is written

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Composition of an "average sample" in the four environmental subsystems.

Weights in grams / m^2

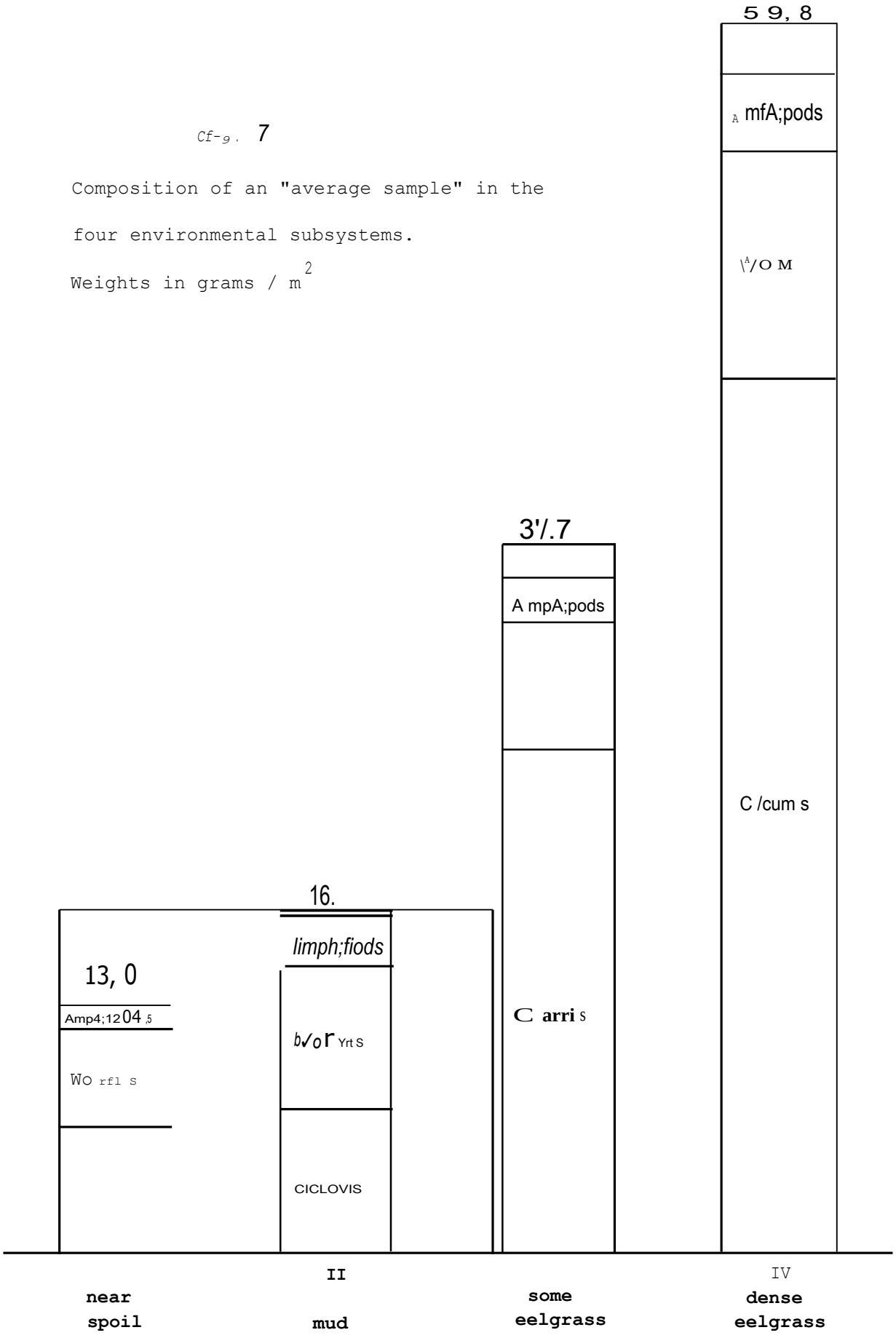


fig. 8 Biomass of clams in an average sample.

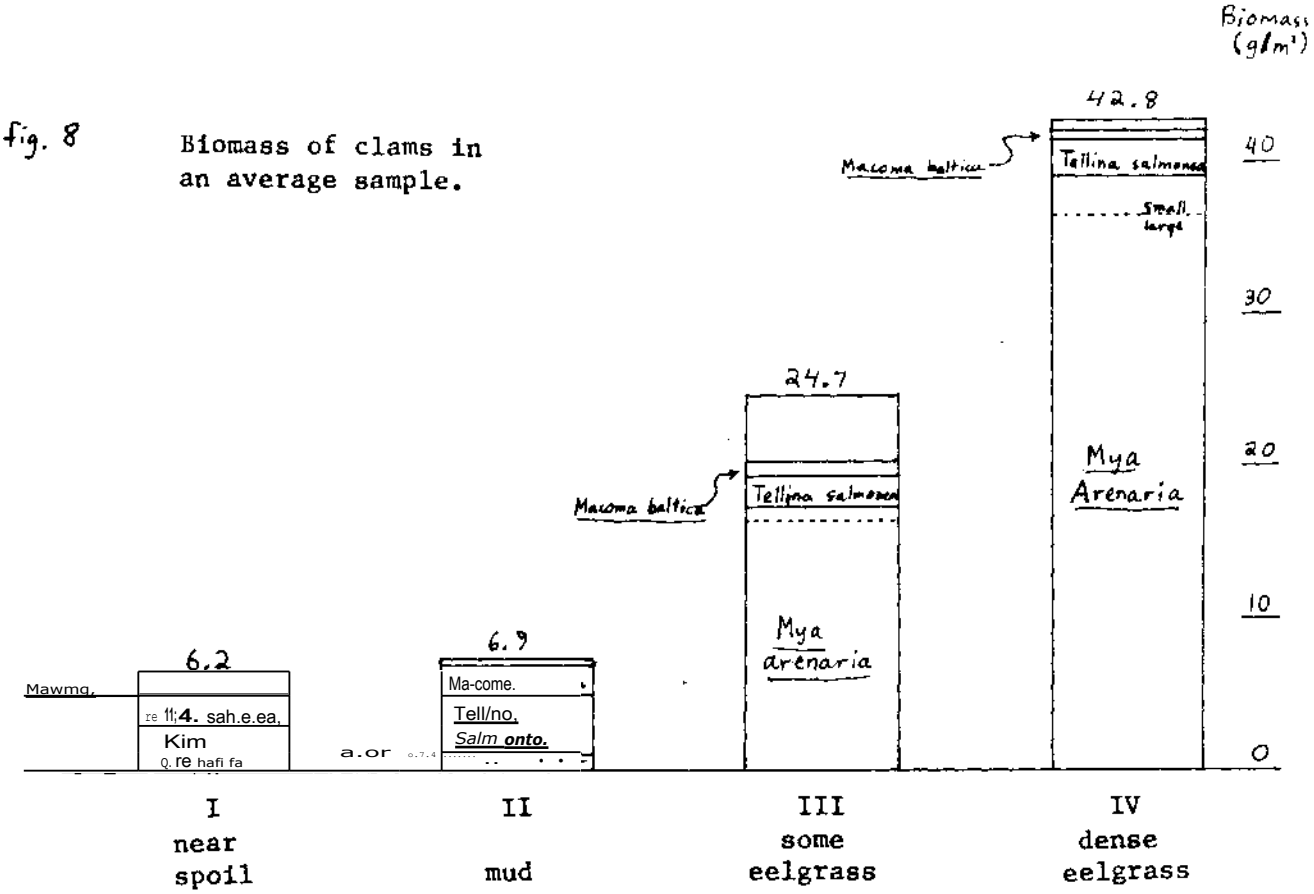
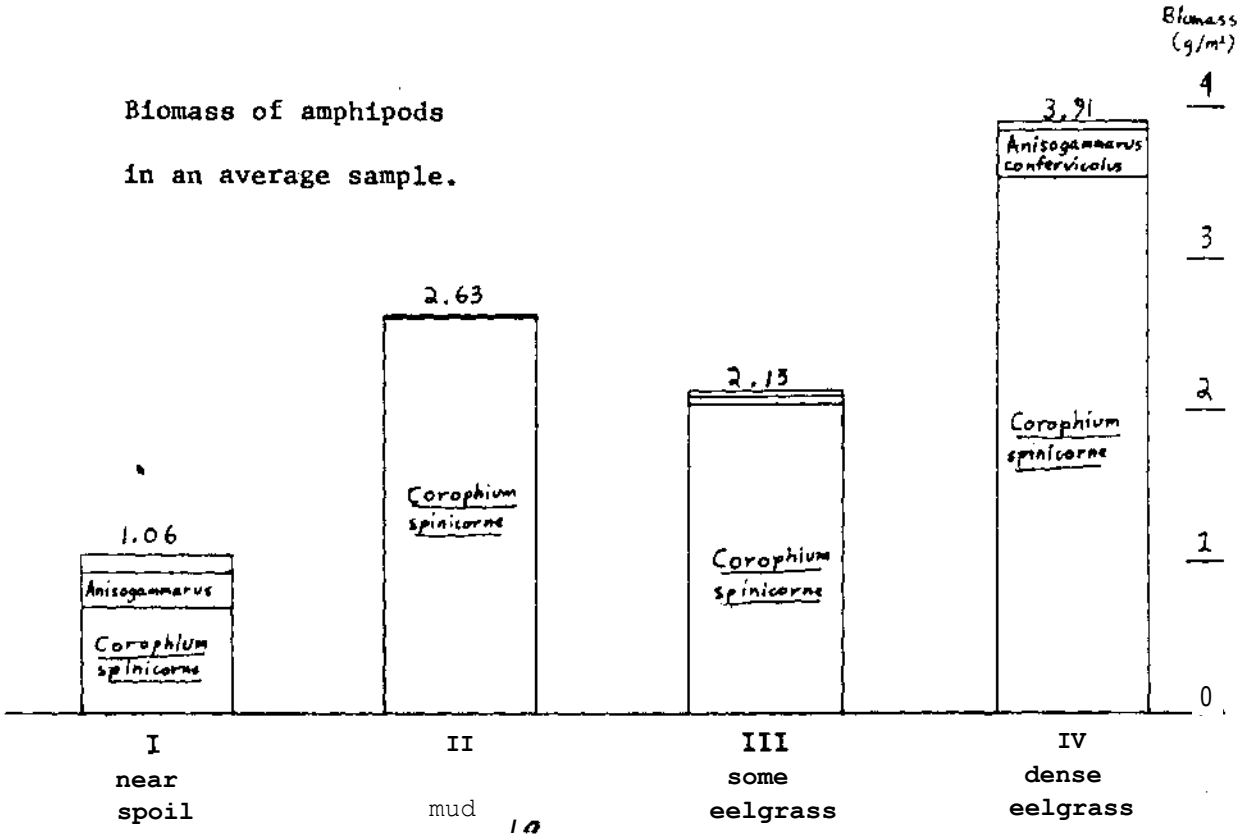


fig. 9 Biomass of amphipods in an average sample.



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Biomass of worms in

An average sample.

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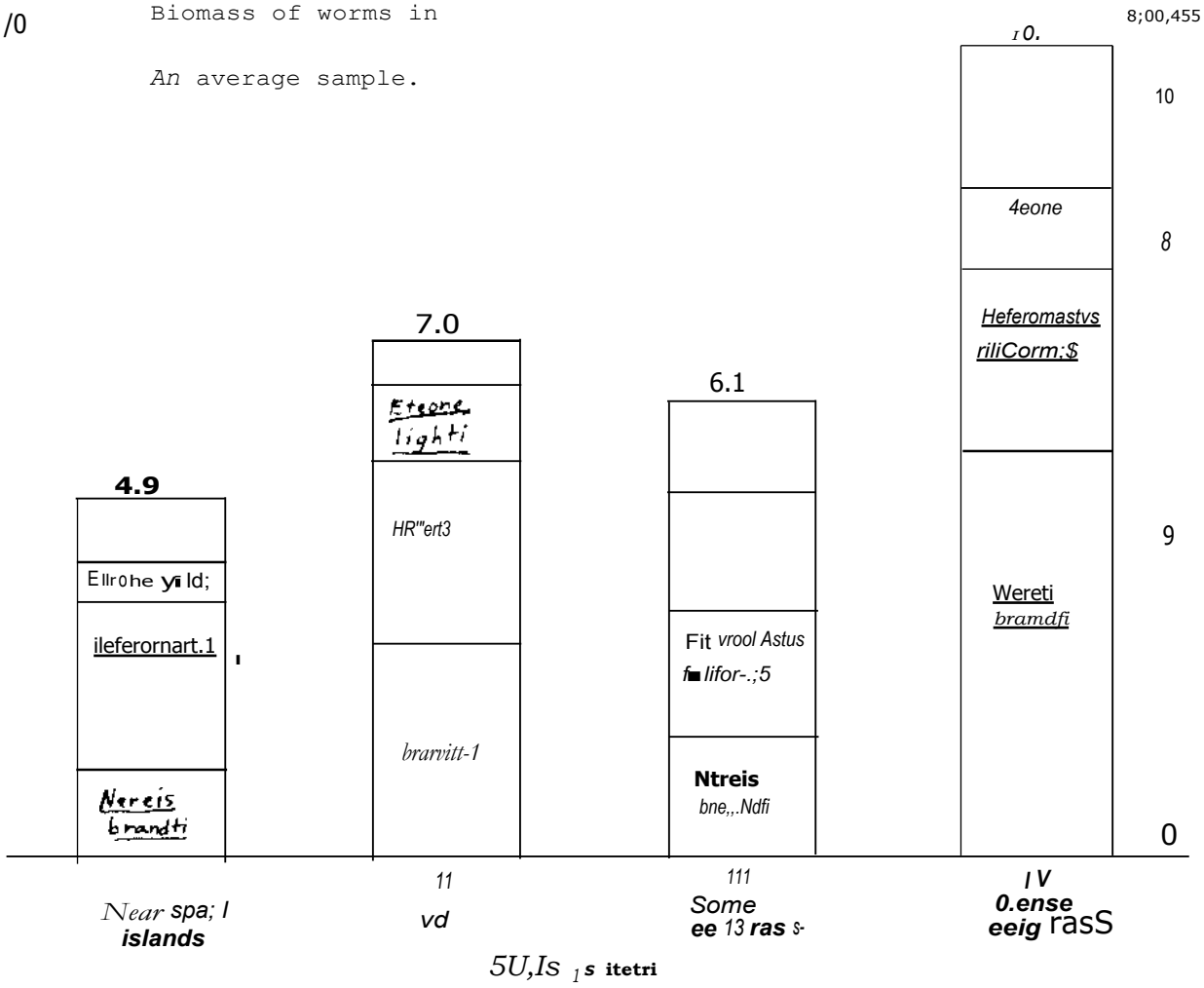
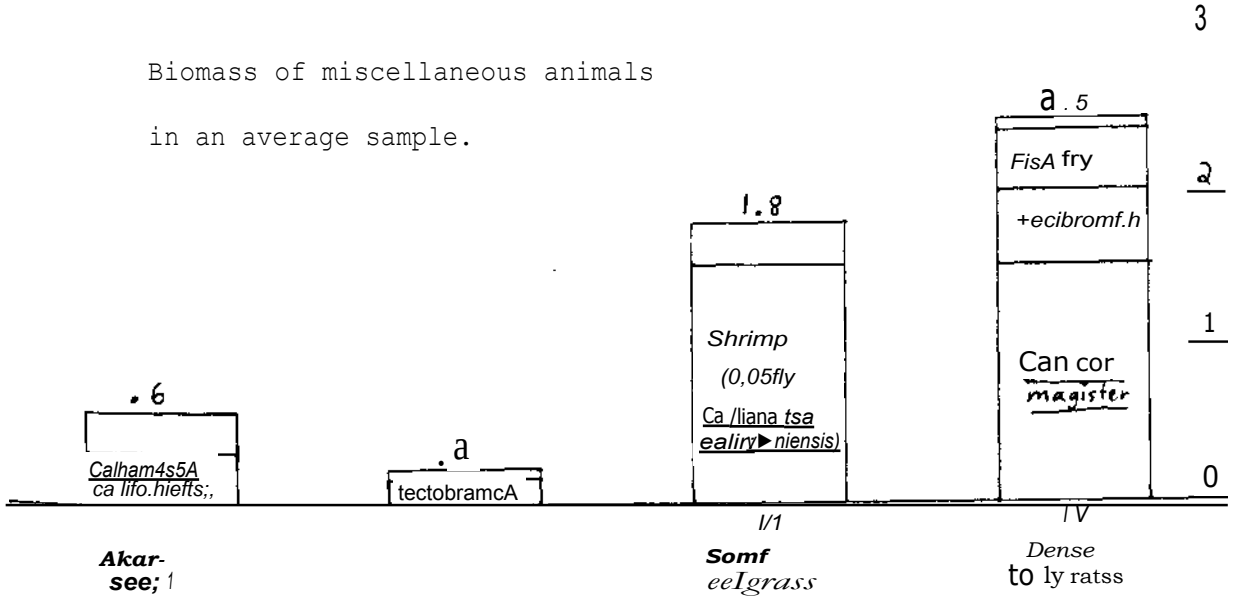


Biomass of miscellaneous animals

in an average sample.

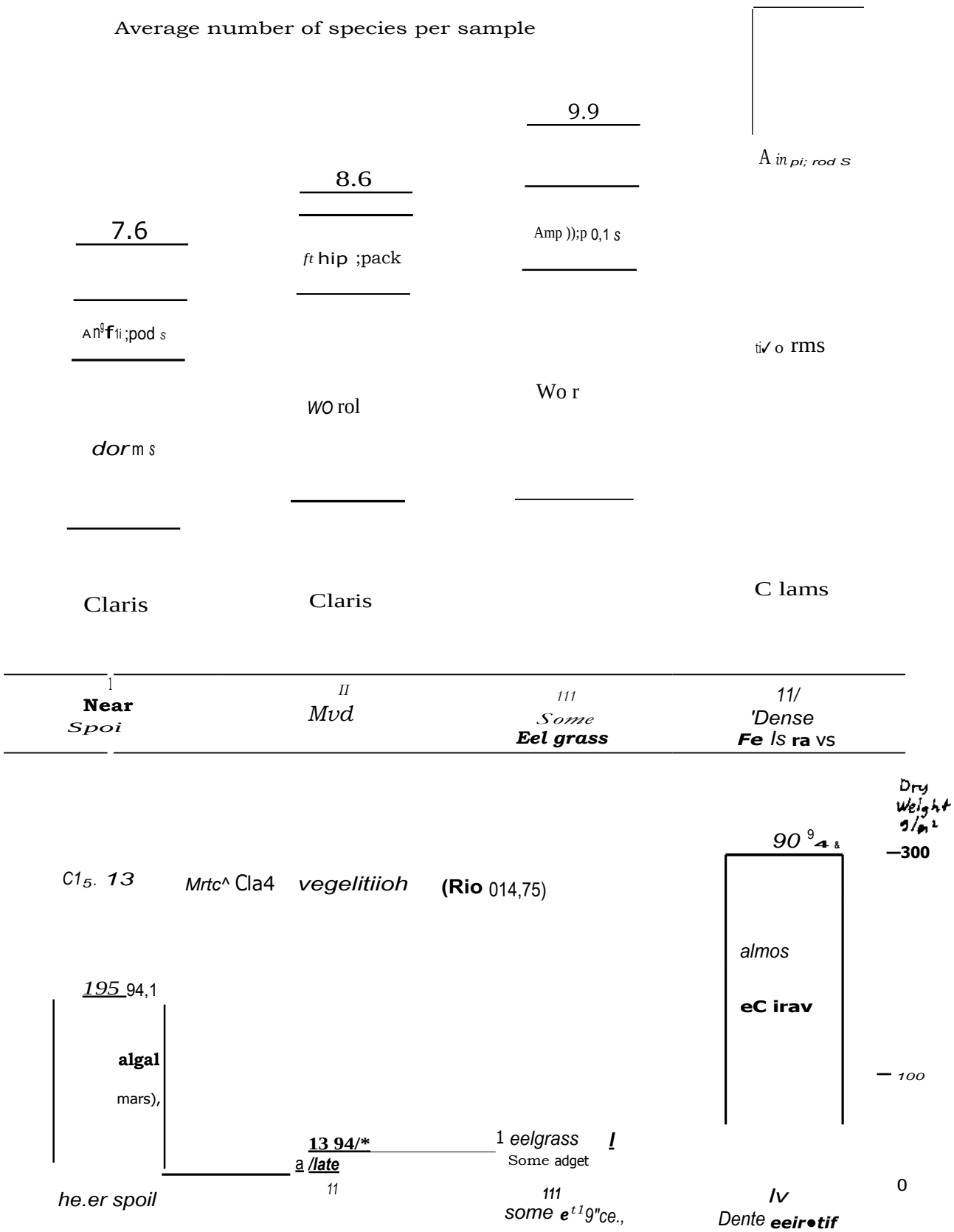


above the column. Unlabelled portions of the graphs represent contributions made by other miscellaneous species.

Several interesting tendencies are apparent from the data. Perhaps most striking is the preference of Mya for the eelgrass beds. The great majority of animals were most abundant in dense eelgrass and least abundant in spoil influenced areas. This tendency is not universal, however, as some animals have living requirements which are better satisfied in non-eelgrass areas. For example, Callianassa and Cryptomya prefer sandy substrate.

The average number of animal species per sample was calculated for each of the four environmental subsystems (Figure 12). It is apparent that more species are likely to occur in dense eelgrass areas than anywhere else, and that there is a gradation toward fewer species near spoil islands. More than fifty species appeared in the biomass samples. Distribution of certain abundant species is presented in Figure 14 as the fraction of samples taken from each subsystem that contained the given species.

Over the course of the summer extensive algae blooms occurred, and much algae, mostly Enteromorpha, washed around freely and often accumulated in the areas of higher elevation. For this reason, and also because of inconsistencies in data collection, the vegetation weights were not included in the biomass calculations. Figure 13 **gives** some idea of the vegetation composition of the samples, but no attempt was made here to divide these totals into contributions made by individual species.


Average number of species per sample
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9.9
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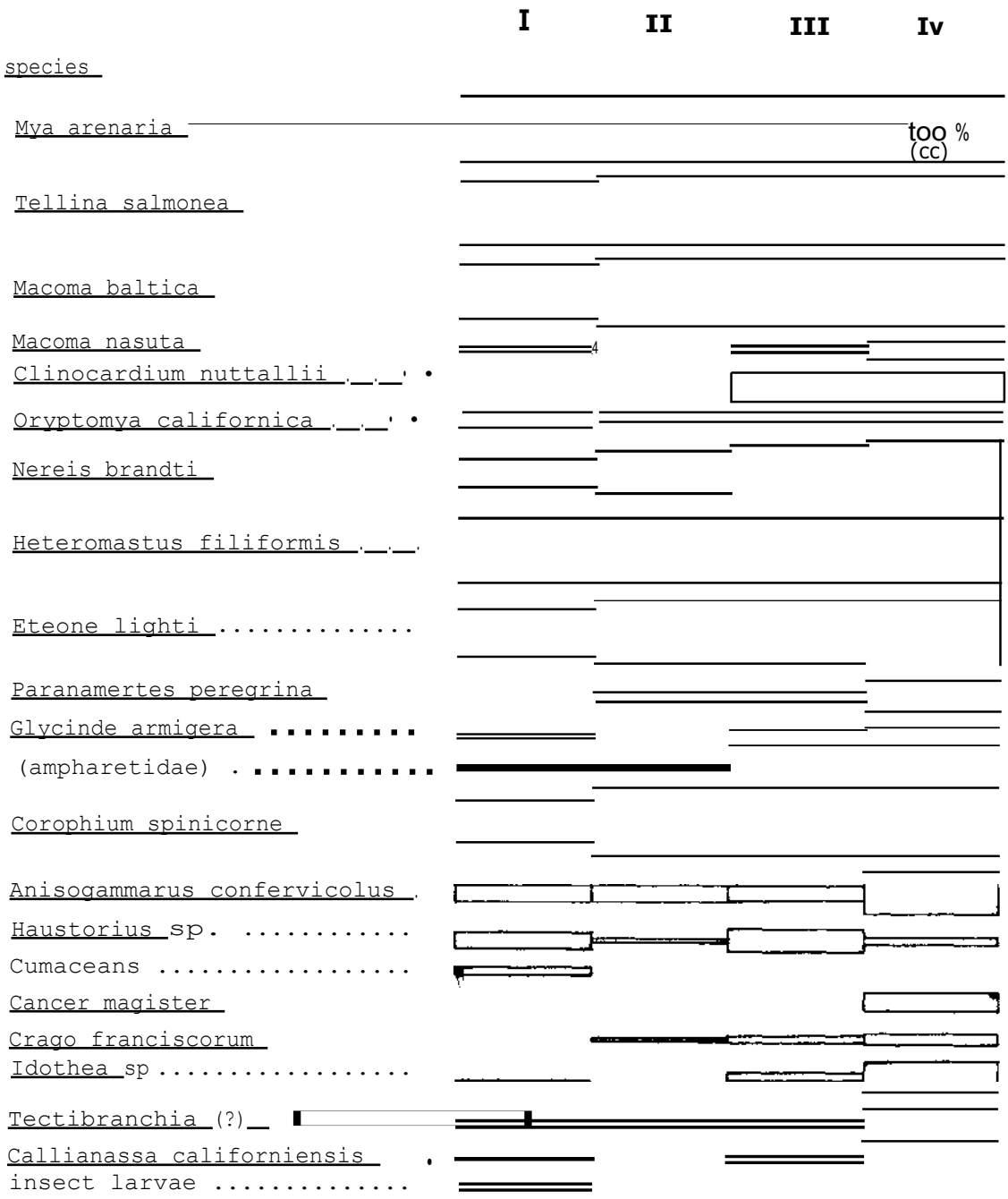

Fraction of the samples having certain abundant species, according to subsystem. The larger the block opposite the species name, the greater the fraction of the samples within that subsystem which contained the species. Subsystems as defined earlier.

as

Benthic populations do not appear to be limited by measured salinities (Figure 15). The most likely reason for this is that lower salinities occurring during winter and spring run-offs would eliminate species unable to tolerate such reduced salinities. In addition, muddy substrates tend to retain water of higher salinity as the tide recedes, so that interstitial salinity may remain above that of the overlying water. This makes possible the colonization of areas periodically exposed to brackish water by bottom dwelling species which normally would not tolerate the salinity stresses of the water (5). Salinity remained above 55% sea water (100% = 31 ppt.) and tended to increase as fresh water inflow decreased during the summer.

Wood chips do not seem to have any definite effects on animal abundance, although the data suggests that large amounts of wood may inhibit eelgrass and Mya and possibly favor Anisogammarus. Data on wood chips is not as consistent as might be hoped, but it was nevertheless surprising that samples having a wood content as high as 5-10% by weight do not show more definite effects of the presence of wood debris.

Substrate type, particularly sand content, appears to affect several organisms. Callianassa, Cryptomya, and Mya, particularly, seem to benefit from sandier substrate, while many of the worms, the amphipod Corophium, and the clams Macoma nasuta and Telliria salmonea appear to prefer muddier regions. Eelgrass was found in quite a wide variety of conditions, but was never dense in sand or gloppy mud. It is doubtful

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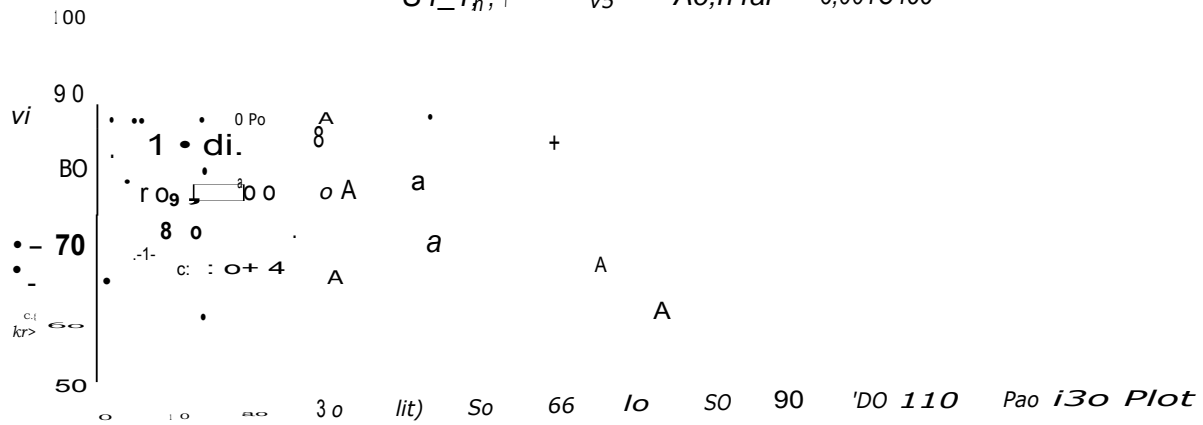

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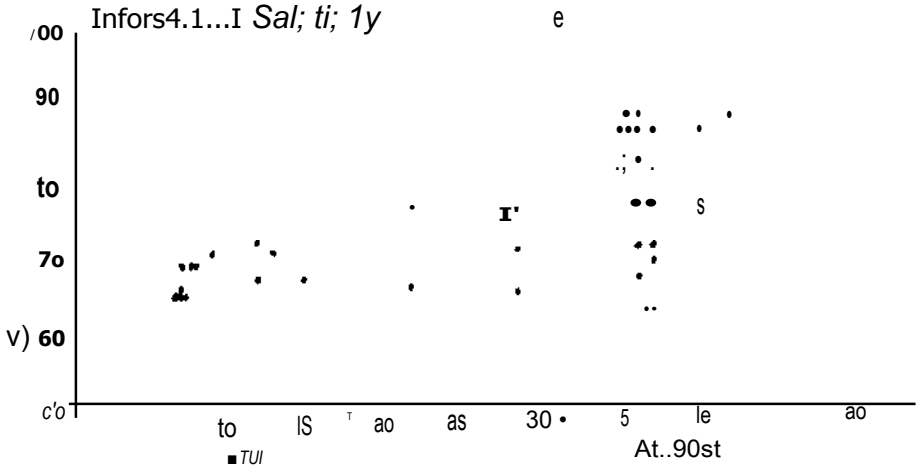

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that strict definitions of substrate would yield very firm information on substrate requirements or preferences.

The, effects of tidal height have already been noted as much as our data allows, but probably elevation is a more important limiting factor than the physical factors which were measured or discussed above.

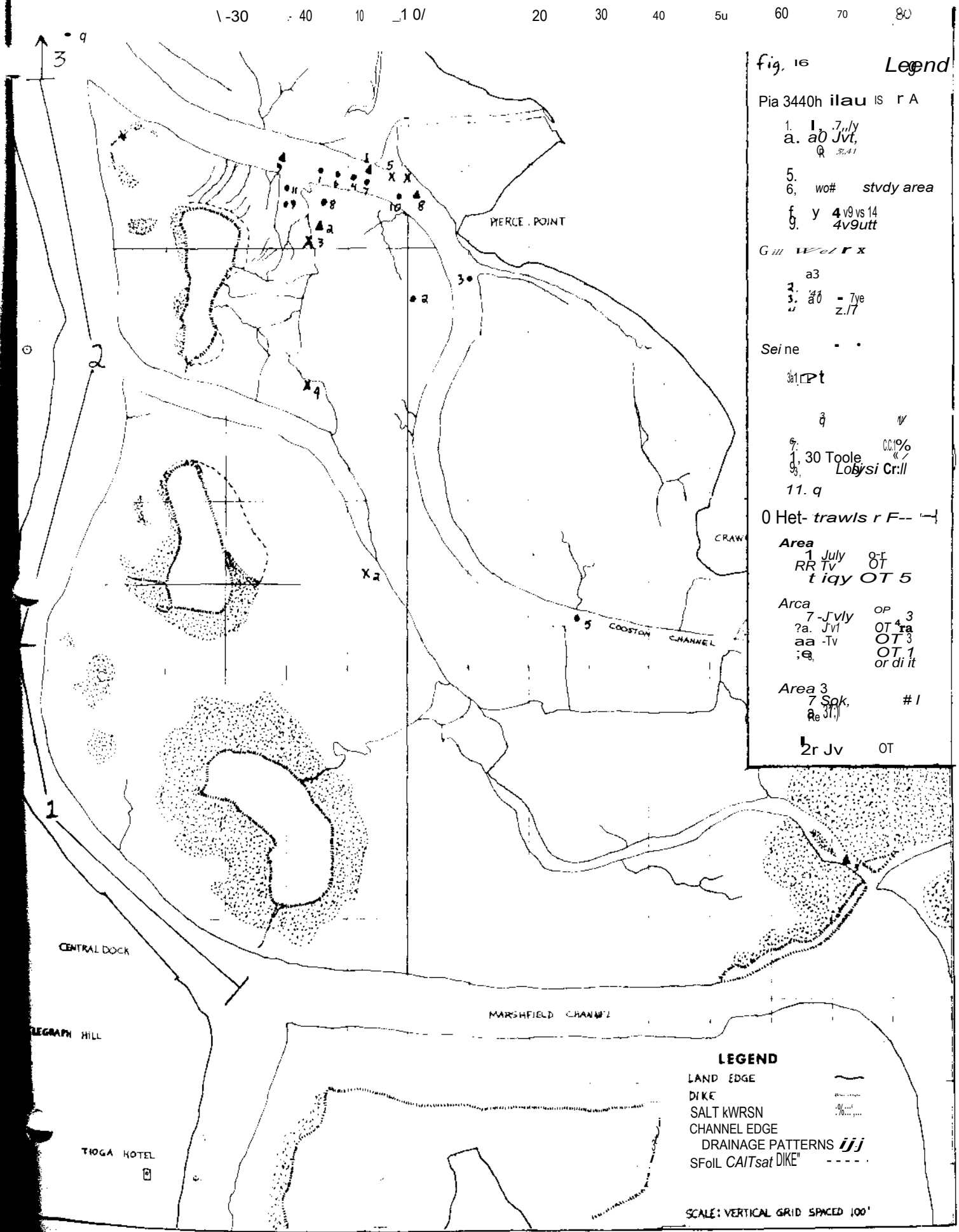
FOOD RELATIONSHIPS BETWEEN BENTHIC INFAUNA: Although the formidable jaws of many of the estuarine worms makes them appear to be voracious carnivores, in fact studies have shown that predation is probably not their primary method of obtaining food. Many different schemes have been devised to distinguish between methods of eating, but the consensus seems to be that the benthic forms reported in this paper are almost entirely detritus feeders (3, 15, 16, 17, 33). Decomposed eelgrass and marsh plants probably make up most of this food source, with plankton playing a lesser role (16). Wood chips might enter into this detritus food chain, but the extent of this is unknown.

The tectibranch Aglaja (?) and the nemertean worm Paranamertes were the most obvious predatory invertebrates, but the soft substrate and salinity stresses make it impossible for the echinoderms (star fish and brittle stars) and some molluscs to settle on the mudflat. Thus invertebrate predators make up only a small fraction of the benthic biomass. Field observations indicate that birds prey heavily on the infauna. And, of course, fish are major predators of benthic invertebrates.

SURVEY OF PLANKTON AND FISH ASSOCIATED WITH THE TIDALFLATS

METHODS: Plankton were collected, using a Clark-Bumpus sampler, on four days during the summer (19, 20, 22 July and 4 August) during fish hauls (see Figure 16). A total of nine plankton hauls were made, six of which were located in the study area. Time, temperature, salinity, and dissolved oxygen were usually measured. Sixty milliliters of the collected sample were preserved with 60 ml of formalin. The samples were taken to the laboratory and allowed to settle for eight hours. The plankton was then concentrated and counted in duplicate using a Sedgewick-Rafter counting chamber. Detailed methods of analysis are included with the data which are filed at the Oregon Institute of Marine Biology (18).

Three methods were used to collect fish during the study. The main channel was sampled from Kentuck Inlet to Marshfield Channel (3.2 miles) with an otter trawl towed behind the 30-foot charter boat Diane. Otter trawl catches were primarily restricted to bottom dwellers. The main channel was divided into three trawl areas (see Figure 16) and tows were made against the tide in each area on three days in July. Surface water temperature and weather conditions were recorded consistently. Shallow channels adjacent to the mudflat were sampled during outgoing, incoming or slack tides with a 125-foot bag seine and a variable mesh monofilament gill net. The gill net was set for one to three hours before being pulled back in. Both nets were set with a 16-foot flat bottom boat.


PIERCE . POINT
COOSTON CHANNEL
CENTRAL DOCK
MARSHFIELD CHANNEL
TIOGA HOTEL
SCALE: VERTICAL GRID SPACED 100'
LEGEND
LAND EDGE
DIKE
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CHANNEL EDGE
DRAINAGE PATTERNS
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Most seining sites were located on a sandbar or on firm eel-grass-covered mud near the northernmost spoil island. Gill netting was attempted only four times during the summer due to the low number of fish captured by this method. Seining was primarily done in June, although one catch was taken in July and two taken in August. Salinity, temperature and dissolved oxygen of the surrounding water and weather conditions were recorded sporadically.

