

sup. was
SP# 1123

DRAFT

Oregon Coastal Juvenile Rockfish Study

- genetic ID

Oregon Department of Fish and Wildlife

Marine Resources Division

Estuarine Habitat

Summer 2000

maternity data

- MR - Stage 6

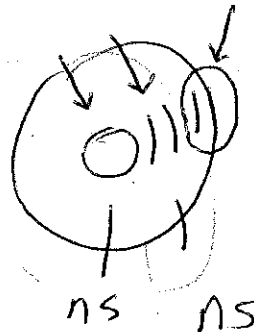
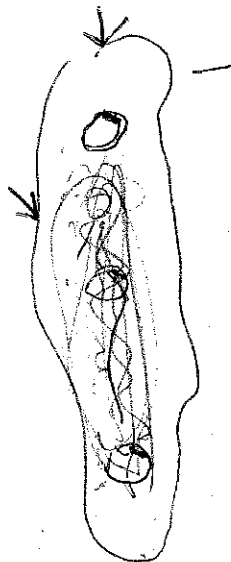
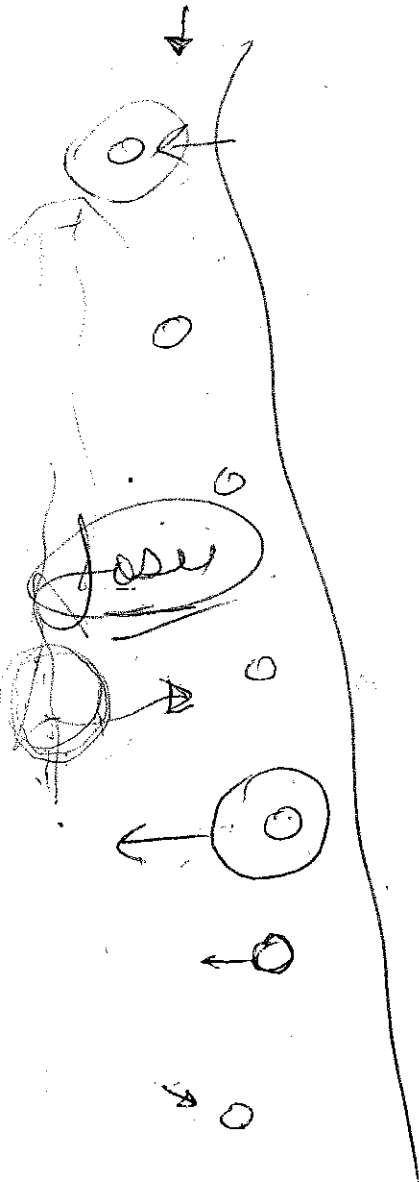
- MR - resting

- early onset
vs
- early part

- POP

- gully,
Lowell
Symposium

Marcus Appy, P.J. Collson



Ba Ba

Contents

Abstract

Introduction

Study Sites and Methods

Results

Discussion

- Problems
- Recommendations
- Conclusions

Appendix

- Maps of sites
- Parameters measured

Abstract

The Oregon Department of Fish and Wildlife conducted a pilot project to investigate the potential of sampling estuarine and intertidal areas for juvenile rockfish. The long-term objective of the survey is to develop a rockfish recruitment index by sampling readily accessible habitat. The study sites ranged from Coos Bay to Tillamook Bay. Sampling took place from late May until late August. Capture methods included a variety of gear including seine nets, fish traps, and snorkel surveys. Black rockfish were caught in Yaquina Bay and on the open coast, and it is recommended that this project be continued and expanded to include more sites along the coast.

Introduction

Several Species of rockfish inhabit the nearshore ocean off Oregon and contribute significantly to the recreational fishery with black rockfish (*Sebastes melanops*) being most important. Nearshore rockfish populations are coming under increased fishing pressure with relatively little assessment due to the difficulty and expense of such an undertaking. The need to monitor these populations over time is essential for proper management.

Rockfish are viviparous and give birth in the winter to planktonic larvae. The larvae live in the plankton for three to five months before settling to the benthos, usually near some sort of structure. Black rockfish are known to settle in nearshore and estuarine environments (Kendall and Lenarz, 1986), but no studies have been published that focus on this area of their life history. It has been shown that beach seining may be an effective method to capture juvenile black rockfish in estuarine habitats (Johnson and Fox, 2000). Beach seining for juvenile rockfish would be a simple and inexpensive tool to aid in the development of a recruitment index.

A pilot project was undertaken to determine the feasibility of developing such a recruitment index. The initial goals of this project were:

- to determine whether rockfish could consistently be captured in estuarine and open coast environments.
- to determine the best capture methods.
- to determine the best capture sites.

Shallow
subtidal
TB-LR

The long-term goal was to collect juvenile rockfish numbers for a minimum of five years to establish a time series and use this information to predict stock strength. Nearshore rocky intertidal sites which corresponded to the estuarine sites were also sampled in order to determine whether estuarine abundances accurately reflected rockfish numbers in the nearshore ocean.

Study Sites & Methods

Selection of Sampling Sites

One of the goals of the project was to establish estuaries that could be sampled for juvenile rockfish. Furthermore, each estuary would be paired with a rocky intertidal sampling site. ODFW personnel preselected the Salmon and Yaquina estuaries as the focal points for the first summer's sampling. We used a variety of methods to locate rocky intertidal sites that were in close proximity to our estuaries of interest. Word of mouth seemed to be one of the most useful ways to learn of possible sampling locations. John Johnson and Dave Fox (ODFW) are knowledgeable of possible sampling locations up and down the coast. Habitat reports were also useful in determining potential sites. The publication, *Oregon Rock Shores Inventory (Fox, 1999)*, was helpful in the establishment of possible sampling locations. Maps and aerial photos were used further to refine our list of potential sites. The final step in the site selection process was to visit the areas that were found to have the highest potential in terms of rockfish habitat and accessibility.

Characteristics of Good Sampling Sites

Specific physical and biological site characteristics seemed to be consistent in areas where we were able to sample for rockfish. Fish habitat and the ability to use the equipment effectively were taken into account.

Open Coast

Rocky intertidal sites on the open coast must be wadable to allow the use of a 10'-15' hand seine. These sites must be protected from the surf. Sites that were protected from the surf were more apt to contain rockfish, safer to sample, and more effectively fished. To achieve a constant sample area rocky slots or pools were fished. The slots and pools provided the best areas for the capture of fish. Vegetation, usually surf grass, *Laminaria sp.*, or feather boa kelp provided good cover for rockfish but worked against the effectiveness of net use. We seined these areas to the best of our ability because rockfish were most abundant among this structure.

Estuaries

Literature (Love et al. 1990) would suggest that estuary sites that were lower in the bay and close to solid structure like riprap or docks provide good rockfish habitat. We saw large numbers of rockfish below docks or next to jetties but it was difficult to consistently sample this population with the equipment at our disposal. However, most sites that produced large numbers of rockfish were within thirty-five meters of solid structure. Eelgrass seemed to make good rockfish habitat. We assume that rockfish use the eelgrass as cover. Some eelgrass sites were difficult to fish due to net fouling, but we found partially vegetated sites that could be effectively sampled. The sites in the lower reaches of the estuaries contained the marine species assemblages in which you would expect to find rockfish. Site depth was important in determining equipment to be used for sampling.

Study Sites

The Yaquina and Salmon estuaries along with Boiler Bay and Seal Rock composed the study's primary sites. Primary sites were fished weekly or as the tides allowed throughout the season (Late May to late August). We also visited a number of secondary sites. Secondary sites were visited while establishing rocky intertidal sampling areas, or when performing a side project focusing on genetic variations in rockfish populations along the Oregon coast. The rocky intertidal secondary sites included Whale Cove, Bob

Creek, Squaw Creek, and Sunset Bay (Appendix A). The estuaries on the secondary site list include: Tillamook Bay, Winchester Bay, and Coos Bay.

The Salmon River creates a small riverine dominated estuary. Rocky structure exists at the river mouth with boulder patches on the north side of the river just in from the mouth. The substrate on the entire south side of the river is sandy with little to no vegetation. No manmade structure, such as docks or jetties, is present. The tidal currents in the lower portion of the river are strong and can make effective seining difficult. This estuary must be sampled at high tide; at low tides the area is too shallow to operate a boat. No eelgrass beds exist in the lower estuary. We found the species diversity to be low in this system with salmon, flatfish, staghorn sculpins, and smelt making up the majority of fish caught here. No rockfish were caught in this estuary.

Boiler Bay is a rocky intertidal site that is protected from swell. Wadable rocky slots provide excellent seining areas, which produced a high percentage of the rockfish caught this season. Surf grass and feather boa kelp are the dominant vegetation here. Vegetation became so thick at this site as the season progressed that it negatively affected our ability to seine. Visual observations of juvenile rockfish were made prior to sampling this area. We often noticed them in small schools swimming amongst the vegetation. A ~~minus 0.6 to a positive 0.1 tide seemed to be the best tide stage to access the slots~~

Yaquina bay is a midsize estuary with little to no natural rocky structure. However, jetties, docks, and riprap are present and seem to attract juvenile rockfish. The lower portion of the bay is marine dominated. The species composition is diverse and large numbers of fish were captured here. The eelgrass beds found on mudflats provide refuge for a large number of species including rockfish.

