Harvesting Clams with Mechanical Gear

Introduction

Members of the clam harvesting industry have been requesting for several year to allow the use of mechanical gear to harvest bay clams. Presently, harvest is limited to hand methods. The method most often used is to use the hands to create a current of water that sweeps away the substrate and exposes the clams. This method creates a hole 1.5 to 2 feet in diameter and exposed all clams in the hole regardless of size or species.

Harvesters are interested in a water jet or "stinger". This gear could be used to selectively harvest individual clams thereby minimizing the disturbance to the habitat and undersized or other unwanted clams. Recently, in some areas, harvesters find butter clams in beds with numerous small (3-4 in) gaper clams. With this gear, they would be able selectively take the butters or larger gapers and not disturb the small gaper clams.

Subtidal harvesting by hand is physically demanding and, as a result, some long-time harvesters are experiencing health problems which may limit their participation in the fishery and affect their livelihood. Many harvesters don't necessarily want to increase their harvest, they just want to make it easier to harvest.

ODFW has been reluctant to allow the use of mechanical gear because it is very efficient and quotas would be needed to establish sustainable harvest levels. Up-to-date survey data are needed to establish quotas.

The purpose of this report is to summarize the use of mechanical gear in the past in Oregon and currently in other areas and to outline our method of establishing quotas to allow the use of mechanical gear on an experimental basis.

Background

After extensive surveys in the early 1970s, harvest of bay clams using mechanical gear was allowed beginning in 1975 on an experimental basis in three estuaries, Tillamook, Yaquina, and Coos. The main species if interest was gaper clams. Subtidal areas with high densities of clams were identified and harvest was closely monitored. Two types of gear were utilized, suction dredge and water jet. The water jets used in the experimental fishery used a 3/4 in nozzle powered by a 8 hp engine, capable of flows of 200 gallons per minute. Harvesting with mechanical gear was discontinued in 1985 because of concerns of the sporadic recruitment of gaper clams and over-efficiency of the gear. In more recent years, ODFW has not allowed mechanical gears to harvest clams due to lack of data on sustainable harvest levels.

A rapid increase in landings of cockle clams from Tillamook Bay in 1993 and 1994 raised concerns. As a result, bay clams were put under the Developmental Fisheries program in 1996 to limit participation. In addition recent landing data were used to establish an annual quota of 90,000 lb for cockle clams from Tillamook Bay and 8,000 lb for cockles from Netarts Bay.

Canada allows the use of a water jet for harvesting geoduck clams in British Columbia. The gear must be hand held, with a manually operated nozzle guided and controlled from underwater by the diver. Each nozzle has a maximum inside diameter of 5/8 inch. There is no directed harvest of gaper clams, but incidental harvest is allowed in the geoduck fishery.

Washington also allows the use of a similar type of gear for harvesting geoduck clams. The gear must be hand held, with a manually operated nozzle guided and controlled from underwater by the diver. Each nozzle has a maximum inside diameter of 5/8 inch. Harvest may not be in waters shallower than 18 feet below mean lower low water and not harvest is allowed in eel grass beds. The gear must be operated with noise levels less than 50 decibels measured at 600 feet from the source.

Determining sustainable harvest levels

Using mechanical gear to harvest bay clams is very efficient. Sustainable harvest levels need to be determined before use of mechanical gear can be allowed. ODFW has been reluctance to allow mechanical harvest methods due to the lack of up-to-date inventory information to determine sustainable harvest levels. Staff does not have resources to conduct necessary surveys in the foreseeable future. Cooperative surveys with the industry are a possibility for consideration in the future. However, industry would like to begin using mechanical methods as soon as possible. Until surveys have been conducted, we could establish temporary quotas for individual estuaries based one of two rationales; 1) biomass estimates from areas surveyed in Tillamook Bay in 1996 or 2) recent harvest information.

Surveyed areas in Tillamook Bay.
The biomass of commercial size clams was estimated from three subtidal areas in Tillamook Bay in 1996. These areas were selected based on high numbers of all clam species located during initial assessment surveys. An annual quota for each species could be based on a percentage of the biomass from these areas. Table 1 lists the estimate biomass from the three subtidal areas in the1996 survey.

The quota would cover all landings from Tillamook Bay; from inside or outside the surveyed areas, with mechanical gear or by hand methods. Since the surveyed areas are a small portion of the total clam habitat, the quota would be based on a conservative portion of the total available population. As other areas in the bay are surveyed, their estimated biomass would be added to the total available for harvesting.

