A REPORT ON THE PORT ANGELES HARBOR INTERTIDAL CLAM AND BIOLOGICAL SURVEY

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AUGUST 1970

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ABSTRACT

The Washington State Department of Ecology (WDE) conducted a clam population study on three Port Angeles Harbor beaches to determine relative abundance of intertidal clams and other marine organisms in relation to beach type and location within the harbor. WDE staff personnel dug substrate samples at two tide levels along measured transects and observed and identified marine organisms at the sampling sites. The field data and samples were processed at the WDE laboratory, Olympia, Washington.

INTRODUCTION

Substantiated statements of long-term Port Angeles residents indicate that large populations of clams inhabited the intertidal beaches of Port Angeles Harbor in the early 1900's. To determine present clam locations and abundance, the Washington Department of Ecology (WDE) and the Washington Department of Fisheries (WDF) cooperatively conducted a clam population density study within Port Angeles Harbor. Phase 1, the subtidal investigation, funded by WDE, was conducted by the WDF, during January and February, 1969, at depths between 10 and 80 feet (Goodwin and Westley, 1). They found good populations of commercially important and noncommercial clams.

This report covers phase 2, the intertidal study which was conducted by the WDE on intertidal beaches at low-low tide. The primary objective of this study was to determine clam abundance by species in relation to location and beach type in the intertidal zone of the harbor. General observations regarding the number and species of other intertidal macro-organisms were also noted.

METHODS AND EQUIPMENT

Three separate beach areas within Port Angeles Harbor were selected on the basis of suitable clam habitat and accessibility (Figure 1). Each beach was measured off into 400-foot transects which consisted of imaginary lines extending from the low-low tide waterline through the intertidal zone to the high-water mark as follows:

Beach #1 (Transects 1 through 14) commenced at the east end of the ITT-Rayonier, Inc., pulp mill property and extended eastward for approximately 1 mile.

Beach #2 (Transects 15 through 23) commenced at the east end of the United States Ferry Terminal and extended eastward for approximately 1 mile to the west side of the ITT-Rayonier mill.

Beach #3 (Transects 24 through 37) commenced behind the eastern end of the log booming grounds on Ediz Hook and extended eastward along the Hook, nearly reaching the end of the spit.

Substrate samples designated by the letter "A" were collected near the intersection of the transect with the low-low tide water line, while those designated by the letter "B" were collected near the intersection of the transect with the zero foot datum as judged by beach slope and rising tide.

At each location a 2 ft.^{2} surface area was dug to a depth of 1/2 to 2 ft. Where beach conditions clearly prevented clam habitation, samples were not collected.

All samples were screened through 1/2-inch hardware cloth. Complete shells, fragmentary shells, hinged valves, and live clams were bagged separately and analyzed in the Department of Ecology laboratory, Olympia, Washington,

(Lab #69-3372-76). Beach type and the presence of marine macro-organisms other than clams also were noted.

Beach samples were processed individually and the resulting data were recorded by transect number (Tables 3, 4, and 5). Live clams collected in each sample were enumerated, measured and weighed (whole wet weight). These data were recorded by commercially important species, noncommercially important species, and marketable size. Whole and fragmentary shells obtained in each sample were combined and weighed while hinged valves were weighed separately.

RESULTS

A total of 229 clams were collected during the intertidal investigation (Table 1 and 2). Three were found in the 23 samples taken from Beach #1, 62 in 20 Beach #2 samples, and 164 in 17 Beach #3 samples. Of the twelve different clam species observed, only two are commercially important (the native little-neck and the butter clam). Nine different species were taken from Beach #3, three species from Beach #2, and one species from Beach #1. The two commercially important clam species were found on Beach #3.

Beach #1 substrate consisted of sand and widely dispersed rocks at the low-low tide line, and sand with closely packed rock at the zero-datum line (Table 3). Small tidal pools were scattered throughout the area. Significant quantities of black sludge were noted at four of the sampling sites.

Two pollution-tolerant bent-nose clams, Quayle (2), were collected near the center of Beach #1 (Table 3). Only four hinged valves were found in the samples; however, complete shells were visible on the beach surface throughout

the intertidal zone. Relatively small amounts of shell fragments were collected in the samples or were observed on the beach. No marine macro-organisms other than shore crabs were observed on the beach or in the Beach #1 samples; however, one or two species of crustaceans inhabited the rocky area at the zero-datum line.

Beach #2 substrate was similar in composition to that of Beach #1. Black sludge in relatively minor quantities also was observed (Table 4).

Noncommercial clam species were collected from most of the Beach #2 samples (Table 4). Fragmentary shell and one hinged shell also were collected in these samples. Many hinged valves and whole shells of both commercial and noncommercial species were observed on the beach surface throughout the intertidal area. Several species of mollusks, crustaceans and annelids were noted in sections of the beach that provided suitable habitat.