Seal Rock is a rocky intertidal site protected from swell. We focused our sampling on wadable rock pools that were less than four feet deep. Numerous boulders were present

in the pools and at times frustrated our sampling efforts by hanging the nets. Surf grass and feather boa kelp are the dominant vegetation here. We caught rockfish at this site, but not in the numbers we found at Boiler Bay.

Sampling Method / Gear Type

Various gear types were used to determine the most effective method to sample rockfish. The gear types tested included: fish traps, 10' seine, 25' seine, 50' seine, 100' seine, dip nets, snorkel/small nets, 4' cast net, and a 6' cast net. Each piece of gear had its advantages and limitations. Due to the fact that catch per unit effort cannot be compared between gear types it is necessary to use the same gear type at each site. Most sampling was attempted at low tide. The Salmon River estuary was sampled at high tide only.

Traps

Minnow traps were used in the rocky intertidal zone and on boat docks. Wave action in the rocky intertidal zone and limited points to which you could anchor the traps made it difficult to set the traps in places that we assumed fish would be present. We had more success with fish traps when we hung them approximately 3 feet below the water line next to boat docks. We experimented with different types of bait and found that there were no preferences. We believe that rockfish use the traps as refuge and become trapped. They do not seem to be entering the traps to obtain food. For example, when traps were set with no bait our catch per unit effort did not change.

10' Seine

We used a 10' hand seine to sample small wadable areas in the rocky intertidal zone. This net has a ¼ inch mesh size and is four feet deep. The 10' seine was useful in accessing small rocky areas where net hanging was a problem with larger nets. We believe that fish escapement was high with this net due to its short length and lack of a bag.

25' Seine

The 25' seine was used successfully in the estuary and rocky intertidal sites. It has a $\frac{1}{4}$ inch mesh size and is 4 feet deep. We found this net to be a good compromise between larger seines (50' & 100') and the 10' seine. It was long enough and had a slight bag that helped reduce fish escapement. This net can be used effectively to sample small gaps in eelgrass when the larger seines would become fouled.

50' Seine

A 50' seine was used in estuaries when a large area was to be sampled and the sampling area was too shallow or rocky for the 100' seine to be used. The 50' seine was deployed either by walking or by boat. This net has a $\frac{1}{4}$ inch mesh size and is 4 feet deep.

100' Seine

The 100' seine was used only in the estuaries and had to be set with a boat. It has a mesh size of $\frac{3}{8}$ inch and is 10' deep. We captured more fish and a greater number of species than any other method attempted while using the 100' seine. This net had an actual bag in the middle that effectively trapped the fish and reduced escapement. The net's depth and length also contributed to its effectiveness. The 100' seine must be fished at slack tide because strong tidal currents make it virtually impossible to carry out an effective set. Another problem was that small fish tended to escape through this net's relatively large mesh size.

Boat & Motor

We used a 15' aluminum boat with a 15hp outboard motor to make our sets. We installed a plywood platform in the bow of the boat to aid in net deployment. All rivets and sharp edges on the boat were covered with duct tape to prevent the nets from hanging up as they were deployed.

Dip Nets

Dip nets were used in the rocky intertidal areas to sample tide pools and areas that could not be fished with a seine net. The effectiveness of dip nets in catching rockfish is low.

Rockfish were able to either avoid the dip nets or do not inhabit the areas we employed this method. Dip nets were most effective at capturing sculpins, greenling and gunnels.

Cast Nets

4' and 6' diameter cast net were used in the estuaries and rocky intertidal sites. The main advantage was that they could fish areas that were too deep to hand seine and too small for a boat. However, the drawbacks of the cast nets out weighed the advantages. They were easily hung on rocks, difficult to use (especially in the wind), and vegetation impeded their deployment.

Snorkel Gear

Snorkel Gear was used to perform some preliminary transect surveys and to attempt a mark/recapture project that was part of another study. This method has promise for future sampling of juvenile rockfish around docks and rock structure within estuaries. Great care must be taken when choosing the appropriate amount of weight.

Results

Species Collected

Forty-eight species were collected during the sampling season, which spanned from May 24 to August 15 (Table 1). Yaquina Bay yielded the highest number of species, with thirty-eight caught throughout the summer (Table 2a). A total of fifteen species were collected at Salmon River, the other estuarine site (Table 2b). The intertidal sites, Boiler Bay and Seal Rock, had catches of twenty-two and twenty-one species respectively (Table 3).

The most abundant species collected in the Salmon River estuary were chinook salmon and surf smelt, making up 37.5% and 30.4% of the catch respectively. There were no rockfish caught in this estuary.

Table 1. Total fish caught during sampling season.

Common Name	Total	Percentage of Total
Shiner surfperch	5860	37.26%
Surf smelt	1844	11.72%
Striped surfperch	1410	8.96%
English sole	1292	8.21%
Staghorn sculpin	1172	7.45%
Black rockfish	1148	7.30%
Chinook salmon	454	2.89%
Saddleback gunnel	326	2.07%
Cabezon	284	1.81%
Pacific herring	228	1.45%
Kelp greenling	222	1.41%
Silver surfperch	216	1.37%
Fluffy sculpin	147	0.93%
Right-eyed flatfish	121	0.77%
Sculpin sp.	104	0.66%
Topsmelt	86	0.55%
American shad	80	0.51%
Penpoint gunnel	78	0.50%
Pile surfperch	75	0.48%
Rock greenling	71	0.45%
Tidepool sculpin	65	0.41%
Flatfish spp.	59	0.38%
Starry flounder	53	0.34%
Chum salmon	52	0.33%
Speckled sanddab	46	0.29%
Bay pipefish	28	0.18%
Ling cod	26	0.17%
Copper rockfish	21	0.13%
Sharpnose sculpin	21	0.13%
Greenling spp.	20	0.13%
Mosshead sculpin	20	0.13%
Sand sole	14	0.09%
Coho salmon	13	0.08%
Calico sculpin	12	0.08%
Tidepool snailfish	10	0.06%
Threespine stickleback	7	0.04%
Tubesnout	7	0.04%
Rockfish sp.	6	0.04%
Pacific tomcod	5	0.03%
Redtail surfperch	5	0.03%
Blue rockfish	4	0.03%
Night smelt	4	0.03%
Buffalo sculpin	3	0.02%
Pacific sandlance	2	0.01%
Snake prickleback	2	0.01%
Bay goby	1	0.01%
Kelpfish sp.	1	0.01%
Longfin smelt	1	0.01%
Northern anchovy	1	0.01%
Rainbow trout	1	0.01%
Walleye surfperch	1	0.01%
Grand Total	15729	100.00%

Table 2a. Species and numbers of fish caught at Yaquina Bay.

Common Name	Total caught	Percentage of Total
Shiner surfperch	5610	48.03%
English sole	1196	10.24%
Striped surfperch	1053	9.02%
Surf smelt	925	7.92%
Staghorn sculpin	909	7.78%
Black rockfish	402	3.44%
Saddleback gunnel	314	2.69%
Pacific herring	206	1.76%
Cabezon	189	1.62%
Chinook salmon	158	1.35%
Right-eyed flatfish	115	0.98%
Kelp greenling	91	0.78%
American shad	80	0.68%
Topsmelt	78	0.67%
Flatfish spp.	48	0.41%
Penpoint gunnel	43	0.37%
Chum salmon	42	0.36%
Starry flounder	35	0.30%
Bay pipefish	25	0.21%
Sculpin sp.	21	0.18%
Greenling spp.	20	0.17%
Speckled sanddab	20	0.17%
Sharpnose sculpin	19	0.16%
Copper rockfish	18	0.15%
Pile surfperch	12	0.10%
Coho salmon	9	0.08%
Ling cod	7	0.06%
Pacific tomcod	5	0.04%
Tubesnout	5	0.04%
Rock greenling	4	0.03%
Rockfish sp.	4	0.03%
Silver surfperch	4	0.03%
Threespine stickleback	3	0.03%
Buffalo sculpin	2	0.02%
Bay goby	1	0.01%
Northern anchovy	1	0.01%
Pacific sandlance	1	0.01%
Sand sole	1	0.01%
Snake prickieback	1	0.01%
Tidepool sculpin	1	0.01%
Walleye surfperch	1	0.01%
Grand Total	11679	100.00%

Table 2b. Species and numbers of fish caught at Salmon River.

Common Name	Total caught	Percentage of Total
Chinook salmon	237	37.56%
Surf smelt	192	30.43%
Staghorn sculpin	146	23.14%
English sole	13	2.06%
Chum salmon	10	1.58%
Shiner surfperch	7	1.11%
Flatfish spp.	6	0.95%
Coho salmon	4	0.63%
Saddleback gunnel	4	0.63%
Cabezon	3	0.48%
Pacific herring	2	0.32%
Sharpnose sculpin	2	0.32%
Starry flounder	2	0.32%
Fluffy sculpin	1	0.16%
Pacific sandlance	1	0.16%
Tidepool sculpin	1	0.16%
Grand Total	631	100.00%

Table 3a. Species and numbers of fish caught at Boiler Bay.