Fish taken from the otter trawls were emptied from the net into a large fiberglass tub for sorting. Fish desired for gut content analysis were weighed and tagged, then injected abdominally with formalin and stored in large plastic bags. Fish not taken for analysis were weighed and released. Seine and gill net catches were emptied into a large plastic bucket filled with sea water for processing. Normally all species were counted, weighed and measured, then selected specimens were gutted for content analysis. Guts were injected with formalin, labelled and stored in baggies for transport to the lab. Whenever a large number of one species was caught, e.g. Cymatogaster aggregata, only those fish processed by two workers were measured, while the rest of the fish were counted and released to avoid undue casualities. Representatives from those fish measured were selected for weight and gut analyses. In all samples processed attention was paid to select members of various sizes from a particular species for content analysis.

Stomachs of channel fish were examined for macro-content with a dissecting microscope. Food items were

identified and assigned relative percentages of total stomach content based on visual approximation. Undetermined contents were further broken down on a 100% basis using a compound microscope. Stomachs from seine and gill net specimens were examined for presence of specific food items using dissecting and compound microscopes. Percentages of occurrence of each food item ingested were then calculated for each species.

Three months during the summer was not long enough for a group of seven people to adequately characterize the fish and plankton populations living over an extensive area of mudflat. Plankton and fish samples were not taken frequently or consistently. Physical factors were not recorded consistently when samples were taken. It would be advantageous to have some estimate of population size of various fish species, but this was impossible to attempt with such limited manpower. Methods of gut content analysis for otter trawl fish were different from those for seine and gill net fish, which made certain comparisons difficult. Despite these shortcomings, much information was obtained during the summer.

RESULTS: Plankton samples were not taken frequently enough to provide much information about composition of these organisms in the study area over the summer. Melosira was by far the most abundant organism except in one haul made near the ocean in which Thallassiosira occurred most frequently (Figure 17). Calanoid copepods were also present consistently. Numbers of total organisms and Melosira are lower in hauls

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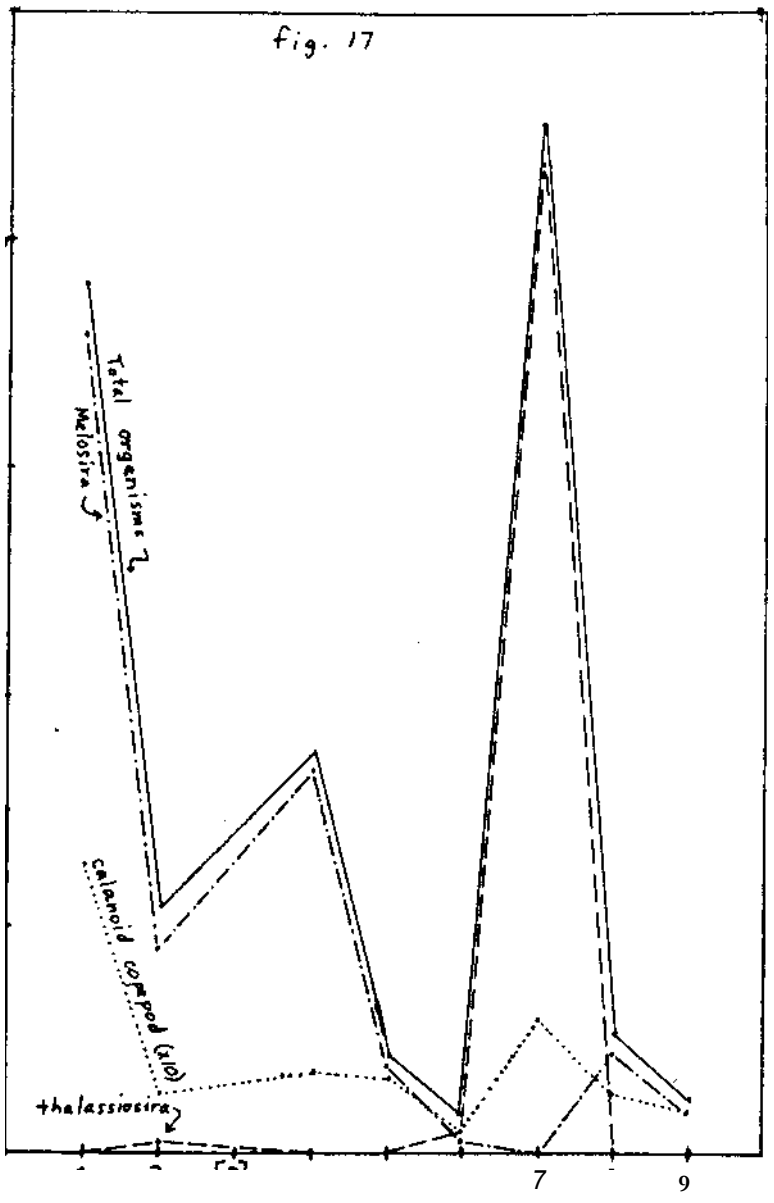
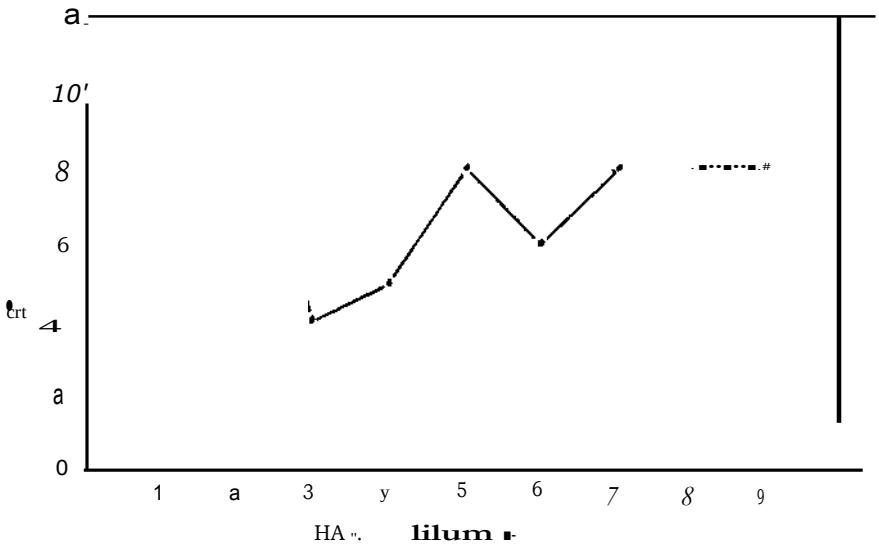
(In *cl tronologiGal Or'cler)*

Hauls 5- 7 bal'ween siudy area and *ocean,*



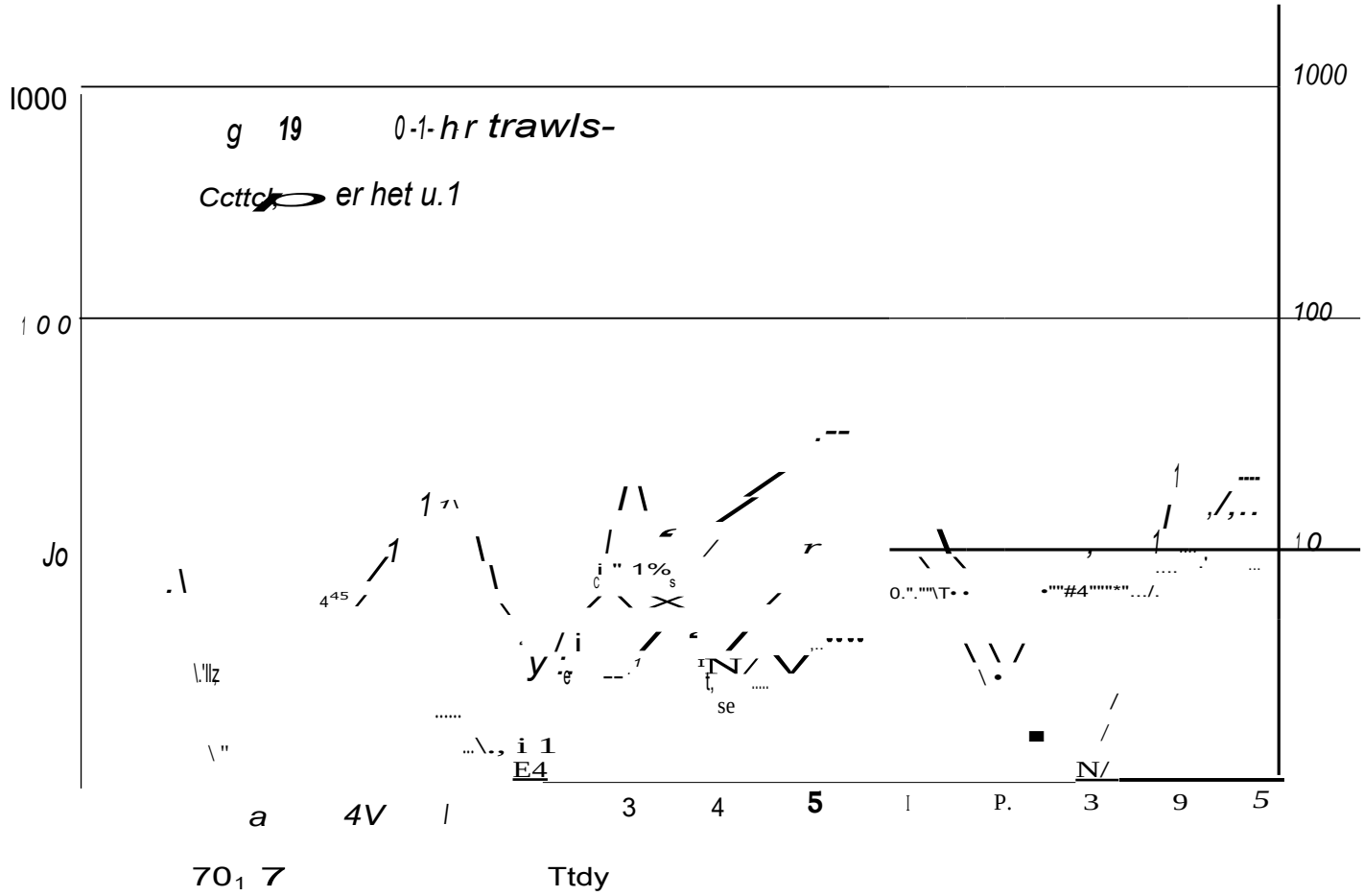


taken in the study area on 4 August (#8 and 9) then on 19 and 20 July (#1 and 2). This may be due to a decrease in plankton in August, but it is more likely a result of making hauls at different times in the tidal cycle. Haul #1 was taken at high low tide, #2 during outflow after high high tide, #8 during inflow after low low tide, and #9 during inflow before low high tide. It is interesting that the greatest number of genera were taken in a haul over the mudflat (Figure 18), but one sample cannot indicate whether this is significant.

Initial data concerning specific fish caught per haul, length, weight, and gut content analyses are contained in separate notebooks filed at the Oregon Institute of Marine Biology (18, 19). The former report also contains data on percentage composition of each haul, and average values and ranges of length and weight for each species.

Figures 19 and 20 present the total number of fish caught and distribution of species per haul using otter trawl, seine and gill net. Figure 21 shows number of species per haul. The number (Figure 19) or letter (Figure 20) above each column denotes the area where the haul was taken (refer to Figure 16). Note that otter trawls were distributed 23% in area 1, 38.5% in area 2, and 38.5% in area 3. Seines were taken 55% over eelgrass, 27% in channels adjacent to eelgrass, 18% off a sandbar next to a large spoil island.

Of the thirteen otter trawls taken, six yielded catches greater than fifty fish. These hauls are well distributed



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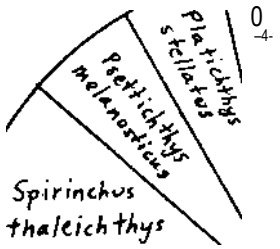

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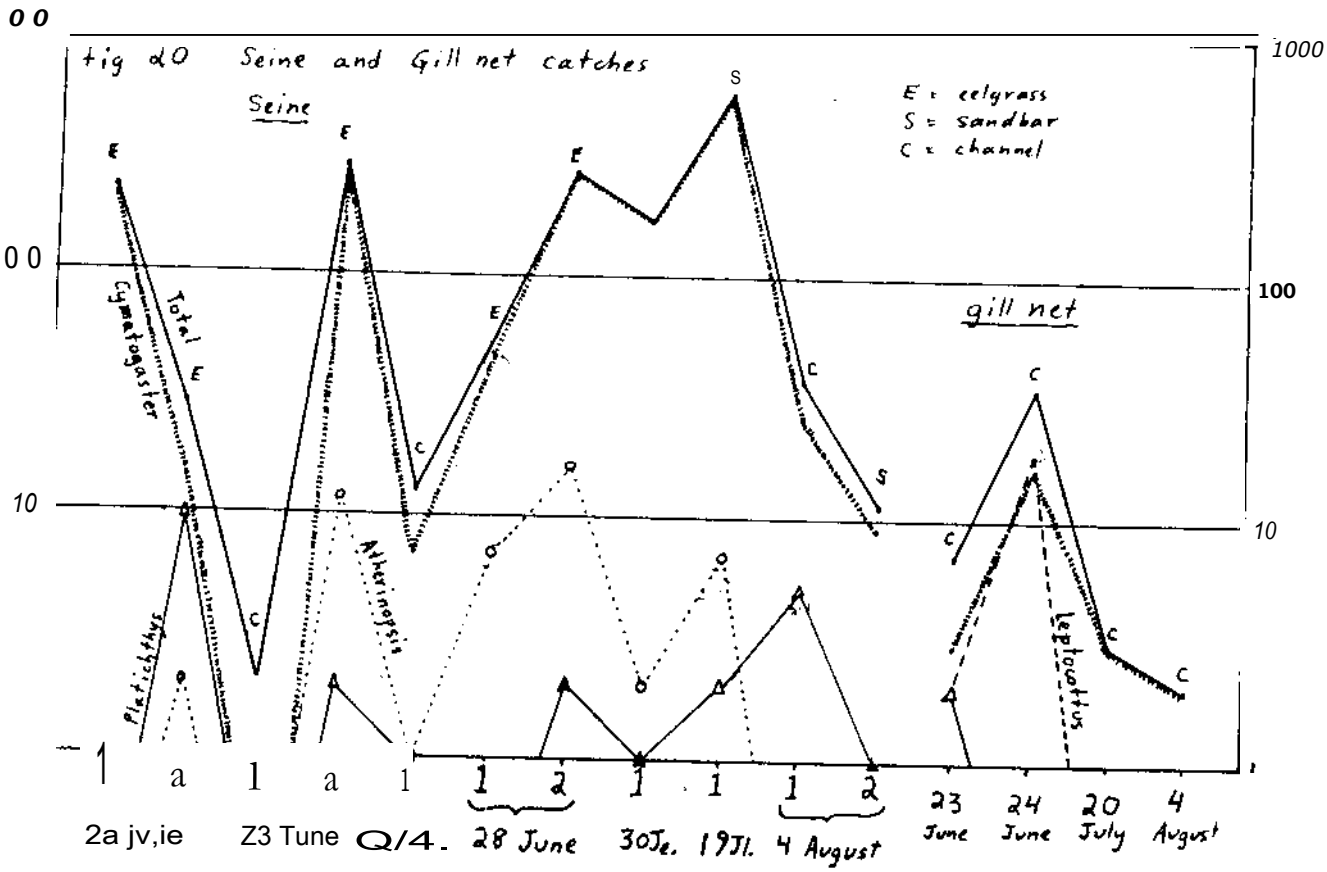

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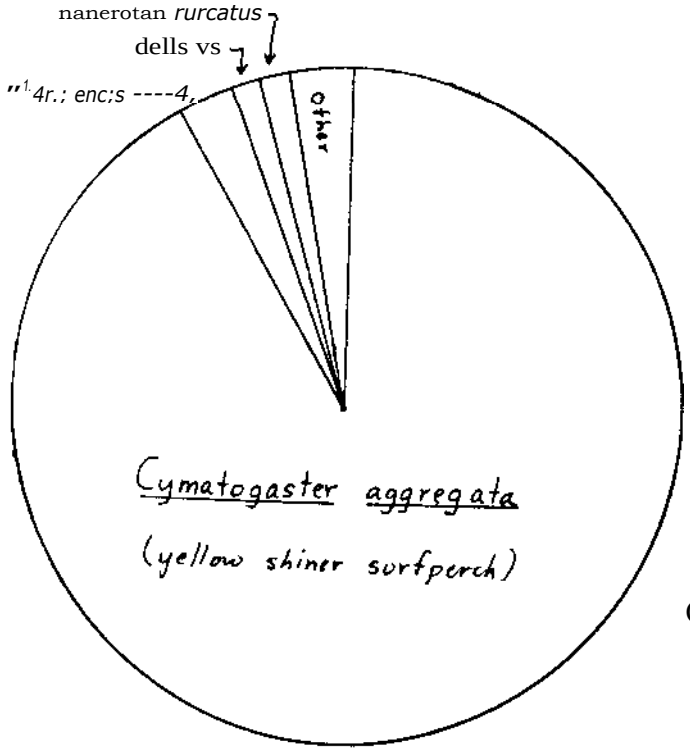

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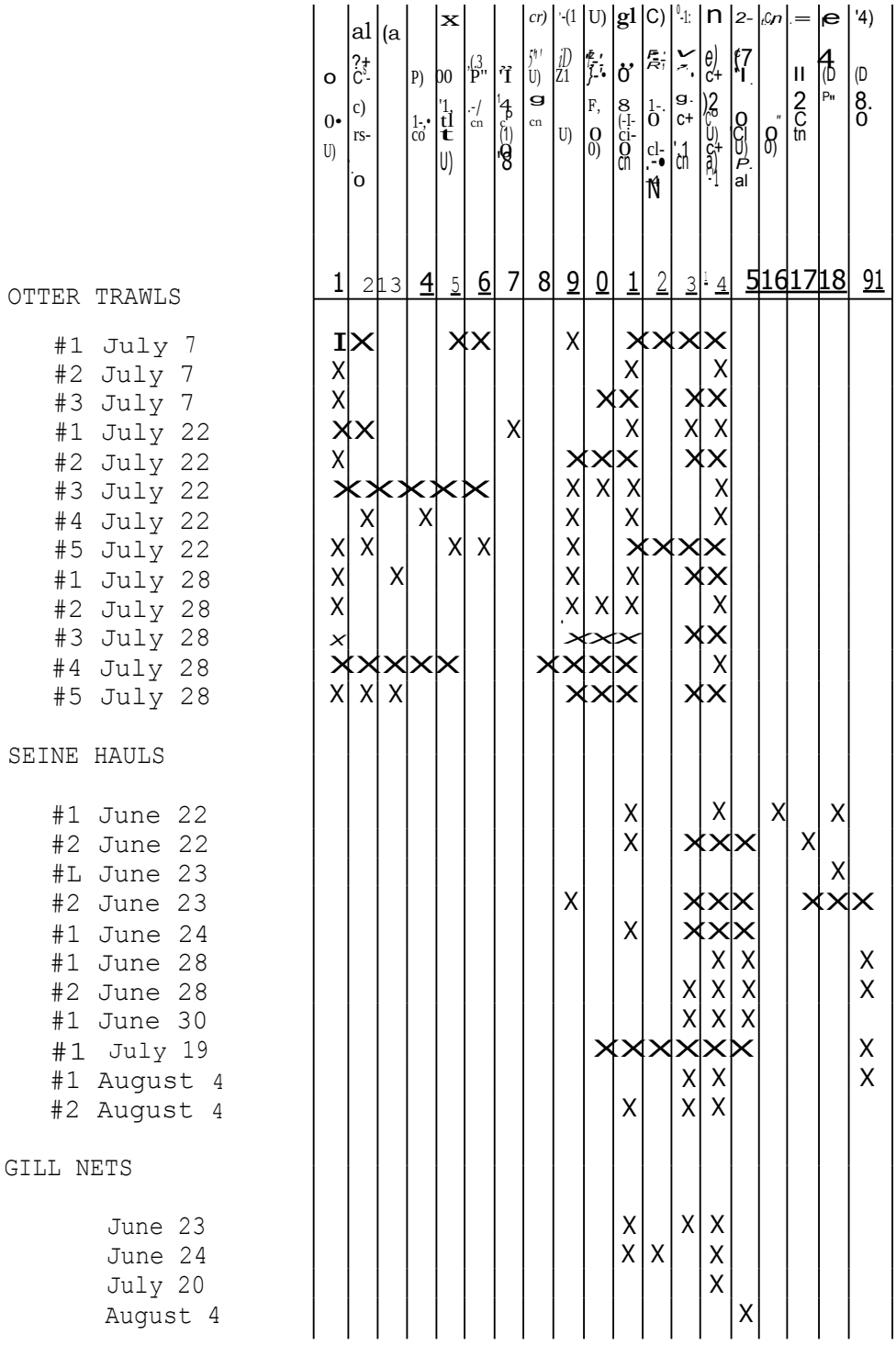
Fig. 21 Species found in fishing hauls



OTTER TRAWLS	
#1 July 7	I X X X X X X X
#2 July 7	X X X X
#3 July 7	X X X X X
#1 July 22	X X X X X X X
#2 July 22	X X X X X X
#3 July 22	X X X X X X X X X X
#4 July 22	X X X X X
#5 July 22	X X X X X X X X X X
#1 July 28	X X X X X
#2 July 28	X X X X X X
#3 July 28	X X X X X
#4 July 28	X X X X X X X X X X
#5 July 28	X X X X X X X X X
SEINE HAULS	
#1 June 22	X X X X X
#2 June 22	X X X X X X
#L June 23	X
#2 June 23	X X X X X X X X
#1 June 24	X X X X X
#1 June 28	X X X
#2 June 28	X X X X X
#1 June 30	X X X X
#1 July 19	X X X X X X X X
#1 August 4	X X X
#2 August 4	X X X X
GILL NETS	
June 23	X X X X
June 24	X X X X
July 20	X X
August 4	X

It is interesting to note that different fishing methods catch various species with different success, due in part at least to the restrictions on where each method may be used.

between the three designated main channel areas, as are hauls yielding less than fifty fish. Thus, there seems to be no significant difference in the number of fish caught per haul between the three areas. Shiner surfperch (Cymatogaster aggregata) and staghorn sculpin (Leptocottus armatus) were found throughout the main channel segment which was studied. These two fish species were also taken in relatively large numbers per haul at least once in each area. Pacific tomcod (Microgadus proximus) was found throughout the channel and was caught in large numbers in areas 1 and 2. Starry flounder (Platichthys stellatus), English sole (Parophrys vetulus), and sand sole (Psettichthys melanostictus) were found along the channel, but only English Sole were found in quantity, and this was in water below the mudflat study area (channel area 3). Longfin smelt (Spirinchus thaleichthys) were found primarily in channel water adjacent to the mudflat, especially in channel area 2. Northern anchovy (Engraulis mordax) were caught occasionally in channel areas 2 and 3.

Shiner surfperch dominated nearly every catch taken with the seine or gill net. Six seine hauls yielded more than fifty fish; each of these was attributable to shiners. Five of these hauls were made in a shallow channel adjacent to eelgrass mudflat. The sixth haul, which yielded 563 fish (524 shiner surfperch), was taken off the sandbar. The great number of fish in this catch was partially due to a large proportion of juvenile shiners, and also due to the ease with which the seine could be manipulated on the firm sand substrate.

This seining site was about 530 feet from eelgrass mudflat. The average number of fish other than shiners caught per haul was eleven. Six seine hauls yielded eleven or more non-shine/ fish and four of these were taken over eelgrass mudlfat. Five catches had less than eleven other fish; two hauls were taken over eelgrass. It is difficult to discuss gill net hauls, since only four were taken. Several important species were captured with the seine and gill net. Starry flounder were found in 60% of the hauls, and were abundant (10 fish) once over eelgrass, as were English sole (11 fish). Speckled sanddab (Citharichthys stigmaeus) were found to be abundant (12 fish) in one seine over the sandbar. Jacksmelt (Atherinopsis californiensis) were found in eight of the hauls (50%), four of which yielded seven or more fish. Staghorn sculpin and white surfperch (Phanerodon furcatus) were found in 33% of the hauls. Pacific herring (Clupea harengus pallas were taken once over the eelgrass.

It is interesting to note that results from these catches extend the distribution of the following species from that previously reported by the U.S. Department of the Inters (37): Pacific tomcod, 14 miles from ocean; longfin smelt, 14 miles; kelp greenling, 13 miles; jacksmelt, 13 miles.

The average number of species taken with the otter trawl was seven. There was no significant difference betweer, channel areas with respect to diversity of species. Four species was the average number taken with the seine; six hauls, four of which were over eelgrass, yielded four or more species.

As mentioned above, shiner surfperch was the most abundant species caught with the seine and was a prevalent species in otter trawl and gill net catches. Figure 22 presents sex and age distributions of Cymatogaster catches taken during the summer. More females than males were consistently captured using the otter trawl, which was not the case with the seine and gill net. The interesting facts to note are the appearance of juvenile shiner surfperch over the mudflat beginning on 23 June and the increase in number of juveniles to over 50 in mid-July. Concurrently, we observed a decrease in the number of gravid adult females. The mean length of juveniles increased gradually from 3.7 cm on 23 June to 4.0 cm on 19 July to 4.3 cm on 4 August for fish caught with the seine. Also notice that juvenile shiner surfperch began to appear in the main channel in late July (average length: 6.0 cm). Apparently Cymatogaster females give birth to their young over the mudflat, which is probably then utilized by juveniles as a rich feeding ground. As the juveniles grow they may then begin to venture from the mudflat into the main channel. Of course, juveniles may have been in the channel earlier in July but were not large enough to get caught **in** the otter trawl. More research should be conducted in this area to explain more precisely the relationship of the shiner surfperch to the eelgrass mudflats throughout its life cycle.

Fig. 22 Population breakdown for Cymatogaster

OTTER TRAWL	Male	Female	not sexed	Juvenile	
#1 July 7	12	15			
#2 "		2			
#3 "		2			
#1 July 22		2			
#2 "	1				
#3 "	4	17			
#4 "		2			
#5 "		1			
#1 July 28	4		1	2	
#2 "				6	
#3 "	1	6			
#4	3	4		1	
#5 "	2	4		7	
SEINE HAULS					
#1 June 22			2,10		(in eelgrass)
#2 "	10	4			(in eelgrass)
#1 June 23					(in channel)
#2 "	131	40		78	(in eelgrass)
#1 June 24	2	5			(in channel)
#1 June 28	7	18		25	(in eelgrass)
#2 "	4	2		241	(in eelgrass)
#1 June 30	12	13		146	(in eelgrass)
#1 July 1			21	503	(over sandbar)
#1 August 4				24	(in channel)
#2 August 4				9	(over sandbar)
GILL NETS					
June 23	2	1			(in channel)
June 24	8	6			(in channel)
July 20	2	1			(in eelgrass)
August 4					(in channel)

Surf perch gave birth to young during the early summer, and seine hauls over and near the eelgrass beds proved to be the most effective way to capture the perch.

The Dungeness crab, Cancer magister, was a frequent component of seine and gill net hauls (Figure 25). Crabs ranged from 1.5 to 5 inches across the carapace. Our data are not sufficient to estimate the number of Dungeness crabs inhabiting the mudflat at high tide, but they do suggest that the mudflat is important to young crabs.

As mentioned earlier, records from gut examinations as well as tables for frequency of occurrence of food items per species are filed at the Oregon Institute of Marine Biology. Figure 26a-p represents compilation of these data. It is readily seen that all of these fish depend heavily on organisms

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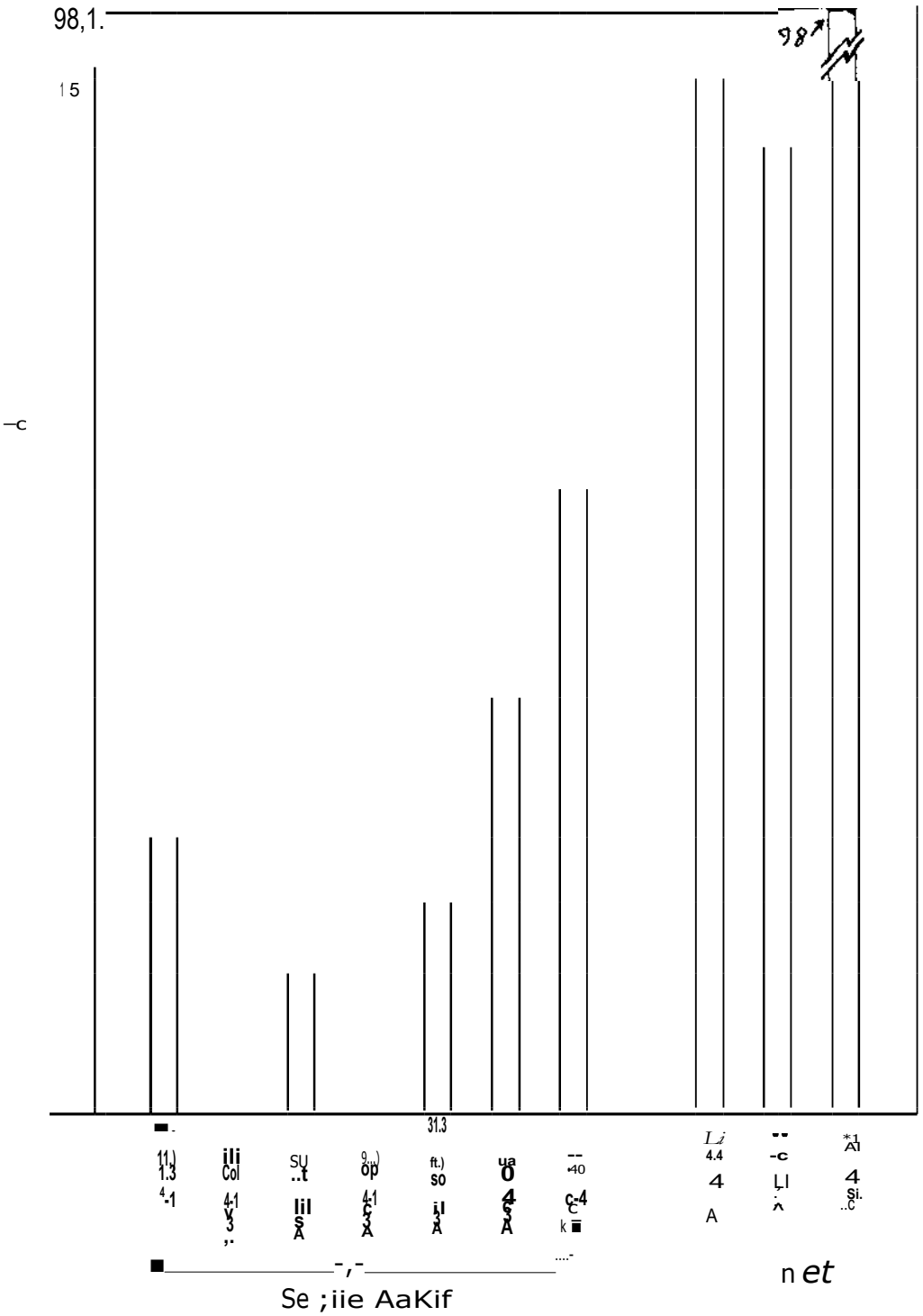
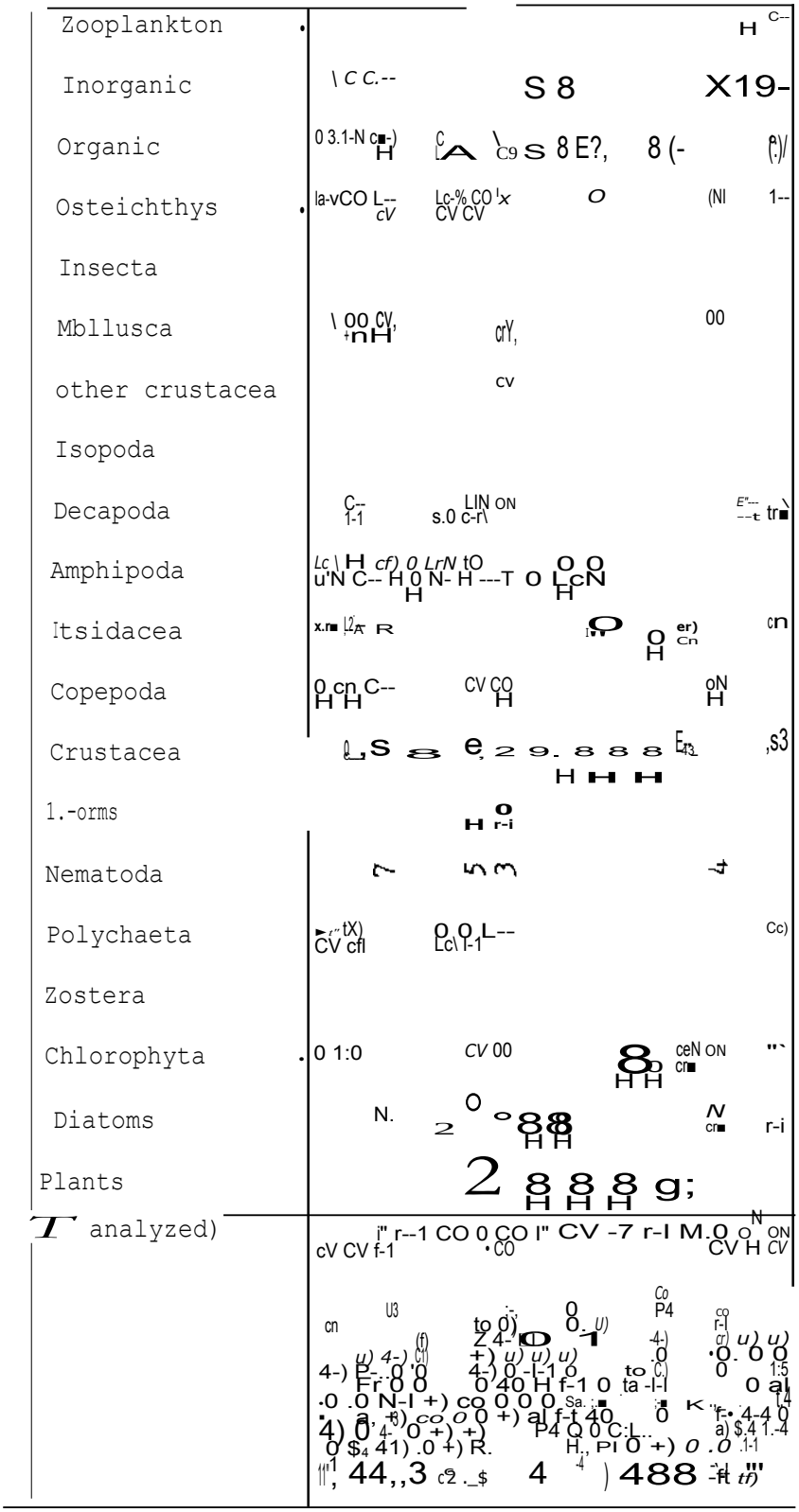


Juvenile dungenous crabs are especially active over the eelgrass flats late in the summer. They probably are a major predator on the benthic infauna, and are themselves important in the fish food chain. None of our capture methods were designed for, or especially efficient at catchin[g] crabs.

Fig. 26 *Fish* foods. Expressed as the percentage of the fish of each genus which were found to contain a particular food item.



associated with the mudflat. Herring and anchovy contained primarily diatoms and small crustaceans. Amphipods, shrimp, diatoms and zooplankton were ingested most frequently by long-fin smelt and Pacific Tomcod. Diatoms, small crustaceans, small fish and clams were common in jacksmelt. Surfperch contained diatoms, copepods, amphipods, clams and worms. Small fish, shrimp and amphipods were found in kelp greenling. Sculpins fed upon algae, diatoms, shrimp, amphipods, small fish worms and clams. Flounder and sole contained diatoms, copepod mysids, amphipods, shrimp, clams, worms and small fish.

The most prevalent species of diatom in fish containins algae was Melosira, which was the dominant organism in most plankton hauls taken during the summer. Many copepods were also found in the plankton hauls. Amphipods identified in fish stomachs were Corophium and Anisogammarus, both of which are dominant organisms on the mudflat. Crago, the gray shrimp was a common food item and was found many times during the summer in both biomass samples and seine hauls. Molluscs found in the stomachs were clams: Clinocardium, the basket cockle; Mya, the soft-shelled clam; and occasionally Telina, the pink tellon. All three of these clams are found in the mudflat study area, Mya being most common of the three. Un-fortunately, it was not possible to specify worm and fish species ingested as food items because we did not have the expertise to make identificaitons based on worm setae or fish scales. It is presumed that worms found in stomachs examined were species living in the mudflat, while fish contained in

guts were species liv] in water n it the mudflat (since the guts examined bel(r,ed to fish caught near the mudflat). It should be obvious teen that much of the food content of fish studied in this report come directly from or is closely associated with the tidal mudflat area in question.

