COASTAL RIVERS INVESTIGATIONS

INFORMATION REPORT 70-11

# Fish in Coos Bay, Oregon, with Comments on Distribution, Temperature, and Salinity of the Estuary

Ed Cummings
Oregon Fish Commission

and

Ed Schwartz
Oregon Game Commission

Oregon Fish Commission
Research Division

January 1971

TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

# Fish in Coos Bay, Oregon, with Comments on Distribution, Temperature, and Salinity of the Estuary 1/

## INTRODUCTION

Personnel of the Oregon Fish Commission (OFC) and the Oregon Game Commission (OGC) sampled various stations of Coos Bay, Oregon, from June through September 1970 to define areas used by the several species of fish in the bay. This effort was supplemented by students at the University of Oregon Institute of Marine Biology (OIMB) who sampled the main channels with an otter trawl and observed animals on the tide flats. Our primary interest was in the distribution of shad and striped bass but other species dominated catches throughout the sampling period.

Available information from previous reports and observations has been included in this report.

## DESCRIPTION OF AREA

Coos Bay is shaped like a horseshoe, open to the south, with the ocean jetties at the west and the river at the east toe of the shoe (Figure 1). Major sloughs such as South Slough near the mouth, North and Haynes sloughs on the north curve and Isthmus and Catching sloughs on the southeast end add to the 9,500 acres encompassed in the bay. The tide affects the Coos and Millicoma rivers for about 15 miles above the bay which, with several of the longer sloughs, add 3,000 more acres to the estuary, for a total area of about 19 square miles.

---

1/ *This study was partially supported with PL 89-304 funds.*

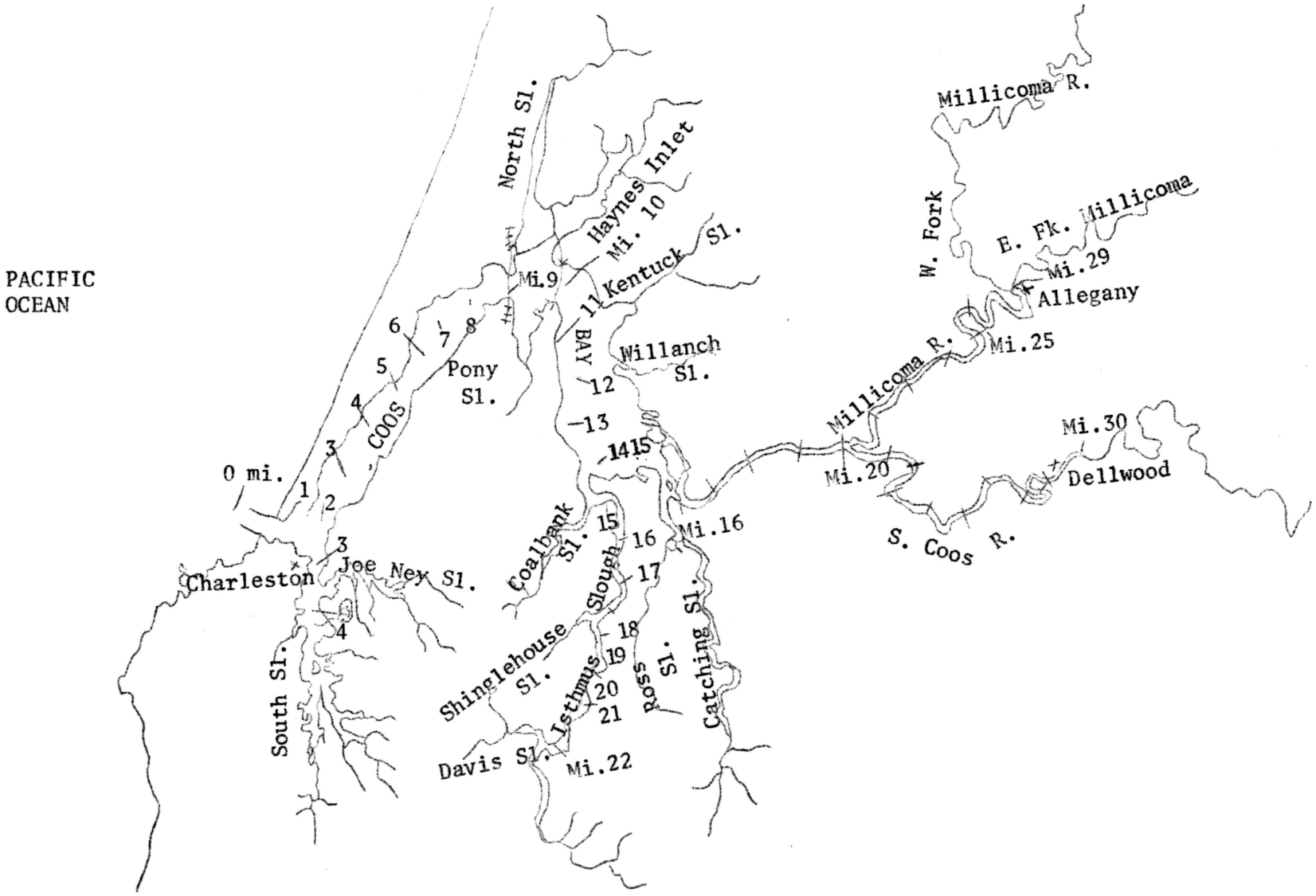


Figure 1. Map of Coos Bay and Tributaries

Some 4,600 acres of the estuary are tide flats. These are the areas that support plant growth needed for nursery and feeding areas by small animals which are in turn food for the larger fish and other animals of the bay. The tide flats are also the areas where clams are available to the digger and where many birds rest and feed.

