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Progress Report, Yaquina Bay  
Oyster Investigation.

by

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Yaquina Bay is a comparatively small estuary on the coast of Oregon about 150 miles south of the Columbia River. It covers a total of about five square miles of territory and has an average depth of 20 feet in the channel at mean low waters. The upper half of the bay contains very little tide lands, but about half of the lower portion is bare on an average low tide. The bay receives fresh water from the Yaquina River and a number of small creeks. Salinity studies indicate that the volume discharged by these streams is small except during flood stages.

Natural oyster beds occur in the channel in the main bay beginning four miles above the mouth and extending about two miles up the bay, also in two small sloughs where the bottoms are not exposed at low tide. In a few places about the bay oysters are found clinging to rocks and sticks at the low water level, but the commercially important beds are found only in the deeper waters.

Oystering has been a local industry since the coming of the white man, but the productivity is limited by the small size of the beds and by a tendency toward a generally light catch.

## Historical

The Yaquina Bay Oystermen's Association was formed about 1868 for the avowed purpose of administering the oyster beds of the vicinity. It was composed of all the local residents "who tonged the natural beds for the whole or part of their livelihood". The organization was recognized by the state and its rules automatically became a part of the fishery statutes. Every member was allowed to tong freely on the natural beds from September until some time in May, and was allotted two acres of barren land for a private bed, upon which he could plant one-half of the seed which he took up from the natural beds with the marketable oysters. In order to hold a private bed, the owner was obliged to mark the corners with poles and to work the ground at stated intervals. Only a single claim could be held by an individual.

For many years the beds were carefully and intelligently administered by this association. As the population increased in the vicinity, the organization became less able to cope with problems, and the State Fish Commission was given powers of general administration. The association proper ceased to function in 1923 when the members changed the constitution in order to allow one person to own any number of private beds. They immediately sold all of their claims to the Oregon Oyster Co., who took over the books of the association and became the Oystermen's Association, in fact. The same company leased the state beds and now controls all of the oyster beds in the main bay. Two small sloughs tributary to Yaquina Bay contain natural oyster beds, which are held by the abutting upland owners.

### Area and Oyster Population.

The area of the oyster bearing bottoms was computed from U.S.C. & G.S. chart No. 6058. The limits of the beds were determined by dredging. In the Shipyard channel the bottom is very rocky, and covered with tree trunks and limbs. Dredging is impossible over a part of the area, and tonged samples from adjacent locations may be entirely different in sizes and numbers. As many as a thousand oysters in large clusters were found on a single square yard. Most of the oysters are confined to the south side of the channel, where they are washed by a swift current on both flood and ebb tides. It is said that this area occasionally has a very heavy set of seed. Apparently, a regular set of medium proportion has been obtained in recent years. This section is the most heavily populated portion of the Yaquina beds and will support a vigorous fishery.

The middle ground, sometimes called Lewis flats, has a smooth sandy surface. It is the most uniformly populated of all the beds. Since the bottom is even, the population was easily determined from dredged samples. The oysters are completely covered with barnacles, which are in turn coated with sand tubes of a small crustacean. Although these oyster shells are heavily coated, they have upon them a light set of 1931 oysters. Experimental culch upon the same area caught a slightly heavier set, although at the termination of the experiments setting was probably not complete. Apparently, clean culch could be used to materially increase the efficiency of setting.

The Oysterville flats are "spotty." In front of the old Multnomah boom the oysters are numerous. Nearby areas are barren, or nearly so, and portions of the beds are covered by a deep, thin mud. A large part of this bed has been destroyed by the construction of docks and a log dump, all of which were later abandoned without removing the obstructions to the current, and at the present time mud settles on ground that previously produced many oysters.

The Big Flat extends from Boone (Caffrey) Island to Hauck's float. It supports only a few oysters although the beds are heavily covered with clam shells. Since this area catches very little seed, and transplantation has never been practiced on Yaquina Bay, the growing power of this area has not been determined.

The Big Bend bed is actually an extension of the Big Flats, but it is considered separately for convenience. The producing area and the population is only roughly approximated. The bottom is heavily covered with clam shells among which are a few oysters. A reference point was made by lowering a dredge to the bottom from an anchored boat. Five to ten tong loads of shell could be taken from one place before any apparent decrease in the number of oysters and shells was noted. The oystermen who have tonged this bed in past years say that it is a heavy producer of marketable oysters, but considerable tonging of shells is necessary before the oysters can be taken in quantities.