Beach #3 substrate was primarily sand and gravel with widely dispersed rocks (Table 5). Eel grass and kelp were abundant in the intertidal zone. No black sludge was observed on this beach.

Of the 164 clams collected from the Ediz Hook samples, 117 were commercial species of which 91% were native little-neck (Table 2). The largest number of clams, the greatest variety of species, and the only commercial clams were found on Ediz Hook. Hinged valves were observed in comparatively greater numbers in these samples. Annelids, crustaceans and other marine macro-organisms were observed throughout the Beach #3 intertidal area.

Numbers of clams per sample collected from beaches #1, #2, and #3 were 0.13, 3.1, and 9.6, respectively. Staff biologists of the WDF and the WDE agreed that Port Angeles Harbor has all the requirements and no natural barriers for intertidal clam populations.

ACKNOWLEDGMENTS

Ron E. Westley, chief biologist, and Lynn Goodwin, biologist, of the Washington State Department of Fisheries, Pt. Whitney Shellfish Lab, assisted WDE in establishing sampling techniques and identification of clam species collected.

Joe McCloskey, WDE, assisted in sampling and making observations.

Harry Tracy, biologist for WDE, edited the manuscript.

LITERATURE CITED

1. Goodwin, C. L., and Ron E. Westley. "Port Angeles Subtidal Clam Survey." Washington State Department of Fisheries. (July 1970).

2. Quayle, D. B., "The Intertidal Bivalves of British Columbia." British Columbia Provincial Museum, Department of Education, Handbook No. 17 (July 1960).

APPENDIX

TABLES AND FIGURES

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Table 1. Species and numbers of clams collected in the Port Angeles intertidal survey, WDE, 1969.

Commercial species*	Total clams collected	No. of samples containing clams
Butter clam *Saxidomus giganteus*	10	2
Native little-neck *Protothaca staminea*	107	11
Noncommercial species*		
Bent-nose *Macoma nasuta*	25	10
Polluted macoma *Macoma irus*	30	11
Macoma *Macoma* (genus only)	3	2
Soft-shell *Mya arenaria*	4	4
Truncate soft-shell *Mya truncata*	1	1
Tellen *Tellina* (genus only)	36	8
Horse clam *Tresus (Schizothaerus) capax*	4	1
Horse clam *Tresus* (genus only)	4	3
Cockle *Clinocardium nuttalli*	4	1
Jackknife *Solen sicarius*	1	1
Total	229	55

*scientific and common names taken from Quayle (2).

Table 2. Numbers taken and length ranges for clam samples by species, for the beaches, (transects 1-37), WDE, 1969.

Transect; dig sample	Species and No.	Length ranges in mm by species
Beach #1		
7A	bent-nose (2)	43-47
10A	bent-nose (1)	38
	Total 3	
Beach #2		
15B	bent-nose (2)	20-41
16A	bent-nose (2)	19-36
17A	bent-nose (2)	22-59
18A	bent-nose (2), tellen (3)	(b)*12, (t)11
19A	tellen (11)	9-18
19A	tellen (5)	9-19
19B	tellen (2)	16-36
20A	tellen (3), polluted macoma (1), macoma (1)	(t)*12-13, (p)19, (m)12
20A	tellen (4), polluted macoma (2)	(t) & (p)11-15
21A	tellen (3), macoma (2)	(t) & (m)9-18
21A	tellen (5)	12-15
22A	bent-nose (3), polluted macoma (2)	(b)26-32, (p)10-15
23A	polluted macoma (6), bent-nose (1)	(p)11-16, (b)35
	Total 62	
Beach #3		
24A	soft-shell (1)	19
27A	little-neck (1), soft-shell (1)	(l)48, (s)26
28A	little-neck (16), soft-shell (1), polluted macoma (5)	(l)14-47, (s)65, (p)17-35
29A	little-neck (3)	28-41
29B	horse clam (T. capax) (4)	105-115
30B	little-neck (49), butter (9), horse clam (Tresus) (1), poll. macoma (3)	(l)12-49, (b)44-78 (h)59, (p)23-37
31A	little-neck (3), poll. macoma (2)	(l)25-47, (p)31
31B	little-neck (8), poll. macoma (3)	(l)15-41, (p)23-35
32A	little-neck (9)	21-23
32B	little-neck (13), poll. macoma (1)	(l)22-42, (p)27
33A	horse clam (Tresus) (2), poll. macoma (1)	(h)35-43, (p)31
34A	little-neck (3), butter (1), soft-shell (1)	(l)38-52, (b)90, (s)53
35A	little-neck (1), bent-nose (3)	(l)34, (b) 15-30
36A	truncate soft-shell (1), horse clam (Tresus) (1), jackknife (1)	(t)32, (h)14, (j)60
37A	little-neck (1), cockle (4), bent-nose (7), poll. macoma (4)	(l)30, (c)15-28, (b) & (p)12-29
	Total 164	
	Total 229	

*(b), letter corresponds to the first letter of each species name for each sample, followed by length range.