## METHODS

### Sampling Gear

A 200' beach seine and a 100' bag seine were our main sampling tools. These were limited to shallow, relatively smooth shore areas. We supplemented the seines with variable mesh monofilament gill nets of 3/4 to 2 1/2" mesh and with information from OIMB otter trawls. The trawl was limited to deeper waters which was difficult to sample with our gear. Angling was tried for some of the larger species but time and skill limited practical application of this tool.

Partlow constant recording thermographs were installed on floating docks along the main channels of the bay, sloughs, and river to determine temperature variations.

Salinity was sampled by OIMB. These data are available at the Institute of Marine Biology in Charleston.

### Species Identification

Samples of each species of fish were preserved for identification at the OFC laboratory. A complete collection of these fish is available at the OFC lab in Charleston.

### Shad Population Estimate

OFC used a standard Petersen mark-recapture technique to estimate the number of shad available to the commercial fishery in Coos Bay. Shad

were captured in commercial drift nets operated by OFC personnel. The fish were tagged with a Floy FT 6 "spaghetti" tag, measured, sampled for scales and sex, and returned to the water in the tagging area (mile 10 to 14). Tagged fish were recovered in commercial gear (mile 16 to 26) and returned to the buying station where all fish were sold.

Sport Landing Estimates

OGC used a sampling procedure designed by Dr. Calvin (Oregon State University Department of Statistics) to estimate the sport catch of shad from the Coos system in 1970. The design incorporated a combination of recording vehicle license numbers of cars in the fishing area (bank fishermen); counting boat trailers at launching areas (boat fishermen); and personal interviews (catch information). This design is similar to some used successfully by OGC for other species and areas and is considered statistically sound.

## RESULTS

The fish known to inhabit Coos Bay are listed in Table 1. Their distribution is shown by mile points from the mouth of the bay whether they were found in the main channel, sloughs, or river (Figure 2). Distance upstream or upbay seems to be a common factor in distribution for a particular species with some variation caused by fresh-water influence in the upper ends of the sloughs.

Sixty-six species of fish have been recorded in the bay. There were 60 in the first 5 miles; 39 to mile 10; 24 to mile 15; and 17 at mile 20. We captured 38 species in our gear and the rest were recorded from other records.

Table 1. Names of Fish Occurring in Coos Bay, Oregon

| Family and Common Name | Scientific Name 1/ |
|---|---|
| Petromyzontidae | |
| Pacific lamprey | *Entosphenus tridentatus* |
| Carcharhinidae | |
| Leopard shark | *Triakis semifasciata* |
| Squalidae | |
| Spiny dogfish | *Squalus acanthias* |
| Rajidae | |
| Longnose skate | *Raja rhina* |
| Acipenseridae | |
| Green sturgeon | *Acipenser medirostris* |
| White sturgeon | *Acipenser transmontanus* |
| Clupeidae | |
| American shad | *Alosa sapidissima* |
| Pacific herring | *Clupea harengus pallasi* |
| Engraulidae | |
| Northern anchovy | *Engraulis mordax* |
| Salmonidae | |
| Chum salmon | *Oncorhynchus keta* |
| Coho salmon | *O. kisutch* |
| Chinook salmon | *O. tshawytscha* |
| Cutthroat trout | *Salmo clarki* |
| Rainbow trout (steelhead) | *S. gairdneri* |
| Osmeridae | |
| White bait smelt | *Allosmerus elongatus* |
| Surf smelt | *Hypomesus pretiosus* |
| Eulachon | *Thaleichthys pacificus* |
| Longfin smelt | *Spirinchus thaleichthys* |
| Alepisauridae | |
| Longnose lancet fish | *Alepisaurus ferox* |
| Cyprinidae | |
| Redside shiner | *Richardsonius balteatus* |
| Speckled dace | *Rhinichthys osculus* |
| Catostomidae | |
| Largescale sucker | *Catostomus macrocheilus* |
| Gadidae | |
| Pacific tomcod | *Microgadus proximus* |

Table 1 (cont'd)

| Family and Common Name | Scientific Name 1/ |
|---|---|
| Atherinidae | |
| Topsmelt | *Atherinops affinis* |
| Jacksmelt | *Atherinopsis californiensis* |
| Gasterosteidae | |
| Threespine stickleback | *Gasterosteus aculeatus* |
| Tubesnout | *Aulorhynchus flavidus* |
| Syngnathidae | |
| Bay pipefish | *Syngnathus griseolineatus* |
| Percichthyidae | |
| Striped bass | *Morone saxatilis* |
| Bramidae | |
| Pomfret | *Brama japonica* |
| Scianidae | |
| White Seabass | *Cynoscion noblis* |
| Embiotocidae | |
| Shiner perch | *Cymatogaster aggregata* |
| Striped seaperch | *Embiotoca lateralis* |
| Silver surf perch | *Hyperprosopon ellipticum* |
| Walleye surf perch | *H. argenteum* |
| White seaperch | *Phanerodon furcatus* |
| Pile perch | *Rhacochilus vacca* |
| Redtail surf perch | *Amphistichus rhodoterus* |
| Stichaeidae | |
| High cockscomb | *Anoplarchus purpurescens* |
| Snake prickleback | *Lumpenus sagitta* |
| Pholidae | |
| Penpoint gunnel | *Apodichthys flavidus* |
| Saddleback gunnel | *Pholis ornata* |
| Anarrhichadidae | |
| Wolf-eel | *Anarrhichthys ocellatus* |
| Ammodytidae | |
| Pacific sand lance | *Ammodytes hexapterus* |
| Gobiidae | |
| Arrow goby | *Clevelandia ios* |
| Bay goby | *Lepidogobius lepidus* |
| Stromateidae | |
| Pacific pompano | *Peprilus simillimus* |