There are many important fish species which occur in Coos Bay at various times throughout the year which we could not study, due to our equipment and the season of the year. However, there are data published about the diet and habits of these species. Below are descriptions for many Coos Bay fishes, based on the references included in parentheses.

Green sturgeon, Acipenser medirostris (6): Sturgeon are migratory and,in the Sacramento-San Joaguin Estuary, feed on shrimp (Crago), bent-nosed clams (Macoma), amphipods (Photis, Corophium), isopods (Synidotea), mysids, annelids, unidentified crab and fish.

White sturgeon, A. transmontanus (6, 11, 29): These fish are also migratory and spawn in lower rivers. In British Columbia they feed on smelt (Thaleichthys), sculpin (Cottus), stickleback, crayfish, insect larvae, and mysids. In the Sacramento-San Joaquin Estuary, sturgeon feed on clams (Macoma), annelids, isopods, shrimp (Crago), amphipods (especially Photis, Corophium), mysids and crab.

American shad, Alosa sapidissima (6, 10, 11, 12, 14, 32): Shad are migratory and spawn in upper estuaries or lower rivers; they may spend several weeks in the bay before

moving up the river to spawn. Shad eat small shrimp, amphipo and small fish at sea; they feed on mysids, copepods, Crago, fish larvae, and Corophlum during migration (before entering fresh water).

Pacific herring, Clupea harengus pallasi (9, 10, 11): Herring are migratory. In the ocean they eat copepods, larva crustaceans and molluscs, and diatoms. Their predators include striped bass, cutthroat trout, salmon, halibut, albacore, dogfish, squid and seal.

Northern anchovy, Engraulis mordax (4, 9, 11): Anchovy are migratory and are numerous in the bay before spawning. They eat small crustaceans, fish larvae, copepods and diatoms. They serve as food for salmon and striped bass.

Chinook and coho salmon, Oncorhynchus tshawytscha and 0. kisutch (4, 32): These fish spawn in the rivers of the Coos system. Adults in the ocean depend on herring and anchovy. Young salmon on their way to the ocean may eat insects, mysids, isopods and amphipods.

Cutthroat and steelhead trout, Salmo clarkii and S. gairdneri (12, 32, 37): Adults are migratory and young spend time in the bay on their way to the sea. Adults feed on crustaceans, insects, worms, herring and smelt.

Striped bass, Morone saxatilis (4, 6, 10, 30, 32): These fish spawn in rivers but may feed throughout the bay especially over the mudflats. Some striped bass can be found in Coos Bay almost year around. Adults feed on Crago, surfperch, shad, chinook salmon, young striped bass, anchovy,

herring, splittail, gables, sculpin. The diets of young fish depend upon their age but may include mysids, amphipods, isopods, Crago, annelids, shad and younger striped bass.

From the above descriptions it is evident that many commercially important fish depend directly or indirectly on the tidalflat portion of the estuary. Many fish such as young striped bass and shad feed on organisms living in the mud, while others such as salmon, trout, and adult striped bass predate fishes which eat mudflat animals. Thus, the mudflat and its associated organisms are important to many fishes including those species important to man commercially and recreationally. The food chain for fish diagrammed in Figure 27 illustrates this point.

DISCUSSION

Energy transfer is a fundamental property of any ecosystem, and the study of energy flow through a food chain is a useful tool for understanding some of the potentials and limitations of animal populations.

At the base of the estuarine food chain are the plants. Larval stages of most fish and benthic forms depend on phytoplankton. Plankton, in general, and, to a lesser extent, algae and eelgrass are also directly utilized as food sources by adult estuarine animals. However, the benthic infauna depend primarily on detritus for nutrition. Much of this detritus comes from eelgrass, which grows underwater (. 16, 25). There is also a tremendous amount of organic plant material

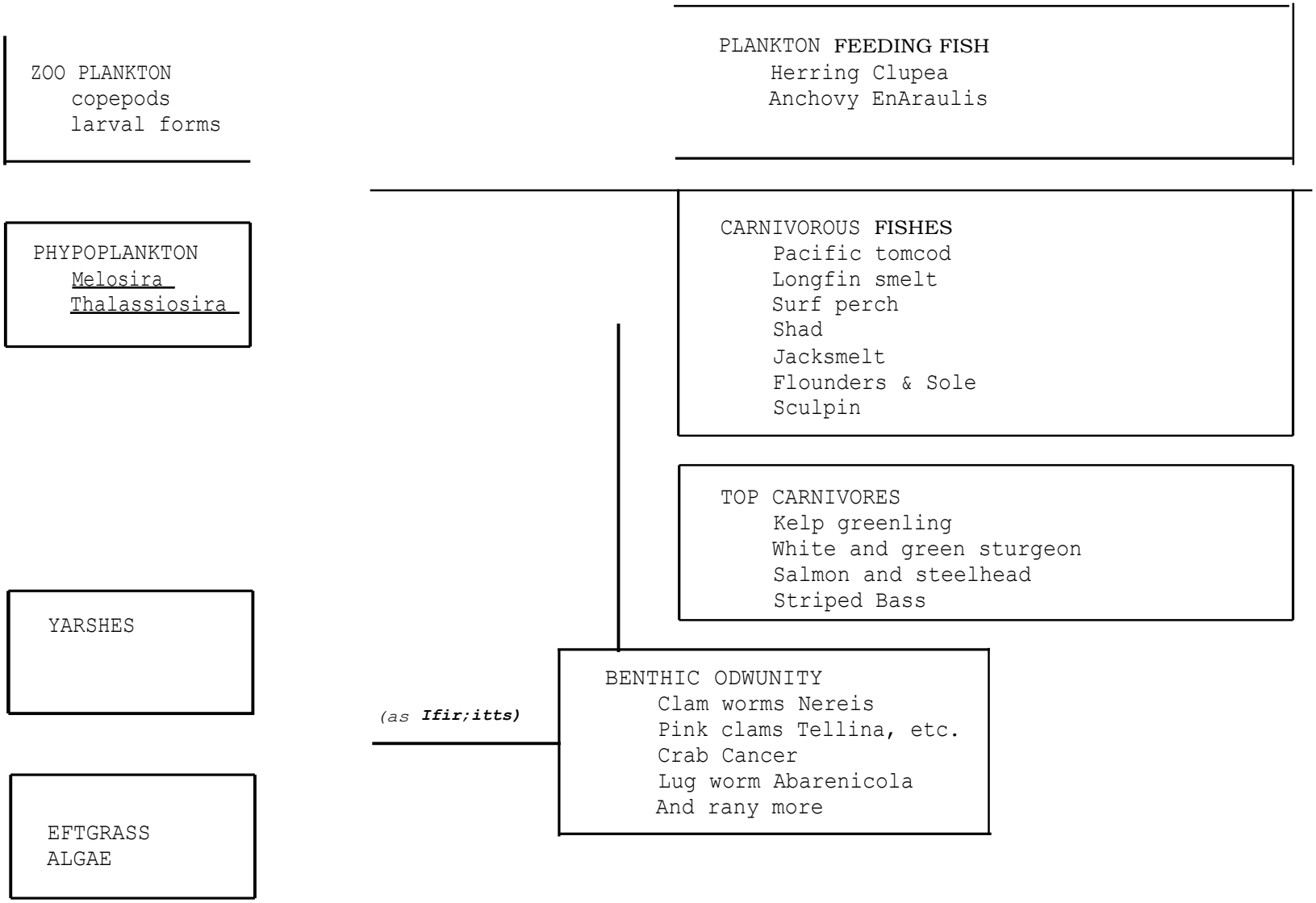


Fig. 27. A crude diagram of the estuarine food chain. Yany links are not shown. Nutrients are **re sled** in the estuary, and there is much influx of nutrients from the sea and from the land.

present in the marshes, but it is not usually directly accessible by benthic infauna. Instead, daily or irregular inundation of most marshlands releases great amounts detritus into the water to be utilized by filter feeders, detritus gatherers, and substrate ingestors.

The mudflat area which we studied is presently home for a great variety of estuarine invertebrates. The total live animal biomass is probably close to 1,000,000 pounds (500 tons) over 1097 acres, estimated from the biomass data and area of each subsystem.

The benthic infauna are in turn food for the fish and birds. Thorson estimated that demersal fish will eat five to six percent of their own body weight per day in benthic foodstuffs (35). Ecologists often assume a ratio of predator to prey biomass conversion of 10%, although some fisheries biologists believe the ratio may be higher in estuaries (14). Because the bulk of predation of tidal flat infauna is due to fishes, it seems reasonable to place the biomass of demersal fish feeding on the mudflat at nearly 50 tons in the biological study area alone (14, 17, 23, 35). To support such a large number of fish might require a daily production of as much as 6000 pounds of benthic food animals or about 0.6% increase in biomass of infauna per day, assuming a steady-state relationship between fish and their prey. This estimate seems low in light of other studies.

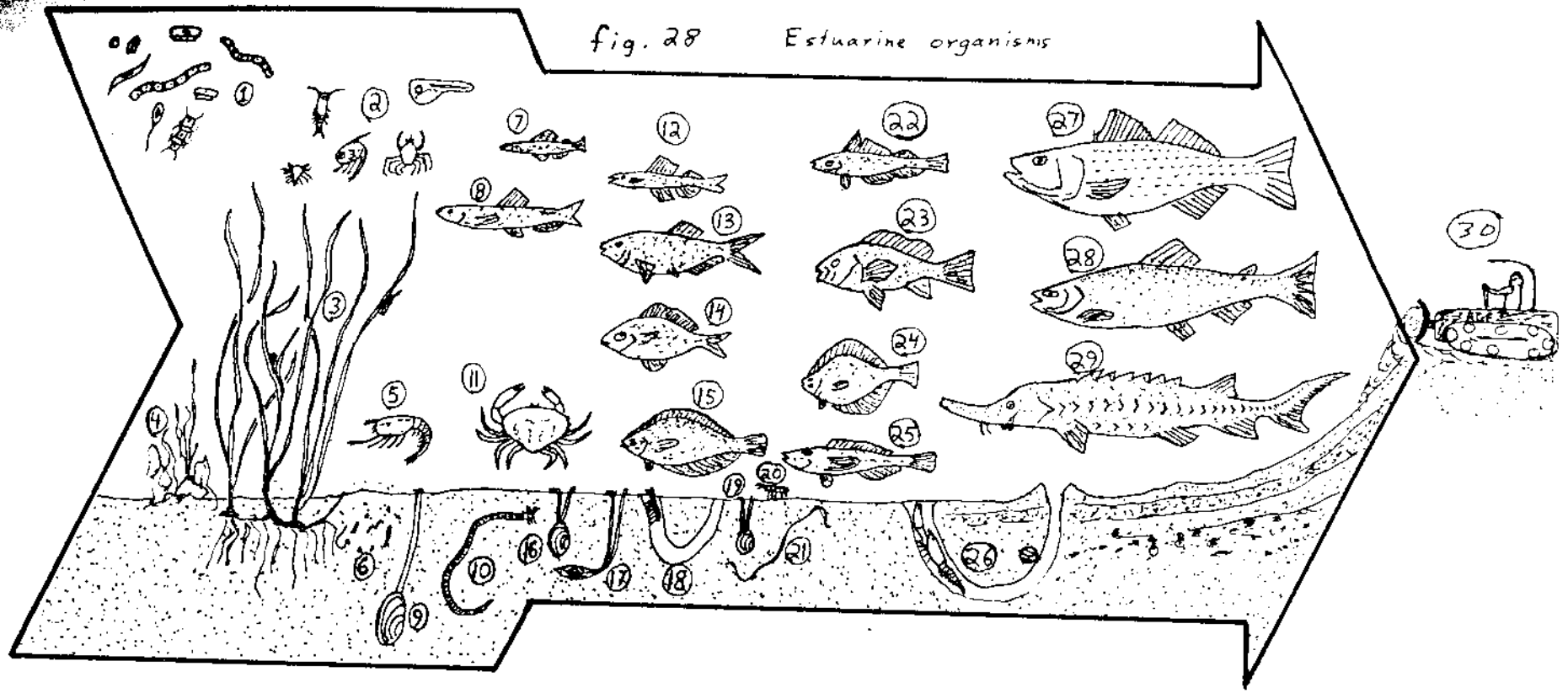
It has been found that estuaries are among the most productive places on earth (17). Our marine fisheries are

heavily dependent on estuarine production. The importance o benthic forms as fish prey is apparent from our data. Specl of commercial and recreational importance which feed, in par on estuarine infauna include chinook salmon, striped bass and the bottom fishes. But more importantly, the larger carnivorous fishes of value to man feed on the smaller fish which in turn feed on the estuarine food sources. This dependence of one group of organisms upon another group of organisms for food and energy results in a series of predator prey relationships know as a food chain. Figure 28 is a graphic representation of a food chain which is based upon the benthic organisms found in the biological study area. It is apparent that commercially important fish depend upon many organisms associated with the mudflat and that man's fisheries depend upon the maintenance of this food chain.

The tidalflats are not only important as a feeding ground, but also as spawning and nursery grounds. At least one fish, the shiner surfperch, which is one prey of striped bass, has been shown to spawn over eelgrass beds in the study area. Juvenile Dungeness crab appear to inhabit the mudflat at high tide. Juvenile cutthroat and steelhead trout, and young striped bass and salmon spend time in the estuary duri spawning migrations and may be using the bay as a place to equilibrate between the saline and fresh-water environments.

Apparently most of the upper bay was once a dense eelgrass bed, surrounded by narrow channels and extensive ma Most of the marshes have now been filled, the channels have

fig. 28 Estuarine organisms



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been dredged, and much of the mudflat has been turned into a dump site for inexpensive spoil disposal. Log rafting and pollution, particularly from the lumber industries, have seriously damaged large parts of the bay. Deforestation and use of splash dams have caused portions of the estuary to be smothered with a blanket of sediment. It should come with little wonder, then, that stories of "fish being as numerous as to make navigation difficult" and of bird flocks darkening the sky must be found in history books rather than travel brochures (22).

The dredging project proposed by the Army Corps of Engineers would be a major step toward irretrievably committing much of the remaining tidalflat to a timetable for filling. The initial dredging would result in about 2,400,000 cubic yards of spoil being dumped in the upper bay, which in itself would occupy over 50 acres. Maintenance dredging is projected to add about 1,000,000 cubic yards of spoil per year to the upper bay alone, or the equivalent of over 20 acres per year at the maximal depth of 30 feet. Plans to consolidate and enlarge the spoil islands in the middle of the bay now exist. At the rate of fill calculated above, this would cover the entire study area within seventy years.

It might be supposed that damage to crab, fish and bird populations would be minimal since these animals can move elsewhere. But, studies indicate that because of food and habitat crowding, a drop in estuarine size and productivity would probably be followed by declines in the populations

of many species, commensurate with the benefit each species accrues from the estuary (13, 17, 21, 24, 35).

Besides directly eliminating estuarine habitat, extensive landfill could profoundly alter remaining parts of the bay by eliminating food sources and changing the physical features of the estuary. Deepened channels and decreased tidalflats might further channelize water flows, decrease aeration, mixing and productivity. Fresh water might flow considerably farther into the bay before significant mixing could occur, which might reduce the number of species that could live in the bay (5).

Bottom sediments of the area to be dredged were analyzed in 1971 by the Environmental Protection Agency, and it was concluded that these sediments were polluted and unfit for open water disposal (20). But damage done by disposal in the estuary would probably far exceed any damage done if the spoils were dumped in the ocean or on land, and would be effectively irreversible.

Our study indicates that the area of mudflat threatened by filling is vital, directly or indirectly, to many species commercially and recreationally important to man. From the estuary, fish and crab derive food, and may also obtain protection during migration or spawning. Therefore, we suggest that further landfill and pollution be abated if the Coos Bay Estuary is to continue to help maintain the fishing industry. We hope that the present research may be used as a baseline study to judge the results of more enlightened estuarine management.

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PSYCHOLOGY

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INTRODUCTION

The Coos estuary is a multiple use resource. Fishing is quite popular and many people also enjoy clam-digging, crabbing, hunting, and boating in the estuary. Commercial and industrial activities including lumber manufacture and shipping utilize the waterway for transportation. Such multiple-use is necessary and desirable, but as the biologists have pointed out, the situation is unstable because of estuarine landfill and pollution. Public attitudes and action will probably play a crucial role in determining the future of the estuar

This section of the report examines some of the links between man and the estuary, with focus on the occupational, recreational, and aesthetic relationships. Public opinions regarding estuarine development are also explored. Quantification of each of these variables poses many problems, largely because channel dredging is so often treated as an economic necessity which will not have serious side effects. For example, a fisherman may not realize that the fish and crabs he catches depend on the estuary during certain stages in their life cycle A motel owner may not think of the estuary and its many life forms as an asset to his business. Aesthetic enjoyment of nature may constitute the most intimate relation between man and nature, but is particularly hard to assess in terms of economic or social value. Sociological met are applied to analyze such relationships in this section, but the same problems are considered from an economic perspective in a later section of the report.

Methods

A pilot study was made to determine the feasibility of methods and to become better acquainted with the people and the area. A questionnaire was then designed to obtain the information we needed. This quell

tionnaire *is* included in appendix A. Although mechanical problems with the questionnaire complicated interviewing and data analysis, *we* nevertheless gained much useful information in this study.

Fourteen second-year students from South Western Oregon Community College. located in Coos Bay, were employed as interviewers. (9 female, 5 male; ages ranged from 18 - 45). **We** hoped this would remove the stigma of "outside' researchers and facilitate more relaxed communications between the interviewers and respondents. In addition this offered local students an opportunity for field experience in social research and community involvement.

Interviewers attended five training sessions during which they were introduced to concepts of interview technique. Mock interviews were staged and group discussions held. At the conclusion of the sessions we were satisfied that a level of consistency appropriate to the demands of the study had been met.

Sample Selection - Demographic Data

The population of Coos County - totalling, in 1971, 56,515 persons - is to a large extent concentrated in the communities surrounding the Coos Bay estuary. A sample of 942 residents of these communities was taken at random from the telephone directory. Of these, 565 responded to the verbally administered questionnaire, a sample constituting 1% of the total Coos County population.

Respondents represented in fair proportion the communities of Coos Bay, North Bend, Eastside, Charleston, as well as the districts of Empire-Barview, Englewood-Libby, Glasgow-Hauser and surrounding rural routes.

The sample shrinkage from the original 942 to the obtained 565 respondents can be explained by two factors: the high number of residents listed in the telephone directory but who yet lived in areas practically inaccessible to **interviews** and the recent influx of salesmen

who have a guise of door-to-door research, thus greatly diminishing the interviewer's credibility in the eyes of the residents. Further shrinkage was no doubt prevented by the cooperation of local news media, who informed the community at large of the study's objectives. Also, an introductory letter was sent to the respondents previous to the first day of interviewing. (See Appendix A).

RESULTS OF THE SURVEY

DEMOGRAPHIC DATA:

The collection of demographic data offered no special problems. Demographic items were straight-forward and clear, and respondents did not for the most part object to answering. The highest frequency of non-response occurred concerning household income level, which is to be expected.

The most frequently mentioned respondent occupation was that of housewife. This is not surprising since almost exactly one-half of the respondents were women, and interviews were conducted in the home, usually during regular working hours. A high percentage of retired persons is also represented. This also is not difficult to understand; retired persons are simply easier to get ahold of and tend to be more cooperative than busier, younger persons. However, the representation of retired persons is not exceedingly disproportionate to the actual population of the Coos Bay area which, like many similar places in America, is experiencing an emigration of younger persons while the older generation remains behind.

Following are tables of the demographic information descriptive of the sample. Each table is preceded by a restatement of the corresponding questionnaire item.

TABLE D-1 - FAMILY SIZE

"How many persons are there in your immediate family." (The following figures represent those members of the immediate family who share the respondent's household.)

Number persons in household	Percent of Sample
1	11.7
2	31.0
3	14.2
4	19.8
5	11.3
6	5.7
7+	6.0
no response	0.4

TABLE D-2 - RESPONDENT AGE

The respondent was asked to give the age of each household member. Table 2 illustrates only the respondent's age.

Respondent Age	Percent of Sample
19-25	11.1
26-32	12.0
33-39	15.2
4o-46	15.2
47-53	13.6
54-6o	9.7
61-67	8.7
68-74	7.7
75+	4.7
no response	2.1

Mean - 45.9
Median - 44.0

TABLE D-3 - RESPONDENT SEX

Interviewers were instructed to attempt to include equal numbers of each sex in their interviews.

Male - 283
Female - 282

Total - 565

TABLE D-4 - RESPONDENT EDUCATION LEVEL

The respondent was asked to give the educational level of each household member. Only the respondent's educational level is taken into consideration here.

Respondent Educational Level	Percent of Sample
0-11	21.8
12 (high school graduates)	40.7
13-15	17.7
16 (college graduates)	8.3
17-22	7.3
No response	4.2

Median - 12.2

TABLE D-5 - HOW LONG IN COOS BAY

"How long have you, personally, been living in the Coos Bay area?"

Number of Years	Percent of Sample
2 yrs. or less	8.5
3-5	7.6
6-10	11.0
11-15	6.5
16-20	11.9
21-25	9.3
26-30	8.1
31-35	6.1
36-40	6.4
41-45	3.8
46-50	5.5
51-55	3.0
56+	8.9

Mean - 25.75 Median - 21.773

TABLE D-6 - AREA OF FORMER RESIDENCE

70.3 per cent of the persons interviewed had not lived in Coos Bay their entire life. These persons were asked to name the state of former residence. Results of this are listed in this table.

States	No./Persons
Alabama	2
Alaska	
Arizona	5
Arkansas	5
California	140
Colorado	14
Connecticut	0
Delaware	0
Washington D.C.	0
Florida	3
Georgia	
Hawaii	1
Idaho	8
Illinois	
Indiana	1
Iowa	3
Kansas	7
Kentucky	0
Louisiana	0
Maine	0
Maryland	0
Massachusetts	3
Michigan	6
Minnesota	11
Mississippi	2
Missouri	3
Montana	
Nebraska	11
Nevada	5
New Hampshire	0
New Jersey	2
New Mexico	3
New York	
North Carolina	1
North Dakota	7
Ohio	2
Oklahoma	5
Oregon	151
Pennsylvania	3

States	No./Persons
Rhode Island	1
South Carolina	1
South Dakota	
Tennessee	1
Texas	3
Utah	1
Vermont	1
Virginia	1
Washington	146
West Virginia	0
Wisconsin	7
Wyoming	5
Foreign	10
Valid Observations	392
Missing	173

TABLE D-7 - RESPONDENT OCCUPATION

"What is your occupation?"

Occupation	Percent of Sample
Housewife	20.4
Retired	17.9
Lumber (skilled worker)	11.3
Wholesale/Retail Salesman or Clerk	6.9
Wholesale/Retail Management	3.5
Unemployed	2.7

TABLE D-8 - HOUSEHOLD INCOME

"Would you please indicate the /income category/ within which your household's annual income is included? Please include in this estimate the income of each contributing member."

Household Income Category	Percent of Sample
$4,000 or less	16.6
4,000-8,000	21.1
8,000-12,000	34.0
12,000-20,000	19.1
20,000 and above	4.2
No response	5.0

Mode - $8,000-12,000

TABLE D-9 - GENERAL AREA OF PRESENT RESIDENCE

Area	Frequency	Percent
Charleston	44	8.0
Empire	51	9.3
Englewood	35	6.4
North Bend	170	30.9
Coos Bay	181	32.8
Eastside	21	3.8
Glasgow	49	8.9
	551	100.0

14 Missing Observations

RECREATIONAL DATA:

Quite a *few* problems arose in connection with the collection and analysis of recreational information. It had been our intent to discover, first, the most frequently done activities of the respondent and spouse, and then to obtain additional information descriptive of each individual activity mentioned. As a result of poor questionnaire design, however, the recreational data could not be computed in such a way as to yield these desired results. Thus, the variables of location, equipment, cost, frequency done, transportation faciliti and season in which it is done could not be cross-tabulated with specific activities. Fortunately, some information can be presented in frequency distribution.

TABLE R-1

Recreational Activity	Percent of Total Responses	Percent of First Priority Responses
Fishing	19.2	24.2
Hunting	11.0	10.0
Camping	10.2	9.4
Picnicing	9.7	9.9
Individual Indoor Activities	7.6	5.9
Beach Activities	7.1	8.1
Group Outdoor Activities	6.3	6.2
Bowling	4.9	3.9
Golf	4.5	5.0
Swimming	3.3	2.5

Of all the activities listed as "most frequently done, 37.0% are water-related. Of the top ten, listed above, only two--bowling and golf--require developed recreational sites, and only two--"individual indoor" and bowling--are done indoo

Attempts at specifically locating, through the use of a gridded area map, the areas where each mentioned activity is done were not successful.

OPINION DATA

From the pilot study we learned that people appreciated the chance to voice their opinions concerning local issues. Provision was therefore made for people to express opinions on development of the area, the Army Corps proposal, and other matters which directly affect the appearance and use of the estuary.

The respondent was first asked what advantages he gained from living in the Coos Bay area, in order of which were most important to him. Answers which conveyed the same general meaning were later grouped together, as we see in the following chart.

TABLE 0-1 - ADVANTAGES OF LIVING IN COOS BAY IN ORDER OF IMPORTANCE.

Advantages	Total	Percentage
Climate	274	19.7
Small Population	226	16.3
Nature	178	12.9
Recreation	171	12.3
Personal Reasons	134	9.7
Jobs	113	8.2
Hunting and Fishing	62	4.5
Lack of Urban Problems	53	3.8
Schools	53	3.8
Lack of Pollution	41	3.0
Economy	14	1.0
Community Services	9	0.6
Other	58	4.2
Total	1386	100.0%

The second opinion item was phrased: "Are there any things about the area that you think need improvement?" The respondent was again asked to give his responses in the order of their importance.

TABLE 0-2 - WHAT WOULD YOU LIKE TO SEE IMPROVED?

Improvements	Total	Percentage
Roads	189	16.40
Recreation	115	9.98
Taxes	97	8.42
Pollution	78	6.77
Education	78	6.77
Municipal Services	75	6.51
Community Appearance	69	5.99
Medical Services	64	5.56
Need More Industry	43	3.73
Retail Business	42	3.65
Employment	37	3.21
Economy	30	2.60
Consolidation	24	2.08
Public Transportation	22	1.90
Prices	20	1.74
Private Services	15	1.30
Shipping	15	1.30
Other	139	12.07
Total	1152	100.00

The interviewer then asked, "Should the channel be enlarged or left *as* it is?" 80.9% of those persons who responded to the question felt that the channel should be enlarged, while 19.9% wished to **see** it remain as is. The percentages listed on Table 0-3 do not represent these adjusted frequencies and instead take into consideration the 15.9% of the respondents who did not reply to the question.

TABLE 0-3 - SHOULD THE CHANNEL BE ENLARGED?

	Frequency	Percent
Enlarged	386	68.3
Left As It Is	91	16.1
Missing	88	15.6
Total	565	100.0

The respondent was asked "Should community leaders attempt to bring more industry into the Coos Bay area?" and asked why he felt as he did. Table 0-4 shows these results. Both the "yes" and the "no"

groups are divided to illustrate the most frequently given reasons for that opinion.

TABLE 0-4 - SHOULD LEADERS BRING IN MORE INDUSTRY? WHY?

YES

Improve Employment	206
Diversify Industry	138
Aid Economy	49
Increase Population	11
Benefit Consumers	7
Improve Community Standards	2
Improve **Natural Environment**	**1**
Miscellaneous	5
No Opinion	35
TOTAL YES	454

NO

Maintain Area As It Is Now	63
Adverse to Natural Environment	19
Miscellaneous	1
No Opinion	S
TOTAL NO	88
MISSING OBSERVATIONS	23

es

INFORMATION ITEMS: We also wished to determine whether people were acquainted with the Army Corps proposal for enlargement of the shipping channel. The series of questions began as follows: "The Army Corps of Engineers has proposed an enlargement of the Coos Bay shipping channel. **Are you familiar with this proposal?"**

TABLE 0-5 - ARE YOU FAMILIAR WITH THE ARMY CORPS OF ENGINEERS PROPOSAL?

	Frequency	Percent
Yes	**324**	57.3
No	233	**41.2**
Missing	8	1.5
Total	565	100.0

The interviewer then asked, "Where did you first hear about it (the A.C.E. proposal)?" Of course, persons not familiar with the project did not respond to this item, but of those who did respond (54%), 73.1% reported having heard of it from either the newspaper or from either radi or television. The complete results are listed below.

TABLE 0-6 - WHERE DID YOU FIRST HEAR ABOUT THE ARMY CORPS PROPOSAL?

Source	Frequency	Percent
Newspaper	166	29.4
Television	57	10.0
Family/Friends	44	7.8
Clubs and Organizations	16	- 2.8
At Work	10	1.8
Community Leaders	5	0.9
Personal Involvement	3	0.5
Missing	264	46.7
Total	565	100.0

Question 115: "If this plan to enlarge the ship channel is carrit out, what effect do you think this might have on the ecology of the bay?' minimal, very harmful, etc.) was not considered. The reference to -ecology of the bay" seemed to be a fault in the questionnaire design. interviewers reported almost unanimously that the respondents did not un stand the term well enough to respond, or else were effected positively negatively by the strong connotations it holds. Consequently, this item was eliminated after the first few days of interviewing, and its results the answers from two similar question were disregarded in the analysis.

The final group of questions in this section asked: "What effec if any, will enlargement of the shipping channel have on: industry, tou trade, fishing, economy, job market, pollution level, population, and sh fish?" The responses to these questions are listed below.

TABLE 0-7 - EFFECT OF DREDGING ON:

INDUSTRY	
Increase	450
Decrease	4
No effect	48
Missing values	65

TABLE 0-7 CONTINUED

INDUSTRY, continued	
Good	389
Bad	47
Missing	129
TOURIST TRADE	
Increase	175
Decrease	12
No effect	302
Missing values	76
Good	226
Bad	34
Missing	305
FISHING	
Increase	111
Decrease	156
No effect	187
Missing values	111
Good	141
Bad	133
Missing	291
ECONOMY	
Stimulate	435
Depress	10
No effect	46
Missing	74
JOB MARKET	
More jobs	437
Fewer jobs	6
No effect	54
Missing	68
POLLUTION LEVEL	
Higher	301
Lower	18
No effect	150
Missing	96
POPULATION	
Increase	349
Decrease	5
No effect	136
Missing value	75
Good	191
Bad	116
Missing	258

TABLE 0-7, CONTINUED

SHELLFISH

Increase	24
Decrease	263
No effect	120
Missing	158

The last question in this group was: "All things considered, what factor is it that you think should be most emphasized by community planners?" In Table 0-8, the results of this question are shown. It is important to note that the items which occur most frequently concern industry and jobs, while fishing and shellfish were relatively low on the list.

TABLE 0-8 - WHICH SHOULD BE EMPHASIZED MOST BY COMMUNITY PLANNERS?

Industry	167
Pollution	94
Job Market	66
Economy	65
Fishing	19
Population	14
Tourist Trade	12
Shellfish	10
Other/Missing	118

EFFECTS OF DREDGING WILL BE:

Total: Good	947
Total: Bad	330
Missing	983

Next the respondent was asked "What would be some of the effec of increased industry in the area?" The answers were often ambiguous in that it was not clear whether the respondent considered the effect **a** good or a bad result of increased industry. For example, some people consider an increase in population to be **a** beneficial occurence, while others feel it is one to be avoided. Interviewers were therefore inst to ask whether the effect was considered "good" or "bad" **whenever** this was not clear. Table 0-9 is a list of effects.

To the right of each effect are found figures indicating the frequency with which it occurred as the first, second, third, fourth, or fifth response. Below the list of effects is a table summarizing the number of "good" versus the number of "bad" effects.

TABLE 0-9 - SOME EFFECTS OF MORE INDUSTRY

	Order of Response					
	1	2	3	4	5	Total
Increase Employment	293	50	20	5	2	370
Increase Population	70	94	38	4	1	207
Benefit Economy	54	97	28	3	0	182
Increase Pollution	62	47	45	8	3	165
Increase Community Services	17	28	23	12	0	80
Effect Taxes	7	49	11	5	2	74
Lower Community Standards	5	3	6	7	0	21
Enlarge the Channel	0	2	0	1	0	3
Other	10	22	18	5	0	55

Effects	Number	**Percent**	1	2	3	4	5
Good	806	71.1	403	264	108	28	3
Bad	329	28.9	109	118	77	21	4

The next item was: "Which of these (effects of industry) do you think is the most important to consider?" Here the questionnaire is perhaps overly repetitive, but the intention was to allow the respondent to point out the one industrial effect considered by him to be most important. The response might also isolate one factor that was most influential in forming the respondents opinion in favor of or opposed to increased industrialization. Results are listed on Table 0-10.

TABLE 0-10 - WHICH EFFECT IS MOST IMPORTANT?

Increase in Employment	242
Increase in Pollution	51
Benefit Economy	48
Increase in Population	31
Increase in Community Service	23
Taxes	4
Enlarge the Channel	3
Lower Community Standards	1
Other	19
Total	422
	143

OTHER OPINION ITEMS:

Along with questions concerning matters of importance to community planning, five opinion items concerning various other topics were included in the questionnaire. Item #4 of Section IV reads as follows: "Who should be responsible for establishing regulations to control pollution: industrial self-regulation, city governments, the county governments, state government, or the federal government?" A frequency distribution of responses to this item compose Table 0-11.

TABLE 0-11 - RESPONSIBILITY FOR REGULATIONS

Control Agency	Percent Response
All Agencies Work Together	43.4
Federal Government	12.6
State Government	11.7
City Government	10.4
Industrial Self-Control	7.4
County Government	6.7
Missing	7.8

Item #5 of Section IV reads: "What is it that in your opinion is the most important issue for area politicians to face?" 29.6% of the respondents did not respond to this question, which may be an indication of disinterest in local politics on the part of the residents. Of those who did respond 12.7% felt taxes to be a pressing issue. Second was budgets (6.5%) and pollution was third. Table 0-12 shows the response categories and the percent occurence of each.

TABLE 0-12 - IMPORTANT POLITICAL ISSUES

Response Category	Percent Response
Taxes	12.7
Budgets	6.5
Pollution	5.8
Schools	5.7
Economy	5.0
Unemployment	4.8
Hospital/Medical Services	4.2
Drugs	3.7
City Government	3.4
The Mall	3.2
The Environment	2.8
Industrial-Ocean Outfall	2.7
Consolidation of Coos Bay-North Bend	2.3
Channel Enlargement	1.2
Road and Highway Improvement	1.1
Other	4.6
Missing	29.6

The next question asked, "In your opinion, what person, group or organization has the most influence in area politics." 69.9% responded to this item; **see** Table 0-13.

TABLE 0-13 - INFLUENTIAL PERSON, GROUP OR ORGANIZATION

Person, Group, Organization	Percent Response
Business and Industry	19.1
City Council	14.9
Politicians	6.0

CONCLUSIONS

In this study, we attempted to study those relationships existing between the Coos Bay area communities and their surrounding natural environment. These relationships we hoped would provide insight into the variables examined by the other disciplines in the project, enabling us to synthesize a broader understanding of the role of man in the entire ecosystem.

Problems in questionnaire design and difficulties in obtaining the data imposed severe limitations on what we can conclude about the social effects of estuary dredging. The information presented can, however, provide a better understanding of the feeling of area residents toward development of the Bay area.

This study indicates that the most popular recreational activities of the Bay area residents are related to the estuary. Tourists are also drawn to the area to fish and to enjoy other environmental resources. The biologists have indicated that damage to fisheries and wildlife will result from continued landfill and pollution, so cultural values and economic diversification may both be long range casualties of port development schemes. For these reasons, the public should insist that port development be consistent with maintenance of a healthy estuary, and if it comes down to a choice between immediate potentially destructive development or delayed, but more cautious development, the public should make these decisions.

However, community planners cannot expect well-founded opinions from the residents until sufficient information has been made readily available to them. The fact is that a large percentage of our sample was not aware of the Corps of Engineers dredging proposal. Since this

project is likely to have long-term effects on the area, we would recommend that a comprehensive program of community education be instituted. Such a program should not confine itself to the specific issue of dredging, but should cover all important issues relating to development of the community and the utilization of its resources.

POLITICAL SCIENCE

BACKGROUND OF THE CORPS PROPOSAL

The Army Corps of Engineers proposal to dredge began when conversation between the Port Commission and lumber companies and stevedores revealed the need for a deeper channel. The Port Commission then hired the firm of Cornell, Howland, Hayes and Merryfield to make a study of the feasibility of improving the channel. When this was submitted, Ernest Payne, harbor master for the Port of Coos Bay, contacted Senator Morris and Representative Derno about allocations for a Corps of Engineers study. A resolution calling for a $25,000 study and public hearing was placed before the Public Works subcommittee of both houses, approved, and passed by the parent bodies.

The Port Commission was required to set up the location of a public hearing. They informed heads of the lumber industries, stevedores, persons interested in shipping, and also groups and individuals in opposition to the project; the Corps requested testimony from all concerned parties. The results of this hearing, plus the required comments of the State of Oregon, the Department of the Interior, the Department of Commerce, the Department of Transportation, the Department of Environmental Quality, and the Fish and Game Commissions were incorporated into the final Corps report.

