A ONE-YEAR SURVEY OF RECREATIONAL CLAMMING ON THE MORRO BAY MUD FLATS FOR THE PERIOD OF APRIL, 1979 TO MARCH, 1980

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ABSTRACT.

Between April, 1979 and March, 1980, this survey was conducted to gather data for estimation of daily clammer attendance, effort, and catch rate. All data were collected on low tide days (tides of 0.0 or less) on the Morro Boy mud flats. Species composition of catch was recorded, as well as areas of the bay in which catch was taken. Information was obtained by total clammer counts at the time of lowest tide and by inteviewing clammers as they left the beds. The days to be sampled were picked at random; four weekdays and four weekend days per month were sampled if tides permitted. Average attendance is estimated at 18.5 ± 4.1 clammers per day, with catch rates of 9.95 clams per hour. Yearly attendance is estimated to be 2,078.5 clammers per day who expend 3,88.3 hours of effort clamming. Fifteen different species were taken by clammers during this period.

INTRODUCTION

The clam beds of the intertidal shoreline and mudflat areas of Morro Bay contain some of the most numerous assortments of edible clams in California. Sport clammers who reach these areas by walking or boating during low tides use a variety of methods to dig up the bay's clams. The clams range in size from the seven-inch Geoduck *(Panopea generosa)* to the one-and-one half inch Common Littleneck *(Prothothaca staminea)*. Clammers' success rates, at the present time, appear to be dependent upon one's experience with bay clamming, and upon one's willingness to work hard.

Recreational sport clamming in Morro Bay is gaining in popularity both locally and statewide. Due to the decline in the Pismo clam beds along much of the county's open coast beaches, many Pismo clam enthusiasts may direct their efforts toward the bay clam of Morro Bay. Will the present management efforts maintain healthy clam beds, as clammer pressure increases on the bay? To consider this question, it is necessary to have accurate information on the current demands being placed on this resources.

The purpose of this report is to analyze and interpret data taken from a year-long California Department of Fish and Game survey of Morro Bay clammer activity. Estimation of total clamming pressure in the bay, total number of clams taken (harvest), average number of clams taken per hour, and an estimation of average daily attendance on low-tide days will all be derived from this survey. This report will also discuss the species composition of clammer activity and success.

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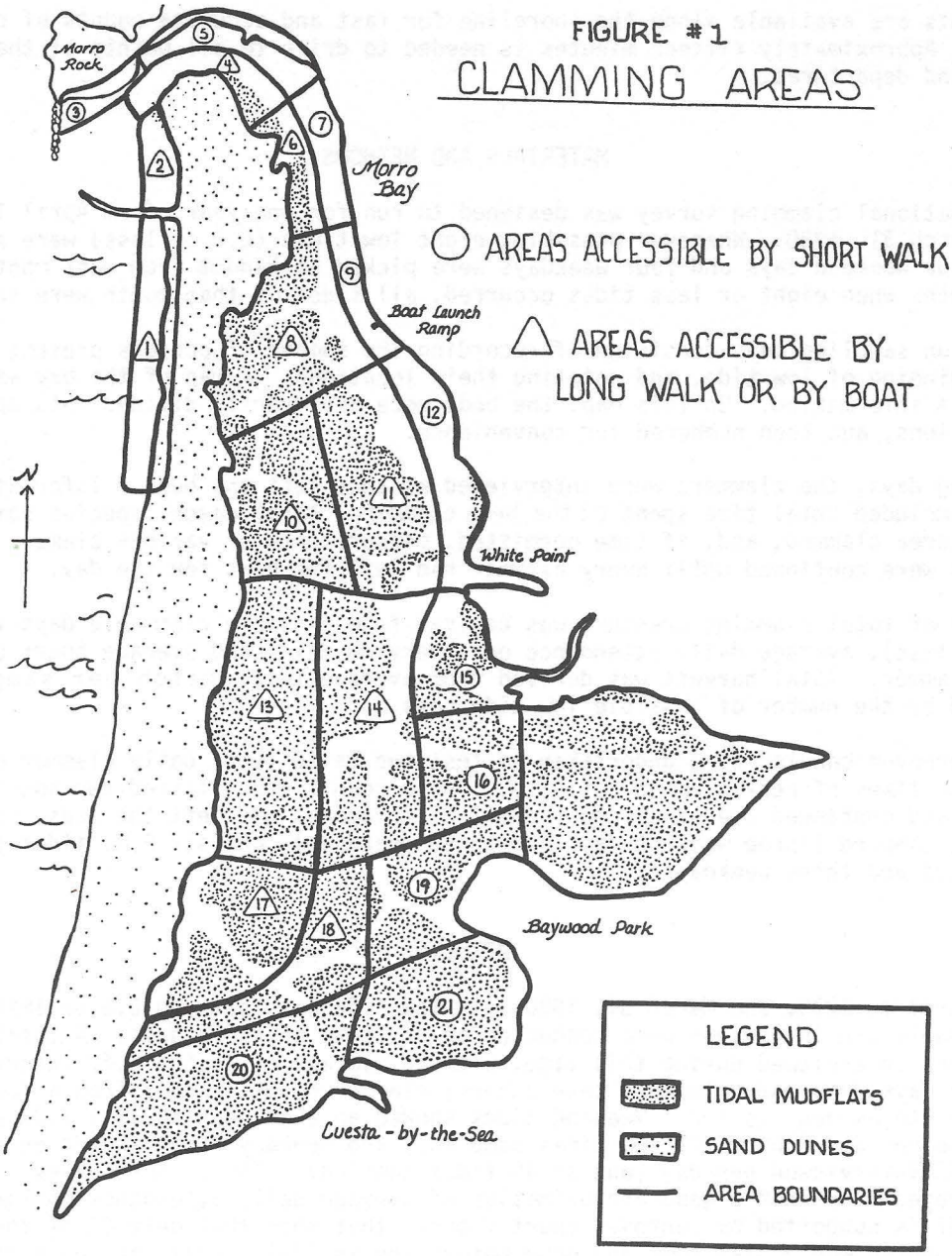
DESCRIPTION OF STUDY AREA