Table 1 (cont'd)

| Family and Common Name | Scientific Name 1/ |
|---|---|
| Scorpaenidae | |
| Copper rockfish | *Sebastes caurinus* |
| Black rockfish | *S. melanops* |
| Bocaccio | *S. paucispinis* |
| Hexagrammidae | |
| Kelp greenling | *Hexagrammos decagrammus* |
| Rock greenling | *H. lagocephalus* |
| Lingcod | *Ophiodon elongatus* |
| Cottidae | |
| Padded sculpin | *Artedius fenestralis* |
| Mosshead sculpin | *Clinocottus globiceps* |
| Prickly sculpin | *Cottus asper* |
| Buffalo sculpin | *Enophrys bison* |
| Pacific staghorn sculpin | *Leptocottus armatus* |
| Tidepool sculpin | *Oligocottus maculosus* |
| Fluffy sculpin | *O. snyderi* |
| Cabezon | *Scorpaenichthys marmoratus* |
| Agonidae | |
| Tubenose poacher | *Pallasina barbata* |
| Bothidae | |
| Speckled sanddab | *Citharichthys stigmaeus* |
| Pleuronectidae | |
| English sole | *Parophrys vetulus* |
| Starry flounder | *Platichthys stellatus* |
| Sand sole | *Psettichthys melanostictus* |