The report then went through a number of reviews. It was checked by the general of the Pacific Division, the

Division of Rivers and Harbors and the Chief of Engineers, and was submitted to the Secretary of the Army. He referred it to the Office of Budgeting and Management, where it was surveyed with respect to the fiscal policy of the administration. The O.B.M. returned it to the Secretary of the Army.

From the office of the Secretary, the report was sent back to the Public Works subcommittee which had originally adopted the resolution concerning the study. The subcommittee agreed with the findings and the Coos Bay dredging was combine with several other projects into the Omnibus Rivers and Harbors bill, which was passed by both houses of Congress and signed by the President.

The Coos Bay project has now been authorized, but it must be returned to the Public Works subcommittees for funding. This funding process could involve several years. When it is funded, the Corps of Engineers will draw up the design memorandum, a detailed blueprint of the project. Bidding is then opened to contractors.

More work will be done with the other agencies on the spoilage sites in the design memorandum. It is the responsibility of the local sponsors to furnish disposal sites; they designate the spots they consider most suitable and obtain the real estate necessary. The Corps then applies for the permits. Numerous agencies have input about disposal of spoils; attempts are made to reconcile and compromise the diverse viewpoints of these agencies. However, it is quite conceivable that the Corps could ultimately do as it wished,

labelling the spoilage "an aid to navigation." Navigation is the paramount right and concern.

ESTUARINE OWNERSHIP AND CONTROL

For the purpose of determining ownership, the estuary is divided into three regions: the area below the low-water mark, that between high and low water (the tidal prism) and the shoreline above high water.

The Corps of Engineers has jurisdiction over navigable waters. Although in some situations, the determination of navigability is a difficult question, in the Coos Bay estuary this does not appear to be a problem. Anything below the low-water mark is under the authority of the Corps.

Under old common law, the king held the title to the shoreline of the sea and its arms and the lands under water. These he could grant or dispose of subject to the public for the purpose of navigation or commerce. The right of the public to use public rivers and arms of the sea was known as jus publicum. Through patent or prescription, the king's subjects could obtain proprietary interest in the tidelands, which was known as jus privatum. Jus publicum took precedence over jus privatum.

Upon atmission to the Union, Oregon acquired the title to its tidelands, subject only to the paramount public right of navigation and commerce. Under the power of ownership, the legislature passed the Act of 1872, providing for the sale of tidelands. In 1872, an amendment was attached inclu-

ding the tide and overflow of the Willamette River for sale. The Coos and Umpqua Rivers were added in an 1876 amendment. The two amendments were repealed in 1878, but the original act remained on the books another seventy years and the sale of tidelands continued until 1947. At that time a program of leasing was initiated.

Today, ownership of most **intertidal lands** rests in private hands, dating from the period 1847-1947 when sale was legal. The Division of State Lands is in charge of guarding the public trust in these areas. It cannot actually control the land, because it does not hold the deed of ownership, so its authority is more a policing power. One pertinent example of this power is the 1967 law which limits the removal of material from the bed or bank of any natural water body. Anyone could take up to fifty cubic yards, but extraction of more material requires a permit. During the last session of the Oregon legislature, SB 224 was adopted, establishing the same fifty cubic yard regulations for filling.

The shore lands, those above high-water mark, are owned by the cities of Coos Bay and North Bend, Coos County, and various private interests. The city's properties are managed by the city administrator, with the approval of the city council. The county's land is under the magistracy of the county commissioners. In both cases a public hearing is generally held to assess public sentiment regarding use of the land. Use of privately-owned land is restricted only by the zoning ordinances and building codes of the city or count in which it lies.

The power to develop land use planning and zoning for lands surrounding the estuary except for lands within incorporated city limits resides with the county planning commission and the county commissioners.

The Port Commission is made up of five port commissioners, elected by the people of the port district, which corresponds roughly to the drain area of the Coos Bay. The commission has the power of a state within a state; its authority and responsibility are extensively outlined in the Oregon State Charter.

One important power of the Port is to "promote industry." This power has never been clearly defined, though in the past most projects have been connected with water transportation. The Port can bond to finance the project and has the right to condemn property under eminent domain.

The Port acts as a liaison with the Corps of Engineers to initiate activities such as the present dredging proposal. Thus far, most of their authority has been used for the promotion and benefit of the lumber industry.

The Environmental Quality Commission and its administrative arm, the Department of Environmental Quality, have no clear-cut legal authority over the Corps of Engineers. They are responsible for water quality problems, including those which arise from turbidity caused by dredging, but their policing is accomplished mainly through agreements with the Corps. The E.Q.C. can also exert influence, in conjunction with other state agencies, through the Clearing House (the governor's office for coordination of the various agencies involved in planning).

There are several local influential groups in Coos Bay, such as the Chamber of Commerce, the Retail Trade

Commission, political parties, the lumber companies, new media, and the labor unions. While they have no legal authority, these organizations can apply pressure to elected officials and try to create an awareness of the problems of the bay among their members and the public. Most groups favor industrial development and hope that this can be done without great harm to the environment of the area. However, to accommodate industry, they are willing to make some concessions regarding pollution and filling of the bay. The longshoreman's union and The World newspaper have issued statements against industrial pollution. None of the groups have made public statement on the Army Corps' proposal to dredge; when concern for the bay is expressed, dredging seems to be a less considered, less questioned activity than pollution.

The Bay Area Environmental Council is a group of Coos Bay citizens concerned with preserving the natural resources of the area. Their power rests in bringing environmental issues to the attention of elected officials and in education and persuasion of the public. They receive copies of all dredging permits from the Corps amd the Department of Environmental Quality and make comments on the proposals. Their continued emphasis has been to reduce the need for dredging through better methods of logging and lumber processing.

URBAN PLANNING

The last session of Congress enacted a bill requiring all cities to be zoned by January 1, 1972. Because zoning restricts property usage, this piece of legislation could have far-reaching effects on the future of the estuaries.

The city of Coos Bay has a method of urban planning and zoning fairly representative of the area. They have hired a full-time city planner who is in the process of drawing up the zoning ordinance. Their planner, Larry Hibbard, is proposing an integrated use of the water front, allowing only businesses which utilize the bay (such as marinas, Coast Guard, restaurants capitalizing on the bay view, etc.) to build on the shoreline. This would shift the emphasis away from concentrated heavy industry, which tends to pollute and require dredging. The waterfront could become a combination of light and restricted industrial zones, with commercial and some residential areas.

The zoning ordinance originates with the planner and his professional staff. The planner is an ex-officio member of the Planning Commission, a seven-man board which investigates and makes recommendations to the City Council on most topics of city government. Required in order to obtain federal funding, the Planning Commission is a random selection of citizens. The zoning ordinance was drawn up in this commission. The final form is a series of compromises between the planner's original and the suggestions of the

planning commission. The City Council then must approve the measure.

Another group which is not actively involved in zoning, but important in urban planning is the Citizens' Advisory Board. It is a broad-based community group, appointed by the mayor to advise the mayor and council. Its size has recently been increased from 26 to 45 members to make it more representative of the citizenry. The members meet at least six times a year and more often if necessary. The group is divided into subcommittees on land use and planning, recreation, community service, and economics and capital improvements. The main purpose of the Citizens' Advisory Board is to be a liaison between the community and the city officials. Because of its size and representative nature, the board is in a good position to study and communicate the feelings of the citizens to the city government and to present and explain the decisions of the government to the community.

In order to receive federal funds, a project must be approved on the district level. Coos Bay is in district seven and its "clearing" body is the Coos-Curry Council of Governments.

C.C.C.O.G. is a voluntary association of general and special purpose units of government, encompassing ten cities, two counties, three ports, and a water board. It is arranged into a general assembly and executive board and employs a full-time planner. The council has five citizen mechanisms, advising on subjects such as economic development and envir-

onmental protection; it will soon have nine.

The council develops a regional plan. This tends to be in broad, goal-oriented terms though there are some specific recommendations. It is set out in a goal-subgoal-objective criteria format.

A group with a project desiring federal funds submits it to C.C.C.O.G. The council then evaluates the project and considers how it will fit in with the overall regional plan. An attempt is made to work out objections between C.C.C.O.G. and the sponsoring group. The project is sent to the federal agency involved, with an approve or do not approve recommendation. The final decision for funding rests with the federal agency. The purpose of C.C.C.O.G. is to promote efficient use of funds on a coordinated regional basis.

SB 687, passed by the 1971 session of the Oregon legislature, created the Oregon Coastal Conservation and Development Commission. The Commission consists of 26 members six from each of the four district "clearing" bodies (the Clatsop-Tillamook Intergovernmental Council, the Lincoln County Sub-Council of Governments, Coos-Curry Council of Governments) and two at-large members, appointed by the governor.

Administrative duties of the group have been delegated to an executive board, composed of one member from each district and the two at-large members. The executive board has the power to hire professional personnel; enter

into contracts with the United States government and appoint advisory committees, subject to the approval of the commission.

At this time, the commission is contacting consultants to draw up a comprehensive plan for the preservation and development of the coastal zone, which will be submitted January 17, 1975 to the Oregon legislature. A preliminary report will be submitted January 12, 1973.

FEDERAL AND STATE FUNDING

Federal funding available is listed in the Catalog of Federal Domestic Assistance. Groups seeking this aid work through C.C.C.O.G. and the funding agency.

The review procedure is the same for state funding as for federal. There are two review committees: C.C.C.O.G. and the governor's planning board.

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Rhonda Wood, The World
Ron Wood, Chairman, Coos Bay Planning Commission
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ECONOMICS .

THE ECONOMY: GENERAL DESCRIPTION

The area studied in this report will primarily be the Coos County area. Following is a topical discussion of the natural and human resources, and the major industries of the county.

CLIMATE: The climate of Coos County is a product of its location. The Pacific Ocean moderates temperature variations while the Coast Range intensifies the amount of rainfall. Temperature varies from a January mean of 50 degrees to a July mean of 60 degrees. Average annual rainfall is about 60 inches. The greatest rainfall occurs from November through March when average monthly rainfall is 9.5 inches, and the driest periods are in July and August which average about 0.4 inches of rainfall a month.

The winds are primarily from the Northwest from March through October and average 17 miles an hour, while from November through February the winds originate in the South-west and average 15 miles an hour.

The length of the growing season varies from 200 days along the coast and in the river valleys to 150 days along the higher eastern border.

PHYSICAL FEATURES: Coos County's coastline is characterized by rocky cliffs, dunes, and sand beaches extending for about 45 miles. Rising almost immediately from the coastline the Coast Range mountains reach average peak elevations of

2,500 to 3,500 feet. Most of the county lies on steep, forested slopes.

The Coos and Coquille Rivers form the two major river systems of the county. The Coquille River extends approximately 99 miles and drains about 60% of the county. The Coos River drains approximately 36% of the county and is 63 miles in length. Its estuary is Coos Bay, making it the most important river economically in the county.

Due to the lack of significant snowfall the annual run-off closely follows the precipitation pattern with about 90% of the total annual yield occurring from November through April and less than one per cent'occurring in August and September.

WATER RESOURCES: Sufficient water supplies are available for existing industries. There is also sufficient water for an expansion of industry in the county; however, new facilities would have to be developed to meet increased demand. Currently, there are two proposals to increase the county's industrial water supply. The Millicoma River, a tributary of the Coos River water system, has been proposed as a source of water supply. The other proposal involves the storage of the annual run-off of the Coquille River which would be pumped into the Coos Bay area and used for industrial purposes. This proposal presents additional benefits in the form of partial flood control for the Coquille River valley, and the formation of a reservoir suitable for numerous recreational activities.

Coos County also has a great many recreational water resources. Numerous lakes, streams, and reservoirs lie in the county; including the Tenmile Lakes which provide several well-known recreational attractions.

FISHES: The estuaries of the county support many important commercial and sport fishes. Among the anadromous species are chinook and silver salmon, steelhead and coastal cut-throat trout, shad, striped bass, and sturgeon. The bays also provide habitat for many shellfish, including clams, crab, oysters and mussels.

The lakes and streams of the county also support a wide variety of resident species; among them cutthroat and rainbow trout, large-mouth bass, yellow perch, bullhead cat-fish, black and white crappie, bluegill, and pumpkinseed sunfish.

WILDLIFE: Black-tailed deer and Roosevelt elk are the main big game species in the area. Coos County supports one of the largest elk herds in western Oregon. Ring-necked pheasant quail, grouse, and brush rabbits are upland game animals, whil the Coos Bay area and the lower Coquille Valley host large flocks of ducks and geese.

MINERALS: Because of grade, quantity, or transportation costs most known mineral deposits are not considered for commercial purposes. Stone, sand, and gravel are mined but play a minor role in the economy of the county.

POPULATION: The population for Coos County was 55,396 in 1970 based on preliminary U.S. Census figures. This indicates an increase of 441 people since 1960. However, when the natural population increase (5,320 from 1960-1970) is taken into account, there was a net out-migration of 4,880. Along with the net out-migration there is an intra-county migration from rural to urban areas. The population breakdown into age groups is consistent with national averages.

Forecasts of the future population of the county generally indicate an absolute decrease.

To explain such forecasts, it is necessary to develop several analytic concepts.

A basic industry is an industry that produces primarily for export outside the area. Other industries, industries that produce primarily for local consumption, are non-basic or residentiary industries. Employment in basic industries is called basic employment, while employment in non-basic industries is considered non-basic or residentiary employment. The ratio of basic to non-basic employment is looked on as remaining relatively constant over time. Using a forecast of basic employment, forecasts of non-basic employment, total employment, and population can be made.

Intuitively, basic employment is seen as generating a demand for the products of non-basic industries. Of course, non-basic employment also generates a demand for the products of non-basic industries. In fact, economic base studies have met with considerable epistemological criticism because of

this fact. But, the theory is especially applicable to areas that do not service large consuming areas, and where extractive or primary manufacturing industries play a large role in the economy. In this historical and locational context basic employment is seen as creating non-basic employment.

The strong influence of basic employment on the county's total population can be seen by a comparison of the changes in basic employment with the corresponding population changes from 1940 to 1970. From 1940 to 1950 basic and non-basic employment increased at about the same rate resulting in an increase in population of about 30%. Between 1950 and 1960, basic employment increased slower than non-basic, but again there was a 30% increase in Coos County's population From 1960 to 1970 basic employment decreased while non-basic employment increased; during those ten years the population increased by 0.8 per cent.

Although these figures do indicate the economic base to be important for economic growth, they also present some discrepancies. The decrease in basic employment between 1960 and 1970 would seem to argue for a decrease in population However, there are several factors that may explain this discrepancy.

Even though the economic base of a community stabilize or declines several factors may cause an increase in residentiary employment:

1. Increased real wages and salaries may increase demand for goods and services produced by residentiary industries.

2. Increased residentiary activity, originally in response to increased basic employment, may expand trade boundaries thus creating demand for even more residentiary industries.

3. Proliferating tastes in consumption may lead to a demand for new goods and services from residentiary industries.

4. Compensatory employment in non-basic industries in response to a decrease in basic employment may also tend to stabilize population.

However, faced with a declining economic base these factors can only temporarily maintain current population.

INFRASTRUCTURE: Power used in the area is primarily electric power. It is supplied by the **Northwest Power Pool.**

The county's medical facilities include four general hospitals and three long-term care facilities. At present, these facilities are not adequate for the county's needs.

Education is, in almost all categories, at least as good as the entire state's average. However, the county ranks second in the state in the per cent of draft rejections.

Housing conditions in Coos County appear to be average for the state. However, 30% of the county's housing is considered unsound.

Transportation facilities for the county include: U.S. Highway 101 that runs in a north-south direction along the coast, State Highways 36, 38, and 42 which connect Coos County with Interstate 5, an airport in North Bend providing transportation to Medford, Roseburg, Corvallis, Eugene, Salem, and Portland, and railway service through Eugene.

A major port facility is located at Coos Bay. The facilities include: one public and eight private lumber handling docks--six of which have rail connections--and five waterfront facilities equipped to receive petroleum shipments Cargo, except wood chips, is generally loaded and unloaded by ship's gear. The bay also harbors a large number of commercial and sport-fishing boats.

INDUSTRIES:

Wood Products: The wood products industry is by far the most important industry in the area. Lumber and wood products employment comprises 27.2% of the county's total employment and 82.2% of its manufacturing employment. Coos County produces over 65% of the total lumber output of Western Oregon. Lumber production in the Coos River tributary area amounts to about 3.75 billion board feet annually.

Logs, lumber, and plywood are the primary exports of Coos Bay. However, in the last ten years woodpulp production has more than doubled to 500,000 tons annually. Since 1965 Coos Bay has also begun exporting woodchips.

Coos County has approximately 900,000 acres of commercial forest lands. 32% of this land is owned by private companies or_individuals involved in wood products industries **There has been some importation of logs into the area in the past, and it appears that the supply of timber is inadequate** to maintain the present level of production in the future. Presently, most of the timber is heing cut from old growth

stands near the eastern edge of the county. However, in the near future most firms will be cutting second-growth timber.

Even though lumber output for the area is expected to increase slightly in the next few years, employment in wood products industries is expected to decrease. Employment in the industry from 1960 to 1969 has declined by about 8.7%. Several factors may have contributed to this decline. Private stands of timber have been mostly exhausted, therefore, the majority of logging operations have been moved to less accessible public lands. This has led to a high degree of competition among firms, which, in turn, has led to increased mechanization. Smaller companies were not able to secure enough capital to make investments in the necessary machinery and were forced to halt their logging operations. Mechanization has also increased the productivity per man hour, allowing firms to maintain the same volume of production with fewer workers.

Agriculture: There are about 248,716 acres of farmland in Coos County. Most of the acreage is in woodlots or pasture. Only about 15,000 acres of cropland are harvested annually. In recent years, the number and size of farms in the county has stabilized. But employment has been steadily decreasing.

Dairy products comprise 65% of the value of all farm products sold in Coos County, approximately $3,000,000. Another $1,000,000 results from the sale of livestock. Re-

cently, the number of dairy cattle has been declining but the value of dairy products sold has increased. Cranberries are grown along coastal areas which are suited to their development.

Fishing Industry: Coos Bay is a major port for offshore sport and commercial fisheries. In 1969, about 34,100 days of recreational salmon fishing took place aboard charter and private boats originating in Coos Bay. This amounts to $630,000 in expenditures by recreational fishermen. About 150 commercial fishing boats are moored in the bay permanent) and about 500 boats are moored there during the height of the fishing season. In 1969, a catch valued at $2,474,000 to fishermen and about $4,950,000 in the market place was landed by these boats.

Coos Bay supports five fish processing plants. Employment in this area has been expanding rapidly from 240 in 1960 to 700 in 1969. However, employment is expected to stabilize in the future due to increased mechanization and the limit to future expansion imposed by the existing transportation facilities in the county.

Tourism: Out-of-state tourist expenditures for Coos County were estimated at $5,514,000 in 1969. The estimate net benefit of intra-state tourism for the county was about $2,400,000.

Coos County presents numerous recreational attractions in the form of fresh water lakes, streams and rivers. Almost all of the recreationally important fish in the state of Oregon abound in the area. The county is bounded by 45 miles of the most scenic and varied coastline in the state.

The future of the county's tourist industry depends, to a great extent, on its bays and estuaries, because most recreationally important animals use the estuary for permanent or temporary habitat.

The demand for recreational activity has been increasing rapidly throughout the last several decades for both the nation and the county. Several factors contribute to this increase. Two very important factors are the increase in leisure time and per capita income. Other factors include a rapidly expanding population, urbanization, industrialization, greater life expectancies, and improved transportation facilities.

Currently, the recreational areas in the county include: 21 areas operated by cities, 3 public golf courses, 11 state parks, 6 forest camps, and 4 recreation sites operated by the Bureau of Land Management. The demand for these facilities has increased dramatically. The day visitors to the county's 11 state parks increased from 520,000 in 1956 to 1,380,000 in 1966. Surveys indicate that approximately 50% of the overnight visitors using the county's state parks originate out of state.

Recreational facilities in the county, however, have

not kept pace with the increase in recreational demand. Many natural tourist attractions are left undeveloped. Only two small areas of the county's 45-mile ocean boundary are visible from the coast highway. There are few access roads and trails. Even though the Port of Coos Bay is the largest lumber shipping port in the world, there are no facilities for tourists to view the loading operations. The Coos River estuary is used as a place of log storage by several of the lumber companies in the area. Frequently logs and woodchips wash out of the bay. As a result, some of the most beautiful state parks in Oregon, located south of Coos Bay, are littered with wood and bark. The estuary itself has been rendered less attractive by the log storage, and by the spoiling in the upper bay. The waterfront of Coos Bay has been squandered by industries being scattered throughout the bay rather than being concentrated in compact industrial parks.

Several proposals for particular developments have been made to promote tourism in the area. One of these is for a community center in the Coos Bay-North Bend area, which would be used jointly by: service industries catering to conventions, the community as a whole, and Southwestern Oregon Community College. At present, there is no large community center in the area or an adequate facility to host more than 350 people at a time. In addition, SWOCC has no auditorium.

Another proposal is the stabilization of the Tenmile Lakes. Most of the county's recreational attractiveness is a result of its sport fishing resources. And the Tenmile

Lakes are widely known for their good trout, steelhead, and salmon fishing. However, winter flooding causes problems with boat launching during the peak of some very important fish runs.

A public oceanarium has been proposed to attract tourists in the off-season. This proposal would also benefit the Oregon Institute of Marine Biology.

Other proposals include: increasing travel promotions, park and campground development, and bay area waterfront development.

Although it is doubtful that Coos County's tourist industry will ever surpass its lumber industry in terms of economic dependence, development of its tourist industry provides the county's only foreseeable chance for sustained economic growth.

THE ECONOMY: THE ESTUARY

This section of the paper will deal exclusively with the Army Corps of Engineers proposal to improve the navigation channel in Coos Bay. It will focus on the claim made by the Army Corps that the project is beneficial.

The project is to be financed by the federal government and the benefits are to accrue to the nation as a whole. The criterion used by the A.C.E. to determine whether or not the project is beneficial is a benefit-to-cost ratio. It is simply assumed that if the benefits (to the nation as a whole) exceed the costs (considered to fall entirely on the federal government) the undertaking of the project on the part of the federal government is desirable. However, if there exist costs other than those that fall on the federal government, there may be, effectively, a redistribution of wealth. This means that some people are made better off while other people are made worse off. In such a case, the fact that total benefits exceed total costs does not mean that total welfare has been increased.

The specific way the benefit-to-cost ratio was developed is as follows: an estimate of the cost of the initial deepening of the channel was made. This cost was amortized over the 50-year life of the project at 0.823% a year. The estimated "first" costs were $9,200,000 which amortized at 0.823% per year is $75,700. Then an estimate of the annual cost of maintenance was derived, presenting another $199,900

in annual costs. In addition to these costs a cost that represents the money that could be made from an alternative use of the money spent on the project was included. This cost represents the interest made on buying a bond that has an annual rate of return of 3.25%. This means that an additional $299,000 must be included in the annual costs. The first costs for non-federal work was $100,000. Amortizing at 0.823% and adding the 3.25% interest charge yields another $84,000 in annual costs.

Benefits were derived as follows: annual benefits were derived for three main areas: savings in petroleum products ($122,000), savings in forest products shipments in inter-coastal trade ($289,500) and foreign trade ($528,000). All these figures were divided by 3.25% so that they were presented in terms of present worth.

The total net annual benefit in the A.C.E.'s report was 361,000, a benefit-to-cost ratio of 1.62 to 1. However, since the time of the report's release the interest rate on projects has risen from 3.25% to 5.12 5%. Using this figure the net benefits become 71,000, making the benefit-to-cost ratio 1.07 to 1. A ratio that in the past has been well below the acceptable ratio for projects.

The A.C.E. listed benefits in two categories: savings accruing to petroleum shipments, and savings accruing to forest products shipments.

In evaluating the economic value of the project the Army Corps of Engineers did not specify the incidence of the

benefits. In overlooking the incidence of the benefits, a project for which benefits exceed costs for the nation as a whole may prove economically damaging for a specific area.

Obviously, in both the savings accruing to petroleum shipments and those accruing to forest products shipments the benefits would immediately fall to shippers of petroleum and forests products. In the case of petroleum shipments one may assume that competition among distributors would lead some of these savings to be reflected in lower petroleum pric But, the percentage of the savings passed on depends on the degree of competition. Imperfect competition and covert collusive action by petroleum distributors could maintain petroleum prices at the present level, in which case Coos County stands to gain none of the savings that would accrue to Petro leum shipments. Even if the savings were passed on in the form of lower petroleum prices, the benefits would be distributed over a six-county consuming area including Coos, Curry Fackson, Josephine, Douglas, and Lane Counties. Coos County therefore, would receive only part of the benefits even if all the savings were passed on in the form of lower prices.

In the forest products industry the situation is more complex. If there is perfect competition among the shippers of forest products then the savings accruing to these shippers would be passed on to forest products consumers in the form of lower transportation costs. This in turn would tend to increase demand for forest products which would enable forest products producers to sell more for a higher price. However,

this analysis is suspect. Imperfect competition and covert collusive agreements could, again, lead to little or no decrease in shipping prices. It is also questionable that lumber production would be able to increase significantly. Many of the smaller producers in the area have exhausted their privately-owned timber resources. Increased competition for federally owned lands can be expected to force some of the smaller firms out of business since they would not be able to afford the increase in mechanization required to make logging on less accessible federal lands profitable..

Another problem with the benefits predicted by the A.C.E.'s report is that the savings to accrue to petroleum shipments were based on an increasing population estimate for the six-county consuming area. The population was predicted to increase from 510,000 in 1970 to 1,410,000 in 2020. Petroleum products distributed through Coos Bay provide for 100 per cent of the needs of Coos and Curry Counties, 50 per cent of Douglas, Jackson, and Josephine Counties' petroleum demands, and 5 per cent of Lane County's needs. The Army Corps estimate was based on projections for the population growth of the state as a whole and the Willamette Basin keeping the six-county consuming area's population in line with its historical share.

However, such techniques are not realistic. Due to increased productivity per worker in timber-based industries, employment and population is expected to decrease throughout Southwest Oregon (an area containing all of the six-county

consuming area except Lane County which draws only 5 per cent of its needed petroleum from Coos Bay). This depopulation is expected to come about even with a 20 per cent incre in log production by 1980.

If the savings accruing to petroleum shipments are figured on the basis of a constant consuming area population the benefits decrease significantly. Following are tables that are used to estimate the savings to accrue to petroleum shipments. All figures used in calculating these savings are the same as used by the A.C.E. except for those concerni projected population.

TABLE 1: PROJECTED DEMAND FOR PETROLEUM PRODUCTS FOR THE SIX-COUNTY CONSUMING AREA, SUPPLIED THROUGH COOS BAY.

Year	Population	Demand per Capita (bbl.)	Total Demand	Tons per Barrel	Total Demand
1970	510,000	23.1	11,800,000	.142	1,670,000
1980	510,000	26.6	13,566,000	.140	1,899,240
1990	510,000	27.8	14,178,000	.138	1,927,000
2000	510,000	27.2	13,872,000	.136	1,887,000
2010	510,000	26.1	13,110,000	.134	1,784,000
2020	510,000	24.5	12,495,000	.132	1,639,000

ESTIMATED DEMAND SUPPLIED THROUGH COOS BAY

PerCent	Tons
40	670,000
40	760,000
40	771,000
40	755,000
40	710,000
40	655,000

TABLE 2

Year	Total Demand (M Tons)	Total Waterborne Traffic PerCent	Total Waterborne Traffic M Tons	By Deep-Draft Tanker PerCent	By Deep-Draft Tanker M Tons
1970	670	50	335	70	235
1980	760	75	570	90	513
1990	771	90	694	90	625
2000	755	90	680	90	612
2010	710	90	639	90	575
2020	655	90	590	90	531

TABLE 3

Year	TANKER SHIPMENTS Total MTons	From S.F. %	From S.F. MTons	From L.A. %	From L.A. MTons	SAVINGS From S.F. PerTon	SAVINGS From L.A. PerTon	TOTAL SAVING S.F.	TOTAL SAVING L.A.
1970	235	70	165	30	70	$0.133	$0.232	21,900	16,200
1980	513	70	359	30	154	0.133	0.232	47,747	35,748
1990	625	70	437	30	188	0.121	0.206	52,877	38,728
2000	612	85	520	15	92	0.121	0.206	62,920	18,952
2010	575	85	488	15	87	0.121	0.206	60,048	17,922
2020	531	85	451	15	80	0.121	0.206	54,571	16,480

The average annual benefit, discounted to its present value at 5.125 per cent simple interest, of the six years shown on the tables is approximately $70,000. The average benefit for the same six years figured on the basis of an increasing population was $130,000. This is a net difference of about $60,000 annually. Using the more realistic constant population figure the benefit-to-cost ratio drops from 1.07 to 1.01.

OTHER COSTS:

COMMERCIAL: As stated earlier, just about every commercially important fish depends on the estuary at some time in its life. Even though the estuary appears to be able to withstand a variety of changes, one change which it cannot withstand is filling.

In filling an estuary the available habitat for commercially important fish decreases. Therefore, the number of fish may decrease. The effect of a decrease in estuarine habitat varies from species to species. For example, juvenile Chinook salmon may feed in the estuary on their way to the ocean, while steelhead trout may spend much less time in the bay during migration.

Since the removal of splash dams, there has been a great increase in the Chinook salmon population for the Coos River. Because of their dependence on the estuary, continued filling could prove extremely dangerous to the population's continued growth.

UNMEASURED COSTS: From even a casual analysis of the resources of the Coos Bay area it should be obvious that the only **sig-**

nificant industry capable of sustained growth is the tourist and recreation industry. The estuary, in supporting the sport fish which draw recreationists to the area, is certainly a vital asset to the community as a habitat for these fish. To quantify the damage to potentially developing recreational commerce lies beyond the scope of this study. But, the estuary as the support of the only industry capable of sustainable growth in the area should be preserved.

There are other costs involved in the Coos Bay navigation project that may never be imputed into dollars and cents terms. The decrease in the physical attractiveness of the estuary, or the loss of some of the diverse richness of fish and wildlife is a very real cost to the citizens of the area.

It is also beyond the scope of this report to try t quantify the loss in amenity value of the estuary. In fact, it may be beyond the scope of economic analysis in general. But, the inability to quantify such costs does not mean that the costs are non-existent or that they are of secondary importance to costs that are imputed into dollars and cents.

SUMMARY: The proposed A.C.E. modification of the estuary would be economically damaging to the Coos Bay area. It would destroy resources which are vital to the fishing industry and to tourism, the latter being perhaps the only industry capable of sustained growth **in** the area.

In the case of the Coos Bay navigation project the

fact that the benefit-to-cost ratio may be greater than one does not mean the welfare has increased.

The immediate benefits fall to people outside the Coos Bay area. The amount of the immediate benefits that, through market interactions, will eventually fall to the people of Coos Bay is speculative. On the other hand, the project represents a cost to commercial and recreational fishing interests, developing tourism, and to the everyday life of the people of the Coos Bay area. Therefore, the navigation project causes a redistribution of welfare away from the Coos Bay area. A benefit-to-cost ratio (even if it is greater than one) in such a case contains no valid statement as to whether general welfare has been improved.

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URBAN PLANNING

INTRODUCTION

"The basic proposition is that any place is the sum of historical, physical, and biological processes, that these are dynamic, that each area has an intrinsic suitability for certain land uses, and finally, that certain areas lend themselves to multiple co-existing land uses."

Ian McHarg

Design with Nature

Within the limits imposed by inexperience and lack of time, our study has been an attempt to realize this basic supposition. Our investigation has been presented in two main sections. First, we trace the historical development patterns which Coos Bay has followed. Next, we examine the present uses of the estuary edge and evaluate each use in relation to the natural features and the immediate man-made environment.

SETTLEMENT PATTERNS:

Plate 1 is a photograph of Coos Bay in 1971. In 1)590, Orville Dodge spoke of the bay as it appeared to the first settlers: "The Bay presented to them a grand and pro-

mising appearance. They had noticed the massive forests of cedar and fir on every hand, the marvelous schools of fish, and extensive clam flats." Conditions have obviously changed. The following examination of the physical and basic economic factors affecting the growth of the estuary attempts to explain how and why the region has taken the growth pattern it has.

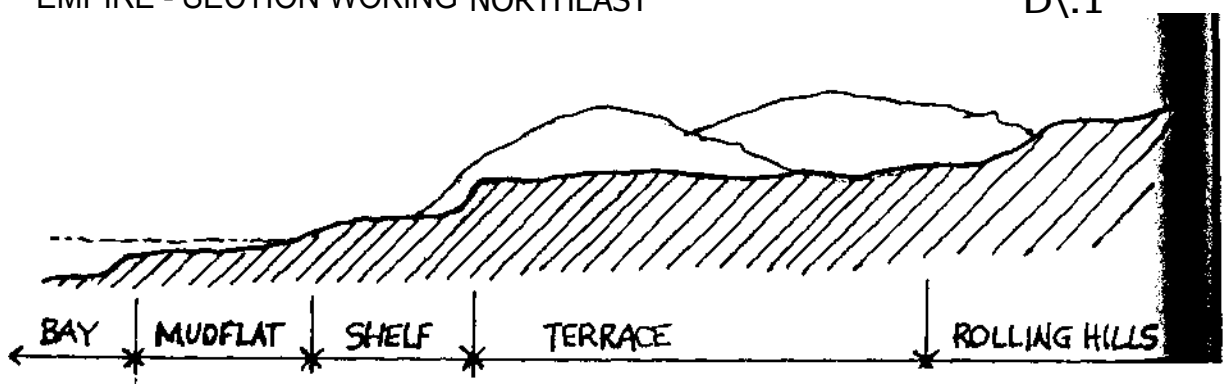
Coos Bay is composed of distinctive geographical elements which give the area a definite shape and have been influential in the development patterns. The bay itself has been the primary feature in the development of the area. As a landscape element it offers broad vistas of the surrounding hills and forms intriguing patterns of inlets and sloughs. The large exposure of mudflat is periodically covered with the changing tides behind which marshes and forests can be viewed. Bordering the estuary are low rolling hills. In most cases, they rise rather abruptly and leave little flat land for agricultural or industrial growth.

In the early development of the area, these features were the predominant organizing elements. The original settlers were homesteaders and farmers who lived a self-sufficient existence. They required flat, fertile land and dispersed up the river valleys and sloughs wherever land was available. The difficult topography of the area limited the

distance away from the waterways in which growth could occur. Consequently, the water served as a natural transportation system. In addition, the river and estuary provided a constan source of food and recreation, and eventually it became indispensable to the industrial development of the region.

GROWTH OF EMPIRE: Following a natural sequence of development trading centers began to grow. These, too, were dependent on the bay and the topographic features. Coos Bay has always been an isolated region. What contact it has with other areas has been a result of its protected bay. Originally this bay was navigable by deep-draft vessels to a point just above the town of Empire. Here, shoaling prevented vessels of larger draft from continuing further into the estuary. Of the accessible shoreline, what is now the site of Empire offered the most inducement for a settlement to grow. An early land transportation route along the beach from the mouth of the Umpqua river cut across North Spit and terminated at Empire. The site itself appeared in cross section as shown in Diagram 1, and was bounded on the east by a low hill, which blocked growth in that direction. Empire was initially founded to serve as a terminous for transportation routes and as a trading center.

