A NEW METHOD FOR DIGGING BUTTER CLAMS

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INTRODUCTION

Landings of butter clams (Saxidomus giganteus L.) in British Columbia have declined steadily in the last 15 years. This trend is due partly to closure of some areas (the northern part of the province has been closed to shellfish digging since 1963 because of paralytic shellfish poisoning) and partly because more rewarding jobs are available to clam diggers. At present there is an urgent need in the industry for a method to improve digging efficiency to make it more rewarding.

Recently mechanical or hydraulic diggers have been designed and built to dig shellfish. Powerful jets of water wash the soil away from the clams, which are then scooped up by an escalator or are easily raked out of the trench. Most of these diggers have been built on the east coast and they have proven to be more efficient, faster and cause less breakage to shellfish than conventional clam forks.

Unlike the east coast, clam beaches in British Columbia are usually small (sometimes less than one acre) and often very rocky. These conditions preclude the use of some types of mechanical diggers used on the east coast. A hydraulic digger suitable for British Columbia beaches should be small enough for a 1- or 2-man operation, and it should be portable, efficient and inexpensive to build. The hydraulic clam digger, which was designed to dig soft-shell clams (Mya arenaria L.) on the Atlantic coast, appeared to meet these requirements and during the summer of 1966 we tested its efficiency for digging butter clams.

DESCRIPTION OF THE HYDRAULIC CLAM DIGGER

The hydraulic clam digger unit consists of a pump with intake and discharge hoses and the digger itself.

The digger is easily constructed, inexpensive and weighs about 60 lb. A perspective diagram of it is shown in Fig. 1. Nozzles of 2, 3, 7, and 9 inches in length have been tested but the 2-inch ones have given the best performance.

The pump is a very important part of the unit and may be floated in a skiff. It should be dependable, efficient, portable and must deliver about 125 gal per min and maintain a pressure of 25-30 p.s.i. at the manifold. It is advisable to cover the end of the intake hose with 1/4-inch mesh screening and float it about 1 ft off the bottom to prevent mud and gravel clogging the pump and nozzles. The hose connecting the pump to the digger is 100-ft lengths of fire hose, preferably 2 inches in diameter.

OPERATING THE HYDRAULIC CLAM DIGGER

The hydraulic clam digger is simple to operate. When the water pressure from the pump reaches its maximum, the digger is allowed to "dig in" so that the water jets (Fig. 2) penetrate 8-10 inches into the soil. The digger is then pulled slowly across the flat to make certain that the water jets penetrate well into the soil. Digging speed is not predetermined but is slow enough to keep the digger in the trench and allow the water jets to penetrate the soil deep enough to wash out the clams, but fast enough so the digger does not bury itself in the trench (Fig. 3). The operator soon learns the best speed.

While one person operates the digger the other rakes the clams washed out in the trench. Manure forks with 6- to 8-inch tines, bent at right angles to the handle, are satisfactory. Raking is necessary or clams washed out by the digger are left covered in the trenches and easily missed. The clams are picked up by hand.

On the east coast this digger is used under water and digging is done in 18 to 36 inches of water. We met with very little success using the digger in these water depths. The water became so cloudy that it was hard to know if the digger was operating properly. Furthermore, raking was haphazard and undoubtedly many clams were missed. However the clam digger worked very well on the dry flat or in not more than 6 inches of water (Fig. 3), and most of our work was done when the flat was dry.

EXPERIMENTAL METHODS

Experimental digging was done in two periods at Seal Island near Comox, B. C. The soil on this clam flat is mostly clay-mud, gravel and shell, with small boulders but no outcrops of large rock. There are numerous oysters and old shell on the surface of the flat. In the first experiment the fire hose was 1-1/4 inches in diameter and in the second it was 2 inches.

The plots were all in the same area, and 2 ft wide, the width of the digger, and well down on the tide level. After the plots were dug the clams were picked up. Butter clams were sorted into commercial and sub-commercial sizes, counted and weighed. Horse clams (Tresus capax Conrad) and little-neck clams (Protothaca staminea Conrad) were also counted and weighed. The number of broken clams, the length of time taken to dig the plot, and the distance dug were also recorded. Close attention was given to the location and condition of small clams left in the plots.