1/ *From Common and Scientific Names of Fishes, AFS Pub. #6, 1970.*

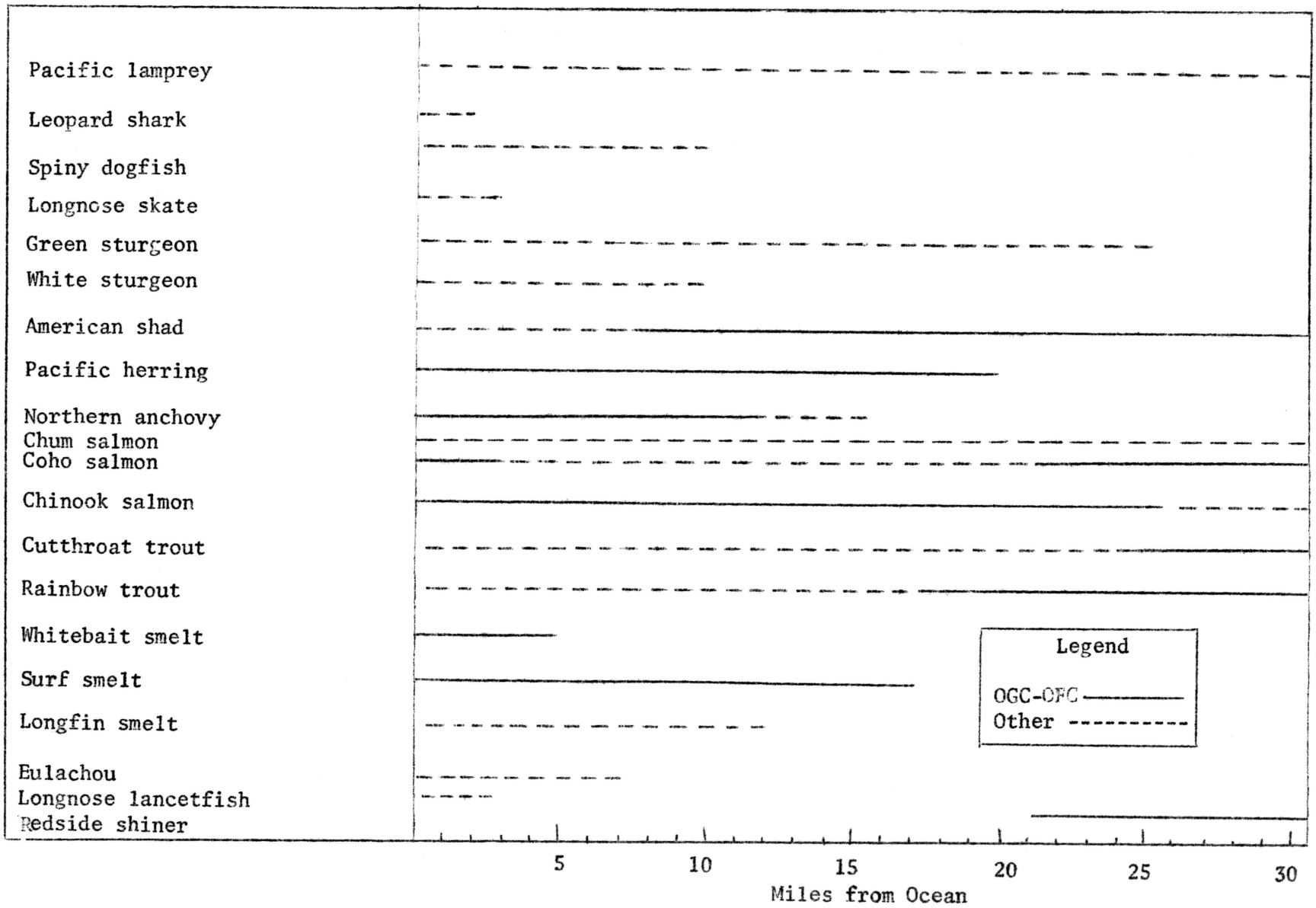


Figure 2. Distribution of Fishes in the Coos Bay Estuary

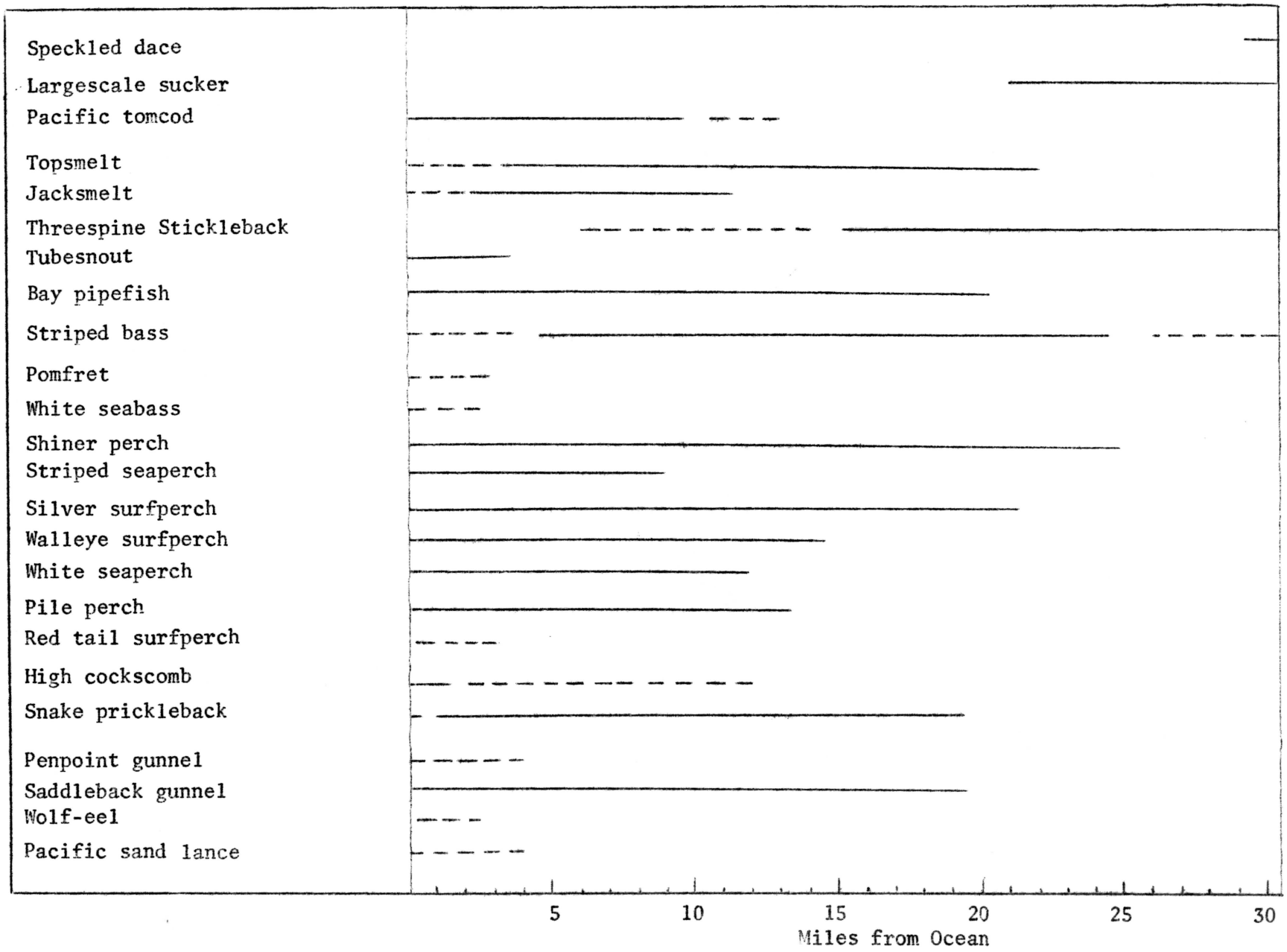


Figure 2. (cont'd)