EMPIRE - SECTION WOKING NORTHEAST D\.1

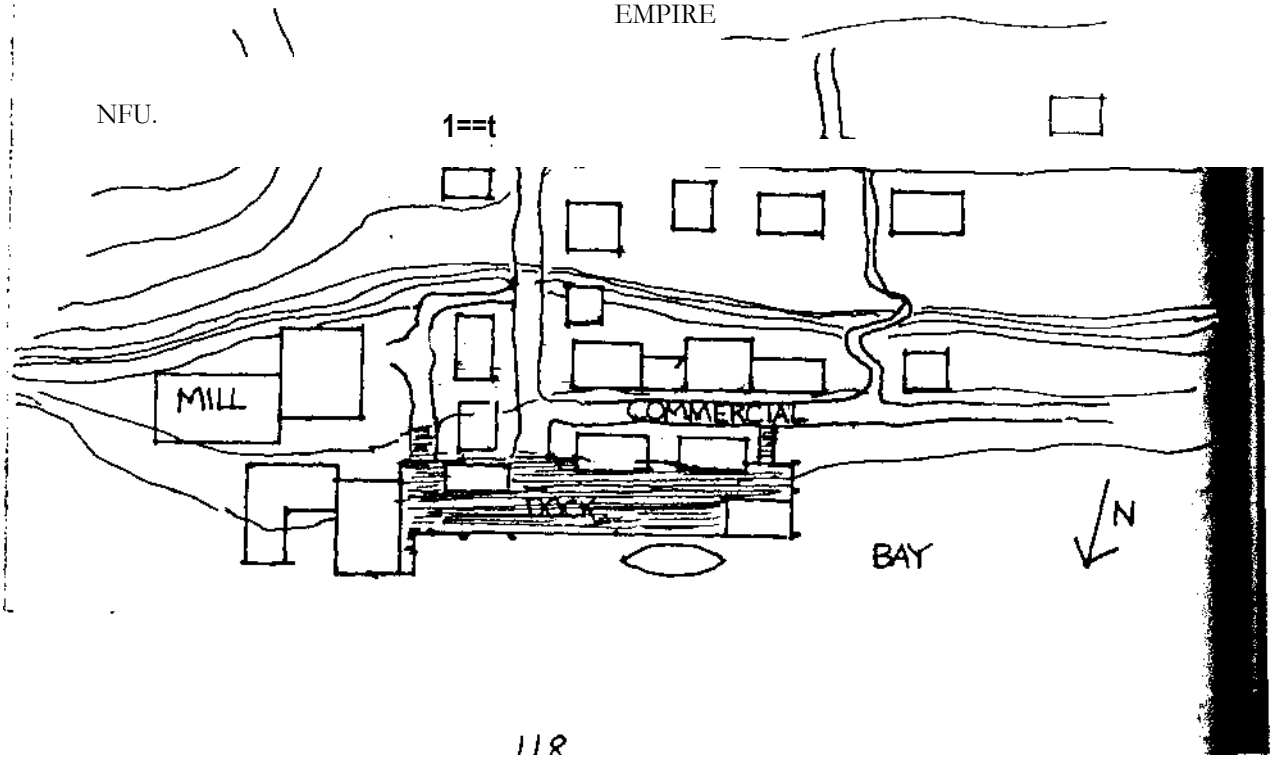


MILLS: With increased trade and population, it became profitable to harvest the vast expanses of Douglas Fir forests in the area. Whereas the original farmers had burned stands to create pasture, now the trees themselves exceeded the value of the land. Soon mills were established to cut lumber and ship it to the San Francisco market for transport east. Thus, mills became a feature of the Coos Bay landscape and they, in turn, influenced the growth of towns. Shipbuilding grew as a function of the mills. Ships were needed to transport the lumber to outside markets. The reliance on the waterways for transport and the increase in population created a demand for river boats and small fishing boats. An advantage to having a Coos Bay built boat was that they could be tailored to the channel depths of the bay. This opened sites further up the estuary which had previously been inaccessible to large draft ocean-going ships. It also made it economically feasible to build mills at the upper end of the estuary. This, in turn, spurred the growth of more diverse settlements.

The location of a mill was dictated by specific requirements. It had to be near a source of logs. Here, the many inlets and arms of Coos Bay were invaluable assets t the lumber industry. Floating logs to the mill is the easiest method of transport. Mills required relatively flat sites for their production process and this land had to be adjacent to a waterway to facilitate log handling and shipping. These requirements severely limited the possible mill sites. It can be seen on th_e topographic and slope maps (Plates 8 and 9) that flat land around the estuary is very limited.

A small flat shelf existed at Empire upon-which the area's first mill was erected in 1855. The mill was only part of Empire's rapid early developments. Other enterprises were also growing in the town. A shipyard was established in conjunction with the mill. Hotels, restaurants, stores and saloons also grew up to accommodate travellers. Empire was declared the county seat which brought even more people to the town. The physical development of the town responded to its dependence on the water and to the natural features of the site. Industry located on the water level shelf. Here, also, was the commercial section of town. Behind on the broad flat terrace the town grew inland somewhat but also spread south capitalizing on the view of the bay. A grid layout was platted which in this case adapted well to the flat straight bay frontage.

DIA.2 — SCHEMATIC, EARLY DEVELOPMENT OF EMPIRE



waterfront and residential and commercial development on the plateau remained constant with the expansion of North Bend. The growing town was platted along a north-south axis with the major avenues on the crest of the ridge. The hills to the south created a natural boundary to the southward expansion of town. Pony Slough on the west impeded growth in that direction. During the early years of North Bend's development, there was little pressure for outward expansion and the waterfront remained the primary focus of the town.

DIA 4 I SCNEMAT(C EARLY DEVELOPMENT NORTH BEND

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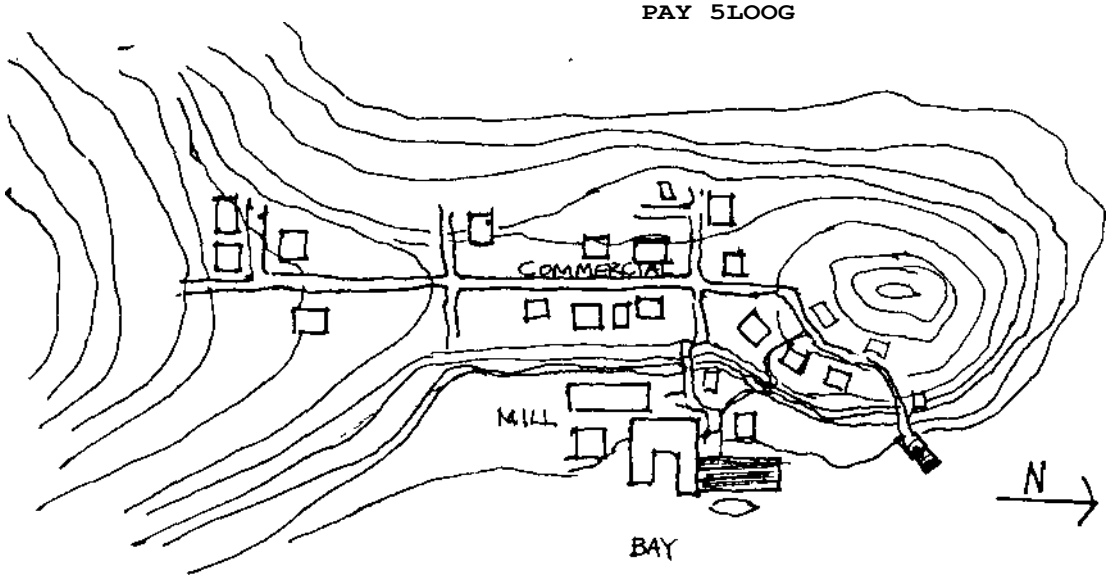
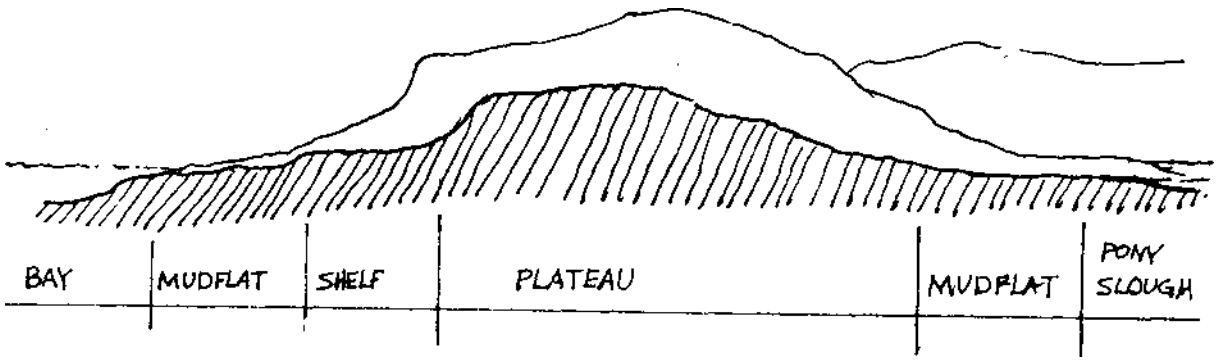


COOS BAY: Concurrently with the establishment of the initial North Bend mill, the town of Marshfield (now Coos Bay) was developing. The first cabin was built in 1853 by a settler who foresaw the area as being a good site for a town. Soon a trading post and store were erected. Little further development took place until 1867 when a sawmill, a shipyard, and

NORTH BEND: Settlement on the bay did not center around Empire alone, however. Shortly following the opening of the Empire mill, another mill opened on the east side of the North Bend peninsula. This mill opened in 1856 and it too had an accompanying shipyard. Unlike Empire, however, the mill was the primary inducement for a town to form at North Bend. Houses, stores, even the post office were provided by the mill, and the whistle sounded the time of day. North Bend remained essentially a mill town until about 1890, when furth development began to take place. In section, the site of North Bend appears as a narrow peninsula. The sides slope abruptly down to a flat shelf -which tapers gradually to the bay on the east and to mudflat on the west.

NORTH BEND
SECTION LOOKING SOUTH

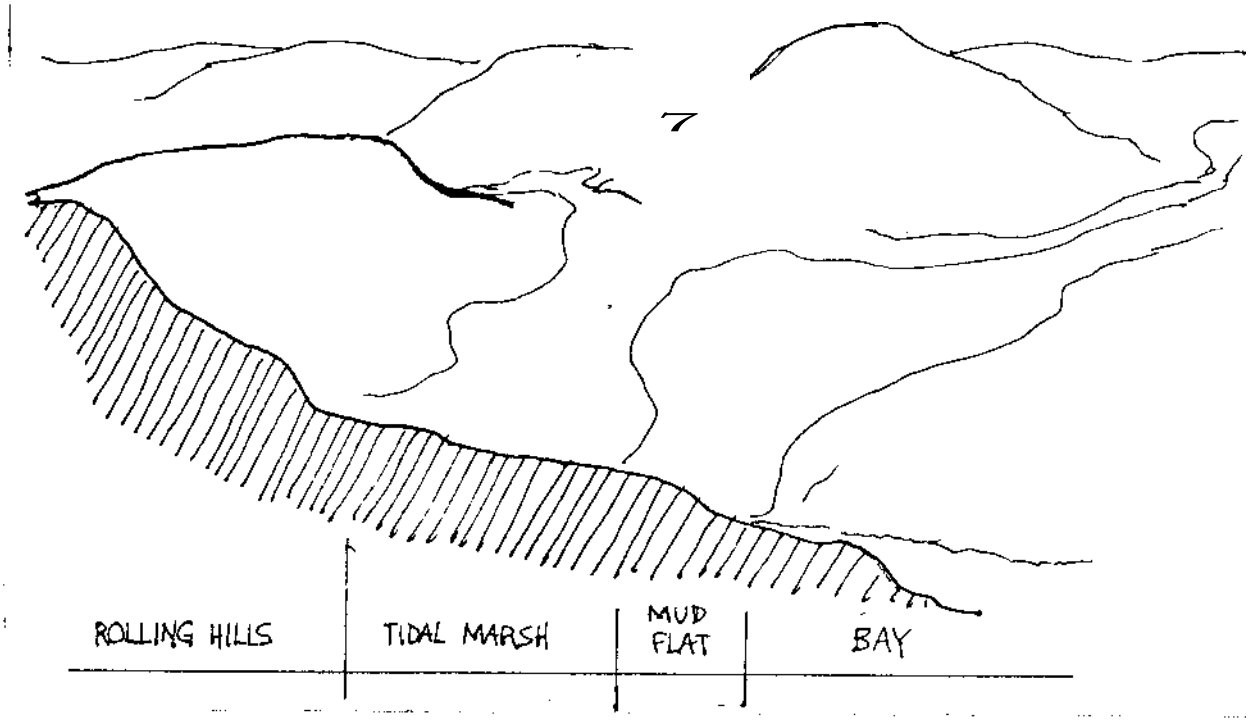
DIA .3



The initial mill site was in the eastward lee of the ridge, bounded by a small hill on the north. This site offer flat ground and access to the bay. The houses were situated above the mill on the ridge where a view both east and west could be capitalized on. The location of industry on the

a direction. The hills rising from the marshes essentially form an amphitheatre with the dock and commercial area of town as the stage. The hills formed the back wall of the town and the dock acted as a front door.

COOS BAY - SECTION LOOKING NORT1-1WEST DIA 5



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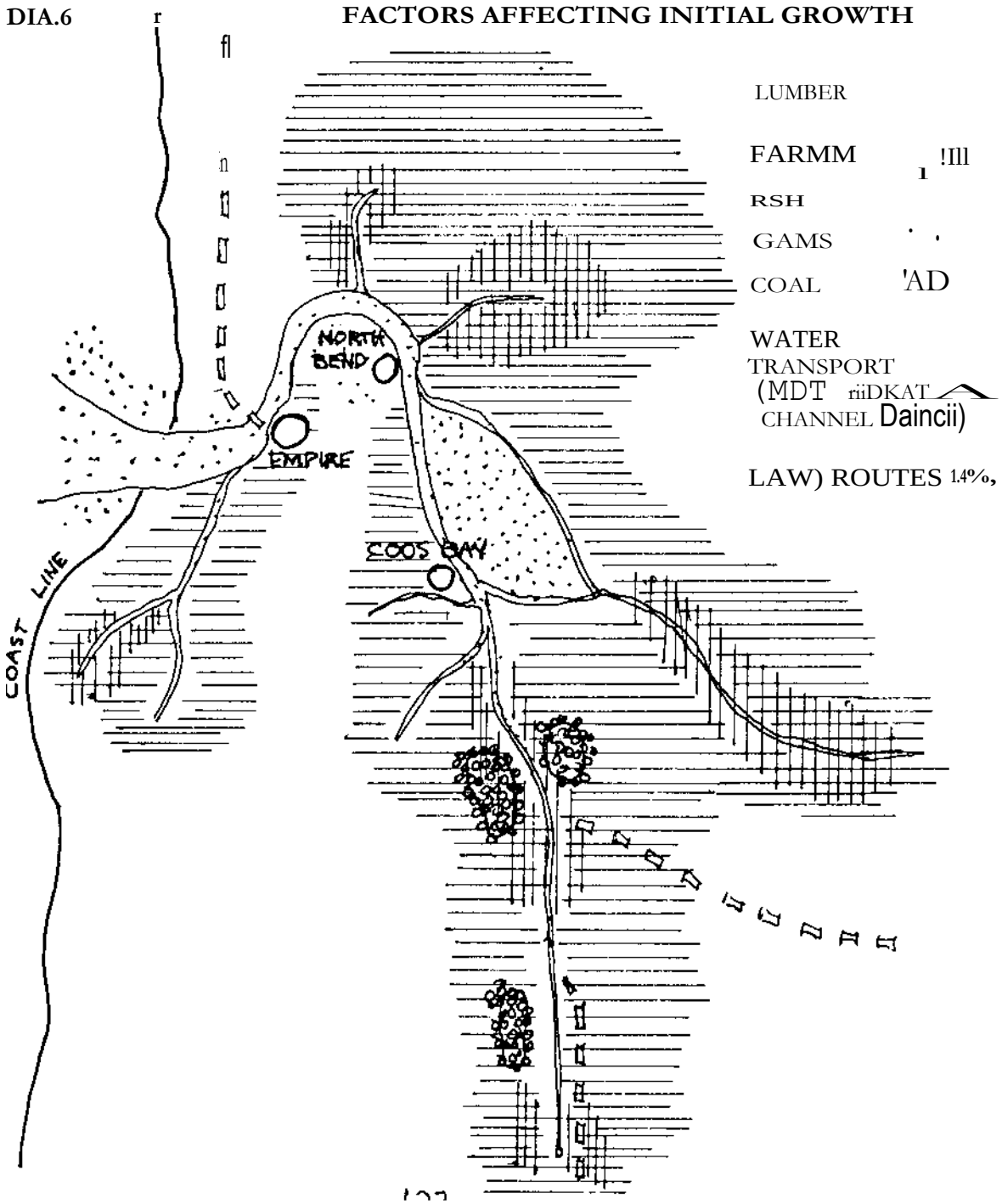
another store were opened. With this added impetus, Marsh-. field soon became the center of activity for all of the coast region of Southern Oregon. This quote from A Century of Coos and Curry summarizes the ensuing growth of the town. "It was the center of all shipping between Coos County and San Francisco. The two leading coal mines, Libby and Bunker Hill, had their bunkers at Marshfield. All freight and passenger steamers and gas boats of the Coos Bay area operated to and from Marshfield. In 1893, the place became the terminous of the railroad connecting the Coos Bay region with the Coqui Valley...".

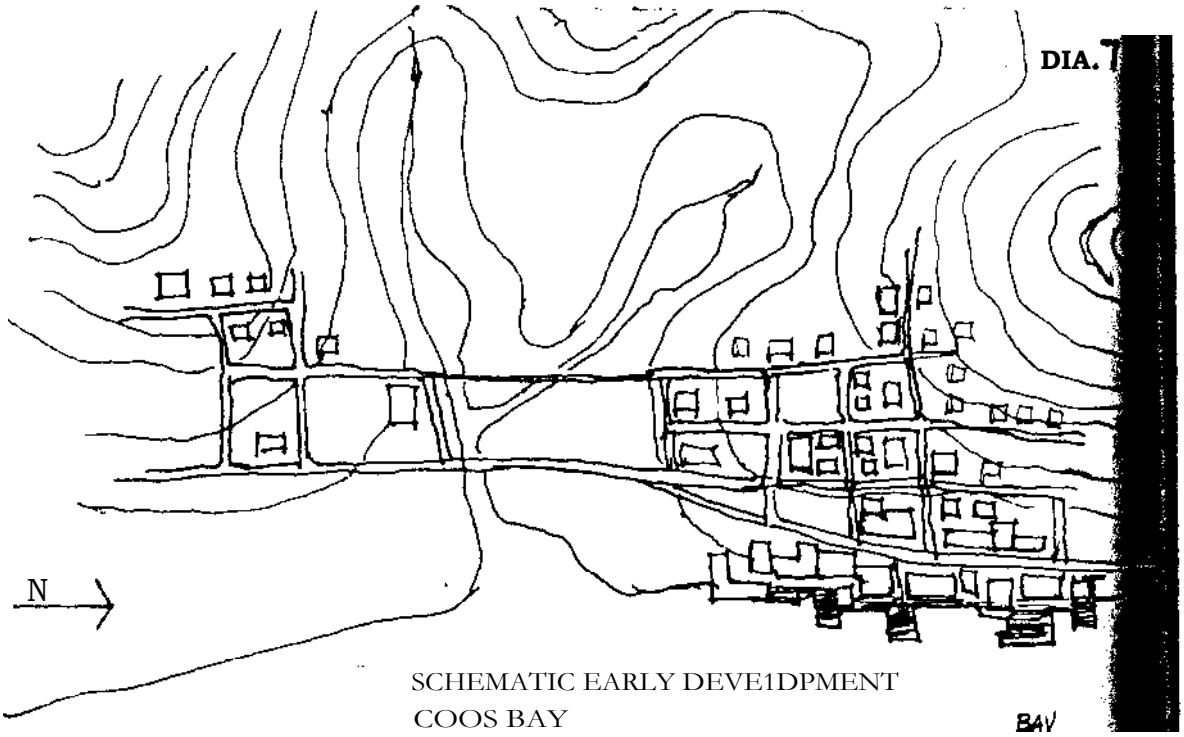
The lead which Marshfield took in the development of Coos Bay is easily understood when the elements affecting its growth are examined. The location of Marshfield near the junction of several estuary tributaries made it a logical site for a trading center. It was also the logical location for coal and produce to be transferred from shipment by rail to shipment by water. In addition, an early overland road to Roseburg, the Coos Bay wagon road, connected with Marshfield. Examination of the topography and slope maps reveal that Marshfield was situated on the greatest expanse of flat land bordering the bay. Draining and filling marsh areas and construction of buildings and roads on pilings allowed for easy and rapid growth.

The site of Marshfield has strong physical determinants which affected the growth pattern of the town. The sequence of bay, mudflat, marsh, and hills gave Marshfield

FACTORS AFFECTING GROWTH OF ORIGINAL TOWN SITES: Diagram 6 schematically illustrates several factors affecting the growth of the initial town sites. The site of Coos Bay is close to the lumber, coal and farming resources, and is near the junction of the water transportation routes. Empire was the point at which the original channel became too shallow for navigation further inland.



LAND ACCUMULATION: The early growth of Coos Bay clustered around the base of Telegraph Hill where the land rose abrupt1y from the bay.



However, the thriving industrial and commercial growth of Marshfield put a tremendous pressure on the available develop-able land. Additional land was continually in demand. This was true in general of the whole waterfront between North Bend and Coos Bay. Plate 3 illustrates the condition of the road between Marshfield and North Bend prior to 1900. Contrasting this with the present four-lane highway graphically illustrates the extent to which the land has been modified.

A significant portion of the town of Coos Bay is built on "made land." This land consists of dredge spoils, wood chips, old dikes, pilings and so on. It has accumulated in several ways. One has been the gradual extension of docks

Blossom Gulch, the area just south of the road to Empire, can be seen as a navigable slough in Plate 5.

CHANNEL HISTORY: From the initial establishment of industrial sites on the upper end of the bay, there has existed a constant need for a deeper channel. Continual channel maintanence has also been necessary. The disposal of the resulting dredge spoils has dramatically changed the landscape of the area. Disposal of spoil has been used to fill sloughs and create land in Coos Bay, to expand the natural shelf running along the westward side of the main bay where Highway 101 and Weyerhauser are now located, to build an airport at North Bend, to extend the land around Eastside, and finally, it has simply been dumped into the bay where it forms desolate spoil islands. Following is a list of modifications made in the Coos Bay estuary (the original bar was about 200 feet wide and 8 feet deep; the original channel was approximately 4 feet deep):

1878 - Jetty from point near Fossil Point (now underwater except at extreme low tide). Considerable work was done on this first project during the early 1880's but was discontinued when it became apparent that the 1890 project would be adopted.

1890 - Original North Jetty (completed in 1894).

1899 - Channel 13 feet deep and 100 feet wide dredged through shoals in upper bay.

1910 - Inner channel 18 feet deep and 200 feet wide from Empire to the point above Marshfield, and width of 300 feet opposite North Bend and Marshfield (completed in 1912).

1913/15 - Port, at town expense, deepened channel to 25 feet from Smith Mill (now Coos Bay Lumber Company) to Pigeon Point Reef in lower bay. Within a few years, several places in channel shoaled to above federal 18 feet project depth.

and pilings into the mud flat. The spaces between wharfs accumulate waste material and sediment which gradually forms dry land. In addition, pilings increase siltation by trapping debris and slowing down the current. A more direct method of creating land is diking and draining of the marshes. This has been done extensively by farmers to create grazing land. Dumping of solid wastes into the bay such as demolished buildings, old car bodies, and garbage has also added in the accumulation of made land. Dredge spoils have been used to fill in much of the lowlands about the bay. Plates 4 and 5 illustrate the changes that have taken place since 1915 on the city of Coos Bay and on the mudflat extending from Eastsi• Diagram 8 illustrates the extent to which Coos Bay is built o

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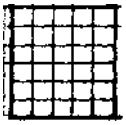

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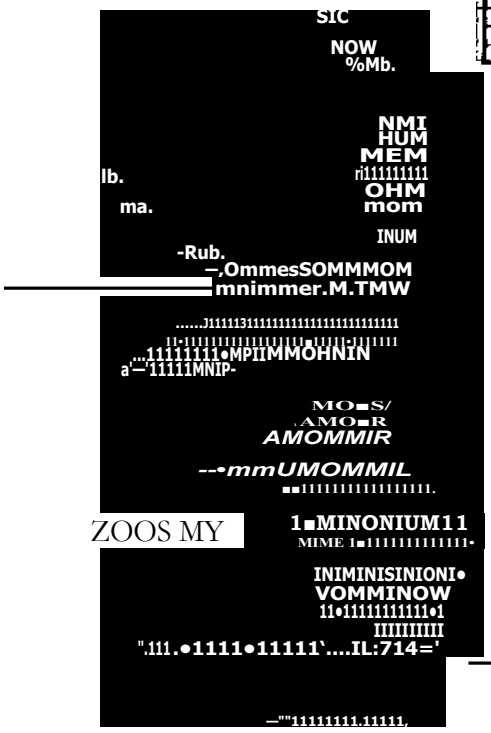

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1919 - Federal project increasing channel depth to 22 feet (completed in 1920).

1922 - Project for restoration of North Jetty and construction of South Jetty; work began in 1924 (completed in 1929).

1931 - Removal Pigeon Point Reef (18 feet to 24 feet depth over width of 300 feet).

1932 - Isthmus Inlet dredged 22 feet deep and 150 feet wide from Smith Mill (Coos Bay Lumber Company) to Millington: distance - 3 miles.

1935 - Federal project increased to 24 feet depth (completed in 1937).

1947 - Present federal project adopted (completed in June, 1951). Provide for 40 feet bar and 15 mile of inner channel with depth of 30 feet and width of 300 feet. Turning basins 600 feet by 1000 feet at Mile 12 and near Mile 15 with depth of 30 feet; anchorage basins 600 feet to 2000 feet at Mile 35 and near Mile 7 with depth 30 feet.

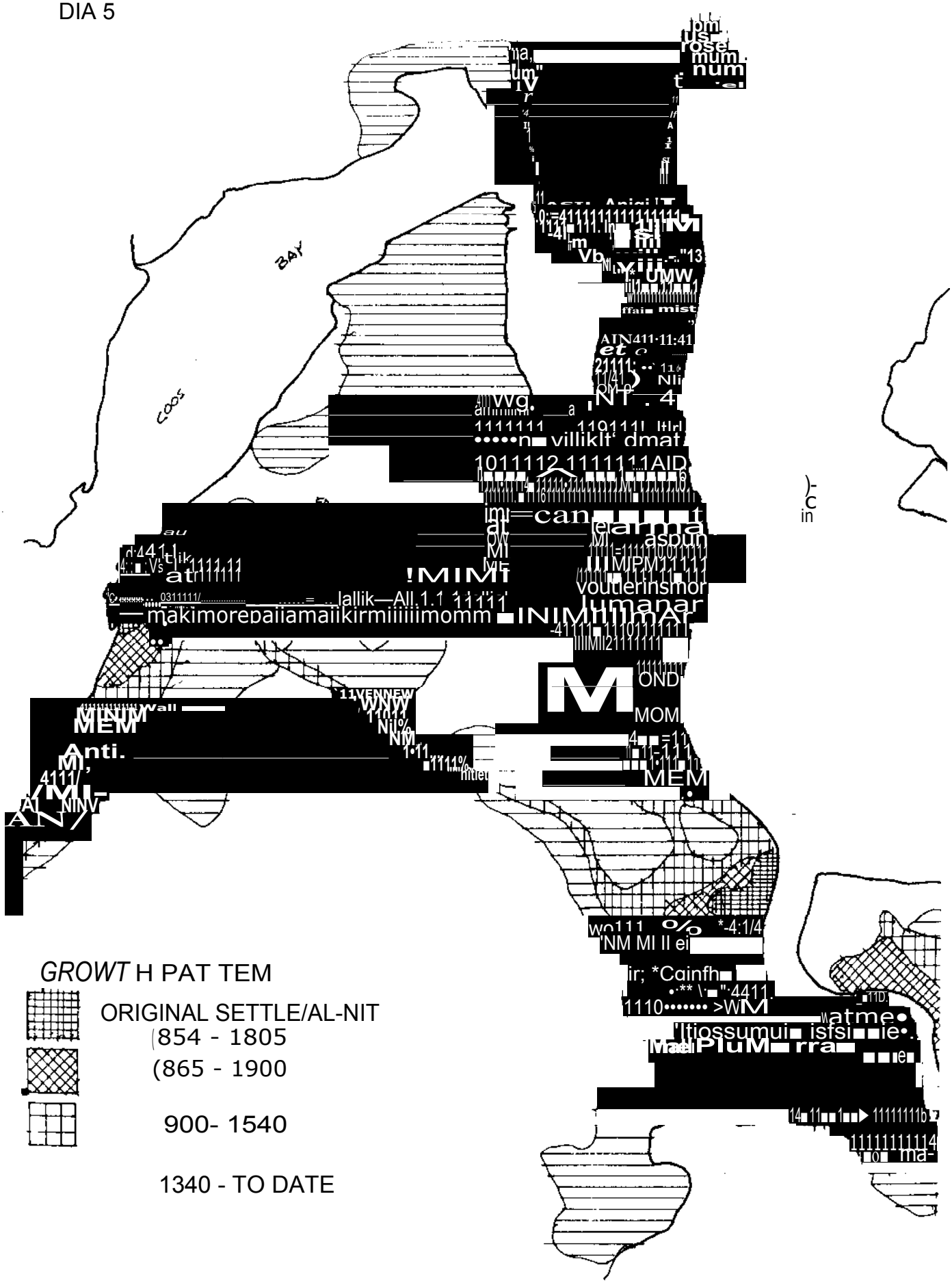
GROWTH PATTERNS: The reliance on the channel was a constant factor in the development of Coos Bay and led to a characteristic community form. The dependence on boats for transportation created a concentrating force. Docks and wharfs and piers were built to connect land and water. These dock facilities became important town centers and growth concentrated around them. A sense of the vitality and activity of this crucial connecting link can be seen in Plate 6. Diagrams 2, 4, 7, and 9 also illustrate the nodal effect of the docks on early development.

More recent modes of transportation have had opposite effects upon the regional growth pattern. The railroad to Eugene which was completed in 1916 crossed the bay at North Bend and terminated at Marshfield. This element tended to

shift the advantage for industrial growth further away from the ocean side of the bay. The train began to accentuate the linear development of the waterfront as opposed to the nodal water transport pattern. The train had another effect, it decreased the reliance on the estuary for commercial develop ment. Buildings which had faced the bay could now turn arou and receive goods from the train. This allowed a deeper 'aye of industrial fringe to develop between the bay and the heart of downtown.

The highway system and the reliance on automobile transportation has further affected the growth pattern of th area. The train still had to stop at specified loading stat hence a nodal pattern continued to exist. But, the advent the automobile made points between stations easily accessible From a predominantly nodal pattern, thearea has shifted to a predominantly linear strip pattern. Highway 101 crosses **in** North Bend, and runs right down the main street. In doing this, the highway has disrupted North Bend less than if it had bypassed the core area. In Coos Bay, however, even thou the highway is either adjacent to the bay or only one block away, it has in effect turned the city around. Where once t h city faced the bay, it now faces the highway. In addition, t automobile has opened up the area lying between Empire and C Bay. Development is cutting directly across the peninsula, whereas it used to be limited to the edges of the estuary. Diagram 9 illustrates the growth pattern around the hay.

DIA 5



GROWT H PAT TEM

ORIGINAL SETTLE/AL-NIT

(854 - 1805

(865 - 1900

900- 1540

1340 - TO DATE

TOTAL URBANIZED AREA

ja g

IMPLICATIONS: This review of the settlement patterns of Coos Bay reveals several developments. Foremost among these has been the gradual "growing away" from the estuary. In the early days, contact with the bay was an intimate and constant factor in the lives of the populace--people were aware of the bay. With the advent of railroads, automobiles and highways, the bay became less of a feature in people's lives. Building turned their backs to the bay. The waterfront became neglect The bay became a forgotten resource, only indirectly affectin the lives of the populace. This attitude resulted in practices which were grossly detrimental to the bay quality. Dumping of untreated sewage, direct discharge of industrial waste, excessive log storage and the disposal of vast amounts of dredge spoil are expressive of an underlying attitude which views the bay as an exploitable resource. Although this attitude has always been held, it was at one time temper by human use and contact with the estuary. When wide public familiarity with the bay ceased, unchecked exploitive practic escalated. In addition, technological advancements made it possible to exploit at a larger scale. Whereas at one time ships of shallow draft were designed specifically for Coos Ba now the bay is designed to allow for deep-draft vessels. It seems ironic and shameful that the estuary which attracted initial settlement to the area and which lends its name to the town on its shore, should be ignored and eventually destoyed by that very town.

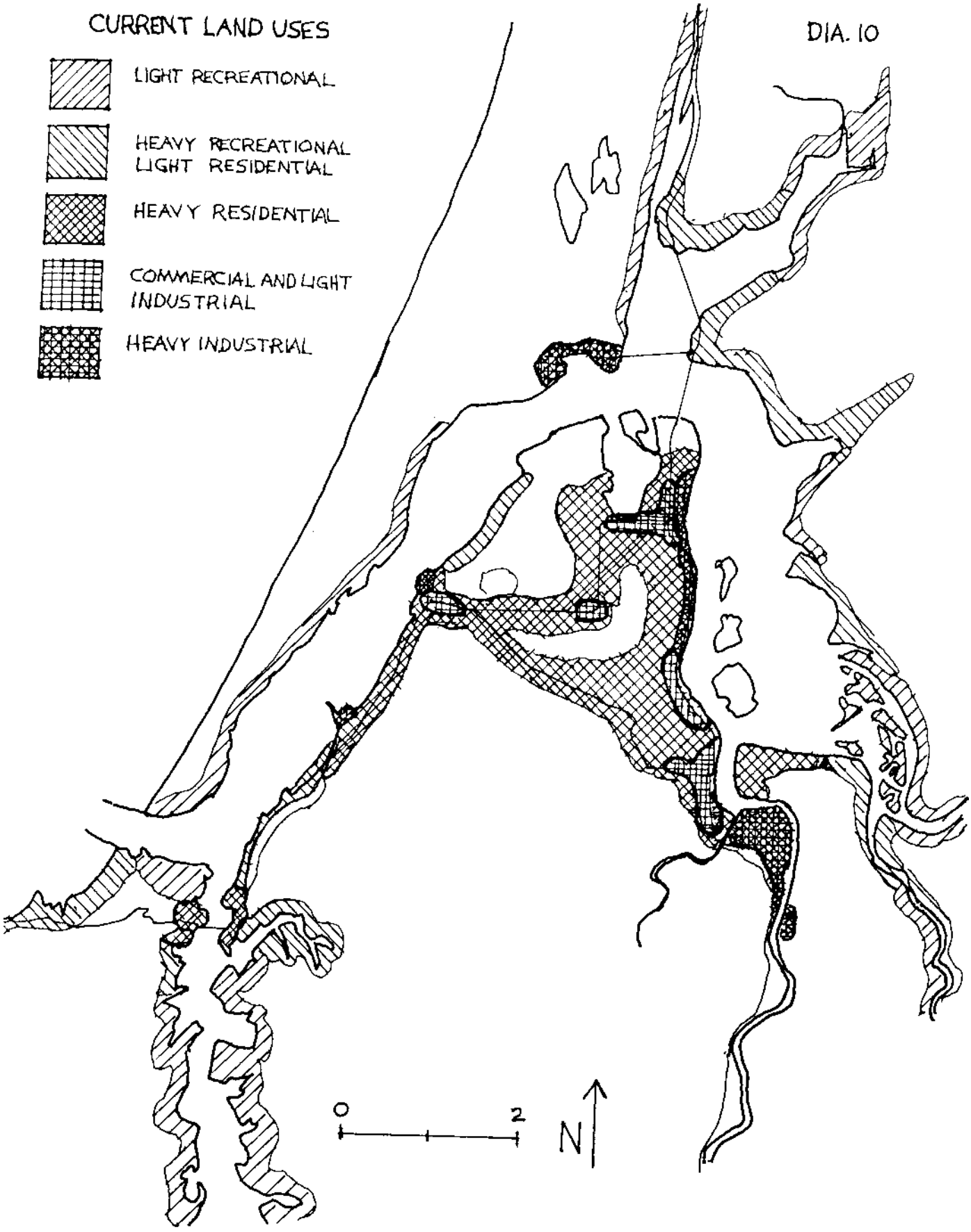
LAND USE ANALYSIS AND SUITABILITY

Our approach in analyzing and assessing the current land uses around the estuary edge has been as follows. We carried out an inventory of how the bay edge is used by all of the activities which border on it or have visual access to it. From this examination we arrived at a set of effects which surrounds each usage classification. This "effect sphere" is integral with each usage. For instance, a lumber mill necessitates log storage, dry or wet, and so, the effects of log storage lie within the sphere of effects surrounding a lumber mill. By developing these "spheres" we can more thoroughly examine the consequences of a certain type of activity in a given location about the bay. The effects can also be viewed as conditions which must be carefully studied and added to before further development occurs so as to minimize harmful qualities and maximize beneficial ones. There will be overlapping of the various "spheres", as certain conditions are integral with more than one activity. In real-life, it must be remembered that the "spheres" know no artificial subdivision, and are, through the interrelated systems of nature, virtually inseparable from one another.

Our inventory is presented as a progression from least intense land use to most intense. The areas currently falling into each category are presented on a base map (Diagram 10). The effect sphere is then evaluated to arrive at some measure of the "appropriateness" of the given land usage.

Where we find discrepancies in the uses and their surroundings we attempt to explore "remedies." Our remedies are based on the suitability of the land characteristics to accommodate the given activity, the appropriateness of an activity in terms of the livability and cultural history of an area, and an evaluation of an activity's effects on the estuarine ecosystem. (See Biology section).

Plates 7, 8, 9, 10 are photographs of the topography, slope conditions, vegetation, and soils surrounding the Coos Bay estuary. Appendix C gives the U.S.D.A. interpretations for uses of the various soil types. We had to revise our original intention of using a regional planning overlay technique in assessing the optimum uses for the estuary edge. We found that we were working at such a small scale that gross land suitability categories were not applicable. Furthermore, the extent of current development made a de facto land suitability plan seem somewhat useless. We also encountered organizational and technical difficulties in preparing meaningful overlays. Consequently, we used the mapped information as a reference source in our analysis and as a necessary tool in visualizing the area.