### Salinity.

Although the rainfall of Western Oregon is quite heavy, only a few small streams enter Yaquina Bay. The discharge during a rainy period is, however, sufficient to lower the salinity considerably. On May 5, after a period of heavy rains, a total of 33 stations was sampled and the salinity determined. Oysters are found between stations 15 and 23 only. At low tide the salinity at the mouth of the bay was 27.97, and the water in the bay at Toledo was fresh. At the lower limit of oysters, the salinity was 17.66 and 7.56 at the upper limit (Table 1.) A rainless period followed, and the salinity over the central portion of the oyster beds rose to 32.22 at high water on June 10. Continued rains during June and early July reduced the salinity during that period, but a uniformly dry period in the latter part of July and all of August was accompanied by a high salinity of the bay water. The upper limit of oysters in Yaquina Bay may be dependent on the winter salinity, although further observations indicate that other factors are responsible. Setting does not occur above station 23, although the summer salinity is sufficiently high as far as Toledo.

There is a uniform tendency for the fresher waters from up the bay to flow over the water of higher specific gravity toward the mouth. The salinity at the surface is less than at the bottom in all cases. The difference may not be of sufficient magnitude to be significant. (Table 2.)

Table 1. Salinity, Yaquina Bay.

Station; 5-5-31 ; 7-30-31 ; 8-11-31			
1	27.97		
2	27.25		
3	27.36		
4	25.30		
5	24.92		
6	25.43		
7	24.52		
8	23.82		
9	23.31		
10	21.94		
11	21.77	33.93	
12	22.30	33.93	
13	19.84	33.06	
14	18.93	33.56	
15*	17.66	33.56	
16		33.09	33.26
17	15.04	33.15	
18	14.07	33.06	32.28
19	13.51	33.01	
20	12.64	31.96	31.38
21	10.81	30.18	
22	9.03	29.63	29.27
23**	7.56	29.04	
24	6.93	29.52	
25	5.63	27.81	
26	4.97	27.99	27.34
27	3.60	27.12	
28	3.36	25.88	
29	2.98	25.77	
30	1.99	23.70	
31	± 1.40	22.09	22.61
32	± 1.10		
33	± 1.00		

\* Lower limit of oysters.

\*\* Upper limit of oysters.

Table 2. Salinity, Surface and bottom.

Date	Station	Time	Bottom Salinity	Surface Salinity	Difference
7-31-51	16	9:00 A.	28.53	27.84	0.67
7-31-51	16	9:45 A.	29.00	28.65	0.35
7-31-51	17	9:30 A.	27.45	26.56	0.89
8- 5-51	22	4:00 P.	31.42*	30.99	0.43
8- 6-51	16	5:55 P.	33.82	33.33	0.49
8-10-51	16	4:30 P.	33.41	30.68	1.73
8-11-51	16	1:25 P.	33.68	33.26	0.42
	18	1:33 P.	32.63	32.28	0.35
	20	1:43 P.	31.88	31.38	0.51
	22	1:55 P.	29.88	29.70	0.29
	26	2:10 P.	28.42	27.34	1.08
	31	2:35 P.	23.15	22.61	0.54

\* Average of two readings.

Table 3. Salinity, Station 19, Yaquina Bay, 1951.

Date	Salinity	Date	Salinity	Date	Salinity
May 5	13.91	July 1	23.59	August 1	29.51
12	15.01	2	28.03	2	31.09
16	19.84	3	22.55	3	29.27
28	23.01	4	27.43	4	30.47
30	23.69	5	23.77	5	30.27
June 3	24.32	6	26.44	6	31.09
10	32.22	7	27.63	7	30.10
12	30.04	8	26.65	8	29.84
13	29.09	9	27.27	9	30.75
14	22.90	10	26.88	10	29.70
15	27.63	11	24.08	11	32.31
16	25.88	12	28.30	12	
17	29.34	13	30.13	13	32.66
18	25.29	14	24.88	14	32.00
19	26.63	15	25.26	15	29.69
20	27.11	16	28.07	16	33.47
21	23.74	17	24.25	17	28.91
22	25.14	18	32.29	18	30.75
23	23.42	19	31.24	19	32.97
24	27.43	20	28.91	20	
25	25.24	21	30.65		
26	24.92	22	30.21		
27	22.29	23	29.85		
28	23.31	24	30.50		
29	27.85	25	28.39		
30	23.57	26	28.56		
		27	27.99		
		28	33.82		
		29	26.59		
		30	30.76		
		31	30.30		



### Spawning.

Larvae were first reported by shuckers in the mantle cavity of the adult oyster on May 5, although the report was not verified. On May 28, white spawn (segmenting eggs) were found in three individuals out of 42 oysters taken from the mouth of Caffrey slough. No larvae were found in oysters from the main bay until June 6, although nearly a thousand oysters were examined before this time. (Table 4). No shelled larvae were found in the oysters until near the middle of June, and it was not until the middle of July that any larvae appeared ready for discharge by the parent. Thermograph records were not obtained, but it was evident from the occasional temperature readings that during the month of June and part of July the water was unusually cold. Between Yaquina and the oyster beds, the temperature of the water at low tide in the early morning was about 15 degrees C. until July 10. Thereafter, it was between 18 degrees C. and 21 degrees C. The spawning oysters in Yaquina Bay never come in contact with the warm waters such as found in the oyster dikes of Puget Sound.