Common Name	Total caught	Percentage of total
Black rockfish	699	86.62%
Kelp greenling	28	3.47%
Fluffy sculpin	19	2.35%
Rock greenling	19	2.35%
Cabezon	10	1.24%
Staghorn sculpin	6	0.74%
Penpoint gunnel	5	0.62%
Bay pipefish	3	0.37%
Ling cod	2	0.25%
Pacific herring	2	0.25%
Right-eyed flatfish	2	0.25%
Calico sculpin	1	0.12%
Chinook salmon	1	0.12%
Kelpfish sp.	1	0.12%
Mosshead sculpin	1	0.12%
Rockfish sp.	1	0.12%
Sand sole	1	0.12%
Sculpin sp.	1	0.12%
Shiner surfperch	1	0.12%
Starry flounder	1	0.12%
Striped surfperch	1	0.12%
Surf smelt	1	0.12%
Tidepool sculpin	1	0.12%
Grand Total	807	100.00%

Table 3b. Species and numbers of fish caught at Seal Rock.

Common Name	Total caught	Percentage of Total
Silver surfperch	197	25.62%
Striped surfperch	156	20.45%
Fluffy sculpin	91	11.93%
Sculpin sp.	73	9.57%
Tidepool sculpin	57	7.47%
Kelp greenling	37	4.85%
Rock greenling	34	4.46%
Surf smelt	25	3.28%
Black rockfish	22	2.88%
Mosshead sculpin	19	2.49%
Cabezon	11	1.44%
Penpoint gunnel	7	0.92%
Calico sculpin	5	0.66%
Flatfish spp.	5	0.66%
Redtail surfperch	5	0.66%
Staghorn sculpin	5	0.66%
Threespine stickleback	4	0.52%
Right-eyed flatfish	3	0.39%
Sand sole	2	0.26%
Tidepool snailfish	2	0.26%
Ling cod	1	0.13%
Longfin smelt	1	0.13%
Rockfish sp.	1	0.13%
Grand Total	763	100.00%

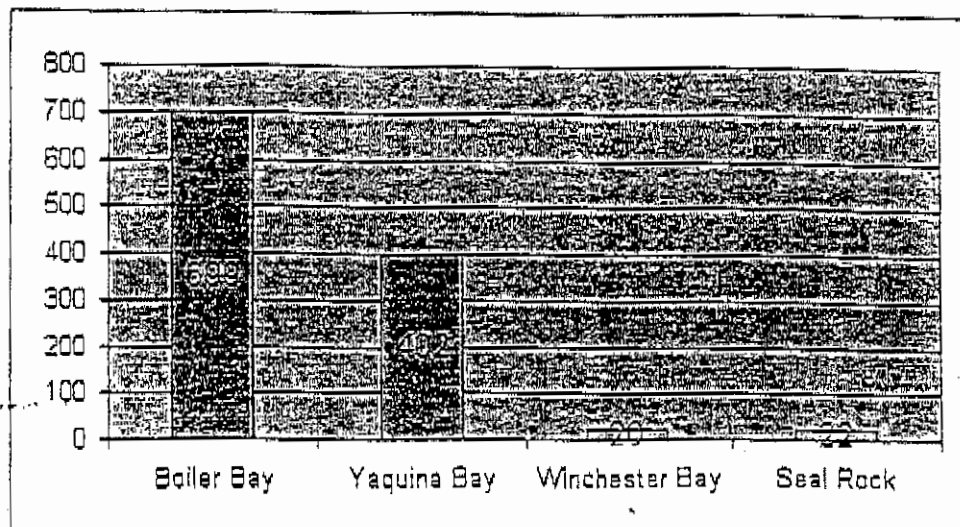


Figure 1. Number of rockfish caught by site during the summer of 2000.

The rockfish catch at Seal Rock was much lower than at Boiler Bay. A total of 22 rockfish were caught there during the season (Figure 1). The daily catch was variable, but the highest was only eleven rockfish (Figure 4). There were no rockfish caught after the middle of July.

The rockfish catch in Yaquina Bay numbered 402 fish (Figure 1). Rockfish were caught starting in June, with numbers peaking in July and lowering in August (Figure 5). The majority of the rockfish in Yaquina Bay were caught at site A. This site is a small eelgrass bed near the finger jetties. The easiest way to sample it was with the 25-foot seine, which resulted in high catches for that gear type. The rest were caught in eelgrass beds at sites C, F, and H (See map). Rockfish catch at site A dropped off during July, but rockfish were still caught at sites C and F in the middle of August.

Rockfish Catch per Unit Effort

The effort that went into capturing rockfish at the different sites was categorized by gear type. A unit of effort is equal to one haul of a specified seine. The results of the catch per unit effort (CPUE) for the different gear types at the different sites are summarized in Table 4b. The highest CPUE was at Boiler Bay using the 25-foot seine and was 67.2

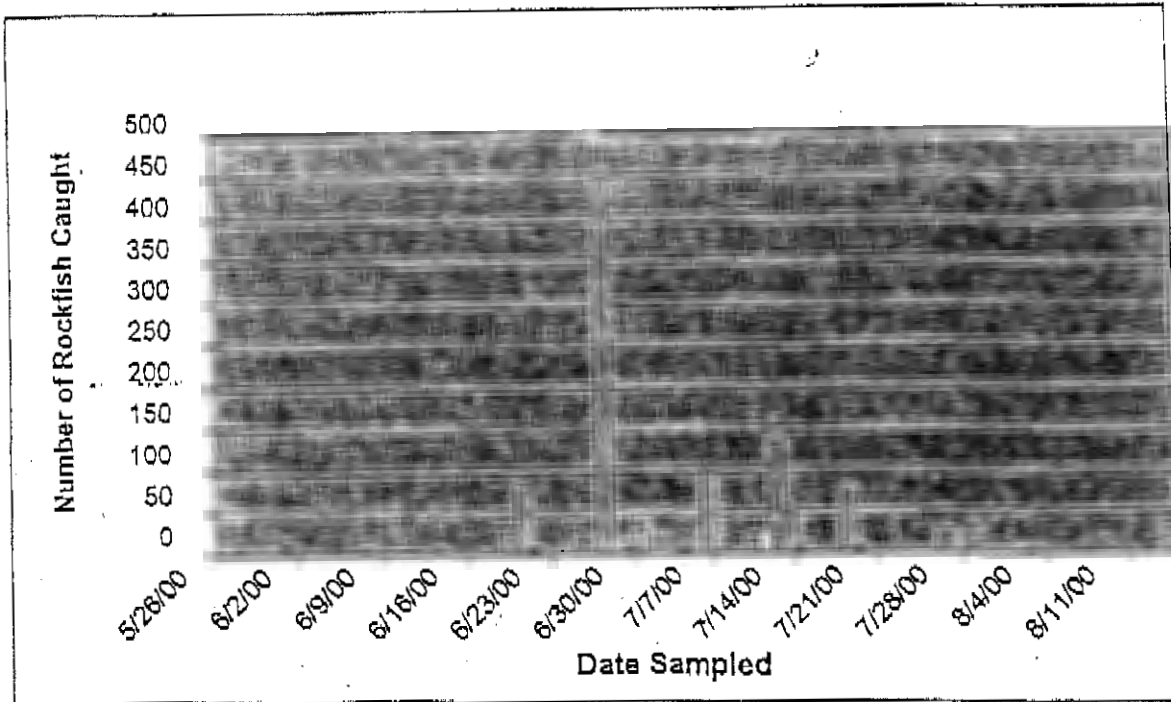


Figure 2. Total rockfish caught at all sites during the summer of 2000.