In the second experiment most of the plots were re-dug by hand to determine the number of clams missed by the clam digger. In addition, 6 plots were dug by hand to obtain an estimate of clam production by fork digging to compare this rate of digging with that of the clam digger.

RESULTS OF EXPERIMENTAL DIGGING

A brief resumé of the results of the 2 experiments is shown in the table.

The digging rate recorded in the first experiment was twice that of the second, but clam production was much higher in the second experiment. The slower speed and greater volume of water through the digger in the second experiment permitted the water jets to penetrate further into the soil, wash out deeply buried clams and so increase production. The efficiency of the clam digger was measured only in the second experiment and was 85%. We didn't measure the flow of water through the digger in either experiment, but in the second experiment the pressure was 15 p.s.i. If the water flow and pressure were increased to 130 gal per min and 25 p.s.i., it is possible that the digging rate and efficiency could be further increased.

Breakage of all size clams was less than 5%. Many of the plots had no broken clams and even most of the horse clams were unbroken.

After digging, the soil in the top 6-8 inches of the trench was quite soft and many small clams observed in this layer were burrowing back into the soil within 15 min after they had been washed out by the digger. Most clams in this loose soil had dug themselves back in by the end of the following high tide. After one tide the trenches became quite firm but remained visible for 2 to 3 months.

Results of the plots dug by hand are also shown in the table. Breakage of both butter and horse clams was high, about 25% for butter clams and 50% for horse clams. These plots were small and the digging time short. It is unlikely this digging rate could have been maintained for a complete tide.

COMMENTS

The butter clam population in our experimental area was much higher than is found on most clam flats. In the second experiment the average density was 13.8 lb of commercial-size butter clams per square yard, but a general survey of the entire flat 2 years earlier indicated the average density was only 3.5 lb per sq yd. The high rate of clam production in our test plots would not be found in other areas of Seal Island or in most parts of the province. However these high clam densities do not invalidate our results, since the essential thing is a comparison of the digger and fork methods, regardless of the density of clams.

Comparison of hydraulic clam digger with fork

The hydraulic clam digger digs clams faster and more efficiently than the clam fork.

The rate of hand digging shown in the table is unrealistically high and could not be maintained for an entire tide. Clam diggers rarely dig over 30 sq yd in a 4-hr tide; certainly 40 sq yd or 10 sq yd per hr would be a maximum. Using this figure, the clam production by hand digging would have been 372 lb for a 4-hr tide. In the second experiment the digging rate of the hydraulic clam digger was 43 sq yd per hr, producing over 2,000 lb per 4-hr tide. This rate was for 2 men so the production for one man would be half the value, over 1,000 lb for a 4-hr tide.

The average production of commercial-size butter clams with the clam fork was 9.3 lb per sq yd, compared with 13.8 lb per sq yd for the hydraulic digger; a difference of 4.5 lb of clams per sq yd. This and other information leads us to believe the efficiency of the clam fork is about 50-60%, compared with 85% for the hydraulic digger.

The hydraulic clam digger is easy to handle and probably could be operated for an entire tide without interruption. Definite areas could be staked out and dug, and since the digger is efficient there would be no need to re-work dug areas, which would reduce damage to the flat and to small clams. Digging with the hydraulic digger reduces breakage to almost nil and the small clams quickly re-dig into the soil.

A further advantage of the digger would accrue if all species of clams dug were marketed: butter, horse, Manila, and little-neck clams and cockles. This would be feasible since all are turned out of the soil unbroken. Horse clams are very fragile and cannot close their valves tightly and become quickly desiccated if the shell is broken. However, horse clams are washed out unbroken and could be used with proper care. The cockles might be minced and combined with butter clams; the little-neck and Manila clams could be set aside and sold fresh.

Cost

The hydraulic clam digger was designed to be simple, inexpensive and portable, so that the investment would be relatively small. The entire unit, not including the skiff, can be built for less than $500, and could be less if used equipment were available and if one built the digger himself.