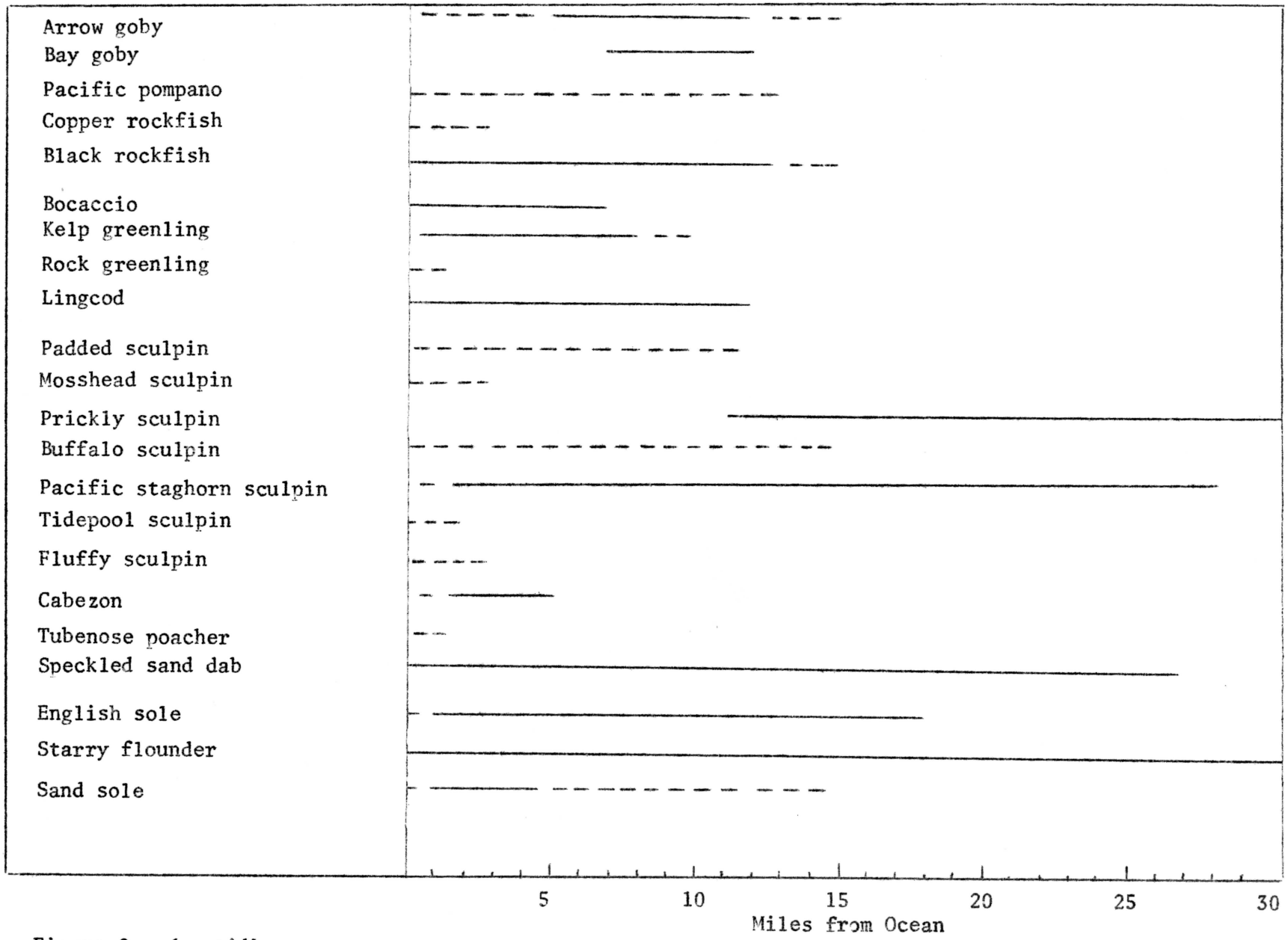


Figure 2. (cont'd)

Shad

Adult shad migrate to the river or upper estuary to spawn each spring. Some arrive early and spend several weeks in the bay before moving up to the spawning area between miles 21 and 30. Shad were abundant from mile 10 to 14 on April 18 when OFC began tagging for a population estimate. Adults began to appear in the river, at mile 20, in the 3rd week of April but the major migration did not commence until about May 1. Most of the spawners had moved above the tagging area by the end of the 1st week in June but fish continued to pass the commercial nets for another 2 weeks. The rate of movement increased as the season progressed and water temperatures in the river rose past 55 F. Migration has not fallen on these exact dates in past years but is usually complete by mid-June in Coos River (later in other streams).

Commercial

OFC estimated 51,000 ($\underline{N}$ = 46,000; $\overline{N}$ = 57,000) shad were available to commercial nets during 1970. This estimate was based on tagging 576 fish and recovering 182 tags (31%) from 15,800 shad delivered to buying stations. This does not represent a total population because smaller shad pass through the nets. The commercial landings were composed of 22.5% males and 77.5% females. Males are not fully recruited to the commercial nets until age 7 while females are large enough to be caught at age 4 or 5 years so we would expect a greater catch rate for larger female shad.

Sport

OGC initiated their sampling program for the sport fishery on May 10 with the first shad checked on May 16. Angler success peaked about June 1 then tapered off until June 25 when the sampling program was terminated.

Biologists calculated 2,910 anglers fished 10,362 hours for a catch of 6,341 shad during the 1970 season. The boat anglers OGC interviewed (558) were more successful than bank anglers (214) with 1,468 shad caught at a rate of 2.67 fish per angler (0.65 shad per hour) compared with 217 shad caught at a rate of 1.02 per angler (0.45 shad per hour) from the bank. Combined success was 2.21 fish per angler or 0.62 shad per hour of fishing. An incidental catch of nine rainbow trout, six cutthroat trout, and seven adult striped bass was observed in creels of the 772 anglers interviewed.

Sportsmen reported catching six tagged fish but only two tags were turned in during the season.

Scales from sport-caught shad showed a good representation of all age groups with a tendency toward greater harvest of young (smaller) fish than were taken in the commercial gear. Fifty-seven per cent of the small sport-caught sample (82 fish) were males while in the commercial catch only 22% were males, indicating a much higher harvest rate of males by the sport fishery.

## Seining

Shad from the 1969 brood were seined from miles 15 through 25 on June 18 when sampling started. In mid-July these fish began to move downstream but a few were taken at mile 9 through the 3rd week of August when their seaward movement appeared to be nearly complete.

The 1970-brood shad were large enough to be captured in the 3/8-inch mesh seine by mid-July when we found them from mile 20 through the spawning area. Some of these young shad moved down to mile 9 by mid-August; thus, were in part of the same area used by the 1969 brood for a short period. The 1970-brood shad were still using the bay and river from miles 9 to 31 when we quit seining in late September. Young shad were not found above tidewater in Coos River.

On September 14, the average length of shad at mile 25 was 4.1 cm while those seined the next day at mile 15 were 5.0 cm long; mile 12, 6.4 cm, and at mile 9 shad averaged 7.5 cm in length. There was very little overlap in the range of lengths between fish from the respective areas.

Striped Bass

We were not able to add appreciably to our knowledge of the areas used by striped bass from our sampling this summer. However, our observations with those from previous years supply some insight to the habits of the species in Coos Bay. Adults come in from the ocean during the spring to join bass already in the bay. They feed throughout the bay mainly over the tide flats, but some can be found near the mouths of streams where salmonid outmigrants enter the estuary each spring. The various groups of bass begin to school and move upriver toward the spawning grounds in May and June. There are several "runs" or different groups moving up as the season progresses. In some years, the migration extends through mid-July.