Table 3. Beach type, dry weights of whole shells and shell fragments, and wet whole weights of clam samples computed in grams per 2 sq. ft. for beach #1, transects 1-14, WDE, 1969.

Transect; dig sample	Date	Beach type	Dry wt. all shell	No. of clams	Wet whole wt., clams	
					commercial species	noncomm. species
1A*	7-28	gravel	28			
1B	7-28	gravel	63			
2A	7-28	sand	0.5			
2B	7-28	gravel				
3A	7-28	sand				
3B	7-28	gravel				
4A	7-28	sand				
4B	7-28	gravel				
5A	7-28	sand				
5B	7-28	gravel				
6A	7-28	sand	1			
6B	7-28	gravel				
7A	7-28	sand	16	2		22
7A	7-29	sand	203			
7B**	7-28	rocks	---	---	---	---
8A	7-28	sand	24			
8B**	7-28	rocks	---	---	---	---
9A	7-29	sand-rocks	23			
9B	7-29	sand	2			
10A	7-29	sand-rocks	338; 130+	1		6
10B**	7-29	rocks	---	---	---	---
11A	7-29	sand	0.5			
11B	7-29	sand-rocks				
12A	7-29	sand	50			
12B**	7-29	rocks	---	---	---	---
13A	7-29	sand-rocks				
13B**	7-29	rocks	---	---	---	---
14A	7-29	sand-rocks	35			
14B**	7-29	rocks	---	---	---	---
Total			++91$\bar{4}$	3	0	2$\bar{8}$

* A designates low tide water edge sample; B, the 0 datum sample.
** no sample taken.
\+ hinged valves (3 commercial butter clams and 1 bent-nose).
++ 91$\bar{4}$, bar indicates the digit of numerical accuracy.

Table 4. Beach type, dry weights of whole shells and shell fragments, and wet whole weights of clam samples computed in grams per 2 sq. ft. for beach #2, transects 15-23, WDE, 1969.

Transect; dig sample	Date	Beach type	Dry wt. all shell	No. of clams	Wet whole wt., clams	
					commercial species	noncomm. species
15A	7-30	sand	2			
15B	7-30	sand	23	2		9
16A	7-30	sand	28	2		2
16B	7-30	sand-rocks	30			
17A	7-30	sand	3	2		18
17B	7-30	sand	19			
18A	7-30	sand	0.5			
18A	7-31	sand	3	5		0.4
18B	7-30	sand-rocks	10			
19A	7-30	sand	51	11		1.8
19A	7-31	sand	13	5		0.5
19B	7-30	rocks	145	2		6
20A	7-30	sand-rocks	53	5		1.3
20A	7-31	sand-rocks	12	6		0.5
20B*	7-30	rocks	---	---	---	---
21A	7-30	gravel-rocks	1	5		0.9
21A	7-31	gravel-rocks	9	5		0.7
21B*	7-30	rocks	---	---	---	---
22A	7-30	gravel-rocks	63			
22A	7-31	gravel-rocks	25;5**	5		6
22B*	7-30	rocks	---	---	---	---
23A	7-30	gravel-rocks	40			
23A	7-31	gravel-rocks	9	7		5
23B*	7-30	rocks	---	---	---	---
Total			544.5	62	0	52.1
			+$54\bar{5}$			$5\bar{2}$

* no sample taken.
** hinged bent-nose.
\+ $54\bar{5}$, bar indicates the digit of numerical accuracy.

Table 5. Beach type, dry weights of whole shells and shell fragments, and wet whole weights of clam samples computed in grams per 2 sq. ft. for beach #3, transects 24-37, WDE, 1969.

Transect; dig sample 8-1-69	Beach type	Dry wt. shell			Wet whole wt.			
					comm. species wt.			noncomm.
		hinged	un-hing. all spec.	total shell	comm. size	noncomm. size	total	species
24A	mud-"gunk"		0.2	0.2				0.4
25A	pea gravel		0.2	0.2				
25B	pea gravel							
26**								
27A	sand-rocks		11	11	26		26	0.5
28A	sand-rocks		24	24	88	22	110	46
29A	sand				30	5	35	
29B	sand							532
30A**								
30B	sand-rocks	3+	34	37	464	181	645	30
31A	gravel-rocks	6+	30	36	49	3	52	9
31B	sand-rocks	15*	8	23	40	7	47	9
32A	sand-gravel				38	30	68	
32B	gravel-rocks	33*,4+	11	48	14	48	62	2
33A	sand-rocks		11	11				16
34A	sand-rocks		14	14	172		172	19
35A	sand-rocks		3	3		9	9	5
36A	sand-rocks		5	5				4
37A	sand-rocks	2+	11	13		7	7	20
	Total	++$6\bar{3}$	162.4	225.4	$92\bar{1}$	$31\bar{2}$	$123\bar{3}$	692.9
			$16\bar{2}$	$22\bar{5}$				$69\bar{3}$