Table1. Estimated biomass (lb) of commercial size bay clam species from three subtidal areas in Tillamook Bay, 1996.

Species	Biomass (lb)	Species	Biomass (lb)
Butter	1,983,246	Cockle	577,616
Gaper	546,788	Native Littleneck	204,557

Natural and fishing mortality rates for Oregon bay clam species have not been estimated. Until these data are available, mortality and harvest rates can be estimated based on the maximum age of the species (Hoenig 1983). Table 2 lists the estimated annual harvest rate based on the maximum age of each species using the combined equation (most conservative) from Hoenig (1983) to calculate natural mortality and using a fishing mortality of 50% of natural mortality.

Table 2. Annual fishing rate for bay clams species calculated from maximum age based on Hoening (1983).

Species	Maximum age cited in literature	Maximum age used in calculations	Annual fishing rate (%)
Cockle	7-10	10	16.1
Native littleneck	10-16	16	11.3
Butter	10-20	20	9.5
Gaper	12-17	17	10.8

Recent harvest information.
Harvest levels of bay clams in other estuaries in recent years have been acceptable. In areas where survey information in not available (ie. Coos Bay), an annual quota could be established similar to recent harvest levels and either mechanical or hand methods could be used. This would continue a stable level of harvest but let the diver chose the method of harvest. When survey data become available, the quota could be adjusted to reflect the survey data. In the past, there has been considerable concern by the general public on the use of mechanical gear for harvesting clams. Basing the quota on previous landings and not allowing an increase in landings until further data are collected may lessen these concerns.

Other considerations

The sporadic recruitment of gaper clams has been a concern for some time. Gaper clams appear to spawn every year, but recruitment into juvenile clams is often sporadic. Past surveys have shown that large areas in an estuary can go for years without successful recruitment. Reasons for this sporadic recruitment have not been identified. Establishing a minimum size limit to ensure clams have an opportunity to spawn would help balance the concerns with recruitment.

All our major estuaries have significant recreational harvest of bay clams. Conflicts between commercial and recreational harvesters have occurred in the past. Currently, boundaries around a major recreational harvest area have been established in Tillamook Bay that is closed to commercial harvest. It would be prudent to establish boundaries around popular recreational areas or a depth restriction in other estuaries where mechanical gear is used (i.e. Coos Bay).

With more traditional intertidal hand harvest methods, harvest levels were not a major concern because the subtidal populations of clams were considered as broodstock. As more and more harvest is taken subtidally, it would be prudent to set aside some areas as reserves with where no subtidal harvest is allowed. There is currently one area in Tillamook Bay closed to commercial harvest as a reserve area. It would be beneficial to establish reserve areas in other estuaries where mechanical gear is used (i.e. Coos Bay).

Recommendations

We recommend allowing the use of mechanical harvest methods on an experimental basis in Tillamook and Coos Bays. Mechanical gear would be allowed in other estuaries after establishing quotas based on recent landings or survey data. The gear would be allowed with the following restrictions.

Gear

The gear must be a hand-held, manually operated water nozzle guided and controlled from underwater by the diver. Each nozzle shall have a maximum inside diameter of 3/4 inch. The pump motor shall not be larger than 5 hp and produce no more than 20 gallons per minute per nozzle.

Size limits

The current minimum size limit of 2 1/4 inches for cockle clams in Tillamook Bay should be extended to other bays using mechanical gear. A minimum size of 4 inches for gaper clams should be established.

Area restrictions

Current closures around recreational areas and the reserve area in Tillamook Bay should continue. To protect the recreational areas in Coos Bay, diving must occur in depths greater than 10 feet from mean lower low water. To establish a reserve area, South Slough (east of the Charleston bridge) should be closed to subtidal commercial harvest.

Quotas

We recommend establishing an annual quota for Tillamook Bay based on 1996 survey data and for Coos Bay based on recent landings. Quotas could be increased in these bays or established in other bays based on additional survey data. Quotas based on survey data will be good for five years after the survey is completed or when 50% of the estimated biomass has been harvested. At which time, new surveys must be completed to continue the quota.

Tillamook Bay

The annual harvest rates for each species based on Hoening's equation range from 9.5 % to 11.3 % (except cockles). For simplicity sake, we recommended using 10% for butter, gaper, and native littlneck clams. This would create an annual quota of 200,000 lb for butter clams, 55,000 lb for gaper clams, and 20,000 lb for native littleneck clams (Table 4). The current quota for cockle clams of 90,000 lb would be consistent with a 16 % annual harvest rate and should continue.