Striped bass males may spawn at age 2 but most are 3- or 4-years old when they begin to spawn. Females are generally age 4 or 5 when first mature. These fish are believed to spawn each year once they start. Most of the fish are age 4 to 12 but it is not unusual to find striped bass from age 15 to 20 and we have checked one that was 27-years old when captured.

We have seen striped bass in Joe Ney and South sloughs during December and there is a sport fishery for adults near mile 30 during the winter and early spring. In 1969, there was an active sport fishery for adults near mile 20 during the fall. Thus, it appears that some bass are present in

the estuary through most, if not all, of the year. Morgan and Gerlach (1950) said of the sport fishery:

> "The region has four main areas each of which supports a large fishery at various times of the year."..."These areas support a year-long fishery with the main winter fishery occurring in Isthmus Slough and in the late spring and summer in areas of the Coos and Millicoma Rivers and the lower bay."

These observations appear to still be valid with the exception of Isthmus Slough where it seems rafting debris has replaced the striped bass (and other species as well).

After spawning, the bass move down into the bay to feed. They seek the deeper holes and channels of the bay and some probably go to the ocean during the late fall and winter.

We found 1970-brood striped bass from mile 20 through mile 25 during the summer. These young fish seem to stay in the deep water of midchannel which is not consistent with observations of bass on the Sacramento system where young bass were frequently seen in the shallows along sandy beaches (Alan McGie, personal communication).

In past years we have caught a few age 1+ bass along with the new brood. The small numbers of these age 1 bass suggest most have vacated the summer rearing area in the river. Since no young bass were caught in seine hauls in the bay or in OIMB trawl tows in the main channel during the summer, we suspect they had moved into the ocean near the end of their 1st year of life.

Salmon

Both chinook and coho salmon spawn in the Coos system each year. The adults enter the bay in September and the migration peaks in October and November. Chum salmon have been seen in some years. During June we sampled chinook from the 1969 brood, which averaged 10 cm in length,

throughout the estuary. During August most of these chinook took on the silvery appearance of smolts and left the upper bay. We continued to catch some, however, below mile 8 through September when they were 14 to 19 cm in length. Smaller chinook with characteristic parr marks of juveniles were taken with coho juveniles near mile 23 during September. Both chinook and coho were about 8 cm long in the vicinity of mile 23.

No coho juveniles were seined in the lower bay during the summer. They apparently stay in the river or fresh-water portion of the estuary during the summer. Coho have been collected from the estuary in past years from March through May as yearlings migrated to the ocean.

Herring

The major spawning effort for herring had apparently occurred in the spring before we began to seine. Adults were not caught in the large numbers often taken from other bays, such as the Umpqua, during the summer.

We found young herring up to mile 20 but they were more numerous below mile 15 throughout the summer. These fish averaged 6-9 cm in length during September.

Anchovy

Large numbers of anchovy were present in the tagging area (miles 10-14) during April and May. We continued to capture adults and young anchovy throughout the bay all summer. They were more numerous in the lower bay later in the season.

English Sole

We found a few English sole in early July (about 3 cm long). During August nearly every seine haul below mile 10 brought up over 1,000 of these young sole and smaller numbers appeared up to mile 17. English sole averaged about 6 cm in length by September.

Sand Sole

An adult sand sole was caught during the shad tagging operation in May. Young were found up to mile 15 along with English sole but were only about 20% as numerous.

Starry Flounder

There are adult starry flounder in the bay through most of the year with large numbers moving in from the ocean during the winter. These fish have supported a commercial fishery in the bay during the winter and early spring of some years. Young were scattered throughout the estuary (to mile 25) all summer.

Surf Perches

Shiner perch form the bulk of the perch population in Coos Bay. Both juveniles and adults were taken through mile 25 the entire summer. The numbers of juveniles often exceeded 1,000 fish per seine haul in the lower bay with peak catches after mid-July and from mile 7 to 9.

Surf perch were seen most often in stomach contents from some 3,800 striped bass examined by OFC from 1963 through 1966. They are, with staghorn sculpins, the most often caught species taken by sport anglers along the docks but certainly not the most sought because of their small size (3-5").

Other species of perch were scattered and only the silver perch was found beyond mile 16 (to mile 21). Most of the large adults were found below mile 9 with good concentrations of all species near mile 5 in the main bay and in South Slough during the summer.

Other Fishes

The bay is used extensively for spawning by sand dab, topsmelt, surf smelt, black rockfish, and to a lesser extent by species other than those specifically noted. The surf smelt is the more common fish with smaller numbers of staghorn sculpin, small black rockfish, juvenile lingcod, and other species appearing in samples taken during the summer season.

Temperature

Average weekly temperature increased from the mouth to upper bay during mid-July (Table 2). Figure 3 shows means of 53 F at mile 2.8, 64 F at mile 12.9, 69 F at mile 20, and 71 F at mile 24.6 for the week ending July 18. The highest temperatures recorded at mile 12.9 was 68 F and records from seining sites showed temperatures of 60 F at mile 9 and 65 F at mile 15 during this period.

Temperatures at points up the bay from mile 3 began to drop during the 3rd week of August. Temperatures in all areas, except Isthmus Slough, were at 60 F or below by September 19. Isthmus Slough temperatures did not drop to 60 F until the 3rd week of October probably because this slough has little fresh water coming in, is not affected by northwest winds during late summer (at least to the extent of the main bay), and the recording station was above the area directly affected by water from the cooler bay.