* commercial species.
\+ noncommercial species.
** not sampled.
++ $6\bar{3}$, bar indicates the digit of numerical accuracy.

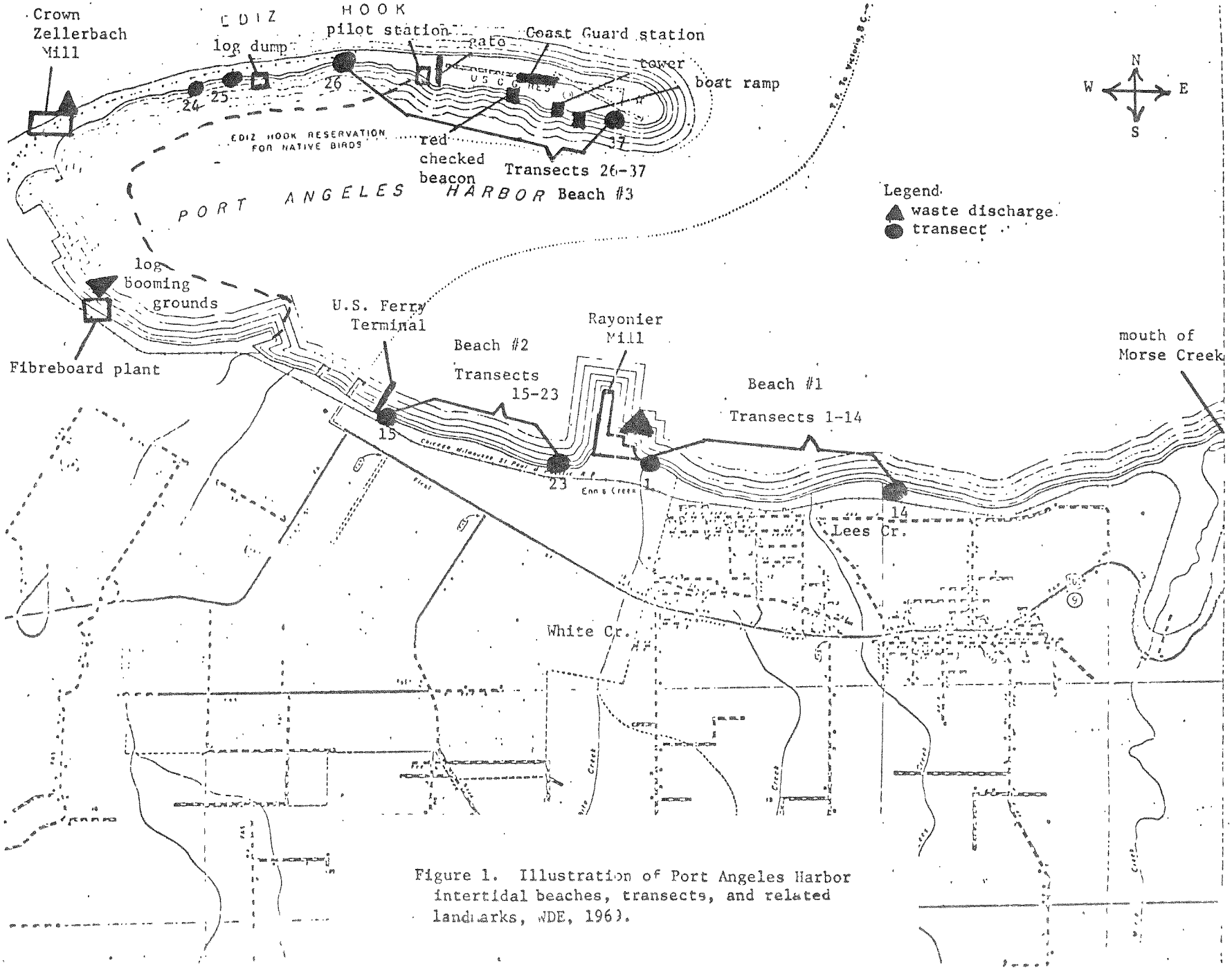

Figure 1. Illustration of Port Angeles Harbor intertidal beaches, transects, and related landmarks, WDE, 1963.