CURRENT LAND USES
DIA. 10
LIGHT RECREATIONAL
HEAVY RECREATIONAL
LIGHT RESIDENTIAL
HEAVY RESIDENTIAL
COMMERCIAL AND LIGHT
INDUSTRIAL
HEAVY INDUSTRIAL
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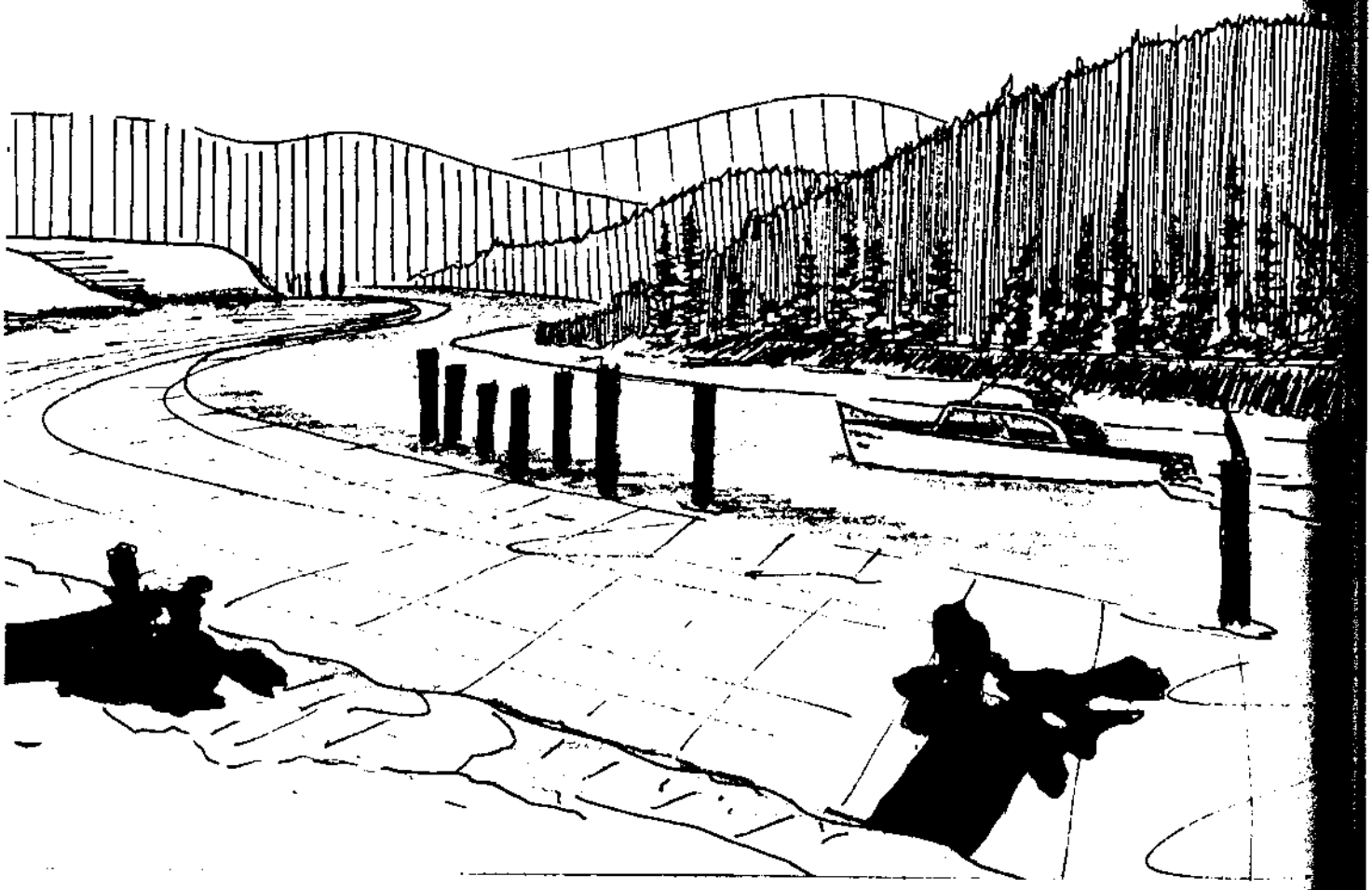
CATEGORY ONE: LIGHT RECREATONAL USES

A significant portion of the estuary shoreline is utilized by light intensity activities. Light recreational uses such as hiking, picnicking, overnight camping, hunting, fishing, clamming, boating or just sitting and relaxing have an impact on the environment. Even one person walking along the shoreline leaves a trail; footprints, trampling of vegetation, clearing a path. Perhaps he stops to turn over a rock or throw a stone. Multiply this one person by many, and it can be seen how even light recreational uses have an impact which should be considered.

DIA.II



CHARACTERISTICS	EFFECTS
Trails	Removal and trampling of vegetation
Camp improvements:	
clearings	Inorganic litter
fireplaces	Organic waste
outhouses	Smoke and fire hazard
disposal sites	Erosion of soil
shelters	Disturbance of natural game habitat

DISCUSSION: Currently around the estuary, the areas which fall into this Light Intensity Use Category are South Slough, North spit, parts of North Slough, and parts of the east bay, Catching Slough and Coos River shorelines. Generally, the land is capable of supporting such light intensity use. In low-lying regions care must be taken in installing septic tank drain fields as the soil is of very slow permeability. This also restricts camp areas, picnic areas and trails. Excessive clearing of vegetation and road building should be avoided.

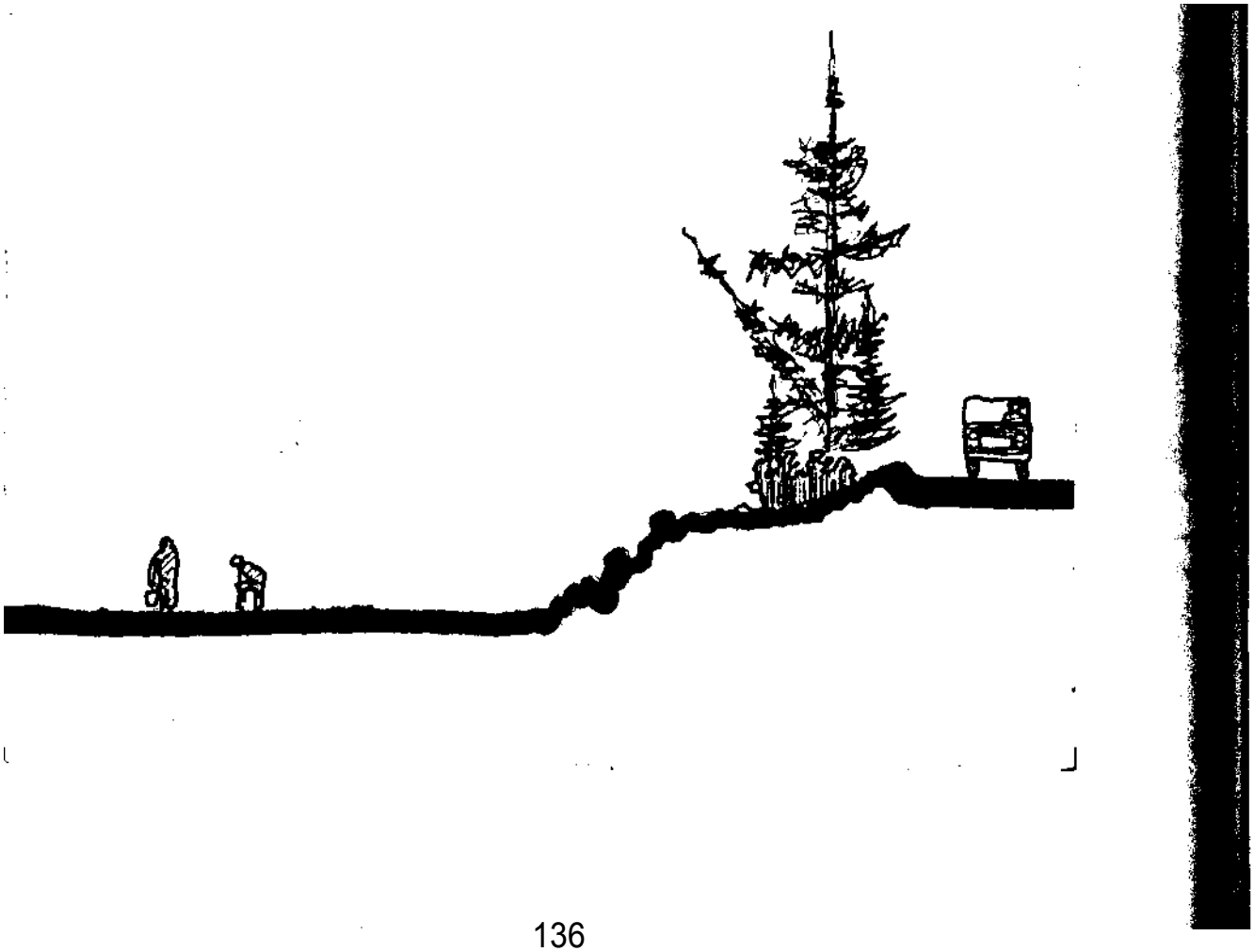
Presently, development is encroaching into the South Slough area. This development has a tendency to clear away acres of trees at a time and build complex access road systems. This is not a wise policy, as it endangers the very assets which make South Slough desirable development property. Because of its relative inaccessability, South Slough has remained virtually undeveloped. Other factors retarding its growth have been its unfavorable micro-climate and the lack of flat ground. Presently its biological productivity is quite high and it is a haven for waterfowl. These factors

seem to make it a good area to preserve in a natural condition. Development should be limited and carefully controlled to cause the least possible disruption.

CATEGORY TWO: HEAVY RECREATION AND LIGHT RESIDENTIAL

The next most intense use of the shoreline has been classified Heavy Recreation and Light Residential. This includes automobile access. Activities such as those mentioned under Light Recreation take place but more people are involved. In addition, scattered residences occur in these areas.

DIA.12.



(MAHACTKHLWIC	HHFHCTC
koads and parking lots	The intensity of the effects
;;igns	under Light Recreation
Park improvements:	is increased
trails	Automobile pollution:
large clearings	dust
facility buildings	exhaust
Water demand	Visual eyesores:
Power demand	garbage
Earth cuts and fills	clutter
Docks and breakwater	Waste products
Housing	Erosion and Sedimentation leads to:
	turbidity in bay
	smothers benthic habitats
	shoaling

DISCUSSION: Areas of this nature border the area of Light Recreational uses. The Charleston end of South Slough falls into this category. Other areas are: the road between Charleston and Empire; portions of the shoreline between Empire and North Bend; most of the shoreline around North Slough and the east side of the bay. The Cape Arago recreational sites also fall into this category as the intensity of the land use is similar to Light Residential. One final area is to be considered in this classification: the top of Telegraph Hill in Coos Bay.

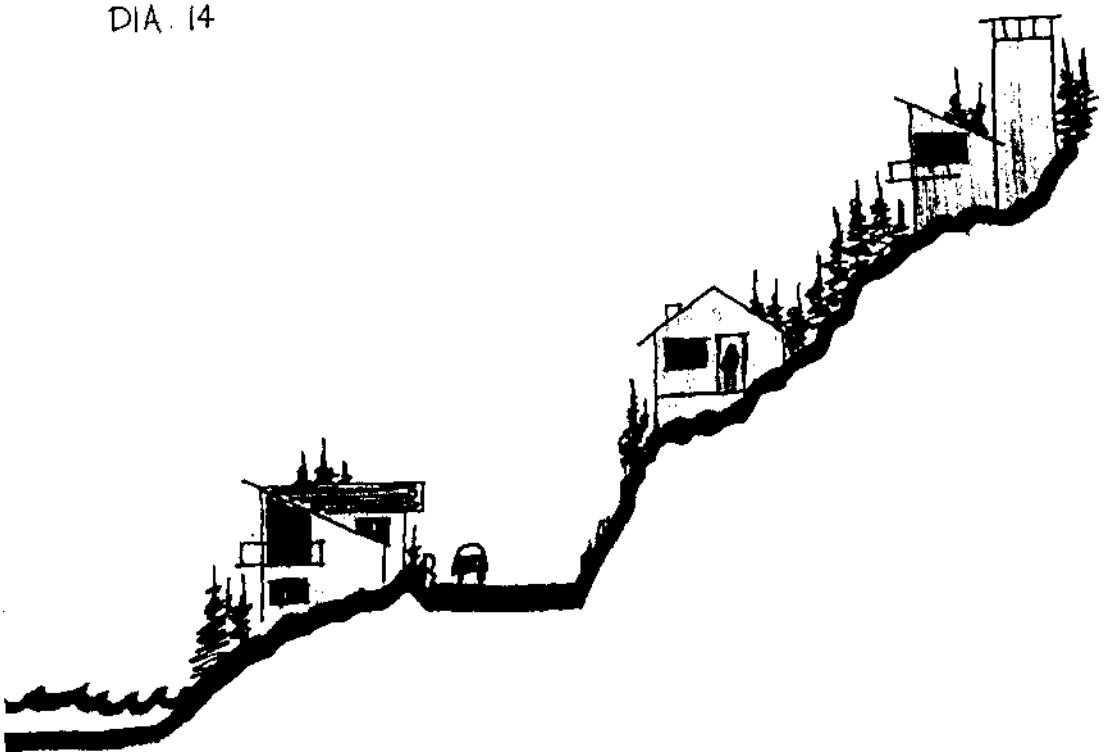
The Empire-Charleston highway area is well suited to this level of use. The land is relatively flat. The soil is Bandon-Bullards sandy loam which has moderate limitations for septic tank absorption fields. Access has already been established to the area, and due to the flatness, erosion problems are not extreme.

In addition to the residential use of this strip of highway, recreational uses such as clamming and pleasure driving

take place along it. In this respect, the highway does not capitalize fully on its location overlooking the clam beds and the bay. The vista is blocked by housing and vegetation for almost the entire length. A possible remedy to this would be to clear some of the brush and build viewpoint pullovers. These viewpoints could also be used for parking on good clamming mornings. "Point of Interest" signs explaining the estuarine ecosystem of which both clams and ships are a part might be incorporated into these parking areas.

Commercial enterprises exist sporadically along the highway. These consist of businesses such as second-hand stores, grocery/gas stores, appliance repair, and so on. Many of these depend on the tourist dollar. It would be to their benefit if they would keep themselves from appearing excessively run-down and junky. Optimum use for this section seems to be low or medium density residential with an acknowledgement of the recreation and tourism opportunities directly on the shoreline. Care must be taken with septic tank drainage fields. Ideally, hook ups to Empire sewers should be aimed for. Cuts and fills should be minimized, and **existing vegetation** should be retained as much as possible with exceptions for viewpoints.

DIA. 14



The East Bay shoreline is characterized by low density residential development. Recreational facilities also exist there. The Kentuck golf course and sightseeing along the highway are the major recreational uses. The steepness of the topography is the primary limiting factor in development. Severe limitations for dwellings, septic tank absorption fields and street construction are recommended for the Dement and iempleton soil types in the area. Between Pierce Point and Crawford Point relatively flat land does exist and there is pressure to develop this into an industrial site (log storage and handling). This would necessitate filling and dredging to create an access channel. This industrial use is incompatible with the surrounding natural conditions. (See Industrial Section). The east side of the bay is valuable

as a contrast to the heavily industrialized west side. Preserving it is important for the biological productivity of the bay and also for those who may occasionally gaze over the smokestacks on the west shore and derive enjoyment from viewing the natural scene.

The best use for this area is to disrupt it as little as possible. Low density residential use seems appropriate, but such growth should not overburden the existing transportation facilities. Limitations on septic tank fields should be carefully controlled. Earth cuts should generally not exceed two to one in this soil type, and they should be replanted immediately to reduce erosion. Development should be tailored to enhance the shoreline as much as possible. It might take the form of cluster developments with access roads and vista points integrated for public use.

Telegraph Hill falls into the light residential use category although it is quite different from the other areas discussed. This hill is an outstanding feature of the Coos Bay topography. It is currently being developed into a high-cost residential district. This development has unfortunately already stripped the hill of an appreciable amount of vegetation. The optimum use of this area will be discussed later.

CATEGORY THREE: DENSE RESIDENTIAL

The next most intense land use is Dense Residential. This category encompasses the bulk of the land in the built-up area. Much of this land is not adjacent to the bay, but visual ties with the bay exist. Residential development around the estuary has taken place intermittently over time and consequently there is a variety of housing types and values. Examination of the Residential Density map, Plate 12, reveals scattered districts and densities.

CHARACTERISTICS	EFFECTS
Transportation network: highways streets sidewalks Habitated buildings Power and phone lines Domestic water usage Large scale landscaping: earth cuts and fills terracing Sewer systems	Intensity of previous effects increased Detracting visual elements Erosion Watershed areas required Sewage pollution: organic wastes increase biological oxygen demand in bay

DISCUSSION: Most of the residential districts within the general built up area have been established for several years. With a few exceptions, it is safe to say that existing residential hillside development has been well carried out and does not overtax the land capabilities. Sewer systems exist and effectively control domestic sewage. Where cuts have been made, erosion problems are in most cases well controlled with new growth vegetation. In the case of new development, measures should be taken to control erosion as soon as possible. Several

places in Coos Bay utilize retaining walls to terrace hillsides. When properly designed and drained retaining walls are a good method for building on steep hills.

The area south of the airport and roughly down to the Empire Lakes is of Westport loamy sand soil type. This soil is subject to wind erosion if the surface layer is removed. Therefore extreme caution should be taken in any development of this area. A prime bad example of development here can be seen in plate 13. Not only has the large white area virtually reverted to dune land, but the developed area is entirely insensitive to local modulations in the topography and it makes no attempt to capitalize on potential views of the bay.

Suggestions for Residential Development

1. Flat land is scarce, consequently, residential development should occur on slopes too steep for industrial use.
   A.) Building on slopes necessitates attention to certain physical limitations, the neglect of which can lead to serious consequences.
      1.) Unretained cuts should be made no steeper than 1 to 3 in sand and 1 to 1 1/2 in clay.
      2.) Retaining walls should provide for adequate drainage--professional consultation should be obtained.
      3.) Foliage should be retained and replaced immediately to reduce the effects of erosion.
      4.) Terracing of hillside up to 20% steepness has

been successfully accomplished. This appears to be the maximum steepness possible for terracing; it should not be exceeded.

2. Life in the Coos Bay area is directly or indirectly tied to the estuary. One way of acknowledging this connection is to capitalize on views of the bay. The surrounding hillsides offer many vistas. Where possible, these vistas should be exploited in residential developments.

3. Residential areas require certain supporting commercial establishments. There already exist within the Coos Bay vicinity definite commercial nodes. Intelligently exploiting appropriate sites for residential development near to these nodes is a more efficient use of land than scattered development in the outlying regions. Higher densities can be obtained and open space preserved by incorporating cluster apartment units into predominantly single family dwelling areas.

4. Vegetation lends variety and interest to a residential area. It retards erosion, blocks wind, creates shade, allows for privacy, and provides a home for animal life. Certain areas in the Coos Bay vicinity have been denuded of vegetation cover and have, as a result, reverted to dune sand conditions. A maximum amount of vegetation has to be retained.

5. Road networks displace valuable land for other purposes. Consequently, maximum residential density should be achieved in the proximity of existing street systems. Streets

should be arranged so that they follow existing shelves and natural landscape contours. Streets should also capitalize on potential views. Cuts should be properly drained and should not exceed the maximum allowable steepness.

6. The Coos Bay environment is a diverse one. Most places are near enough to wooded areas to make those areas a usable asset. Where feasible, cluster developments should capitalize on pathways through the woods. Following the lead of inquisitive children who seem to invariably play "out in the woods" can add a rewarding dimension to the life of a harried adult. Such pathways can be "shortcuts" to the corner store, walking paths, bird watching places, places *for* rope swings, tree forts and lots of other things that make life exciting and rewarding.

CATEGORY FOUR: COMMERCIAL

The commercial and central business districts about the bay comprise the next usage classification. There are three main areas of this usage: Empire, North Bend, and Coos Bay. Commercial use can be further broken down into two main types: the established downtown center (the central business district: C.B.D.) and the newer strip commercial areas.

CENTRAL BUSINESS DISTRICT (PLATE 14)

CHARACTERISTICS	EFFECTS
Traditional heart of town	Concentrated development:
Large amount of paved area:	grid pattern predominates
highways	open space lacking
streets	Automobile pollution:
sidewalks	exhaust
parking lots	noise
Multi-story buildings	Accumulation of litter
People activity	Lack of vegetation
Power and water requirements	Large bearing loads on soils
Sewer systems	Penetration of water into soil retarded
	Dirty, heated water added to bay

COMMERCIAL STRIPS (PLATE 15)

CHARACTERISTICS	EFFECTS
Development along major arterials	Inefficient, low density development
Oriented at auto	Visual chaos:
Parking surrounds each business	signs
Low-cost construction	utility poles
Power and water demands	Oriented at auto to the neglect of the pedestrian
	Rapid deterioration

DISCUSSION: The Empire Commercial center consists of the main highway going through the town and turning southwest along the bay. Approaching Empire from Coos Bay along Newmark Avenue, new strip development exists for roughly a mile before you make a right hand jog and enter the semi-C.B.D. of Empire. The main street of Empire is perpendicular to the bay, but advantage of this opportunity is not taken as the view is blocked by low buildings. A fish cannery is located on the flat shelf below where the highway turns towards Charleston. This waterfront has potential tourist interest but no advantage is taken of it. After making the turn, commercial use

rapidly tapers off and takes the form of second—hand stores and similar low density uses.

From the edge of the high terrace upon which Empire is built a fine view of the bay exists. Currently, this strip is not densely utilized. Commercial growth in Empire will most likely be tourist facilities: restaurants and motels. These facilities would be enhanced by capitalizing on the view. If development does occur along the bluff, care should be taken to retain public glimpses of the bay and its activities.

The North Bend commercial district is also split into the older C.B.D. and the strip development. Highway 101 plays a major role in the older C.B.D. of North Bend. The highway runs through the heart of the old downtown. Views exist to the east of Coos Bay and to the west of Pony Slough (Plate 16). Two- and three-story buildings line the street closely, giving a confined feeling to the downtown, and in many cases blocking the view from street level. Highway 101 is such a busy arterial, that it acts as a detriment to the business along it. Parking is difficult and there is constant noise. These were factors in the development of a newer strip along Virginia Avenue. This is where new businesses are locating. Pony Village, a large self-contained shopping center has almost taken over the function of the old C.B.D. of North Bend. Unfortunately, all of the development along Virginia Avenue is on fill and is almost at bay level. No one has capitalized on the proximity to the water's edge or on the vista which exists over the water.

Future development of the North Bend commercial district should stay within the boundaries of the present development. No more fill should be allowed in Pony Slough and existing development should attempt landscaping to soften the starkness of its present condition. Vacant buildings along 101 in the older section could perhaps be remodeled or restored. They have a much more dramatic location than does the new development, and if off-street parking were provided, it seems they could again house thriving enterprises.

Coos Bay is the leading commercial district in the region. It again consists of two elements, the strip and the established C.B.D. The strip extends south along 101 from the main business area. Gas stations, drive-ins and other such automobile-oriented businesses have grown up on it. This area along with some of the more established C.B.D. is built on fill and, as a result, has a barren wasteland look. Approaching from the south, the Tioga Hotel indicates the presence of a more established business area. This is the heart of the Bay area commercial enterprise. The central feature of this downtown is the Coos Bay Mall (Plate 17). The Mall has been a good effort to centralize and stabilize the main commercial center. Particularly in a region like Coos Bay where flat land is in such demand, concentration rather than dispersion should be aimed for.

North around the base of Telegraph Hill is an area of mixed commercial and light industrial uses. This area is formed by a recess in the hills and continues north until

the hills again crowd the bay. Commercial development here has some strip qualities, but it is primarily motel, restaurant and recreational facilities.

The potential for future development of the central Coos Bay commercial district is interrelated with the development of the light industrial section of the town. Growth possibilities will be discussed following the analysis of these industrial uses.

CATEGORY FIVE: LIGHT INDUSTRY

Fishing and seafood processing, boat building and repair, iron works and machine shops, creameries, warehouses, industrial supply houses, heavy equipment sales and other uses requiring transport facilities are considered in this classification. These enterprises can be broken into two main groups: those which, of necessity, require waterfront locations, and those that don't. A quick analysis of several different uses follows:

FISHING AND SEAFOOD PROCESSING

CHARACTERISTICS	EFFECTS
Boat dock facilities	Impact on bay:
Buildings on pilings over water for access to fishing boats	buildings block sunlight land begins to accumulate may affect hydrology
Truck loading facilities	Odors
Cooking and packaging of seafoods	Wastes dumped into bay
Parking lots	

DISCUSSION: To facilitate easy access by fishing boats, seafood processing plants are restricted to locations close

to the mouth of the estuary. Activity at these plants is interesting due to its peculiarity to the coast. The fishing boats are themselves a tourist attraction. The bridge at Charleston provides a good view of the fishing industry activities. No such view is capitalized on in Empire. There are no fresh fish markets in the bay area. The introduction of such a market perhaps along the Coos Bay waterfront would be one means of relating the upper end of the bay to the lower and would act as a tourist attraction.

BOAT BUILDING AND REPAIR, TOWBOAT COMPANY HEADQUARTERS

CHARACTERISTICS	EFFECTS
Waterfront location	Pressure to external land
Boats, docks and waterfront activity	Pollution from industrial process: debris
Industrial clutter	paint chips, solvent, etc.

This constitutes another industrial waterfront usage. A medium deep water channel and adequate dock space is required. Ancillary developments such as machine shops and iron works are necessary nearby.

DISCUSSION: These shoreline activities have historically developed on the upper end of the bay, centering on the Coos Bay city waterfront (Plate 18, 19). The location is near rail and truck transportation lines. The water is protected and remains calm. These activities are housed in old buildings in a distinct section of town. The area has essentially been closed off by Highway 101 and little pedestrian traffic ventures into the area. This is unfortunate as the activities are interesting and relate directly to the bay, an almost

forgotten element in the lives of many area residents, and a prime tourist attraction.

FUTURE DEVELOPMENT OF THE COOS BAY CITY WATERFRONT

The history of the waterfront reveals that it was once the heart of downtown activity. Over time, however, the main center of business has shifted inland several blocks and has become dominated by the automobile. One effect of this is that the bay as a feature of downtown has been neglected. Elements such as the highway, the railroad tracks and industrial clutter impede access to the shoreline. Where buildings once addressed the bay, they now have blank walls to it, and picture windows to the street (Plate 20). There are, however, activities natural to a waterfront which attract people to it. Some of these already exist in the light industrial section of the town. Furthermore, the motels and restaurants along 101 would benefit from an attractive usable waterfront. The area north of Telegraph Hill is currently the site of motels, restaurants and recreation centers. Because of its current use, its proximity to transportation routes, and its central location between Coos Bay and North Bend it seems to be a good site for needed convention center facilities. The adjacent shoreline and Telegraph Hill itself could be capitalized on by such a facility. Frpm the top of this hill, a tremendous view of the shoreline and of the bay spreads out below. Looking west, North Spit, and the Pacific Ocean can be seen. It is an ideal location for a pocket park, and trails

could extend from the peak down to. the waterfront and motel areas.

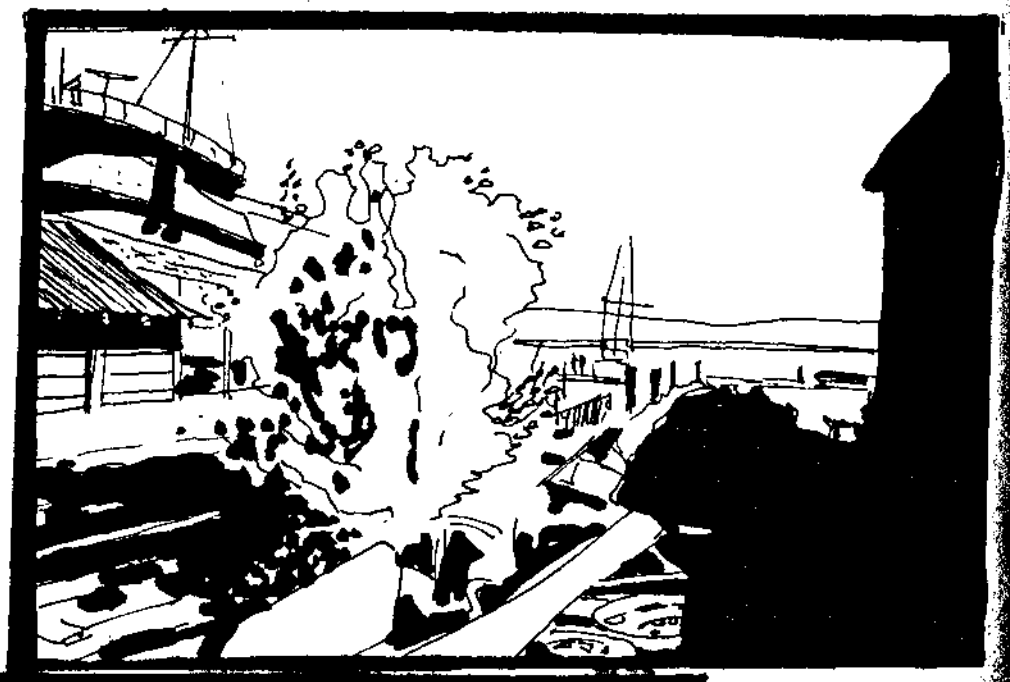
A sketch design including the light industrial section of Coos Bay is presented to illustrate a few possibilities for diversifying use and opening up pedestrian access to the waterfront. Opportunities exist for pedestrian walkways, observation platforms and places to sit and eat lunch. Perhaps an open air market could be established as an extension of the Coos Bay Mall. A fresh seafood market and seafood restaurant could also be incorporated into the waterfront development. Such a development could reintroduce area residents to the tremendous natural feature in the front yard of their town.

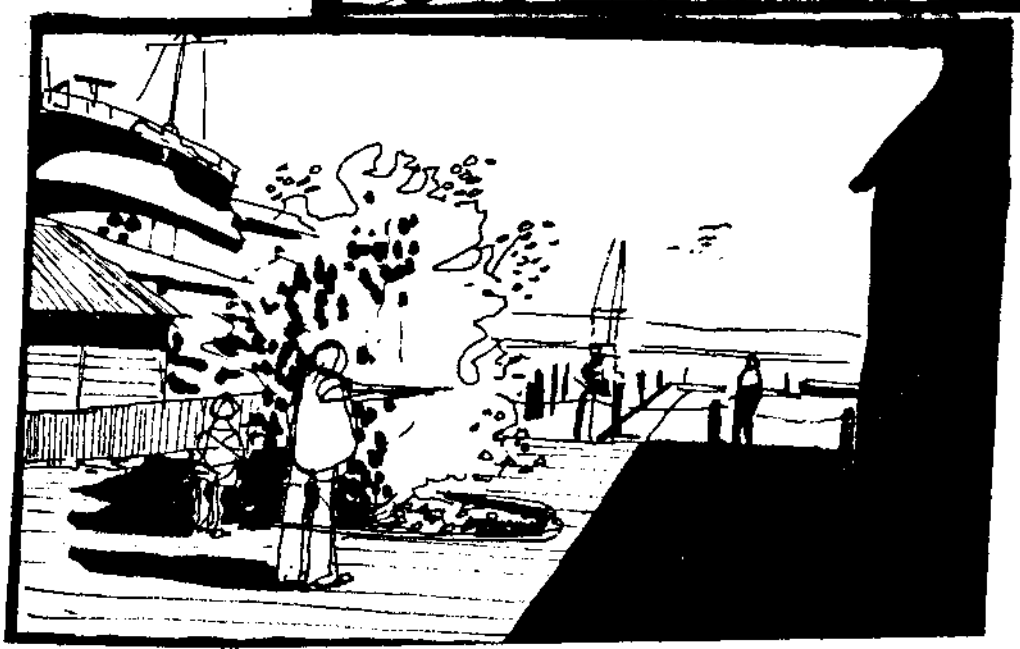
We feel this would be beneficial in several ways. It would be an added stimulant in the lives of bay area residents by acknowledging a unique regional characteristic. The tourist industry, an expanding part of the Coos Bay economy, would benefit both directly and indirectly. Furthermore, by making the resource attractive to a multiple of users, concern for the use of the bay and its welfare would be increased. This to the end that single purpose exploitation of such a resource is an inequity and should be remedied.

Plates 21 and 22 are photographs of a plan to incorporate some of the above mentioned developments into the existing waterfront. The Coos Bay Mall can be seen at the right of Plate 22. Pedestrian access to the water is achieved by an accentuated crossing of 101 at this point. An open

market then extends north, adjacent to the tugboat docks. The dotted line represents a pedestrian pathway. Diagrams 15, 16 and 17, 18 illustrate the potential this waterfront has to be an exciting, accessible place. Diagrams 19 and 20 show a spot just north of Central Dock. Here, a wide spot between the highway and the bay creates room for a small turnout, a few benches, and a grassy area. Across the highway are several hotels whose guests would be prone to utilize an area such as this. Also indicated is a bayshore walkway/ bicycle path.