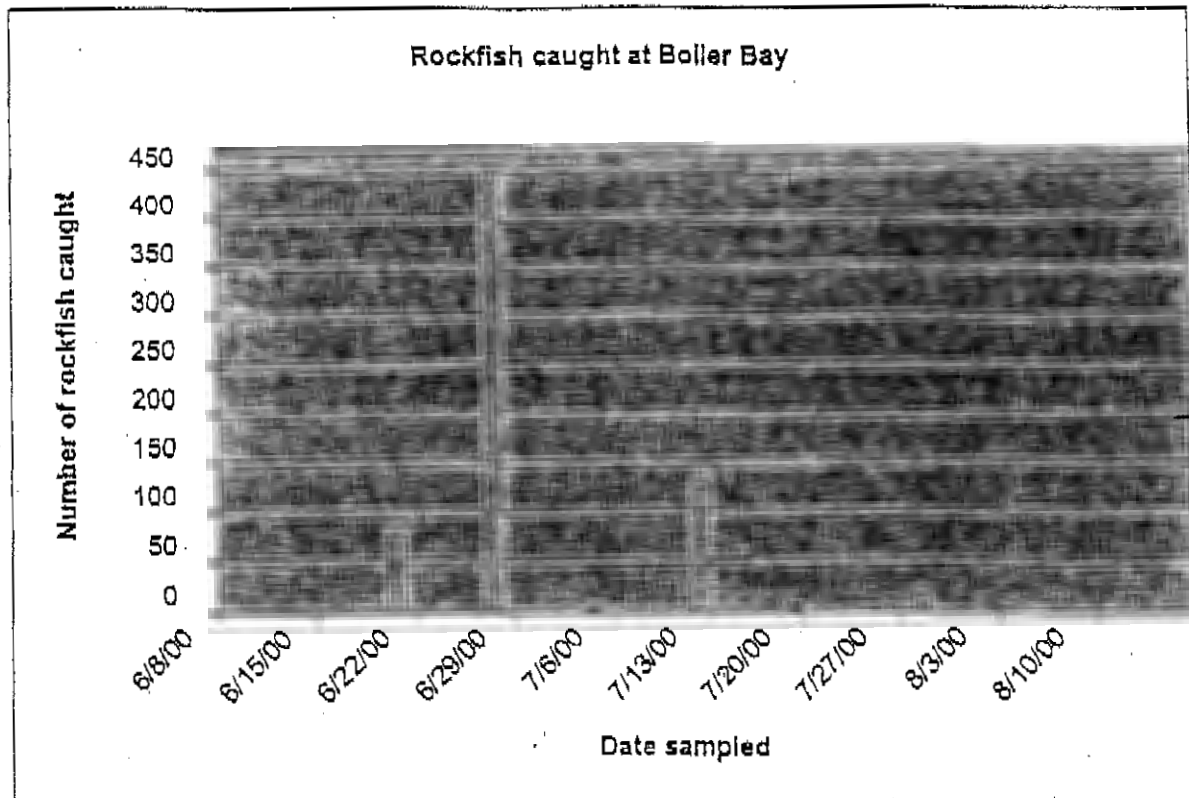


Figure 3. Total rockfish caught in Boiler Bay during the summer of 2000.

The most common species caught in Yaquina Bay was shiner surfperch. It made up 48% of the catch in Yaquina Bay (Table 2a). Black rockfish were the sixth most abundant fish caught in Yaquina Bay and made up 3.4% of the catch.

Black rockfish were the most commonly caught species in Boiler Bay and made up 86.6% of the catch (Table 3a). Silver surfperch and striped surfperch made up 25.8% and 20.5% of the catch respectively at Seal Rock. Black rockfish were the ninth most common species and made up 2.9% of the catch (Table 3b).

Rockfish collected

A total of 1,179 rockfish were caught during this study. Black rockfish made up the majority of this catch, comprising 1,148 of the total (Table 1). Boiler Bay had the highest rockfish catch, followed by Yaquina Bay, Seal Rock and Winchester Bay (Figure 1). There were no rockfish caught at the Salmon River estuary. Rockfish catches began in June, peaked in the middle of July, and went down through the month of August (Figure 2).

A total of 699 rockfish were caught at Boiler Bay, which makes it the most productive site for juvenile rockfish (Figure 1). Rockfish were first caught in Boiler Bay at the end of June and continued to be caught through the end of July. There were no rockfish caught in August (Figure 3). The rockfish catch at Boiler Bay was highly variable throughout the season, ranging from zero to 450 fish.

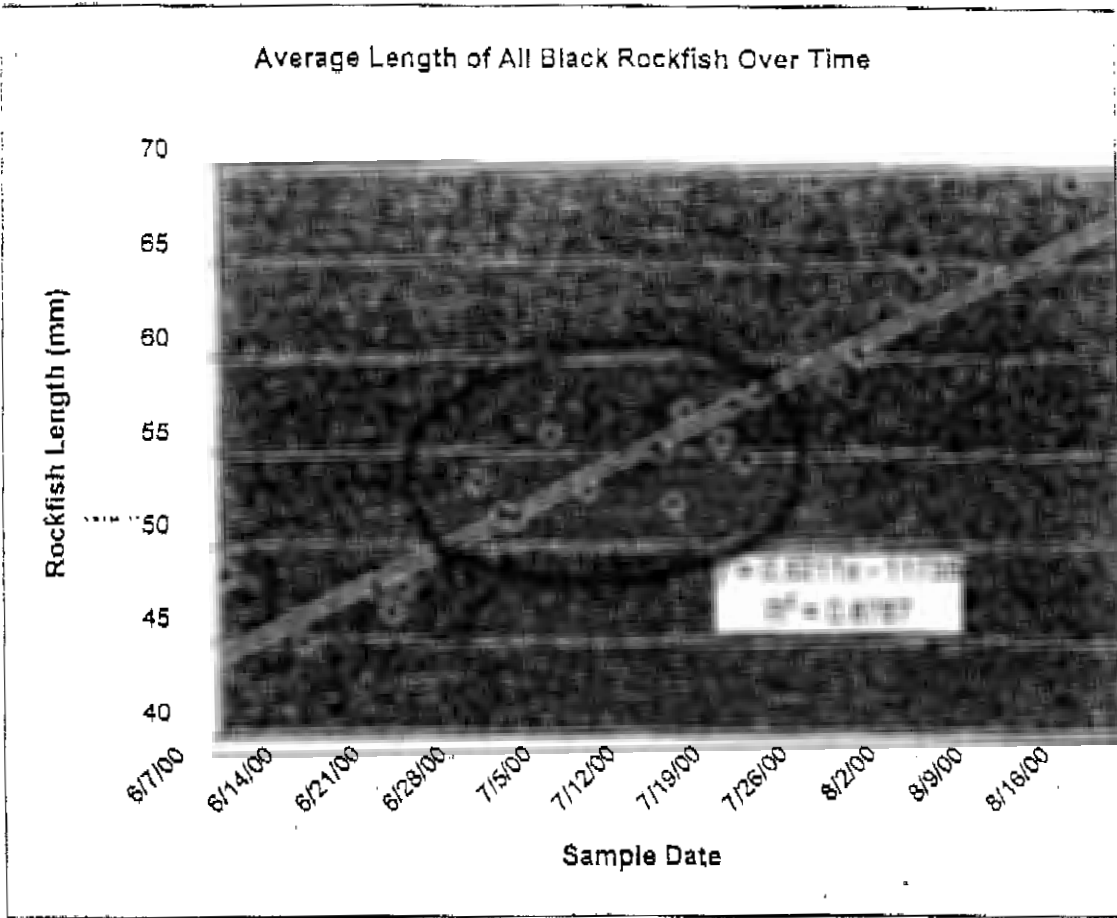
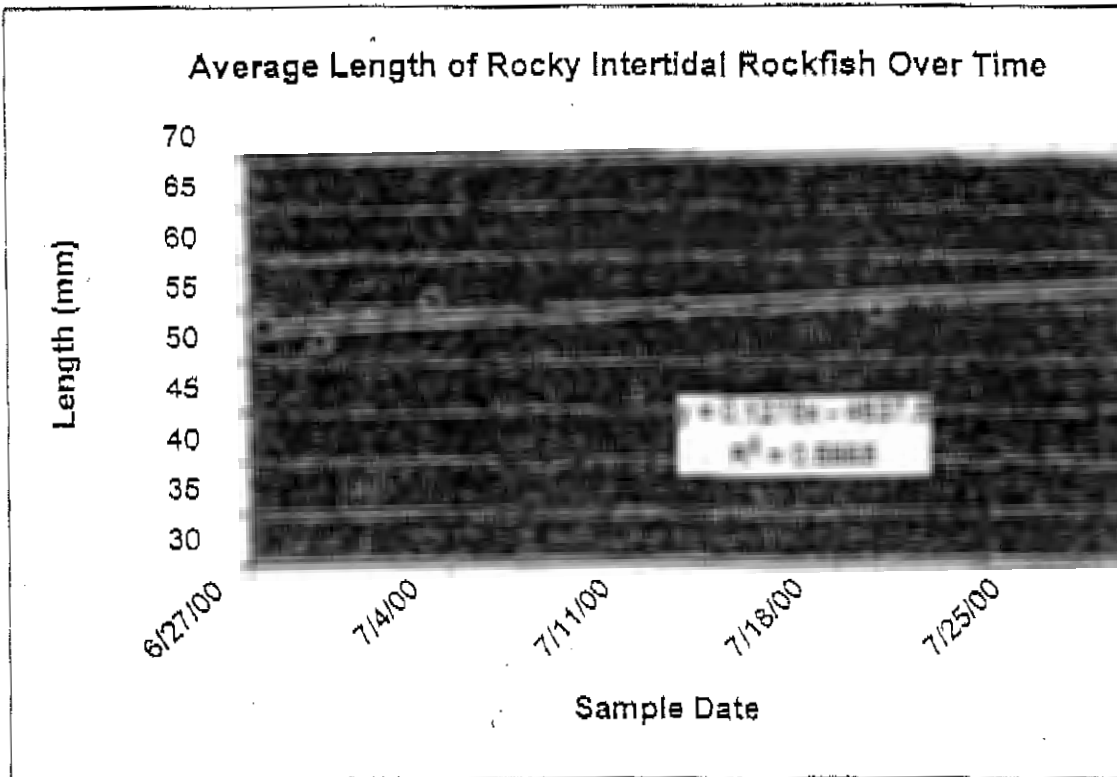