Improvements

Further improvements may be made to the digger and would result from experience. The volume of water and pressure could be increased (to 130 gal per min and 25 p.s.i.), and this would probably increase the speed of digging and the efficiency of the clam digger.

The fire hose hampers control of the digger slightly. Arrangements might be made to reduce its drag on the flat. Adjusting the position of the handle to alter the angle of the nozzles may increase efficiency in certain situations.

The size of the manifold, the shape and number of nozzles might be altered for different types of soil. Where the beaches are rocky one might wans to use a short manifold, perhaps 10-12 inches in length. In soft soil a manifold larger than 24 inches might be more efficient. Probably the best arrangement would be 2 or 3 manifolds of different sizes, which could be interchanged quickly.

Summary

The hydraulic clam digger digs clams faster and more efficiently than the clam fork. The investment is small and the digger could be used profitably on most of the clam beaches in British Columbia.

Comparison of digging speed and production of commercial-size butter clams and horse clams by hydraulic clam digger and clam fork.

	Hydraulic clam digger		
	First experiment	Second experiment	Fork
Digging speed: square yards per hour	86	43	16.5
Number of commercial-size butter clams per sq yd	7.0	37.6	23.6
Pounds of commercial-size butter clams per sq yd	2.7	13.8	9.3
Number of horse clams per sq yd	2.6	6.3	7.3
Pounds of horse clams per sq yd	0.9	9.0	5.4
Number of commercial-size butter clams per hr	595	1,613	389
Pounds of commercial-size butter clams per hr	229	593	152
Number of horse clams per hr	220	269	121
Pounds of horse clams per hr	74	193	88