DIA . 15
EXISTING
CONDITIONS





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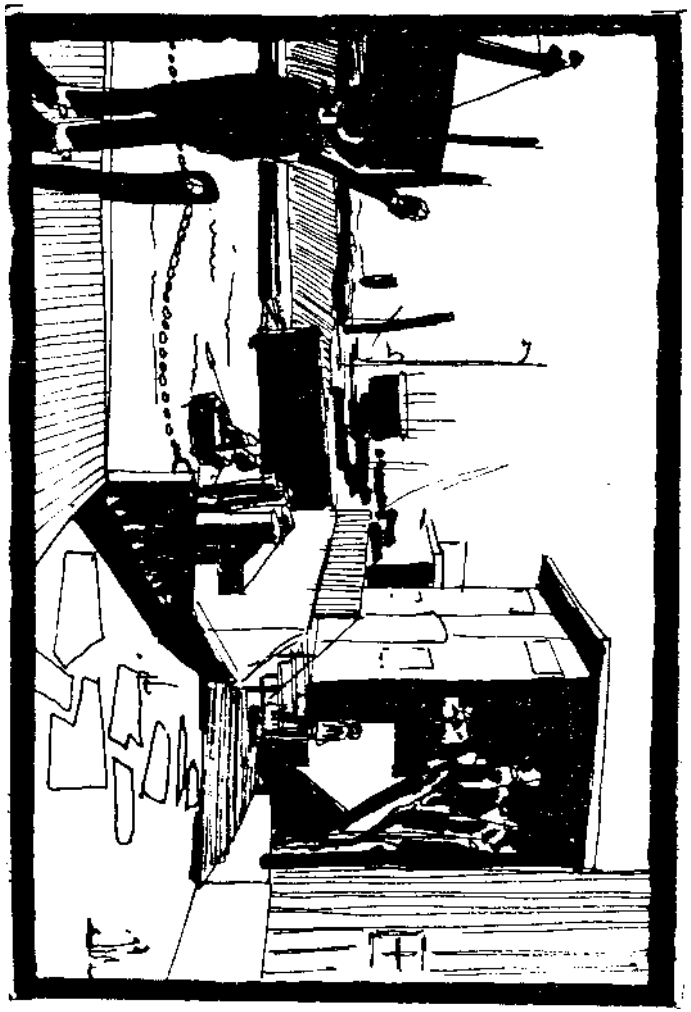

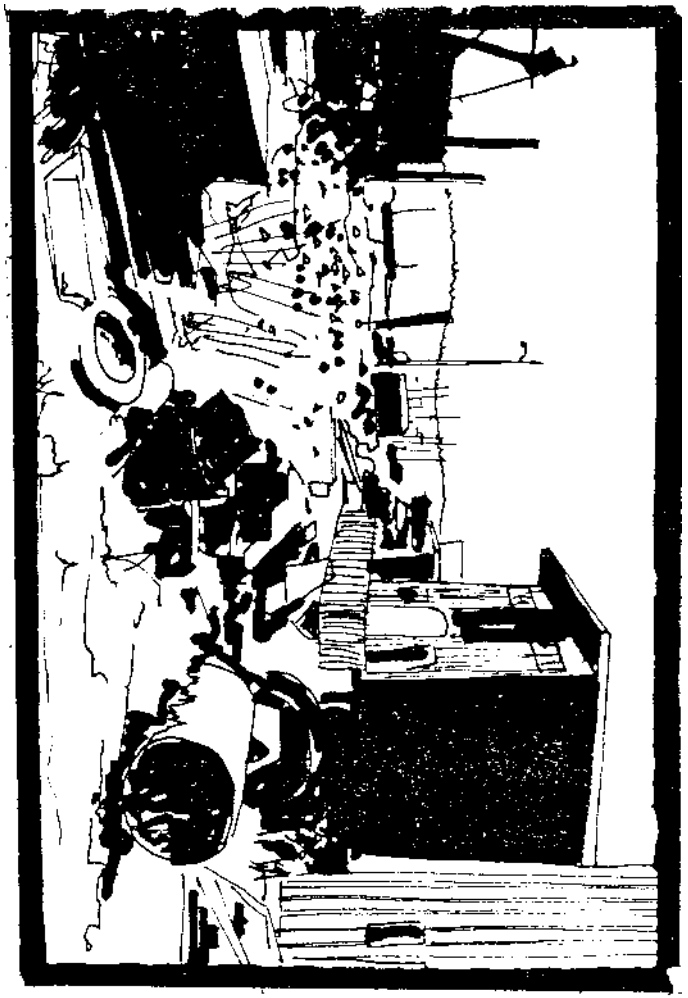

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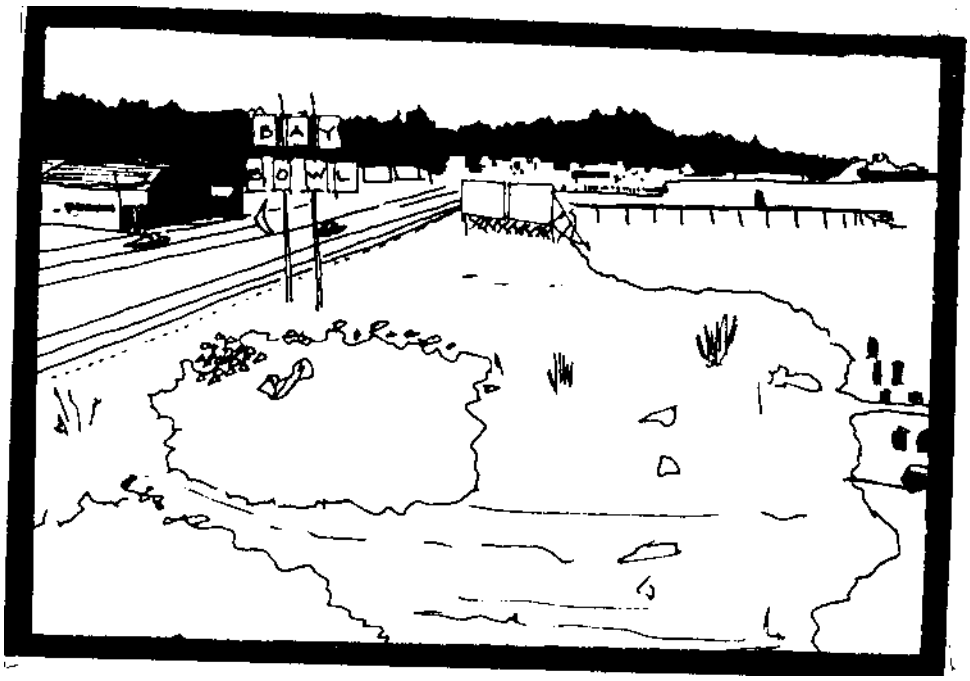
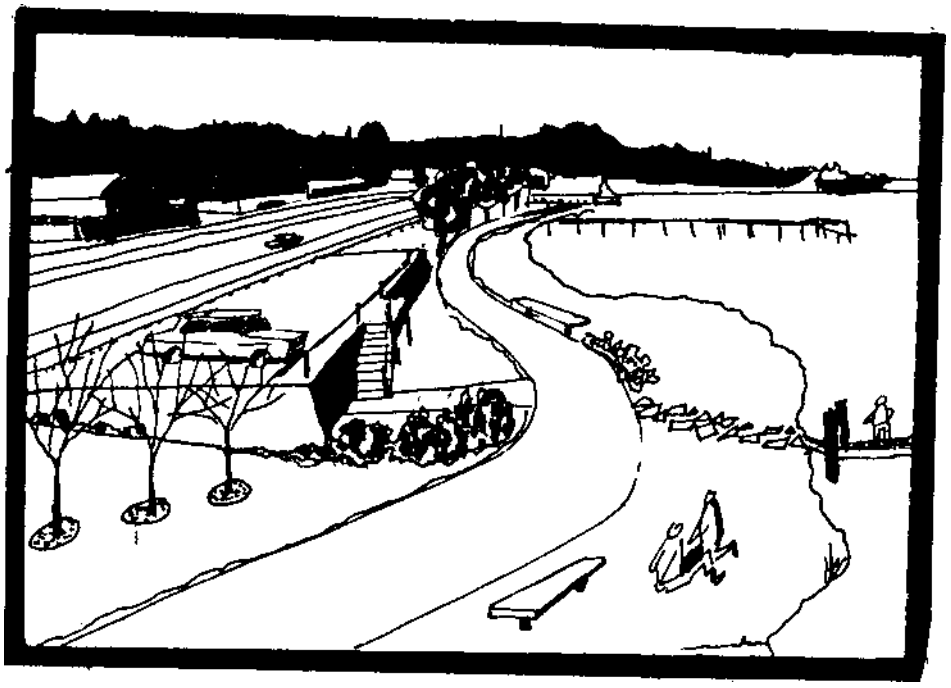


DIA. 19 ***EXISTING***



- ***t)IA.2.0 POSSIBLE***

INDUSTRIAL LAND USE

Industrial uses comprise the largest portion of the built up shoreline and have the biggest impact on the surrounding environment.

The oil industry in Coos Bay is second to lumber in the volume of shipping. However, the facilities are not extensive. They consist only of several storage tanks and one receiving dock. The dock is located midway between Coos Bay and North Bend. The tanks are located nearby at the base of the hills (Plate 23). This location is on Highway 101 and is well suited for truck transportation. The main effect of the oil industry is that it requires a deep draft channel; the consequences of the channel will be covered in the analysis of the lumber industry. The tanks themselves are nestled in at the base of the hills, and could potentially cause some amount of disruption to the other uses. Screening them with vegetation could blend them better with the hillside.

LUMBER INDUSTRY

In order to evaluate the effects and appropriateness of the lumber industry and the location of the mills about the bay, it is necessary to look briefly at the sequence of processes leading from the forest to the mill.

The lumber industry initially depends on the forest for its raw material. Logs must be harvested and transported to the mill. The effects of these operations bear directly on conditions in the estuary. By utilizing sound erosion

control procedures at the cutting stage, much of the damaging effects of upstream sedimentation on the lower portion of the estuary can be avoided.

The transport of logs to the mills is accomplished by floating, by trucking and by trains. Logging is seasonal and a large portion of the logs are cut during the spring and summer. These logs must be stored until needed at the mill. It is easy, efficient, and economical to leave them floating. Consequently, areas such as Isthmus Slough have become communal log ponds with as much as 20% of the surface area covered with logs. As was pointed out in the Historical Development section, this reliance on the estuary waters for log transport and storage has been the major reason that mills are located adjacent to the bay. The following is a summary of the characteristics and effects of log rafting:

CHARACTERISTICS	EFFECTS
Large areas of surface water covered by logs: Up to 20% of sloughs and channels	Obstructs channel Reduces available dissolved oxygen Deteriorates banks of shore Affects hydrology: slows water increases siltation Reduces available sunlight Interrupts natural view of bay

Highways and railroads are also utilized to transport logs from the woods to the mill.

CHARACTERISTICS	EFFECTS
Cuts and fills for routes Trains parked on tracks Log trucks on highway	Erosion and corollary effects Visual and physical barriers Noise Deterioration of highway surfaces Air pollution from exhaust Hazard to other vehicles

The mill process is the next step in the industry. Here the logs are trimmed and cut into marketable lumber. This process can be carried on at a range of scales from small gypo mills to huge industrial complexes. Large mills are more typical of the major portion of the estuary. A large complex usually includes a plywood or hardboard mill.

CHARACTERISTICS	EFFECTS
Large buildings	Industrial noise
Complexes of operations	Physical and visual block to bay
Smoke stacks	Neglect creates eyesore
Power requirements	Air pollution:
Water requirements	unpleasant odors
Fills	haze
	detrimental to image of area
	Water discharged into bay:
	glue waste
	logwash water
	bark chips
	Solid waste accumulates as fill

As a by-product of the cutting process, wood chips are produced. These are stored in large chip piles awaiting shipment.

CHARACTERISTICS	EFFECTS
Large mounds of chips	Visually and physically block bay
	Blow sawdust

Much of the cut lumber from this area, and all of the chips are shipped by sea. This necessitates a deep water channel to the point where the product will be loaded. This channel needs to be dredged and the spoil must be deposited.

CHARACTERISTICS	EFFECTS
Deep water channel	Turbidity
Creation of spoil islands; currently about 130 acres	Siltation
	Smothering
	Eyesores
Dredging operations	Affect hydrology

Portions of Coos Bay which are built on made land are gradually sinking (up to 18 inches in the last 35 years). There is speculation that this is due to its being adjacent to the deep channel cut. Apparently some of the land under tidal effect is gradually "squishing" into the channel.

SHIPS

The deep water channel allows large ocean-going ships to virtually navigate right through downtown Coos Bay. To the tourist this juxtaposition of sea and land elements are very interesting. Other effects of the ships however are not so desirable. Domestic sewage from the ships is usually dumped into the bay. In addition, the presence of the large ships labels the waterways industrial and deters people from thinking of them as recreational resources.

PULP MILLS

Pulp mills, although primarily a forest-based industry, have different characteristics than the lumber mills in the area. Raw material for the pulp mills are woodchips, sawdust and waste paper. The mills on Coos Bay are sulphite mills. This process produces a lot of waste, much of which can be treated or recycled. The Menasha Mill has a large settling lagoon on North Spit for aerating its waste waters. The Coos Head Pulp Mill discharges waste into the bay. There is evidence of some seepage from the Menasha lagoon into the bay proper, and, at times, there is a distinct odor off of the pond.

INDUSTRIAL LAND USE - DISCUSSICN

Industry is the predominant element along the Coos Bay shoreline (Plates 25, 26, 27). Consequently, the ultimate condition of the local environment is dependent on the policies and practices of that industry. The Isthmus Slough site (Plate 26) includes a plywood mill, a lumber mill, a hardboard plant and chip exporting. The plywood and hardboard are transported by rail. The chips and lumber are shipped by sea. The slough is utilized to facilitate log handling in the production process. This and the proximity to log storage, makes location on Isthmus Slough desirable. Heavy industry at this location, however, has a negative impact on the bay, and the quality of the adjacent human environment. The physical condition of several mill buildings is unsightly. They appear old and in need of repair. The use of the land seems haphazard and inefficient. Odorous smoke is continually exhausted into the air. The "made land" upon which the mill is located is desolate of vegetation. This makes the mill site appear even harsher.

The Weyerhauser complex, located between North Bend and Coos Bay is more concentrated than the Isthmus Slough area. This is due primarily to the site. The mill buildings are located at the base of the bluffs which rise abruptly from the bay. Highway 101 funnels through the space between the mill and the bluff, creating in effect a "Weyerhauser Canyon" which accentuates awareness of the mill. This contrasts with the spread out nature of the Isthmus Slough site. Whereas

the Isthmus Slough industrial development is visible from most of the hills facing the bay, it is far away. Weyerhauser is more hidden, but is viewed from very close up.

Plate 28 illustrates the conditions created by Weyerhauser. The buildings totally eclipse any view of the bay. The railroad fills the space between the highway and the buildings, and the highway itself acts as a barrier to contact with the bay. The Weyerhauser plant, like the Isthmus Slough industry emits a constant plume of smoke. It also utilizes the bay waters for log transport, sorting, and debarking, and requires a deep draft channel for shipping of cut lumber and chips.

The arguments developed in the discussion of "light industrial use" apply equally well to exclusive use of the bay frontage by heavy industry. The undesirable surroundings created by industrial activities (i.e. noise, smoke, operations) are worsened by sprawl and clutter, particularly in the Isthmus Slough area. A first step to improve the conditions of the bay shoreline would be for industry to clean up clutter and introduce vegetation to soften the starkness of the mill sites and screen industrial operations from adjacent activities. Pedestrian or auto access to the bay at points near industry could be incorporated into this clean-up effort. These points could also be vantage spots from which to view the water side of the industrial process. This includes shipping, log handling, the sorting process and other interesting aspects of the industry which would appeal particularly to tourism.

The above suggestions address one aspect of industrial use of the shoreline. There remains a more basic question as to the suitability of the present locations for heavy industry. These locations may be understandable when viewed in the context of their gradual evolutionary development. However, the cumulative effect of the modifications to the natural environment has been drastic, and is taxing the ability of the environment to absorb the shock. The size of the deep water channel has escalated over time. Advancements in technology and increased power have turned dredging practices, relatively harmless at a small scale, into major disrupters of the estuary. The biology section of this study deals directly with the effect of spoil deposits on estuarine productivity, and presents evidence illustrating the severity of that damage. Currently, there is pressure to deepen and widen the existing channel. To do so would result in more damage to the bay, and further entrenchment of the negative physical and aesthetic qualities commensurate with industry, particularly at the Isthmus Slough site.

To alleviate this, we recommend that dredging past McCullough Bridge be limited to maintenance levels only, and that no additional spoil be deposited in this portion of the bay. Removal of the third spoil island (Plate 28, left) has been recommended to improve the bay hydrology. Removal would also increase the biological productivity and improve the aesthetic quality of the bay. Chip ships create the biggest demand for a deeper channel. Consolidating the scattered chip

piles into one area on North Spit would decrease the demand for a deeper channel past that point. Shuttle barges could be utilized to haul chips from the different mill sites, thus eliminating increased pressure on roads. This measure would also remove the chip piles as obstacles to the natural view of the bay.

The North Spit-Jordan Cove area also seems to be a logical site for any future industrial expansion that might require deep water shipping facilities. It is located on the bay, is close to an existing railroad system, has adequate flat ground capable of supporting the anticipated building loads, is near a supply of industrial water (dunes), and is far enough away from the large population concentration so that inevitable industrial commotion would not be a hindrance. It seems feasible also that if such an industrial development ever did occur on North Spit, worker transportation to it could be provided by a shuttle ferry system. This would reduce the additional traffic volume that would have to be carried by McCullough Bridge. Heavy industry location on North Spit might also have some effect on the land use at the Isthmus Slough site. This site is optimally suited for cleaner light industry which could be developed as an industrial park. Any phasing out of heavy industry here, due perhaps to duplication or re-location at North Spit would open this site up for such development.

We acknowledge that some of the above recommendations are drawn from incomplete data at best, and that they may not be within the realm of immediate possibilities. However, they are a response to what we see as a dilemna facing Coos Bay. On the one hand, if the channel is enlarged to support industrial uses about the bay, the estuary environment suffers and ultimately (if not directly) the quality of human life suffers. This must be balanced against the economic theory that holds if the channel is not expanded, the economy suffers and consequently, so does the quality of life. The solution to this dilemna lies within a set of societal values. Historically, our society has opted towards visible, short-term economic gain--expediency--over an approach towards growth which is sympathetic to the natural environment. We are now, however, reaching a point in the earth's evolution when man can no longer afford to simply follow expediency. In the end, the earth supports us; we cannot afford to be short-sighted in our manipulations of it.



Plate 1: Coos Bay 1971. Bottom right to top left: [illegible] lands, industrial/commercial strip, residential, [illegible] commercial, airport, bay, North Spit, Pacific Ocean.



Plate 2: North Bend skyline seen from [illegible] Slough. Fog lies over the bay in the background.

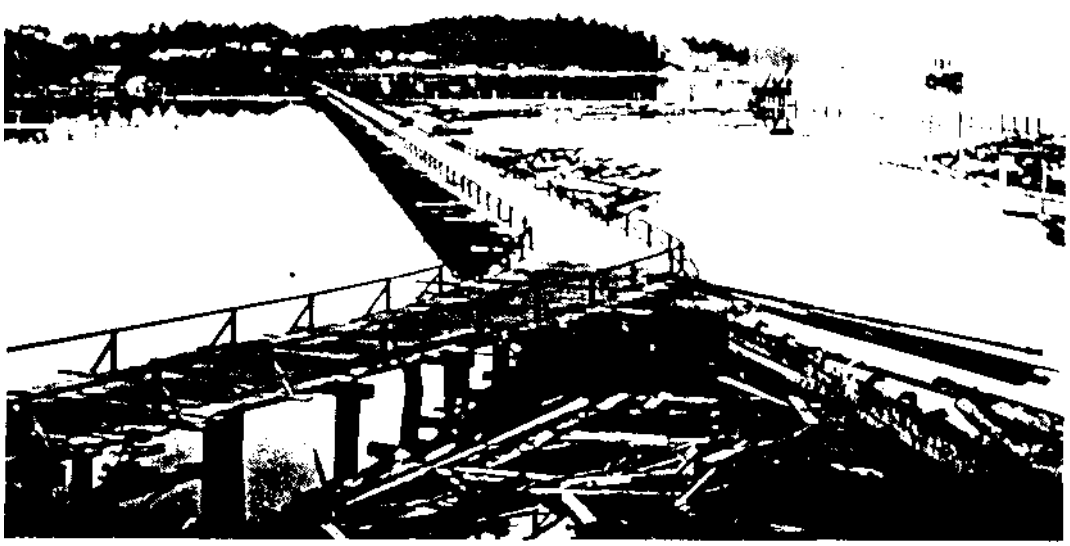


Plate 3: liirliway between North Hood and Coos Bay prior to 1900. Now H i i^{r},hway 10 t .

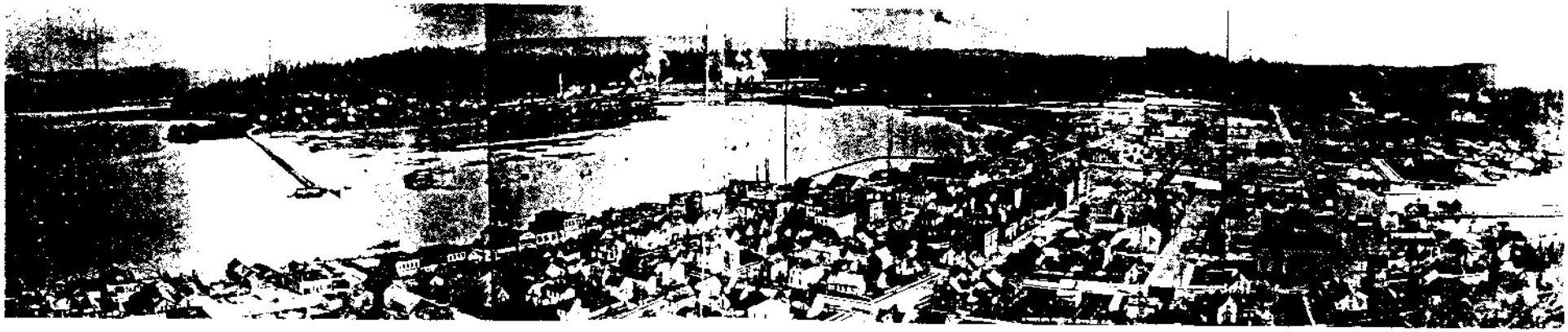


Plate 4: Town of Marshfield 1915. Note tideflat area, sloughs through town.



Plate 5: Town of Coos Bay 1971. White area is dredge spoil taken from channel.

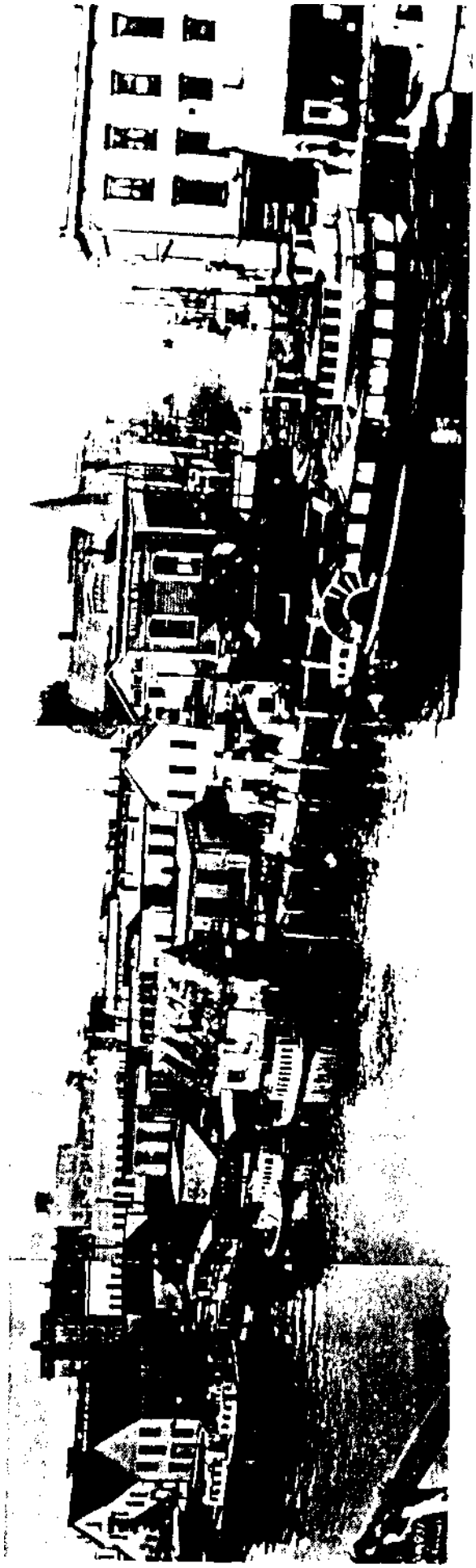


Plate 6: Marshfield waterfront, 1915.

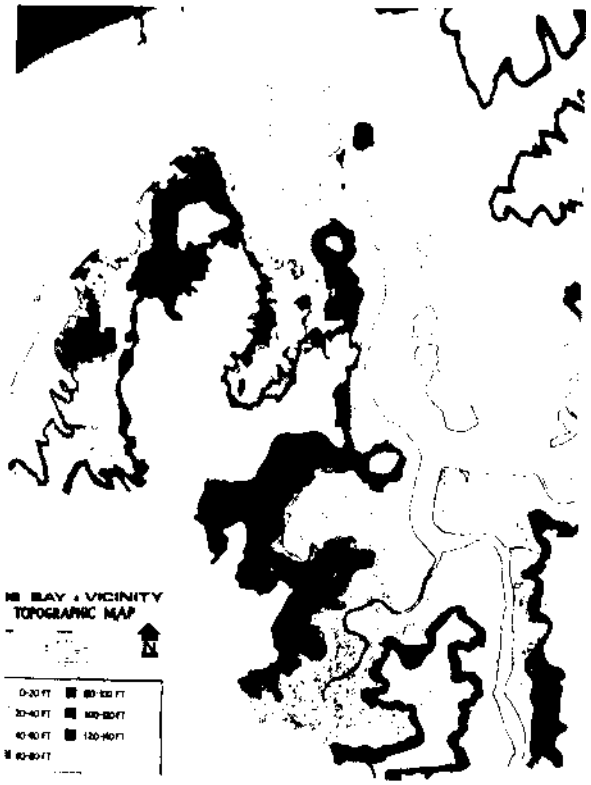


Plate 7: Topographic map.



Plate 8: Lope map.

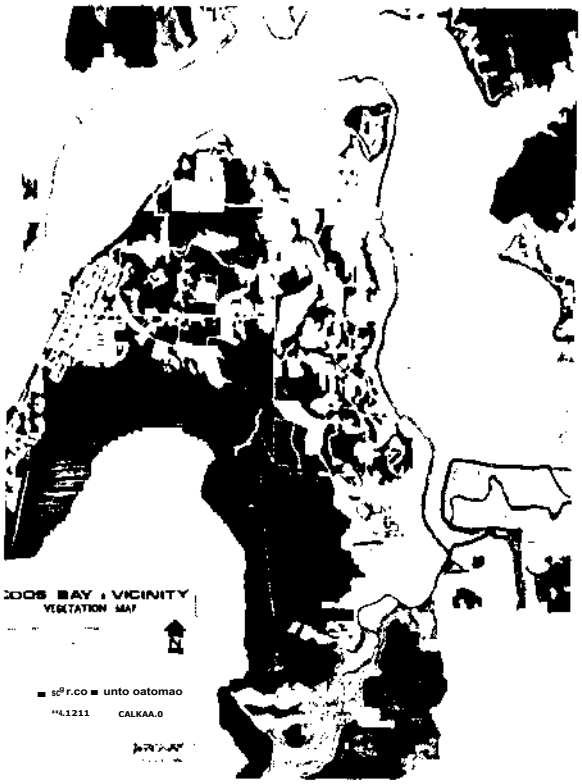


Plate 9: Vegetation map.



Plate 10: Soil map.

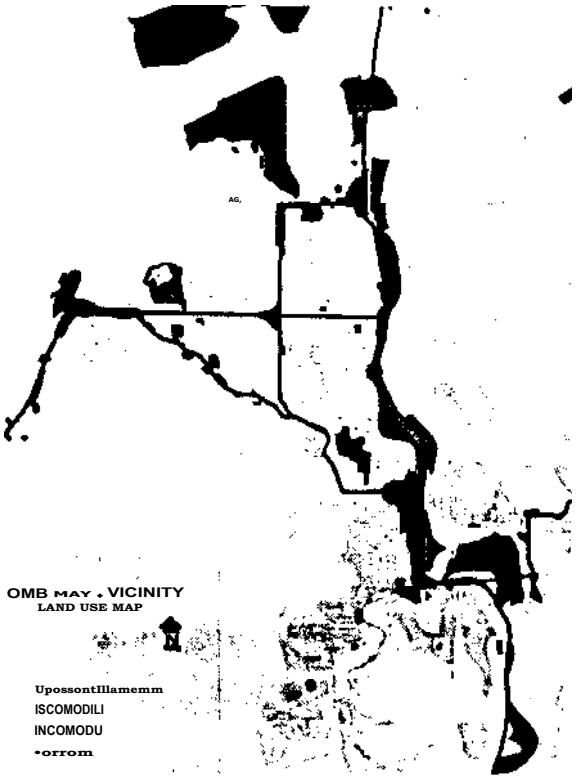


Plate 11: Land use map.

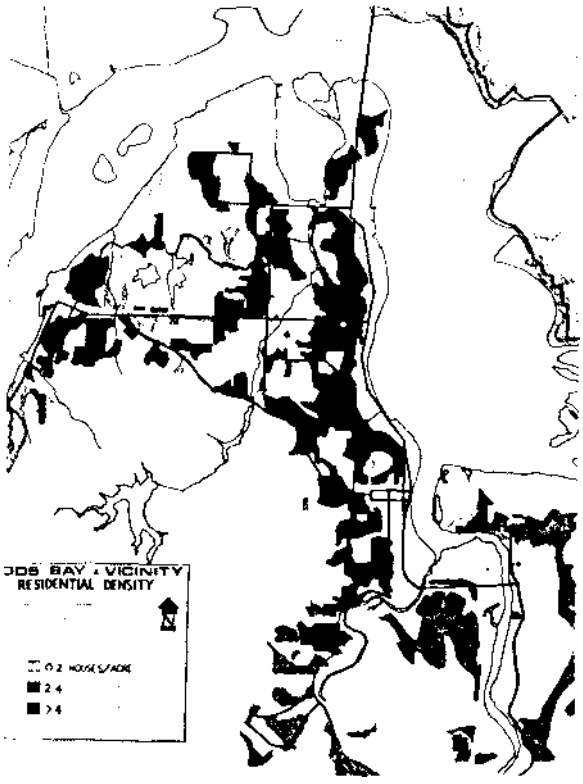


Plate 12: Residential density map.



Plate 13: [illegible] development [illegible], a result of removing vegetation and top layer of soil. Airport, Sony Slough and North Bend commercial district in back [illegible].



Plate 14: [illegible] business district. [illegible] in [illegible].

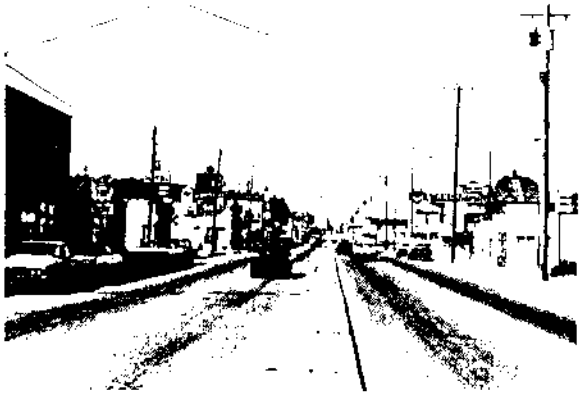


Plate 15: Coos Bay commercial strip.

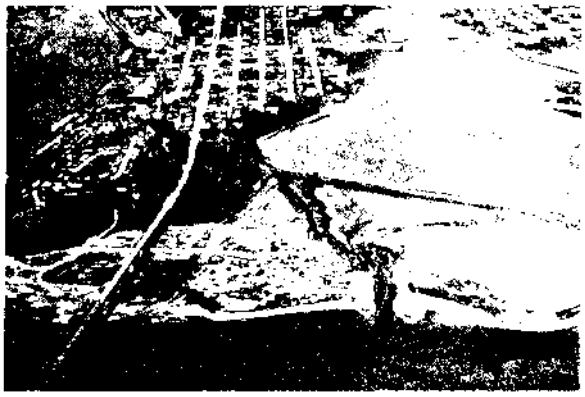


Plate 16: North Bend peninsula highway [illegible] right through main [illegible]. Log storage and [illegible] in foreground.



Plate 17: Coos Bay Mall, looking towards bay.





Plate 19: Tugboat docks, light industrial area.



Plate 20: Coos Bay turns its back on the bay.



Plate 21: Plan for integrating pedestrian access into the light industrial area and along waterfront.



Plate 22: Detail. From the mall. Path runs through open air market into industrial section (dotted line). Telegraph Hill at left.



Plate 23: Oil tanks juxtaposed with housing.



Plate 24: Industrial waterfront.



Plate 25: Industry at mouth of Isthmus Slough.

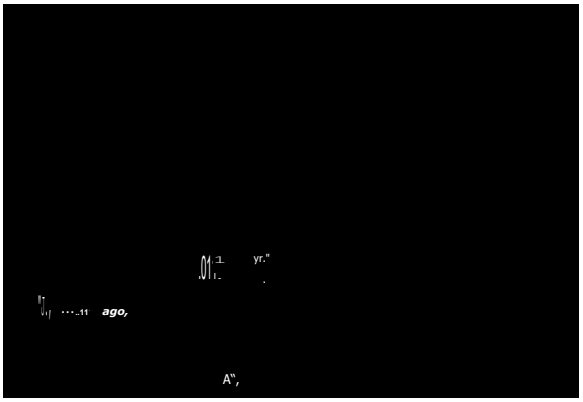


Plate 26: Industry at mouth of Isthmus Slough.

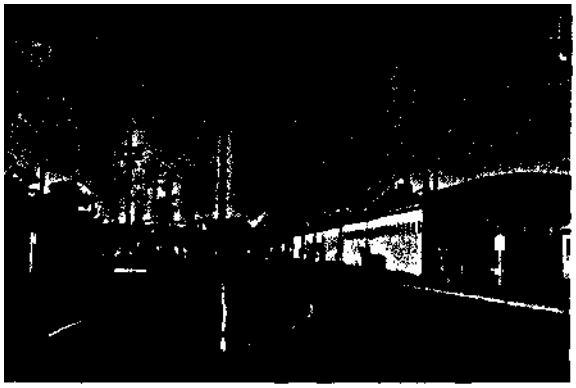


Plate 27: Weyerhauser industrial site.



Plate 28: Spoil islands and log storage.

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Communication with:

Coos County Historical Museum
Coos Curry Council of Governments
Coos County Soil conservation Service
Don Dilles, Weyerhauser
Engineering Department, North Bend
Ernie Manders, Menasha Corporation
Ernest Payne, Port of Coos Bay
Jim Whitty, Al Pierce Lumber Company
Planning Department, Coos Bay

CONCLUSIONS

CONCLUSIONS

We will not attempt to summarize the results of each research group, but rather present some of the conclusions which can be drawn from the project as a whole.

It seems obvious, due to the dependence of marine life on the tidal mudflats, that filling part of upper Coos Bay with dredge spoil will not only destroy a wealth of invertebrates but may jeopardize the well-being of crab and some species of fish. If spoil disposal within the bay continues, this practice may eventually have noticeable effects on commercial and recreational fishing.

Deleterious effects on clamming, crabbing, and sport fishing may also adversely influence the tourist industry. The economist suggests that this would not be a healthy economical situation. In view of the fact that it is not clear whether economic benefits from the Corps project will fall to a majority of people in Coos Bay, it seems wise to think twice about short-term results in relation to possible long-term consequences.

Of course, people of the greater Coos Bay community must decide whether the projected consequences of dredging and spoiling should be risked in favor of proposed economic gain. This may, in reality, occur via the action of any number of political entities which can exert influence. The psychologists have reported that a majority of people they interviewed are in favor of channel enlargement because it might

stimulate industrial and economic growth. This appears to be very important, since nearly 84% responding wanted more industry, primarily because it would increase employment opportunity and diversify the existing industrial base. On the other hand, the third and fourth rated advantages of living in the Coos Bay area were related to nature and recreation. The most frequent recreational activity listed was fishing.

It is difficult to assess whether the opinions people expressed about the benefits of channel dredging and bay enlargement were based on true feelings or were reiterations of information received through news media. At any rate, people seemed to be unclear about what the A.C.E. is actually proposing. This indicates a need for more extensive public education dealing with all aspects of the proposal before a decision is made. As pointed out by the psychologists, it is very important that this community education, once established, include a wide range of topics pertinent to local problems.

Some of the proposals for improved land use presented by the urban planners indicate that industrial growth and expansion may be possible without further channel enlargement. However, it is beyond the scope of this study to estimate whether this idea is realistic for the Coos Bay area at the present time.

This concluding statement has dealt with ideas concerned primarily with the A.C.E. proposal. The purpose of this study was not to criticize the Army Corps of Engineers, but to study relationships between man and the estuary. In fact,

there are many such relationships presented in the previous sections of this report. Unfortunately, the findings of each research group are so diverse that it is very difficult to integrate them into a cohesive whole. Each group has responded in some way to the Corps proposal, hence it is a logical thread with which to interrelate the disciplines.

One thing remains clear. We, as members of this project and as human beings, are just beginning to understand the long range impact that man's manipulations can exert on his environment. We must try to not be so hasty in looking for quick solutions to immediate problems that we fail to consider the significance of our actions.

APPENDIX A

PSYCHOLOGY

Coos Bay Community Study

Chadcst(m,orcgull 97420 Ph. -4297

tudent originated
:_11,iies program of the
'ationai Science Foundation

June 9, 1971

near Resident:

The National Science Foundation has recently funded a grant for the study of the Coos Bay Area. A portion of this grant will be used to stuay the ways 'n which families use the area for recreational and occupational purposes. The information gathered from this study will be made available to persons concerned with the future development of the Coos Bay area so that they might take the needs and desires of residents into consideration when they plan.

Your address has been randomly chosen as one to be included in the survey. This will give you the opportunity to have your voice heard in the future planning of your community.

The community survey will be conducted by students from Southwestern Oregon Community College, under the direction of the University of Oregon. One of these students will be coming to see you in the evening or on Saturday sometime within the next three weeks.

If you have any questions call 888-4297.

Sincerely yours,

C-3-4•-) (L

Annette VanDecar
Community Study Coordinator

AVD:kle

COOS BAY COMMUNITY STUDY

NSF/SOS/U OF 0/01MB

SUMMER 1971 Psychology

Interviewer _____ Date Time Residence Code _____ Length of Interview _____

I. HOUSEHOLD INFORMATION

1. Number of people in your family _____

2.

Family Member	Age	Sex	Living at Home YES	Living at Home NO	Respondent	Level of Education
Man _____			❑	❑	❑	
Lady _____			❑	❑	❑	
Cl			❑	❑	❑	
C2 _____			❑	❑	o	
C3 _____			❑	❑	❑	
C4 _____			❑	❑	❑	
C5 _____			❑	❑	❑	_____

3. How long have you lived in Coos Bay _____ 4. Moved Here _____ Life _____

5. From where _____ 6 How long do you plan to stay _____

II. OPINIONS ABOUT COMMUNITY

Advantages of Living in Coos Bay, in Order of Importance	Things You Would Like to See Improved, in Order of Importance.
1 _____	1 _____
_____	2 _____
_____	3 _____
4 _____	4 _____
5 _____	5 _____

III. ARMY CORPS PROPOSAL

1. Are you familiar with it? YES ❑ NO ❑ GOOD ❑ BAD ❑

2. *Where* did you first hear about it? _____

3. What does the "ACE" intend to do to the Bay? _____

4. Do you think the shipping channel should be enlarged? ❑ Or left as it is? ❑

5. What effect do you think enlargement of the channel would have on the ecology of the Bay? _____

6. Do you think enlargement of the channel will have any effect on

INDUSTRY	Increase	❑	Decrease	❑	No Effect	❑	Good ❑	Bad ❑
TOURIST TRADE	Increase	❑	Decrease	❑	No Effect	❑	Good ❑	Bad ❑
FISHING	Increase	❑	Decrease	❑	No Effect	❑	Good ❑	Bad ❑
ECONOMY	Stimulate	❑	Depress	❑	No Effect	0		
JOB MARKET	More Jobs	❑	Fewer Jobs	❑	No Effect	0		
POLLUTION LEVEL	Higher	❑	Lower	❑	No Effect	0		
POPULATION	Increase	❑	Decrease	❑	No Effect	❑	Good ❑	Bad ❑
SHELLFISH	Increase	❑	Decrease	❑	No Effect	0		
OTHER _____	Increase ❑		Decrease ❑		No Effect ❑		Good ❑	Bad ❑

7. Which of these should be most emphasized by community planners? _____

v INDUSTRIAL DEVELOPMENT

it! cununnity leaders attempt to bring more industr y into Coos Bay? YES NO Why?