Figure 6. Average length of black rockfish caught summer of 2000. Slope of line (.32) approximates the growth rate in mm/day.



recruitment window?
poor comparison

Figure 7. Average length of black intertidal rockfish during the summer. Growth rate is .13 mm/day

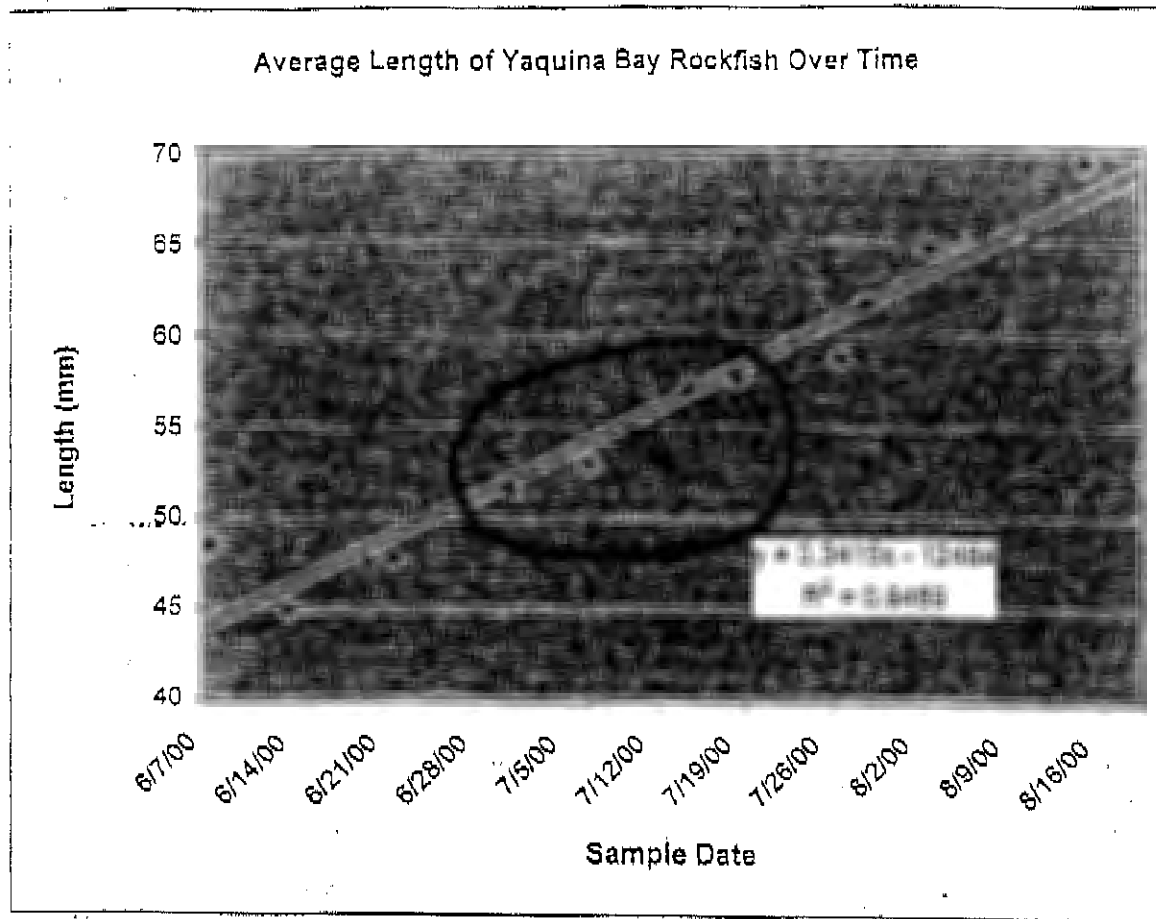


Figure 8. Average length of black Yaquina Bay rockfish over the summer. Growth rate is .34 mm/day.

haul
net
=

rockfish per haul. The highest CPUE in Yaquina Bay was 17.1 rockfish per haul with the 25-foot seine.

The CPUE is also summarized for the individual Yaquina Sites in Table 4c. Site A had the highest CPUE with 18.1 fish per haul. Site F had a higher CPUE, but only three hauls were made there, and in the time period when the rockfish numbers were peaking in the bay.

Table 4a. Catch per unit effort across all gear types. One unit of effort equals one haul of each seine

Site	CPUE
Salmon River	18
Yaquina Bay	254
Boiler Bay	22
Seal Rock	13
Winchester Bay	69
Total	82

Table 4b. Catch per unit effort for the different gear types at the different sites.

Gear Type	Site			
	Yaquina Bay	Winchester Bay	Boiler Bay	Seal Rock
10' Seine	N/A	N/A	3.3	0.62
25' Seine	17.	N/A	67.2	0.04
50' Seine	1.	0	N/A	N/A
100' Seine	2.	4.75	N/A	N/A
Cast nets	0.4	0	0	0

Table 4c. Catch per unit effort for the different gear types at the Yaquina Bay sites.

Gear Type	Site			
	A	C	F	Finger Jetties
25' Seine	18.		N/A	N/A
50' Seine	N/A		1.8	N/A
100' Seine			2	4.3
Cast nets			0	0
				0.43

Rockfish Growth

The average length of the rockfish caught over the sampling season is plotted in Figure 6. The rockfish grew in a linear fashion, at about .32 millimeters per day. The rockfish caught in Yaquina Bay grew at a rate of .34 millimeters per day. The length of the rockfish caught in the intertidal areas did not increase at as high of a rate (Figure 7), with a growth rate of .13 millimeters per day (Figure 8).

Discussion

Rockfish collected

We successfully and consistently captured good numbers of juvenile rockfish at several sites in Yaquina Bay and in Boiler Bay. We caught lower numbers of rockfish at Seal Rock and none in the Salmon River estuary. We only visited Winchester Bay twice but we captured enough rockfish to recommend it as a site for next year.

Boiler Bay was the most productive site for capturing juvenile rockfish, but the catch rate varied and seemed dependent upon environmental variables. When the conditions were good, high numbers of rockfish were caught. However, there were sampling days, especially in August, when large numbers of rockfish were observed at the site, yet the catches were low to zero (Figure 3). This may have been due to the difficulty of seining this site when the tide is at the wrong stage. Also, an increase in vegetation during the summer, or confounding factors such as the presence of predators or escapement around the net made fish capture difficult.

We captured a large number of juvenile rockfish in lower Yaquina Bay. Most were caught at site A with the 25-foot seine due to the presence of excellent rocky habitat in a readily sampled area. Catches were also good with the 100-foot seine in eelgrass beds. The large 3/8" mesh of the 100-foot seine did allow some escapement of very small rockfish in early sampling efforts.

Seal Rock had low rockfish catches throughout the sampling season. Boiler Bay had higher catches and the reasons are unclear.

No rockfish were caught in the Salmon River estuary. There is limited rockfish habitat in the estuary, most of which empties at low tide leaving only riverine freshwater flow. We expected an influx of juvenile rockfish on the flood tide but this did not occur.

Winchester Bay was sampled twice and Tillamook Bay once. We caught rockfish in both places, and both Bays have good juvenile rockfish habitat.

Problems

Identifying juvenile fish to species can be quite difficult, particularly early in the season when fish are small. Rockfish, flatfish, and sculpins were the species that gave us the most trouble. Steve Berkley (HMSC Researcher) was of some help in identifying juvenile rockfish. We feel our species identification was reasonably accurate, but not perfect. Fish were taken back to the Newport office when field identification was difficult. Variability exists in the data. Continued sampling will reduce this variability. However, future samplers should pay close attention to vegetation change throughout the season, tide stage, water quality, and effectiveness of equipment use to eliminate as much variability as possible.

Rockfish escapement may have been a source of error in the early part of the field season. We assume that in May and June juvenile rockfish could go through the mesh of the 100' seine. In mid June we often found rockfish gilled in the 100' net. The mesh size of the three smaller seines seemed to reduce the incidence of gilling and possibly escapement. However, with the 10' and 25' nets we assume there was escapement around the ends of the nets due to their shorter lengthen. The 50' seine may be a good compromise between net lengths and mesh size.

Some sites on Yaquina Bay were eliminated from regular sampling because of the high levels of by catch (non target species). We found that it took so much time to document large hauls of perch that we missed seining opportunities at other sites.

Net fouling or rolling can be a problem when seining highly vegetated areas. To combat this we installed a second footrope on the 100' seine. The second footrope is made of chain and has enough weight to be pulled through areas that are moderately vegetated without rolling. In addition, it is best to target areas on the fringes of vegetation beds.

Recommendations

It is important to be consistent with the methods and sites in order to collect data that can be used to construct a rockfish recruitment index. The tide stage and environmental conditions at the sites often dictate what types of gear can be used. However, in the name of consistency, one piece of gear per site should be chosen for future sampling.