Salinity

Salinity was measured by students and a crew from OIMB during the summer. Their records showed salinity patterns similar to those recorded in data by John Queen and Wayne V. Burt (1955) for the years 1930-31. Further confirmation of a relatively uniform salinity pattern comes from a report by McAlister and Blanton (1963) who said:

Table 2. Average Weekly Temperatures from Selected Stations in Coos Bay, Oregon, July-October 1970

| Week | Station: Coast Guard Boat Station (Charleston) 3 Mi. from Mouth F | Coast Guard Light Station (Coos Bay) 12.9 miles from Mouth F | Humberts Landing (Haynes Inlet) 11.8 mi. from Mouth F | Al Peirce Dock (Isthmus Slough) 20.2 miles from Mouth F | Millicoma River 22.2 miles from Mouth F | Coos River 24.6 miles from Mouth F |
|---|---|---|---|---|---|---|
| July 5-11 | 50.3 | - | - | - | 70.8 | 71.6 |
| 12-18 | 52.4 | 63.7 | - | 69.7 | 70.8 | 71.2 |
| 19-25 | 52.3 | 63.1 | - | 69.3 | 70.4 | 71.1 |
| 26-Aug. 1 | 54.0 | 65.1 | 65.8 | 70.3 | 70.4 | 70.8 |
| Aug. 2-8 | 54.3 | 64.1 | 64.0 | 69.6 | 68.8 | 69.1 |
| 9-15 | 53.3 | 66.3 | 65.3 | 70.4 | 70.0 | 70.1 |
| 16-22 | 51.0 | 62.3 | 61.1 | 68.1 | 68.3 | 69.1 |
| 23-29 | 52.7 | 61.7 | 61.8 | 66.8 | 66.6 | 67.0 |
| 29-Sept. 5 | 53.0 | 61.8 | 61.6 | 66.8 | 64.3 | 65.0 |
| Sept. 6-12 | 54.0 | 62.7 | 61.3 | 66.8 | 62.4 | 63.8 |
| 13-19 | 50.6 | 59.3 | 58.1 | 64.1 | 59.7 | 60.8 |
| 20-26 | 52.7 | 59.6 | 59.0 | 64.0 | 59.7 | 60.4 |
| 27-Oct. 3 | 51.6 | 59.3 | 58.3 | 63.0 | - | 59.2 |
| Oct. 4-10 | 52.0 | 58.6 | 56.6 | 62.4 | - | - |
| 11-17 | 50.0 | 56.0 | 54.3 | 60.7 | - | - |
| 18-24 | 51.6 | 53.7 | 52.1 | 58.3 | - | - |
| 25-31 | 51.1 | 52.4 | 50.0 | 55.3 | - | - |

> "Temperature and salinity data at the three principle stations indicate that Coos Bay ranges from a well mixed estuary during periods of low runoff to a partially mixed estuary during periods of maximum runoff. This agrees with earlier studies."

There was an indication of slightly higher salinities in the main channel stations during 1970 than before; however, there was also a similar variation between the 1930 and 1931 data. Summer salinities have been about 26-32‰ at mile 5; 25-30‰ at mile 10; 20-30‰ at mile 14; 20-30‰ at mile 16, and about 10‰ at mile 18 (1930-31 data). At mile 20, salinities were variable probably showing the effect of tide action near the upper end of the salt-water influence.