Larvae continued in the mantle cavity of the oyster until the end of August, except in the Shipyard where spawning was apparently completed or had ceased on July 27.

Black spawn such as found in the mantle cavity of the spawning oysters in Puget Sound is never encountered in Yaquina Bay. The larvae, when apparently ready for discharge, form a reddish gray mass which is never as large in amount as that from oysters from other beds.

In four cases segmenting eggs were found in the mantle cavity of the parent along with shelled larvae. It is, therefore, possible for a native oyster to spawn while carrying larvae in the mantle cavity, fertilize the eggs and incubate two broods of different ages at one time. In each case the broods were small in numbers and volume.

Table 4. Spawning Data.

Date	Number : Spawners	Number : Opened	Per cent : Per cent	Location	Color of : Larvae
5-5-31	1*	1200	0.1	Peole Slough	white
5-28	3	42	7.1	Caffrey Slough	white
6-1	3	33	9.1	Caffrey Slough	white
6-6	3	40	20.0	Middle ground	white
6-8	6	50	12.0	Shipyards	white & gray
6-14	4	16	25.0	Middleground	gray
6-14	4	38	10.5	Big Bend	White
6-28	12	150	8.0	Middleground	gray
6-22	22	116	19.0	Shipyards	gray
7-12	4	20	20.0	Middleground	dark
7-12	6	20	30.0	Shipyards	dark
7-12	7	20	35.0	Big Bend	gray
7-14	8	20	15.0	Big Bend	gray
7-27			21.0	Oysterville Flats	white & gray
7-27**			18.0	Big Bend	white & gray

\* Reported by oyster opener.

\*\* No spawning in Shipyard Channel on this date, apparently complete.

Larvae in mantle cavity in about 5% oysters by middle of August. A few spawners reported by openers in September.

### Setting.

The short period of general setting was not found in Yaquina Bay in 1931. The first set was found on July 25 when one was taken from the experimental dike and another from the Oysterville Flats at the Multnomah boom. Both were in fresh cultch bags. By August 1, a light set was down. About 90% of the shells were blanks (without set), seldom more than one spat could be found on one shell. Setting continued slowly; by the middle of August less than 50% of the shells were blanks and in the Shipyard Channel a fair set could be seen. Outside of the Shipyard the total number of set was about equal to the number of all other oysters on the ground. Experiments with cultch bags indicate that setting takes place at all levels in Yaquina Bay just as it does in Oyster Bay, Elkhorn Slough, and other places where it has been tried. Owing to the lateness of the light set, the results obtained from cultch bag experiments are not considered of importance.

### Experimental Diking.

Oysters do not grow naturally on any part of the inter-tidal zone in Yaquina Bay. This is true probably because there is no suitable bottom or cultch to catch seed. Most of the exposed-area is very soft; it will not support a man's weight and is not of permanent contour.

To determine the feasibility of diking, an experimental structure was built in Caffrey's Slough, near the mouth. An area 20 by 200 feet was floored with inch lumber and surrounded by a dike of similar material. The floor was held in place by three inches of mud and a surface layer of shell. The bed was shelled during the first week of June and again in July. Bags of shells were also planted at intervals until August 5, when attention to the project was suspended until another season.

A number of large oysters planted in the dike made excellent growth during the summer. The first set of the year was found in this bed, and the final set was about equal to that of the natural beds.

The efficiency of this bed probably can be greatly increased by a few minor changes. Further attention should be ~~given~~ this experiment, as it represents the only way to increase the industry naturally. The results thus far do not indicate the advisability of undertaking commercial development along this line, but, if it can be done, the Yaquina Bay industry will be more than doubled.

### General Conclusions.

If oyster production on the State grounds is to be increased, it will be necessary to adopt the following procedure:

1. Oyster the entire area immediately.
2. Supply ample cultch to the most productive seed beds to obtain the maximum set possible.
3. Transplant the seed so obtained to the best growing areas.

Considering these recommendations separately, it should be noted that in regard to (1) the seed and small oysters should be removed to the lower beds, Big Bend and Big Flat, as these appear to be the best growing areas.

(2) The best seeding areas are in Shipyard Channel and on the Oysterville Flats. These should, therefore, be planted heavily with clean shells just before setting time next year.

(3) As stated above under (1), the best growing areas are at Big Bend and Big Flat. The seed from next year's strike should, therefore, be relaid on these growing areas.