The 25-foot seine was the most productive piece of gear for capturing rockfish in Boiler Bay. There were, however, times, when the 25-foot seine was too big and the 10-foot seine was deployed. The best method to sample this site is to wait for the tide to come in enough so that the 25-foot seine can be used effectively.

The 10-foot seine caught the most rockfish at Seal Rock. The smaller slots seemed to hold more fish than the larger, more open areas. The best method to sample this site is to complete many 10-foot seine hauls, as opposed to fewer hauls with a larger net.

The 100-foot seine is the best piece of gear to use in the estuaries. However, site A in Yaquina Bay is too shallow to use the 100-foot seine. The 25-foot seine is the best gear type to use for capture of rockfish at this site. Sites C, F, and H also provided good catches of juvenile rockfish routinely. They would be worth sampling in the future with the 100-foot seine.

Other methods of sampling juvenile rockfish in estuarine habitats have been discussed. One method that may prove very useful is SCUBA or snorkel surveys under the docks or along the finger jetties. Juvenile rockfish tend to form small schools, and are not frightened by people in the water (Personal observation), and would be relatively easy to count. Steve Berkeley's research assistants have captured juvenile rockfish for mark/recapture studies under the Embarcadero docks using dip nets early in the season, and very small jigs late in the season. This capture method has good potential for estimating juvenile rockfish numbers, but will not be useful for providing any habitat association information.

It would be useful to broaden the extent of this project in the future. Major estuarine finfish studies were last conducted in the late 1970's and inventory data is drastically outdated. Future expansion of this project will help update needed estuarine finfish data, but also continue to provide meaningful rockfish recruitment information.

Some rockfish samples were collected to determine their genetic background for future reference. We recommend that this part of the project be continued as relatively little additional effort will be required.

Growth rates of juvenile rockfish appeared to be greater for rockfish rearing in nutrient-rich estuarine waters. This trend should be examined in future studies.

Conclusion

Our short-term goals were met. We have established sampling methods and sites for future studies of juvenile rockfish. In addition, our results prove that it is possible to capture juvenile rockfish in a wide variety of habitats including rocky intertidal areas. We would strongly recommend that this study be continued to aid in the development of a rockfish recruitment index for the Oregon Coast.

References

- Adams, P. and Howard, D. 1996. Natural mortality of blue rockfish, *Sebastes mystinus*, during their first year in near shore benthic habitats. *Fishery Bulletin*, 94:156-162.
- Adams, S. 1976. The ecology of eelgrass, *Zostera marina* (L.), fish communities. I. Structural analysis. *J. exp. Mar. Biol. Ecol.*, 22:269-291.
- Bayer, R. 1979. Intertidal shallow-water fishes and selected macroinvertebrates in the Yaquina Estuary, OR. Master's thesis, Oregon State University. Newport, OR.
- Bottom, D., and Forsberg, B. 1978. The fishes of Tillamook Bay. Portland OR: Ore. Dept. Fish Wildl., Final report fish research project. Project number F-100-R.
- Fox, D, et al. 1994. Oregon rocky shores natural resource inventory. Newport OR: Ore. Dept. Fish Wildl., Marine Region.
- Haldorson, L., and Richards, L. 1986. Post-larval copper rockfish in the Strait of Georgia: Habitat use, feeding and growth in the first year. *Proc. Int. Rockfish Symp.* pp 129-141.
- Johnson, J. and Fox, D. 2000. Nearshore juvenile rockfish survey. Ore. Dept. Fish Wildl. Project proposal, Marine Region.
- Johnson, J., Liscia, D., and Anderson, D. 1986. The seasonal occurrence and distributions of fish in the Umpqua Estuary, April 1977 through January 1986. Ore. Dept. Fish Wildl., Fish Division. Information reports 86-6.
- Kendall, A. Jr. And Lenarz, W. 1986. Status of early life history studies of northeast Pacific rockfishes. *Proc. Int. Rockfish Symp.* pp 99-129.
- Laroche, W., and Richardson, S. 1980. Development and occurrence of larvae and juveniles of the rockfishes *Sebastes flavidus* and *Sebastes melanops* (Scorpaenidae) off Oregon. *Fishery Bulletin*, 77:4:901-923.
- Love, M, Carr, M., and Haldorson, L. 1991. The ecology of substrate-associated juveniles of the genus *Sebastes*. *Environmental Biology of Fishes*, 30:225-243.
- Matarese, A., et al. 1989. Laboratory guide to early life history stages of northeast Pacific fishes. NOAA technical report NMFS 80.
- Myers, K. 1980. An investigation of the utilization of four study areas in Yaquina Bay, Oregon, by hatchery and wild juvenile salmonids. Master's thesis, Oregon State University, Corvallis, OR.

Singer, M. 1985. Food habits of juvenile rockfishes (*Sebastes*) in a central California kelp forest. Fishery Bulletin, 83:4:531-541.

Parameters Recorded

Here is a list of the parameters that were recorded during the course of this project.

Photos- Pictures of sampling methods, study sites, fish, and other related images

Date- Keep it consistent in spreadsheet (i.e. dates should be in exactly the same format)

Primary Site- Overall area that is sampled

Secondary Site- Specific sampling area

Fish Species- Record species name and/or specific characteristics (i.e. right-eyed flatfish)

Capture Method- What piece of equipment fish were caught with

Unit Effort- Keep each seine set as a discrete piece of data.

Specimen Length- Record in millimeters

Time- Record for each set

Tide Stage- Record stage for each set (there is software available that will convert time of day into a tide stage)

Water Clarity- Measured with a secchi disk

Water Temperature- Check thermometer accuracy

Salinity- Could be recorded in future with hydrometer

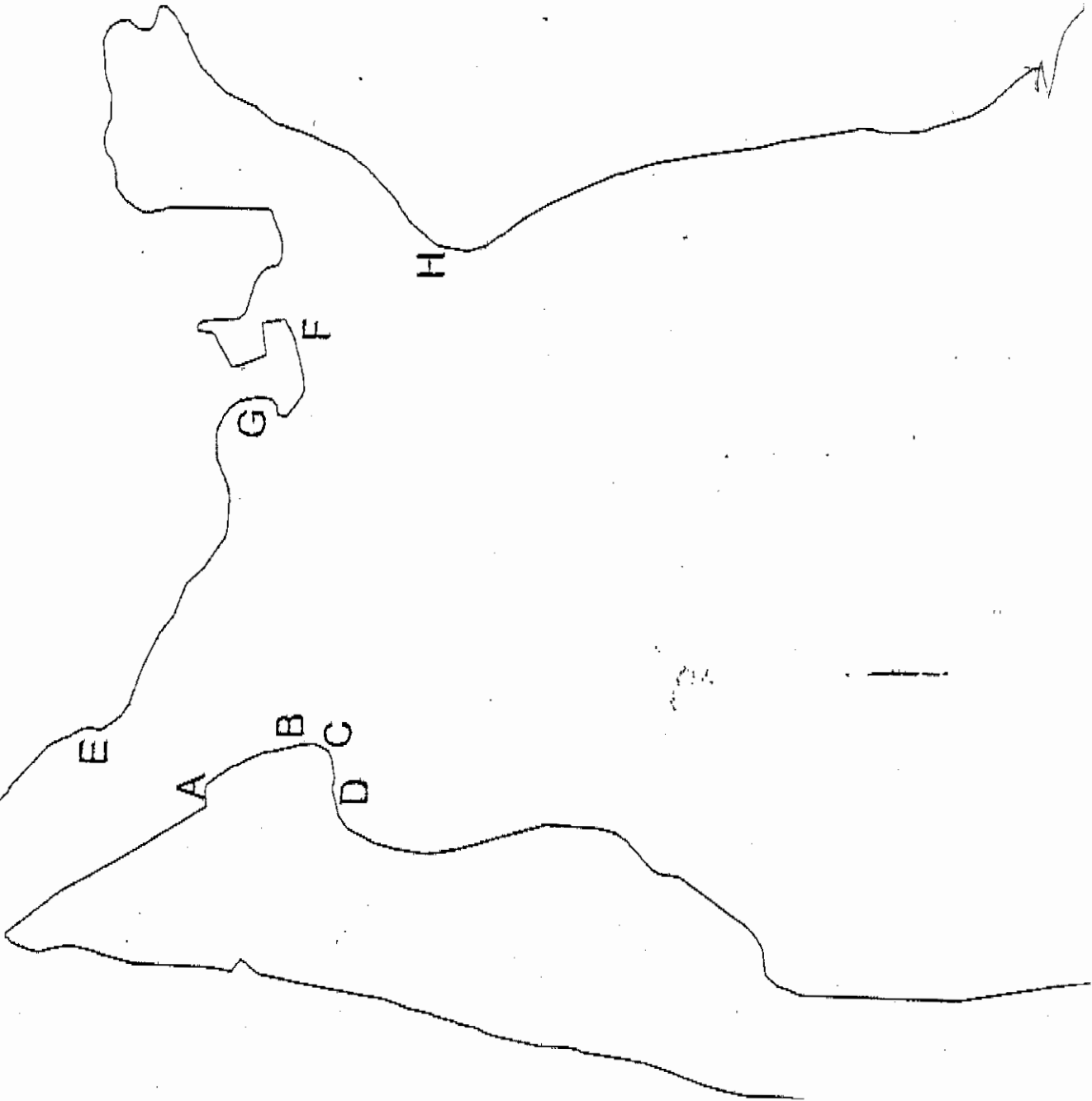
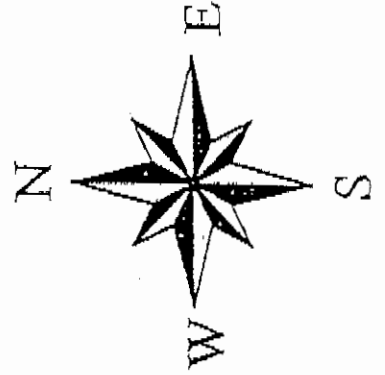
Location on Laminated map- These maps work well in the field