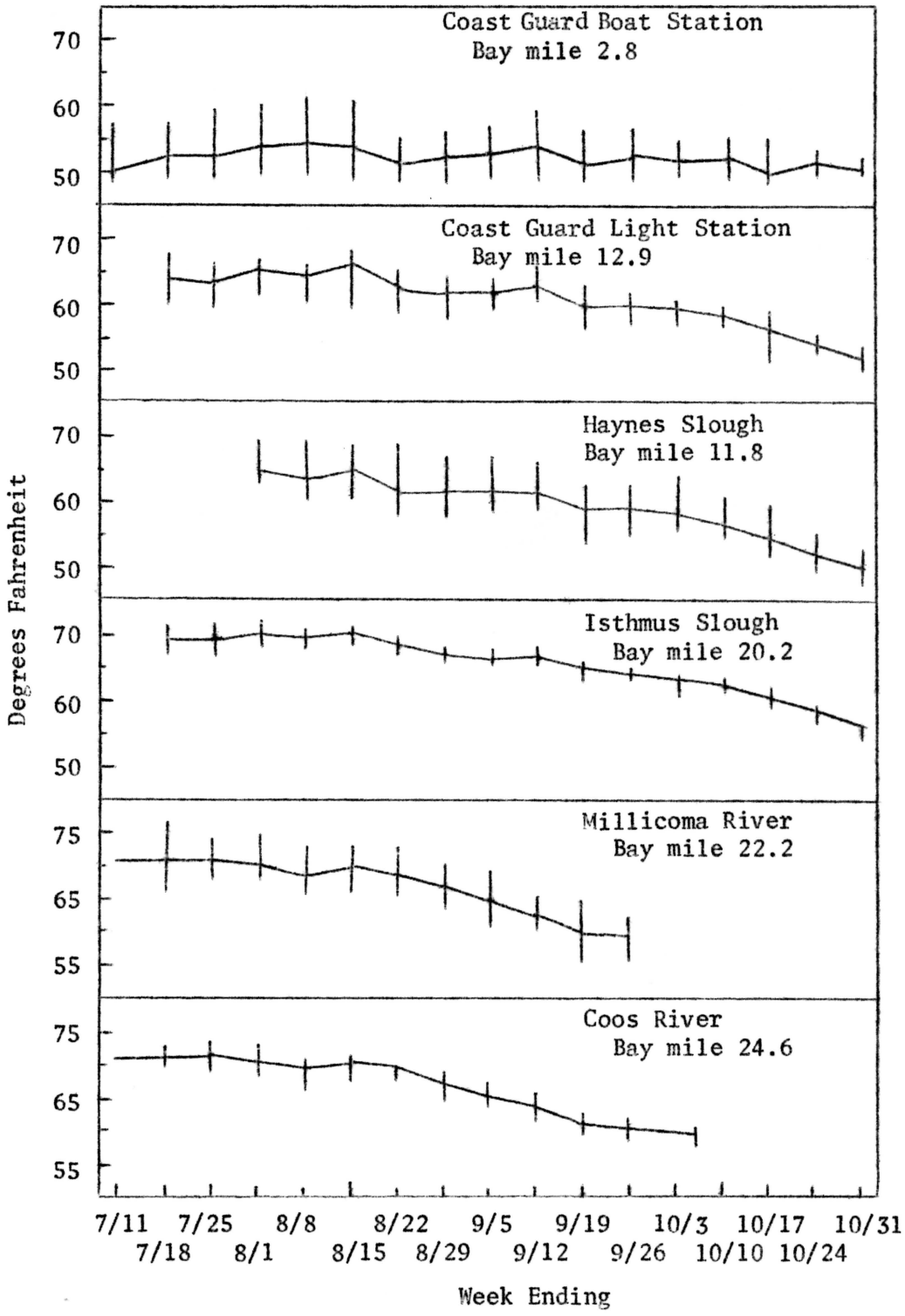


Figure 3. Weekly Mean Temperature and Range at Selected Stations in Coos Bay, Oregon, June-October 1970

Students (OIMB) sampled salinity during the summer on the tide flats at low tide by digging holes to collect surface water and selecting water from small channels. These samples gave salinities lower than those recorded for the main channels of the bay at low tide. Their information gave some indication of lower salinities as samples were taken farther from the main channel and closer to shore or areas above the high tide mark. This phenomena was more apparent as samples were taken farther up bay and appears to indicate a variation in the rate of water exchange between the flats and the main channel during the tide cycles.

Salinity patterns change considerably with the onset of winter and river freshets (Burt and Queen, 1955).

## DISCUSSION

We captured a larger variety of species in the lower bay than were taken farther up the estuary. Salinity is higher in the lower bay which allows some of the species more commonly associated with the ocean to reside here. All but six of the 66 species recorded for the Coos system can be found in some part of the lower 5 miles of the bay at one time or another. The mud flats from mile 2 to mile 6 are heavily used by all but a few of these species. Mile 8 is the upper end of this group of mud flats and is also the upper end of the area where gaper clams (*Schizothaerus nuttalli)* and cockle clams (*Clinocardium nuttalli)* are found. Both of these are species which will not tolerate very much fresh water (Dale Snow, personal communication). Large numbers of young English sole and shiner perch with lesser numbers of other species occupied the area on up to mile 10.

From mile 10 to 16 the bay again forms major mud flats on the east side. These flats support large numbers of soft shell clams (*Mya arenaria)* which are found in areas of lower salinity and can stand some fresh water

during part of the year (Dale Snow, personal communication). Salinity samples taken during the summer indicated a lower salinity here than down bay and winter freshets sweep the upper mud flats as they enter the bay. There have been 38 species of fish reported using this area at some time during the year and it is an important feeding area for species such as shad, striped bass, etc. Adult shad may spend several weeks in the various channels along these flats before moving up to spawn in the late spring and bass can be found here through most of the year. The area has been very productive for commercial catches of salmon in past years indicating that adults also use the area, probably to adjust to fresh water and wait for proper river conditions before proceeding upstream to spawn.

Temperatures and salinities in the upper bay are median between the lower bay and the river during the summer and fall. Young shad and salmon coming down (past mile 16) from the river appear to grow rapidly compared to those which remain in the river above mile 20 (tidewater). Thus we can envision the bay as a two stage adjustment from the fresh water, high temperature influence in the river during the summer to full strength sea water, and colder temperatures near the mouth of the bay.

The mud flats and marsh areas support organisms which assimilate nutrients and are in turn used for food by larger animals in the food chain. Some of the fish provide food for other animals both in the bay and in the ocean. Examples of this are shiner perch which are used extensively by striped bass for food in the bay and such species as herring and anchovies which are used by fish in the bay and by salmon or other fish in the ocean.

We have discussed some of the fish that use the bay and to some extent the inter-relationships between fish and a few of the other species in the bay. The importance of the bay in providing food, spawning, and rearing area for fish of both sport and commercial importance becomes more evident as one considers the species that have been listed and their relationship to other species both within the bay and in the ocean. No doubt there are other species that use the estuary but we feel most have been listed there.

## ACKNOWLEDGMENTS

Personnel working on the project were Joe Baker, Jerry MacLeod, Dave Zeman, Ed Schwartz, and Ed Cummings. Bob Mullen identified the fish in our collection and Dr. Rudy (OIMB) made his file of student reports available to us. Other staff members of both OGC and OFC gave assistance when needed.

## LITERATURE CITED

McAlister, Bruce W., and Jackson O. Blanton. 1963. Temperature, salinity, and current measurements for Coos Bay, Oregon during 1960-63; Dept. of Oceanography Sch. of Sc. OSU Corvallis, 36 p.

Morgan, Alfred R. and Arthur Gerlach. 1950. Striped bass studies in Coos Bay in 1949 and 1950. A joint report to the 46th Legislature OFC and OGC. 31 p.

Queen, John and Wayne Burt. 1955. Hydrography of Coos Bay Data Rpt. #1. Office of Naval Research Contract No. 1286(02) Proj. #083-102 Sch. of Sc. OSC. 16 p.