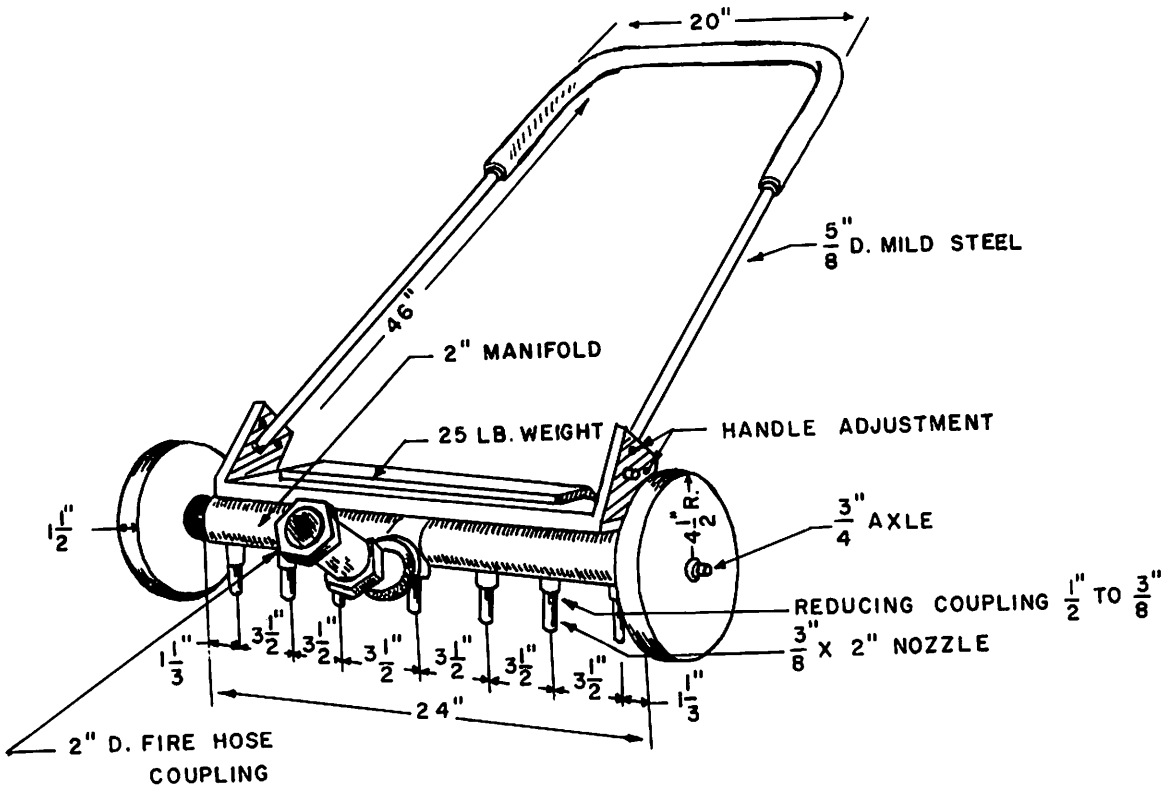


Fig. 1. Perspective drawing of the hydraulic clam digger.



Fig. 2. Pattern of water spray from jets on hydraulic clam rake.

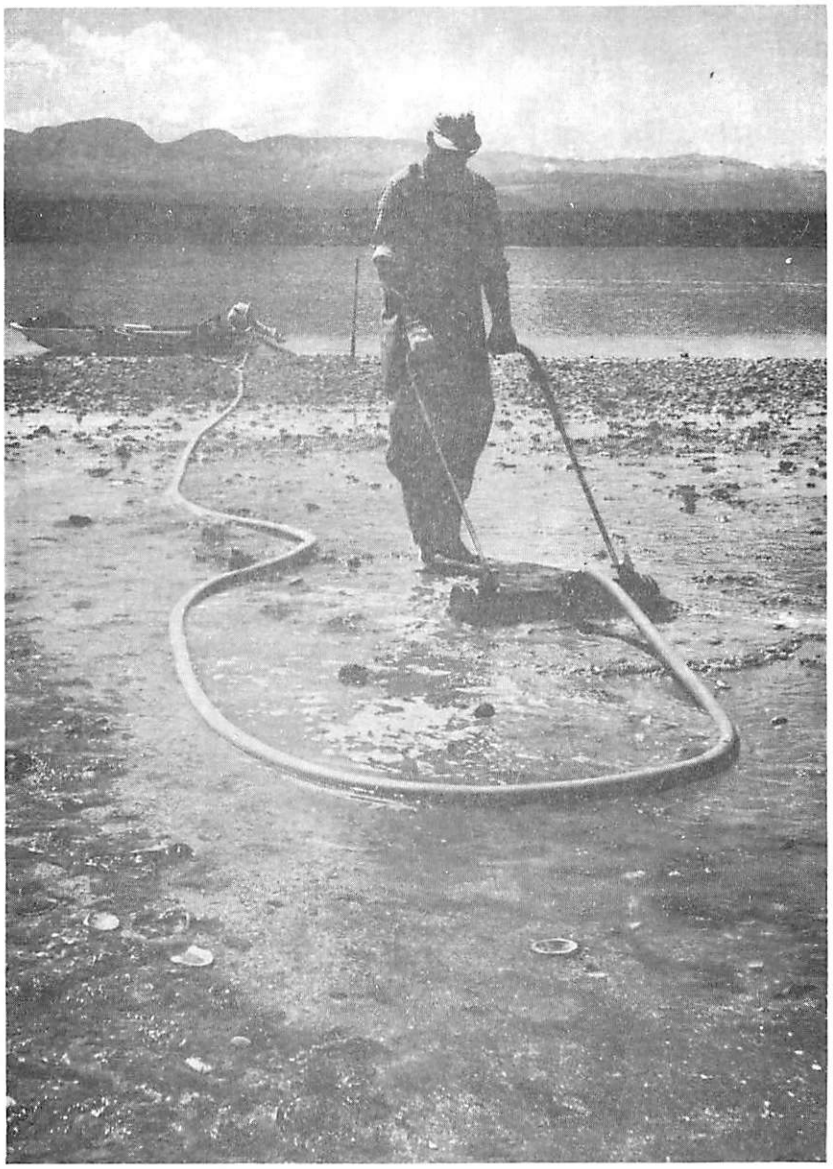


Fig. 3. Operating hydraulic clam digger on dry flat.