GPS coordinates- Record with hand held device

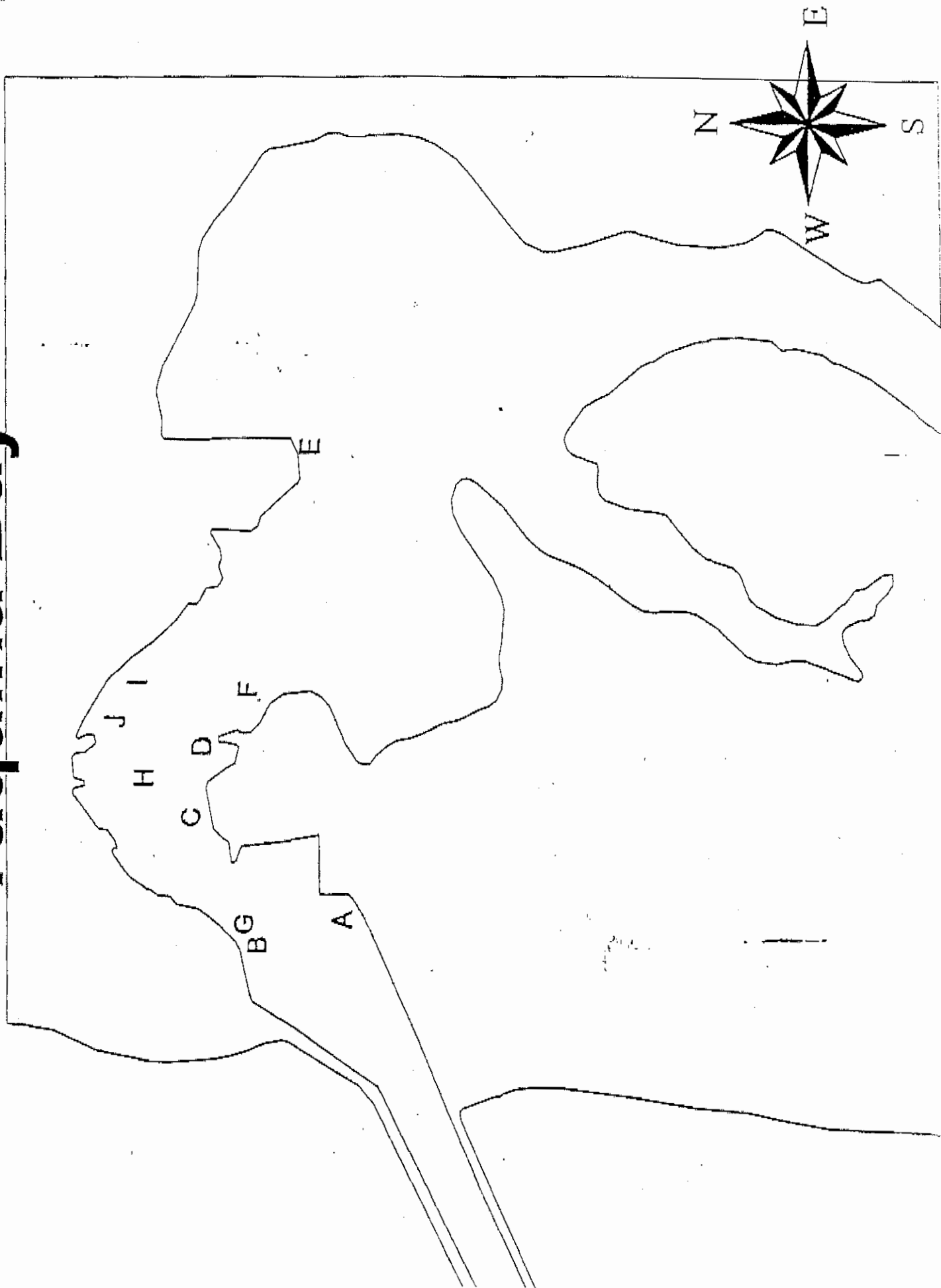
7 Most Likely Habitats Rockfish Will Be Found In

- Eel grass
- Surf grass
- Boat docks
- Sargassum weed
- Feather boa kelp
- Jetties
- Riprap