What would be some of the effects of more industry in the area?

Good Bad

1) Good U Bad

Good u Bad

(I Good U Bad

Good ❑ Bad

3 Which of these is most important? _____

4 Who should be responsible for establishing regulations to control pollution?

Self Regulating (11 City ❑ County U State ❑ Federal U

5 What is the most important issue in local politics?

6. What person, group, or organization has the most influence in local politics? _____

V. RECREATIONAL ACTIVITIES

1 Respondent

Activity	Season	Frequency	Location Transportation	$ Equipment	No. Participants
	F W Sp Su				
	F W Sp Su				
	F W Sp Su				
	F W Sp Su				

2. Spouse

Activity	Season	Frequency	Location Transportation	$ Equipment	No. Participants
	F W Sp Su				
	F W Sp Su				
	F W Sp Su				
	F W Sp Su				

3. Which of these would you be least willing to give up? _____

4. Which of these would you be most willing to give up? _____

5. How many fish, crabs, and clams do you bring home in a year?

a_ Number _____ h_____ Number

c_____ Number _____ rl_____ Number

6. Proportion of meat budget O ❑ 1/4 ❑ 1/2 ❑ 1/4 ❑ All ❑ made by the above?

7 What type of game and how many of each type did you bring home in a year?

a a Number _____ b_____ Number

c _____ Number _____ d_____ Number

e ___ _____ Number _____

8. Proportion of meat budget O ❑ 1/4 ❑ 1/2 ❑ % ❑ All ❑ made by the above?

VI. **OCCUPATION**

1 How would you rate the economic situation in Coos Bay? Very Good ❑ Good ❑ Bad ❑ Very Bad 0

2 What action should be taken to improve the economic climate of the community? _____

3 Respondent's occupation _____ Firm _____ Years Worked _____

Share of income % ❑ % ❑ A11 ❑

Spouse's occupation _____ Firm _____ Years Worked _____

Share of income % ❑ 1/2 ❑ % ❑ All ❑

5 Income Catagory—How Many Persons Contribute? _____

4000 or less ❑ 4000 to 8000 ❑ 8000 to 12000 ❑ 12000 to 20000 ❑ over 20000 ❑

Coos Bay Community Study

NSF/SOS/U of 0/0IMB Summer 1971

Interviewer Instructions

(INTRODUCTION)

Hello, my name is . I'm working with the Coos Bay Area Community Survey Team, under the direction of the University of Oregon. Are you the lady/man of the house?

(BE SURE THAT RESPONDENT IS EITHER THE MAN OR LADY OF THE HOUSE)

You may have read about us in the newspaper. We're asking residents in the area to supply us with information concerning the ways in which they use the area for economic and recreational purposes. All this information will be made available to agencies concerned with the future development of the Coos Bay area. Would you mind allowing me about 40 minutes of your time so that your answers might also be included?

Thank you. By the way, we're interested only in obtaining general information about area residents *as a* whole, and you'll remain completely anonymous. Your address was chosen at random. (SHOW RESP. ADDRESS CARD) To assure that there'll be no way to find out exactly whose answers these are, I'll tear up this address card after the interview is completed.

I

1. How many persons are there in your immediate family?

2. Could you please list each household member by their sex, age, and whether or not they live at home. (TO MAKE YOUR MEANING CLEAR, SHOW RESP. THE FAMILY SECTION OF THE ANSWER SHEET. MARK RESP. BLANK, AND GET ED. LEVEL)

3. How long have you, personally, been living in the Coos Bay area?

4. You moved here, then, or have you been here all your life?

5. How long do you plan to stay?

II. These following questions are designed so that you might express your opinions concerning life in the Coos Bay Area.

1. First, what--in your opinion--are some of the advantages to living in the Coos Bay area? Please try to list these in order, beginning with what you feel is the largest advantage. (CONDENSE EACH RESPONSE, CHECKING WITH RESP. TO ASSURE YOUR ACCURACY)

2. Are there any things about the area that you think need improvement? If so, could you please list these in the order of their importance. (CONDENSE: CHECK ACCURACY WITH RESP.)

---

1. The Army Corps of Engineers has proposed an enlargement of the Coos Bay shipping channel. Are you familiar with this proposal?

2. Where did you first hear about it?

3. What is your opinion of this proposal?

4. As far as you know, what is it that the Army Corps intends to do?

5. In your opinion, should the shipping channel be enlarged or not?

6. What is the reason for your having this opinion?

7. If this plan to enlarge the ship channel is carried out, what effect do you think this might have on the ecology of the bay(i.e. minimal, very harmful, etc.),

8. What effect, if any, will enlargement of the shipping channel have on:

   a. Industry (Increase, Decrease, Have no effect; is this effect good or bad)
   b. Tourist Trade (Increase, Decrease, No Effect; good or bad)
   c. Fishing (Increase, Decrease, No Effect)
   d. Economy (Stimulate, Depress, No Effect)
   e. Job Market (More Jobs, Fewer Jobs, No Effect)
   f. Pollution Level (Increase, Decrease, No Effect)
   g. Population (Increase, Decrease, No Effect; good, bad)
   h. Shellfish (Increase, Decrease, No Effect)
   i. Is there anything else that you think might be effected by port enlargement? (PROBE FOR GOOD, BAD)

9. All things considered, what factor is it that you think should be most emphasized by community planners?

IV.

1. In your opinion, should community leaders attempt to bring more industry into the Coos Bay Area?

2. What is the reason for your opinion?

3. What would be some effects of increased industry in the community? (FOR EACH EFFECT MENTIONED, PROBE FOR GOOD, BAD.)

4. Which of these do you think is the most important to consider?

5. Who do you think should be responsible for establishing regulations to control industrial pollution? (Industrial Self-Regulation; Local Government; State Government; Federal Government)

6. What is it that in your opinion is the most important issue for area politicians to face?

7. In your opinion, what person, group or organization has the most influence in area politics?

V. The following questions concern the recreational activities of your husband/wife and yourself; that is, the sorts of things you do for enjoyment rather than income. This information will be helpful in planning future recreational sites. Let's start with your own activities.

1. What recreational activities do you do most often? (LIST ACTIVITIES IN APPROPRIATE BLANKS, THEN ASK THE FOLLOWING QUESTIONS CONCERNING EACH ACTIVITY TO WHICH THEY APPLY)

   a. In what season or seasons--fall, winter, spring, summer--do you most often engage in this activity?
   b. How many times during the year would you say you do this?
   c. Where do you most often do this? Here is a map of the area. As you can see, it's gridded to help me pinpoint your answer. If the area you've mentioned is on this map, please point it out.
   d. When you do this, what sort of transportation do you use? For instance, do you walk or drive. If you drive, what kind of vehicle do you use (i.e. dune buggy, family car, trail bike, boat)
   e. Do you own any special equipment that you use for this activity? If so, would you please combine the values of these into a single dollars and cents figure. (WHEN CONCERNED WITH EQUIPMENT FOR SUBSEQUENT ACTIVITIES, BE CERTAIN THAT ONLY VALUE OF EQUIPMENT PARTICULAR TO THAT ACTIVITY, AND NONE WHICH HAS BEEN MENTIONED EARLIER, IS INCLUDED BY RESP. IN HIS ESTIMATE)

2. What recreational activities are most often engaged in by your husband/wife?
(USE SAME FORMAT FOR EACH ACTIVITY MENTIONED HERE AS WAS USED CONCERNING RESP.)

3. Considering again all your own recreational activities; which of these would you be most willing to give up? Least willing to give up?

(IF FISHING WAS MENTIONED)

4. Can you tell me the types of fish, crabs, or clams, along with the approximate number of each, that were brought home from recreational fishing in this area during the past year? (EMPHASIZE THAT FISH CONSIDERED SHALL HAVE BEEN CAUGHT WITHIN THE AREA ON THE MAP)

5. Considering your household's overall annual meat consumption, how much of this would you say is made up of the fish, crabs or clams you've just mentioned (Very Little; About ¼; About 1/2; More than)

(IF HUNTING WAS MENTIONED)

6. Can you tell me the types of game or fowl that were brought home from hunting in this area--including the approximate number of each--during the past year. (AGAIN, EMPHASIZE THAT THE HUNTING IS IN THIS AREA)

7. Consider all your household's overall meat consumption; how much of this would you say is made up of the game or fowl you've just mentioned (Very Little; About k; About 1/2; More Than 1/2)

VI.

1. What is your opinion of the present economic situation in the Coos Bay Area? (Very Good; Good; Bad; Very Bad)

2. What action, if any, shoutd be taken to improve the economic life of the area?

The questions that follow concern the occupations and income level of you and your husband/wife. We're asking you to offer this information so that the financial flexibility of residents might also be considered in future community developments. As I've mentioned before, all the information you offer is confidential.

3. Do both you and your husband/wife work?

4. What is your occupation? (PROBE FOR SPECIFICS; i.e. LOG TRUCK DRIVER RATHER THAN JUST "LUMBER")

5. For what firm are you employed?

6. Considering your household's overall annual income, about what portion of this is your contribution? (About t; About 1/2; More than 1/2)

7. What is the occupation of your husband/wife? (PROBE)

8. For what firm is he/she employed?

9. Considering your household's overall annual income, what portion of this is the contribution of your husband/wife? (About 1/4; About 1/2; More than 1/2)

10. Here are six general income categories. (SHOW CAT. TO RESP.) Would you please indicate the one in which your household's annual income is included? Please include in your estimate the income of each contributing member.

APPENDIX B

URBAN PLANNING

INVENTORY 0F. SHORELINE CONDITIONS FROM EMPIRE CITY LIMITS TO BRIDGE ACROSS ISTHMUS SLOUGH

(Figures indicate linear feet of shoreline)

I. Loose Residential

Characterized by fisherman's shacks, decrepit buildings, no street improvements.

Empire	2,000 feet
North Bend	400 feet
TOTAL	2,400 feet

II. Limited Access Open Space

Characterized by undeveloped shoreline, relatively natural conditions, brush and scrub.

Empire	7,800 feet
Airport	10,000 feet
North Bend	4,000 feet
TOTAL	21,800 feet

III. Accessible Open Space

Characterized by improvements, access paths or trails, direct views of the bay.

North Bend	3,300 feet
Coos Bay	3,200 feet
TOTAL	6,500 feet

IV. Tight Residential

Characterized by improved streets, permanent housing

Empire	1,800 feet
North Bend	2,500 feet
Coos Bay	700 feet
TOTAL	5,000 feet

V. Commercial

Characterized by commercial uses such as antique shops, second-hand stores, restaurants, motels, bars, sporting goods, marinas, gas stations, small business, etc. This category includes those uses which are not directly adjacent to the bay but which are in intimate visual contact with it.

Empire	1,900 feet
North Bend (and Pony Slough)	2,600 feet
Coos Bay	5,000 feet
TOTAL	9,500 feet

VI. Built Industrial

Characterized by buildings, docks, storage facilities, 9,500 feet of dock facilities are included in these figures.

Empire	2,100 feet
North Bend	7,800 feet
Coos Bay	6,400 feet
TOTAL	16,300 feet

VII. Open Industrial

Characterized by unenclosed industrial activity such as log storage, gravel areas or vacant land in industrial areas.

Empire	500 feet
North Bend	6,400 feet
Coos Bay	3,900 feet
TOTAL	10,700 feet

Soil Name: Westport loamy sand; 0-12% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Slight to moderate

   Some slopes greater than 7%; SM material; excessively drained

2. Septic tank absorption fields - Moderate

   Slopes up to 12%; excessively drained (potential groundwater pollution)

3. Local roads and streets - Moderate or slight

   Slopes up to 12%

4. Recreation

   Camp areas - Moderate

   Slopes up to 12%; loamy sand surface

   Picnic areas - Moderate

   Loamy sand surface; slopes up to 12%

   Paths and trails - Moderate

   Loamy sand surface

Subject to blowouts if surface layer removed.

APPENDIX C

URBAN PLANNING

The following information has been used to evaluate where possible the appropriateness of a given land use to a soil type. It was obtained from the U.S.D.A. in Coquille. The soil interpretations are advanced copies and are subject to change.

"Suitability ratings of good, fair, poor, and unsuitable are given by soil mapping units for several uses. Limitations ratings, of slight, moderate, and severe are shown for several other uses. Good suitability or slight limitations do not require any special planning, design, or management, or there are restrictions that are easy to overcome. Fair suitability or moderate limitations have restrictions that can be overcome with planning, careful design, and good management. Poor suitability or severe limitations indicate that the use is doubtful and, generally, unsound."

Soil Name: Westport loamy sand, 12-30% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Moderate to severe

   Slopes greater than 12%; SM material - subject to wind erosion; excessively drained

2. Septic tank absorption fields - Severe (?)

   Slopes over 12%; excessively drained; potential ground-water pollution

3. Local roads and streets - Moderate

   Slopes over 12%

4. Recreation

   Camp areas - Severe

   Slopes over 12%; loamy sand surface

   Picnic areas - Severe

   Slopes over 12%; loamy sand surface

   Paths and trails - Severe

   Slopes over 12%; loamy sand surface

Subject to blowouts if surface layer removed.

Soil Name: Westport loamy sand; 0-12% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Slight to moderate

   Some slopes greater than 7%; SM material; excessively drained

2. Septic tank absorption fields - Moderate

   Slopes up to 12%; excessively drained (potential groundwater pollution)

3. Local roads and streets - Moderate or slight

   Slopes up to 12%

4. Recreation

   Camp areas - Moderate

   Slopes up to 12%; loamy sand surface

   Picnic areas - Moderate

   Loamy sand surface; slopes up to 12%

   Paths and trails - Moderate

   Loamy sand surface

Subject to blowouts if surface layer removed.

Soil Name: Templeton silt loam (and similar soils)

30-50% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Severe

   Steep slopes (over 12%); variable depths to bedrock

2. Septic tank absorption fields - Severe

   Slopes over 12%; moderate permeability

3. Local roads and streets - Severe

   Slopes over 12%; ML material

4. Recreation

   Camp areas - Severe

   Slopes over 30%

   Picnic areas - Severe

   Slopes over 30%

   Paths and trails - Severe

   Slopes over 30%

Soil Name: Templeton silt loam (and similar soils)

12-30% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Severe

   Steep slopes (over 12%); variable depths to bedrock

2. Septic tank absorption fields - Severe

   Slopes over 12%; moderate permeability

3. Local roads and streets - Severe

   Slopes over 12%; ML material

4. Recreation

   Camp areas - Severe

   Slopes over 12%

   Picnic areas - Severe

   Slopes over 12%

   Paths and trails - Moderate

   Slopes 12-30%

Soil Name: Dement silty clay loam (and other similar soils)

12-30% slopes

Soil Interpretations:

Limitations for:

1. Dwellings without basements - Severe

   Slopes over 12%; moderate shrink - swell potential

   ML or CL material

2. Septic tank absorption fields - Severe

   Slopes over 12%; moderate to slow permeability

3. Local roads and streets - Severe

   Slopes over 12%; ML or CL material; moderate shrink - swell potential

4. Recreation

   Camp areas - Severe; slopes over 12%

   Picnic areas - Severe; slopes over 12%

   Paths and trails - Moderate

Soil Name: Dement silty clay loam (and other similar soils)

0-.12% slopes

Soil Interpretations:

Limitations for:

1. Dwellings without basements - Moderate

   Some slope over 7%; moderate shrink - swell potential

   ML or CL material

2. Septic tank absorption fields - Moderate to severe

   Slopes up to 12%; moderate to slow permeability

3. Local roads and streets - Moderate

   Slopes up to 12%; ML or CL material; moderate shrink - swell potential

4. Recreation

   Camp area - Moderate; slopes up to 12%

   Picnic areas - Moderate; slopes up to 12%

   Paths and trails - Moderate

Soil Name: Bullards sandy loam, 7-12% slopes

Soil Interpretations:

Limitations for:

1. Dwellings without basements - Moderate (slopes over 7%)
2. Septic tank absorption fields - Moderate (slopes over 7%)
3. Local roads and streets - Moderate (slopes over 7%)
4. Recreation

   Camp areas - Moderate (7-12%)

   Picnic areas - Slight

   Paths and trails - Slight

Soil Name: Coquille silt loam, 0-1% slopes

Soil Interpretations:

Limitations for:

1. Dwellings - Severe

   Very poorly drained, seasonal water table, moderate to high shrink - swell potential
2. Septic tank absorption fields - Severe

   Very poorly drained, slow permeability
3. Local roads and streets - Severe

   Very poorly drained, moderate to high shrink - swell potential, CL material
4. Recreation

   Camp areas - Severe

   Very poorly drained, very slow permeability

   Picnic areas - Severe

   Very poorly drained

   Paths and trails - Severe, very poorly drained

Soil Name: Bandon sandy loam, 0-7% slopes

Soil Interpretations:

Limitations for:

1. Dwellings without basements - Slight
2. Septic tank absorption fields - Moderate

   Slowly permeable layer within 40 inches of surface
3. Local roads and streets - Slight
4. Recreation

   Camp areas - Moderate (slow permeability)

   Picnic areas - Slight

   Paths and trails - Slight

Soil Name: Bandon sandy loam, 7-12% slopes

Soil Interpretations:

Limitations for:

1. Dwellings without basements - Moderate (slopes over 7%)
2. Septic tank absorption fields - Severe (slopes over 7%)

   Slowly permeable layer within 40 inches of surface
3. Local roads and streets - Moderate (slopes over 7%)
4. Recreation

   Camp areas - Moderate (7-12% slope), slow permeability

   Picnic areas - Moderate (7-12% slope)

   Paths and trails - Slight

APITADIX D

BIOLOGY

1. Average sample composition in each of the "subsystems".

Weights in grams/m2. (Macrofauna invertebrates only)

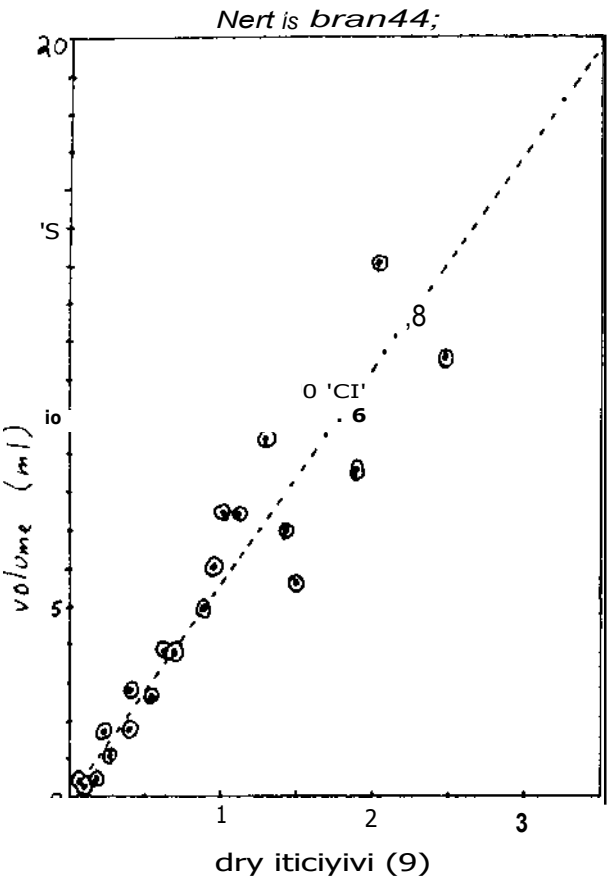
Organism	Subsystem 1	/I	III	IV
Mya arenaria	3.02	.97	17.28	39.20
salmanea	1.69	3.95	2.02	2.27
Macoma baltica	.71	1.95	.91	.61
Clam total	6.19	6.94	24.72	42.73
Nereis brandti	1.25	2.89	1.60	5.42
Heteromastus f.	2.26	2.48	1.88	2.49
iteone lighti	.53	1.04	1.62	1.08
CUIEXELWL	■••67	66	1.04	1.9J
Worm total	4.91	7.07	6.14	10.90
Corophium s.	.71	2.62	2.05	3.53
Anisogammarus c.	.24	.00	.05	.32
Haustorius sp.	.01	.01	.03	.01
nther amphtpruis	....31)	.O	44	.115.
Amphipod total	1.06	2.63	2.13	3.91
Cancer magister	,00	.00	.00	1.55
Oallianassa c.	.34	.00	1.56	.00
Tectibranch (?)	.07	.16	.01	.49
Total biomass	12.97	16.75	34.72	59.85
Number of samples	38	16	9	11

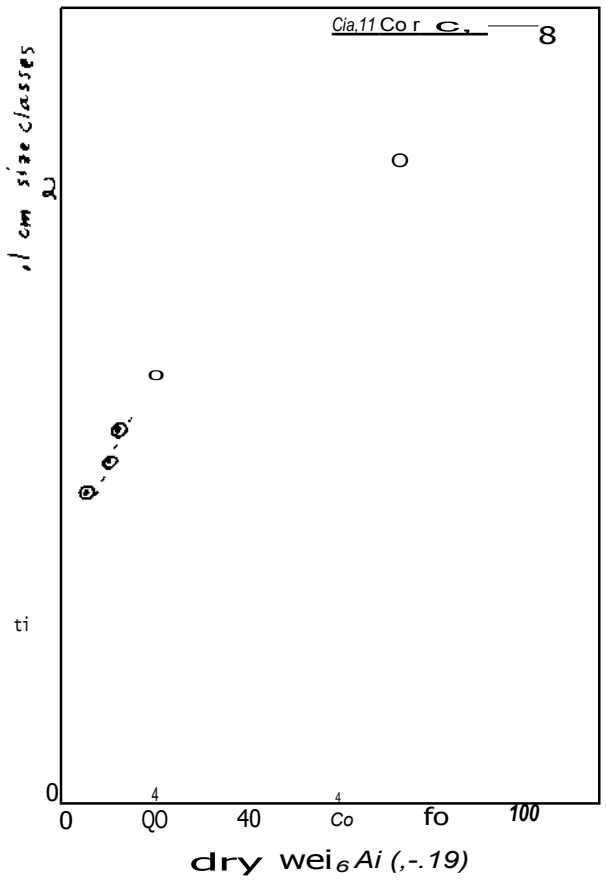
Subsystems are defined in narrative and mapped.

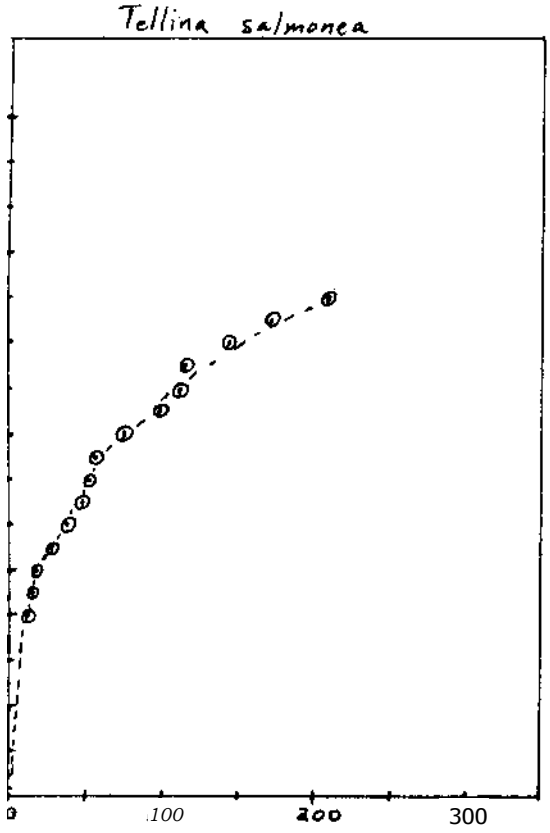
Briefly, they may be characterized as:

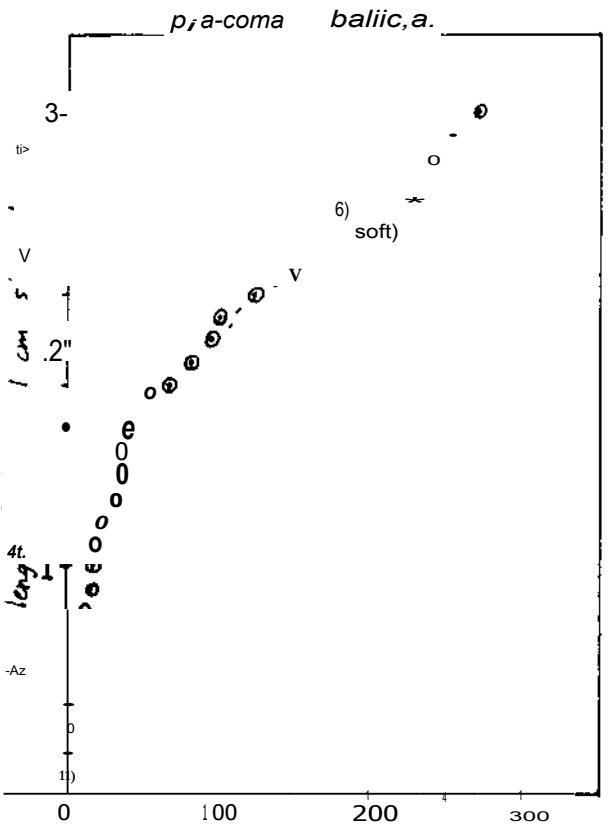
1. near spoil islands, sandy substrate, high elevation.
2. gloppy mud **without** eelgrass.
3. areas with **spars**e to medium density eelgrass.
4. areas with dense eelgrass covering.

f';1. 3 *Lev* y f1 **tv'e;**91, f a. d Volume - Weight **Re** ***;p5***









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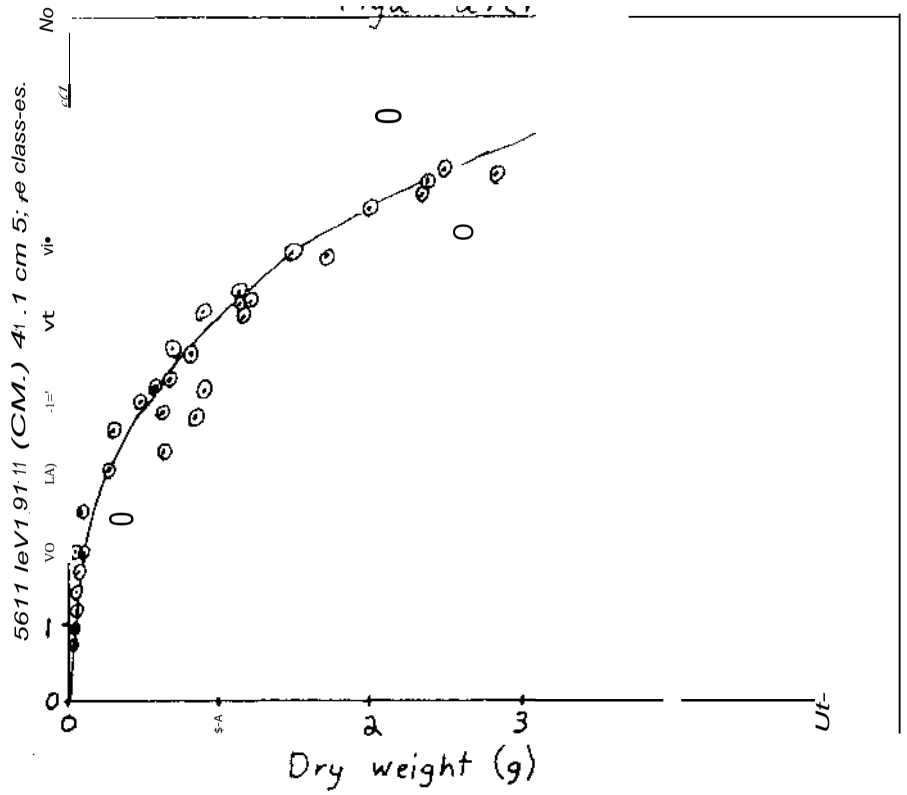

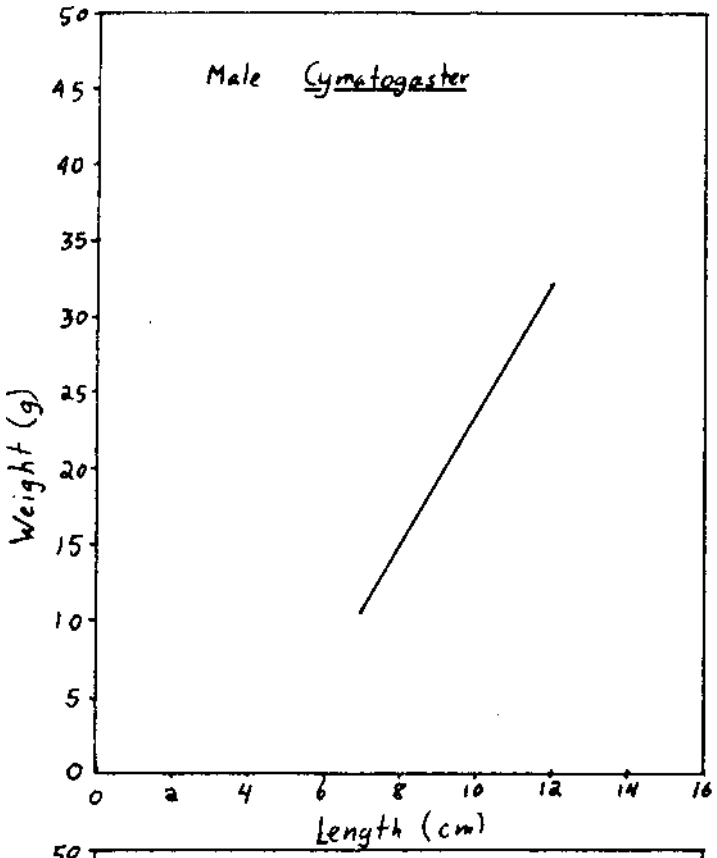
Male Cymatogaster
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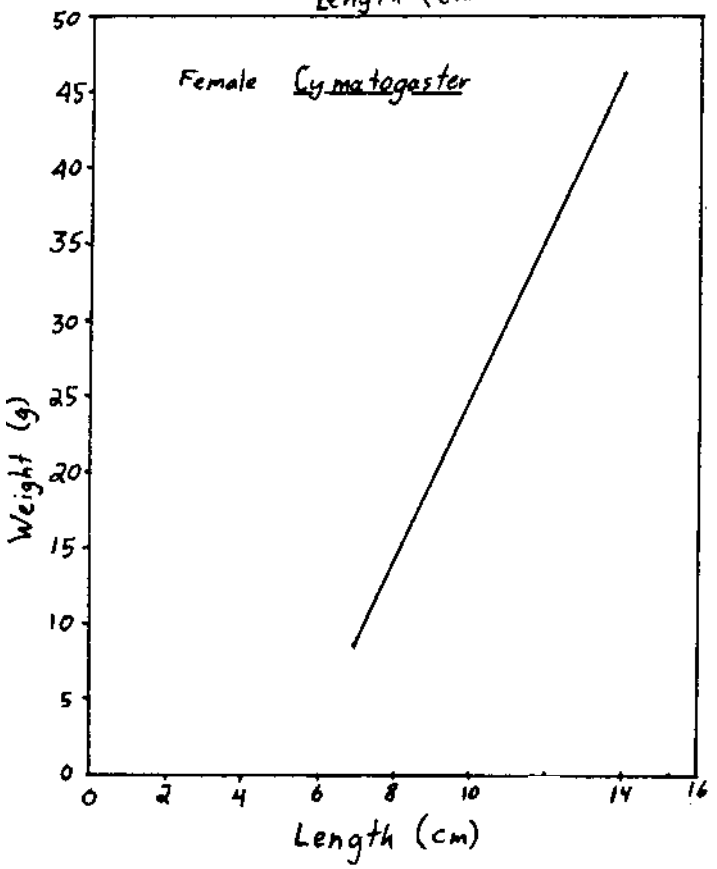
Female Cymatogaster
Weight (g)
Length (cm)
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hods	4.14	3.57	1.85	4.54	0.83	4.50	1.89	1.06	0,66	0.50
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T0TAL FTMASS, C(NTTIVED

[α]n rni P	*25,79*	30,70	35,70	4o,65	40,70	40,80	40,85	40,90
'.ro,-ms	19.36	4.01	3.05	2.70	5.98	12.48	16.20	2.87
r-1airc	6,41	5.03	3.92	5.72		16.18	5,86	15.42
Ammh i mod	5,30	4,23	4,11	1.12	3.31	0.53	1.15	0.03
Fish	0,00	0.00	0.00	0.00	0.00	0.20	0.05	0.25
rri ' stacea	0 .00	0.00	0,00	0.00	0.00	0.00	0.00	0,00
other	1.39	1.31	1.31	0.00	0.00	0.00	0.00	0.00
Total Animals	32.55	14.52	12.39	9.54	9.29	29.39	23,27	18,57
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	6.11	4.71	3.92	4.58	20.15	21.15	3.89	7.46	43.41	106.07
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-ris	19.26	4.18	3.69	1.95	1.54	3.95	1.40	4.78	6.38	2.53
firs	44.69	33. 94	3.16	2.55		0.4	2.39	13.62	5.R1	2.43
n-innds	5.03	3.41	2.98	1.16	0.10	5.7	0.33	1.06	3 , 94	n,P0
,h	0,00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
stacea	4.47	2.80	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
pr	1.33	1.88	0.00	0.00	0.00	0.0	1.31	0.00	0.00	0.00
ai Animals	74.77	46.27	9.83	5.66	1.64	10.1	5.43	19.46	16.13	5,85
nts	490,40	215.20	A 36.3	7.00	E 8.16	Es-/N 0.52	A 8.16	1.56	52.48	A 0.PR
a1 iomass	564.00	261.50	46.15	12.66	9.80	10. 1	13.59	21.02	68.61	6.73

TOTAL FIOYASS, CONTTNPED

'arnle	-21,30	-22,0	-23,0	-23,30	-36,19	-36,20	-36,21	-36,22	-3[6],23	-36,,x.
Worms	3.6	2.35	0.00	o.9•	2.18	6,41	6,64	0.35	5.4g	6.1(
Cl.ams	9,P7	2.04	0.00							32.31
/^mrhin^ds	0,43	0.03	0.00							0.0(
Fish	0.00	0.00	0.00		0.00					0,n(
Cr,^st.acea	0.00	0.00	0.00		0.00	12.76				0.0(
Other	0.00	0.00	0.00		0.00	0.0				0.0C
To+,al Animals	13.76	4,42	0.m		2.42	26.1				38.7'
Plant	5,40	0.00	0.00	18•.40	o.o0	0.00	37.60	0.00	170.40	5.6i
Total piomas	19.36	4.42	0.00	192.03	2.42	26.14	66.76	1.95	1P7.30	584.4;
– qpmrie	-36,25	-39,0	-40,0	-40,30	-41,0	-41,3$	-42,0	-42,30	-43,0	-44,,
'dorms	2.40	0.70	3.31	11.35	9.50	11.1	9.92	10.47	7.92	P.9.
Clams	5.06	0.06	3.28	32.3	6,90	11.3'	3.50	10.21	2.60	4,5
Amnhinods	0.03	0.22	0.03	0.00	2.53	0.01	2.72	0.28	1.97	0.0
wish	0.00	0.00	0.00	0.06	0.00	0.0•	0.06	0.00	0.00	0.0
cr[y]stacea	0.00	0.00	0,00	0.00	0.00	0,01	0.00	0.00	0.00	0,0
Other	0.00	0.44	0.00	0.00	0.00	0.01	0.00	0.02	0.04	0.0
Total Animals	7.49	1.42	6.62	43.76	18.93	22.4'	16,20	20.98	12.62	13.5
Plants	A 390.00	A845.88	A 8.80	A217.16	A 252,24	A 60.01	16.16	A236,16	A244.84	4189.3
Total piomAss	397,49	847.30	15.42	260.9.	271.17	82.4	32.36	257.14	257.46	202.P

TOTAL BIOMASS, CONTINUED

	-45,0	-45,30	-46,0	_46,27	-46,30	-47,0	-44 , 30
rms	3.31	3.29	0.00	4.22	6.to	10.31	0.00
ams	0.09	2.71	0.00	40.82		1.61	2.11
	0.00	0.00	0.00	1.19	0.00	0.00	0.00
	0.00	0.00	0.00	o.oo	0.00	0.00	0.00
5,6cstacea	0.00	0.00	0.00	i4.oc	0.00	o. 00	0.00
	0.414	0.12	0.00	0. 00	0.00	0.07	15 . 41
tal Animals	3. 94	6„n	0.00	60.23	6.10	11.90	17.52
nts	1103.60	1129P.oo	171,76	0.00	o.00	1.08	354.40
Piomass	127 .44	304.06	71.76	60.23	6 .1 0	13.07	371 . 90