

INTERTIDAL BLASTING EXPERIMENT  
Special Report No. 8  
April 27, 1949

Introduction

On April 12, 1949 the Port Commission of Bayocean, Oregon made two test blasts directly out from Bayocean on Tillamook Bay. The purpose was to determine the feasibility of blasting a channel in that area to permit small boats to dock closer inshore. Although no consequential shellfish, except oysters (beds 500 feet from blast), were present in the immediate area that might be damaged, observations and tests were made to attempt to determine what effect such blasting might have were it done in clam or crab areas. Sincere thanks are due to the Bayocean Port Commission, and Mr. Donald Teye of Atlas Powder Company who did the actual blasting, for their excellent cooperation in the matter, and to Messrs. D. Handley and C. Smith for their donation of oysters for testing in the blast.

The area involved was a sandy mud bottom ranging from about a  $\frac{1}{2}$  to a  $\frac{3}{4}$  foot tide level. The center line for the blasting was drawn up through a small depression, or channel, through which a "creek" of drainage water was running. Both blasts were set and fired during the afternoon low tide of April 12 (Low water  $\frac{1}{2}$  0.3 feet at 6:25 PM, corrected for Garibaldi).

The first charge consisted of an upper string 70 feet long joined by a lower portion 25 feet long. ~~A total of three~~ cases of 50% strength dynamite (ditching type) were uniformly set along the upper 70 foot string with one additional case being set in three closely spaced rows along the lower 25 foot portion. The second charge consisted of one case set along a 70 foot line extending down from the lower end of the first charge. The mean depth of planting of the dynamite was about three feet below the surface in both instances.

Although the results varied with the manner of setting the charge, in general the effect of the blasts was to blow a ditch approximately 10-15 feet wide at the top, or 5-8 feet from the center to the sides, and about 4-5 feet deep. Immediately following the blast the water began to "boil" up very strongly through the surrounding area out to about 75 feet on the lower (west) side of the channel. A large sector extending out about the same distance began to loosen up and settle down towards the ditch. A large amount of mud was scattered about, in places deposited up to a foot deep but for the most part merely scattered about in masses. The general effect on the surrounding flat was to loosen and soften it up muddying the surface. However it is believed that each effect will be very rapidly erased with the soil returning to normal in perhaps but a few runs of tides.

#### Clams, Crabs, and Oysters

To test the effect on shellfish, a line was drawn out to one side perpendicular to the center of the upper 70 foot strip in the first blast. Stations were then paced off along this line at various intervals and specimens placed at each as listed below: The table also gives the final affect of the blast on each specimen.

<u>Dist. from center of blast in feet</u>	<u>Specimen</u>	<u>(Through April 22) Results</u>
0	2 cockles - buried	Blown 150 ft, destroyed
	2 cockles - on surface	Pretumed destroyed, not found
	1 cluster oysters	" " " "
	1 crab ( <u>Cancer productus</u> )	Blown 150 ft. destroyed
10	2 cockles - buried	Shells smashed, destroyed
	2 cockles - on surface	No effect
	1 cluster oysters	No effect
	1 crab ( <u>C. magister</u> )	Dead - April 22
15	2 cockles - buried	No effect
	2 cockles - on surface	" "
	1 cluster oysters	" "
	1 crab ( <u>C. magister</u> )	" "

(Blast effect table continued)

<u>Distance</u>	<u>Specimen</u>	<u>Results</u>
20	2 cockles - buried 2 cockles - on surface 1 cluster oysters 1 crab ( <u>C. magister</u> )	No effect " " " " Small crack in carapace, still alive & active April 22
25	2 cockles - buried 2 cockles - on surface 1 cluster oysters 1 crab ( <u>C. productus</u> )	No effect " " " " Dead - April 18
30	2 cockles - buried 2 cockles - on surface 1 cluster oysters 1 crab ( <u>C. magister</u> )	No effect " " " " " "
35	2 cockles - buried 2 cockles - on surface 1 cluster oysters 1 crab ( <u>C. productus</u> )	No effect " " " " " "
45, 60, 75	Clams and oysters as above	No effect

The cockles, Cardium corbis, were specimens brought up from Yaquina Bay, secured a week previously and held in an aquarium tank until taken to Tillamook. They ranged in size from 60 to 79 mm in rib length (about normal size) with an average rib length of 70.0 mm. They were randomly distributed to each station.

The oysters were clusters of one and two year old Pacific oysters, Ostrea gigas, taken at the time from the adjacent beds of Handley and Smith at Bayocean. They ranged from 4-12 oysters per cluster with an average of 8.4 oysters per cluster.