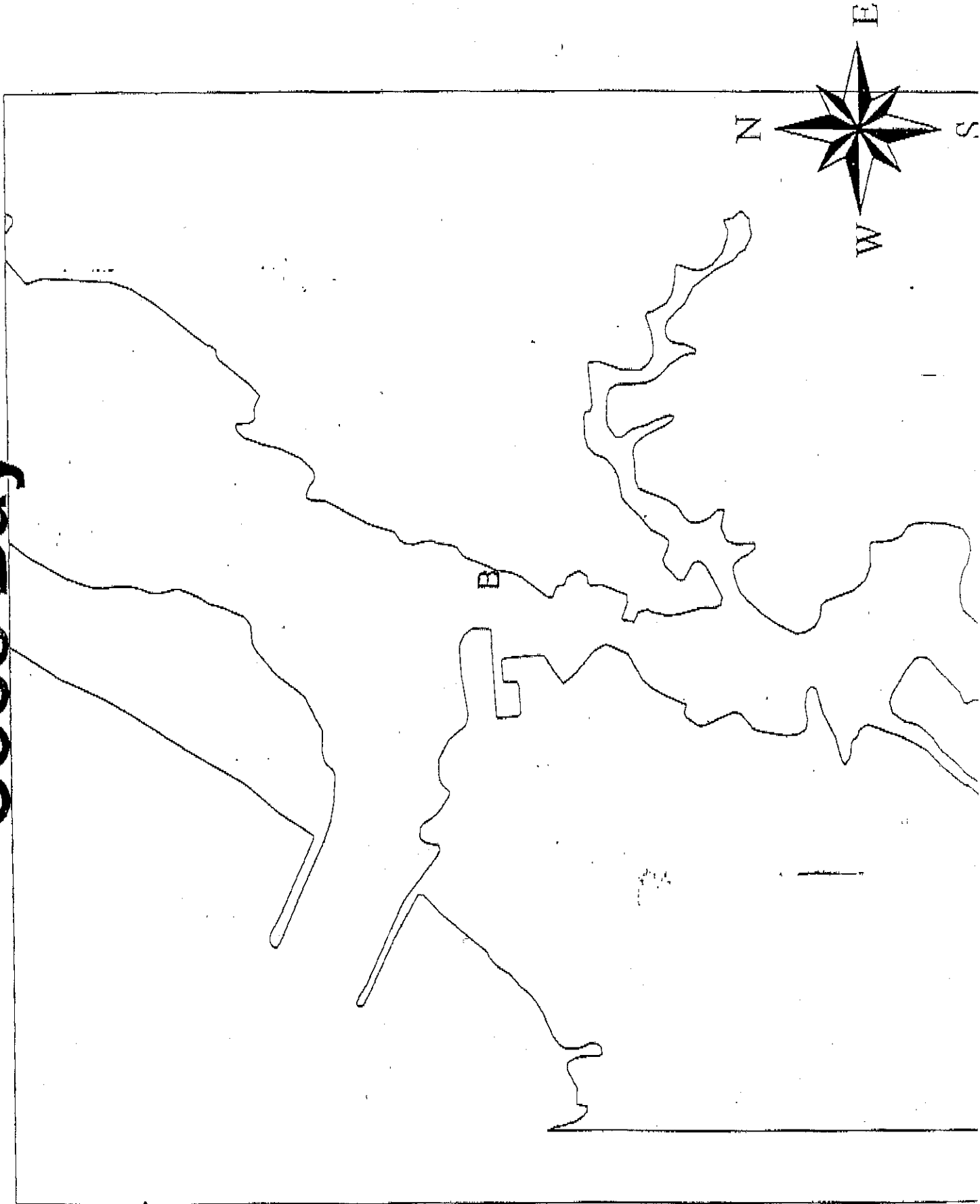
Tillamook Bay



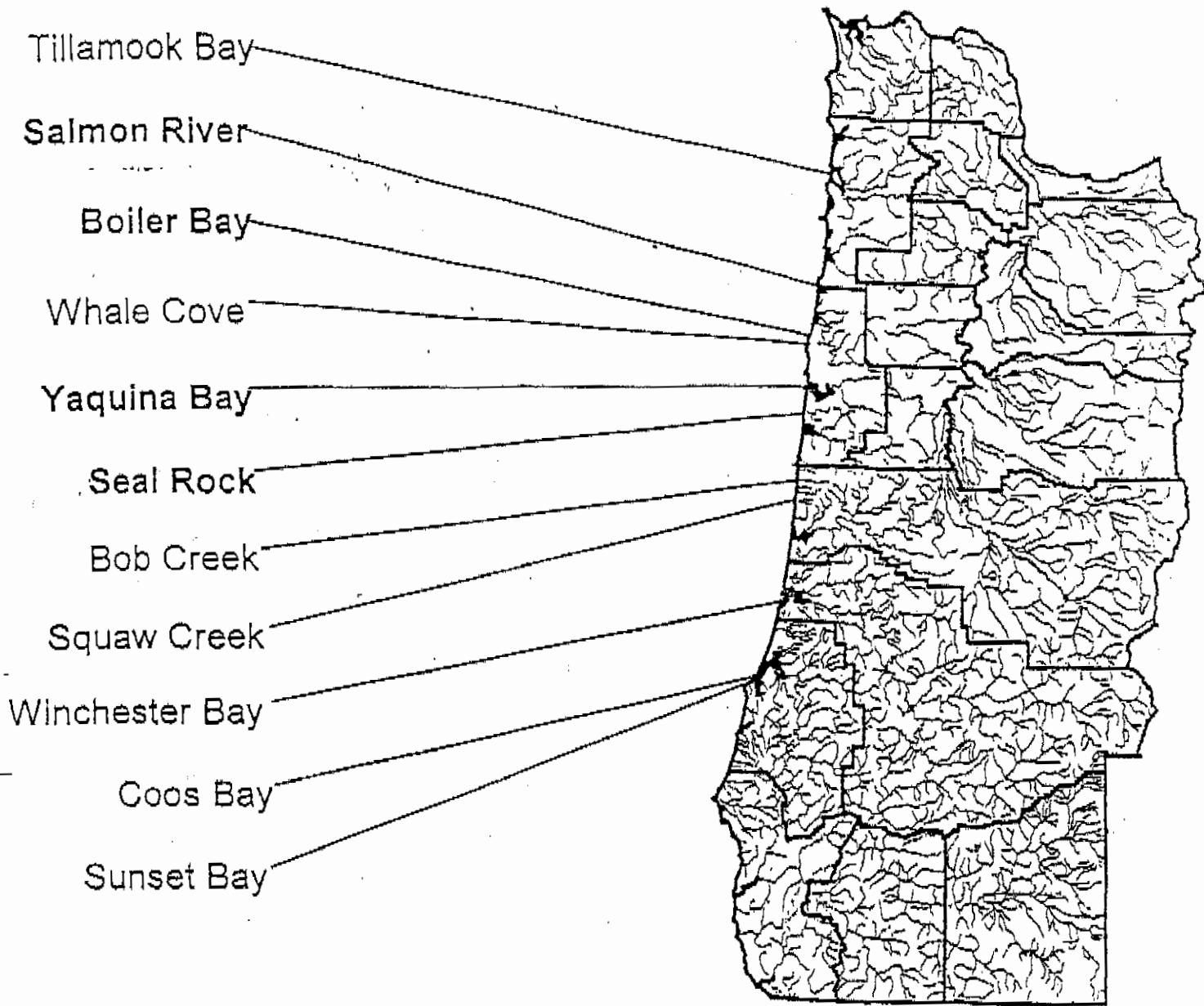
Yaquina Bay



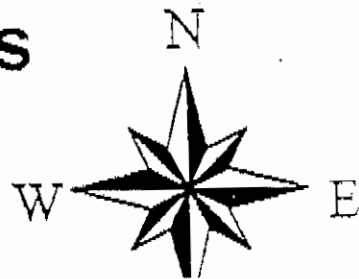
Coos Bay



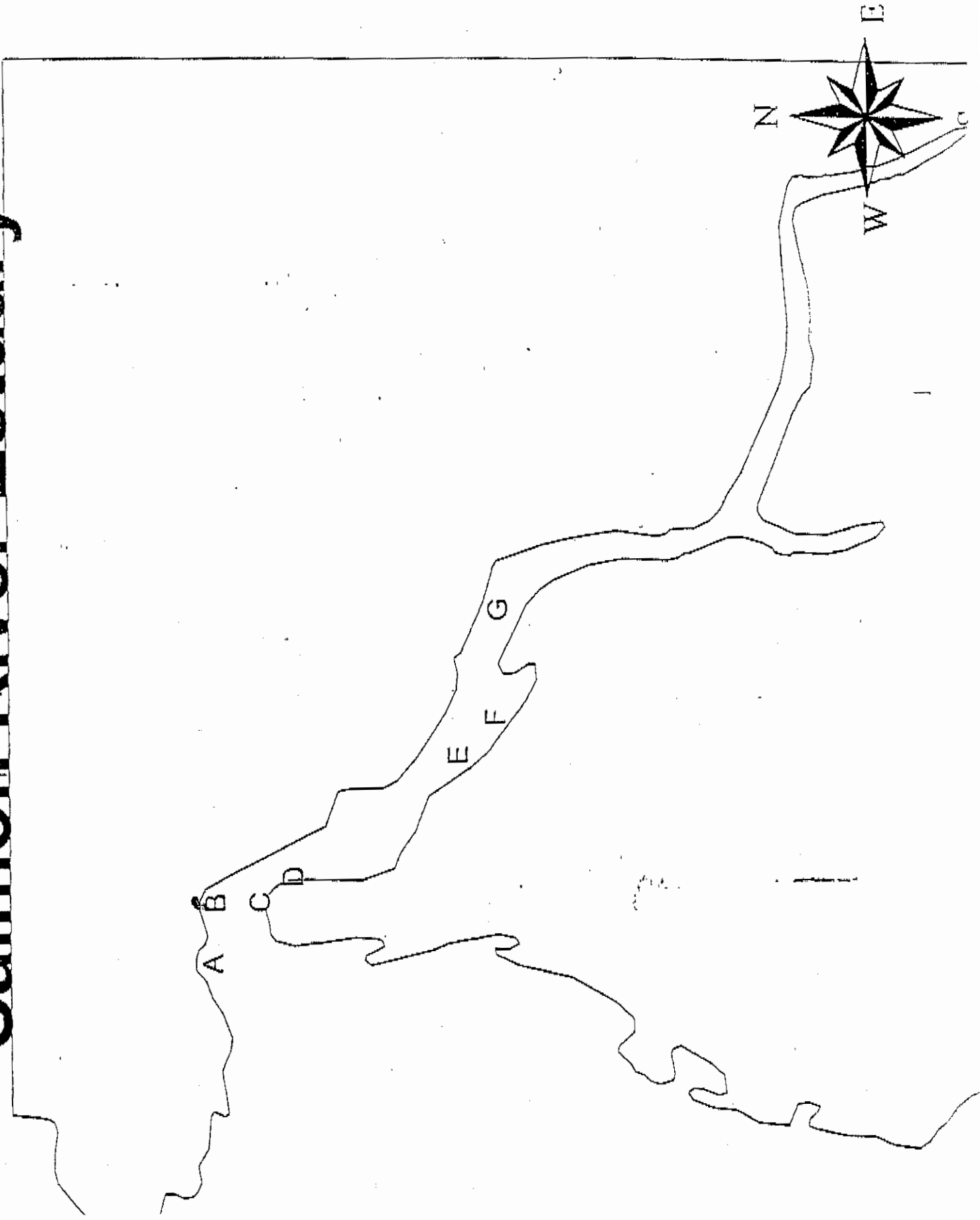
Juvenile Rockfish Project Study Sites 2000



 **Western Oregon Counties**
Rivers



Salmon River Estuary



Parameters Recorded

Here is a list of the parameters that were recorded during the course of this project.

Photos- Pictures of sampling methods, study sites, fish, and other related images

Date- Keep it consistent in spreadsheet (i.e. dates should be in exactly the same format)

Primary Site- Overall area that is sampled

Secondary Site- Specific sampling area

Fish Species- Record species name and/or specific characteristics (i.e. right-eyed flatfish)

Capture Method- What piece of equipment fish were caught with

Unit Effort- Keep each seine set as a discrete piece of data.

Specimen Length- Record in millimeters

Time- Record for each set

Tide Stage- Record stage for each set (there is software available that will convert time of day into a tide stage)

Water Clarity- Measured with a secchi disk

Water Temperature- Check thermometer accuracy

Salinity- Could be recorded in future with hydrometer

Location on Laminated map- These maps work well in the field

GPS coordinates- Record with hand held device

7 Most Likely Habitats Rockfish Will Be Found In

- Eel grass
- Surf grass
- Boat docks
- Sargassum weed
- Feather boa kelp
- Jetties
- Riprap