Coos Bay

Table 3 shows landings from Coos Bay since 1980. Annual landings in recent years have not been consistent. Annual landings after 1985 (when mechanical gear was discontinued) reached as high as 16,000 lb but averaged 4,700 lb between 1987 and 1992. More recently, annual landings have not been over 3,500 lb. We assume population levels in the 1980s and 1990s have remained similar, but suggest being conservative until data are updated. Based on historical landings, we

recommend annual quotas for bay clam species from Coos Bay of: 3,000 lb for butter clams, 5,000 lb for gaper clams, 4,000 for cockle clams, and 500 lb for native littleneck clams (Table 3).

Table 3. Landings (lb) of bay clam species from Coos Bay, 1980-2001 and average of shaded years.

Year	Butter	Gaper	Cockle	Native Littleneck
1980#	40	64,350	460	85
1981#	2,249	62,142	459	4,686
1982#	2,892	104,235	726	1,458
1983#	3,260	89,682	380	2,380
1984#	3,231	50,304	840	388
1985	517	20,121	1,759	400
1986	1,668	16,519	943	165
1987	1,333	5,478	3,242	44
1988	1,491	1,481	3,825	247
1989	2,511	2,474	951	22
1990	3,373	9,366	1,157	467
1991	2,689	6,110	1,941	296
1992	382	3,090	2,459	25
1993		120	5,491	
1994	104	785	11,077	56
1995		60		
1996		25		25
1997	408	40	53	
1998		24	630	
1999		3,428	5,406	197
2000	377	1,322	2,738	
2001*			2,264	
average of shaded years	2,178	4,667	3,469	234

mechanical harvest allowed
* through October

Table 4. Suggested annual quotas (lb) for each bay clam species for Tillamook and Coos Bays.

Species	Tillamook	Coos
Butter	200,000	3,000
Gaper	55,000	5,000
Cockle	90,000	4,000
Native Littleneck	20,000	500

References

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin. 8(1): 898-903.

Table x. Estimated total and commercial biomass of bay clam species from surveyed areas in Tillamook Bay in 1996, and annual quota based on different harvest levels.

Species	Total biomass (lb)	Commercial biomass (lb)	50% Commercial biomass (lb)	annual quota (lb)			
				10%	13%	15%	17%
Butter	1,983,246	991,623	495,811	99,162	128,911	148,743	
Gaper	546,788	273,394	136,697	27,339	35,541		
Cockle	577,616	288,808	144,404	28,880	37,545	43,321	49,097
Native Littleneck	204,557	102,278	51,139	10,227	13,296	15,342	

Table X.	
natural mortality	fiahing mortality
ln(M) = a+(b*ln(tmax)) where: M = natural mortality a = 1.44 (constant from Hoenig's "combined" equation) b= -0.982 (constant from Hoenig's "combined" equation) tmax = maximum age of species	μ = (F/F=M)*(1-e^-(F+M)) where: μ = annual fishing rate F = fishing mortality M = natural mortality

Table 2. Landings (lb) of bay clam species from Tillamook Bay, 1980-2001 and average of shaded years.

Year	Butter	Gaper	Cockle	Native Littleneck
1980#			1,054	4,183
1981#	115		3,993	151
1982#	762	40	9,754	945
1983#	775	162	1,999	208
1984#	1,611	267	17,052	23,467
1985	1,129		27,413	5,532
1986	1,002		25,797	2,526
1987	1,713	890	16,460	3,873
1988	1,001	597	26,215	6,724
1989	1,295	100	42,325	5,930
1990	1,231	575	44,043	1,284
1991	570	1,550	45,744	3,216
1992	601		32,024	4,241
1993	6,289	277	65,569	4,240
1994	1,857	5	147,243	389
1995	7,816	5,846	89,298	976
1996	1,389	2,005	56,749	3,196
1997	12,652	4,226	47,957	4,769
1998	30,434	2,494	15,937	2,474
1999	37,972	3,474	33,762	1,557
2000	40,110	3,142	61,367	
2001*	25,360	3,565	86,445	
average of shaded years	33,469	3,536	49,976	3,395
harvested since 1996	146,528	16,901	243,104	8,800

mechanical harvest allowed
* through November