The crabs were small miscellaneous specimens brought up from the Newport laboratory where they had been held for several months or more. As such they may not have been normal in reaction (possibly weak, etc.) but were all that were available at the moment. All but one were males. They ranged in back width from 115 to 144 mm, average width 129 mm.

All specimens, except the oysters, which were set at 20 feet or less

from the center of the blast were first placed in separate canvas sample bags with appropriate labels to facilitate locating and prevent any mixing of specimens following the blast. It is not believed that this would have exerted any appreciable cushioning affect. The buried cockles were set about four inches under the surface.

Following the experiment all specimens were brought back to the Newport laboratory where they were examined and taken care of that same night. All specimens still alive were placed in aquaria and observed through April 22 at which time the experiment was closed.

In addition to the foregoing, once miscellaneous group of left-over cockles was placed on the surface 20 feet from the blast center on the opposite side of the regular test. Eight clams were put out, five of which were recovered, the missing three believed buried or picked up by other parties present. These were also brought back to the Newport lab and put in the aquaria. One of these was found dead April 22, the other four still showing no ill effects.

Immediately following the firing of each charge, the area was examined for other specimens of any sort that were originally present on the grounds. Five small crabs (C. magister) were found within the 25 foot zone. They ranged from 77 to 97 mm back width, averaging 90.2 mm. Three had broken or cracked carapaces and were dead on recovery. One showed no external signs of damage but was also dead. The remaining one showed no <sup>ill</sup> effects whatsoever through April 22.

One horse clam neck (Schizothaerus) was found. It was estimated that the clam originally had a shell length of 80 to 100 mm.

#### Ghost Shrimp

A considerable number of ghost shrimp were found within the 25 foot zone. Although all living specimens were also placed in an aquarium at Newport, the

final observation on these was made the following day, April 13th. Since past experience has shown it to be difficult to hold any of these forms very long it was felt that this was about the limit of reliability of such observations.

A total of 76 of these collected were Upogebia pugettensis. Fourteen of the 76, or 18.4%, were broken up or otherwise obviously mutilated by the blast. Including the above, a total of 39 were dead by April 13, or 51.3% mortality. Nine specimens of Callianassa were found; three, or 33.3%, being broken or killed by physical mutilation. Four others died, giving a total mortality of 77.8%.

The average body length of the dead Upogebia was 86.2 mm against 66.3 mm for those surviving. For Callianassa the average lengths were 109.6 mm for the dead and 102.5 for the surviving. This would seem to indicate either a differential mortality depending upon size of the individual with the larger ones more susceptible to injury, or else merely a differential in collection of the specimens.

#### Fish

Three salmon fingerlings (tentatively identified as chum) were found within the 25 foot zone. Fork lengths were 36, 38, and 46 mm.

Eight gobies (Clevelandia ios) were also found, ranging in length from 58 to 65 mm, averaging 61.3 mm.

All the fish were either dead or in a very near state of such when collected.

#### Miscellaneous Invertebrates

A small snail (Thais sp), height of 15 mm, was found unharmed within 25 feet of the center.

A specimen of mud clam (Macoma) 38 mm in length was also found uninjured.

Three large sand worms (Nereis sp) were found. Two were torn in half and the third had the body cavity ruptured.

Several thread worms (Nemertinea) were found in dead and broken condition.

One of the ghost shrimp (Upogebia pugettensis) was found with the small commensal clam (Pseudopythina rugifera) attached to its abdomen on the ventral surface. The clam was still alive and attached on April 13th.

### Summary

Four cases of 50% strength dynamite were fired as a single shot along a 95 foot line in a sandy mud bottom of  $\pm 1.0$  to  $\pm 3.0$  foot tide level at Bayocan, April 12, 1949. A second smaller charge was also fired and observed.

Specimens placed at known distances from the center of the blast showed:

1. Little or no damage to surface cockles located 10 feet or further from the center.
2. No damage to sub-surface cockles located 15 feet or further from the center.
3. No damage to crabs located 30 feet or further from the center.
4. No damage to oysters located 10 feet or further from the center.

(The foregoing does not consider any possible after-effects such as silting)

A 50-75% mortality of ghost shrimp was found within 25 feet of the center.

In the case of the invertebrates involved it is believed likely that almost all damage done by blasting is grossly physical in nature, that there is little shock or other physiological damage.

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TEST AREA      BEFORE BLAST



FIRST BLAST



RESULTANT CHANNEL AFTER FIRST BLAST