Approximately halfway between Los Angeles Harbor and San Francisco Bay lies the protected lagoon known as Morro Bay. Located in San Luis Obispo County, 12 miles northwest of the city of San Luis Obispo, Morro Bay has a population of 8,600 and attracts thousands of tourists each year (Figure 1).



The southern end of the bay is bordered by the communities of Los Osos and Baywood, while the city of Morro Bay lies along the eastern side. A million-dollar fishing industry operates out of the bay, and the mudflats support a successful commercial oyster industry.

Morro Bay is about four miles along, with a maximum width of approximately 1¾ miles. About 2,101 acres of water surface is present at high tide. At low tide approximately 1,452 acres of mudflats are exposed, with the water surface covering 649 acres. The mudflats stretch across the bay and are interlaced with channels of water. Some clam beds are best reached by boat, while others are easily accessible by walking. A "clam taxi" is often operating during low tides to ferry clammers across the main channel to the beds for a nominal fee. Ownership of the mudflats is divided between the State of California and the city of Morro Bay, with a small percent of the tidal areas under private ownership. J.R. Johnsons Morro Bay Oyster Company is alloted 846 acres of the State of California's tidal lands for the purpose of cultivating and harvesting the Pacific oyster *(Crassostrea gigas)*.

Vista points are available along the shoreline for fast and accurate counts of clammers on the beds. Approximately fifteen minutes is needed to drive to all points of the clammer's arrivals and departures.

MATERIALS AND METHODS

This recreational clamming survey was designed to run for one year, from April 1, 1979 through March 31, 1980. Whenever possible, eight low tides (0.0 or less) were sampled per month. Four weekend days and four weekdays were picked at random from most months. During months when eight or less tides occurred, all tides of that month were sampled.

Procedure on sampling days consisted of recording the number of persons present on the beds at the beginning of low tide, and notating their locations. A map of the bay was used to record this information. On this map, the beds were arbitrarily divided into approximately equal sections, and then numbered for convenience.

On sampling days, the clammers were interviewed as they left the beds. Information obtained included total time spent on the beds clamming, total catch, species composition of catch, area clammed, and, if time permitted, measurements of various clams. Clammer interviews were continued until every clammer had left the beds for the day.

Estimation of total clamming pressure was derived from possible clammable days (low tides of 0.0 or less), average daily attendance on interview days, and average hours clammed per day per clammer. Total harvest was derived from average total catch per sample day multiplied by the number of possible low tide days.

Twelve "turnover counts" were undertaken to test the validity of daily clammer counts, and to show the times of peak clammer activity. These counts were started two hours before low tide, and continued every half hour until all clammers had left the beds. Six A.M. tides were sampled (three weekend days and three weekdays), and six P.M. tides (also weekend days and three weekdays).

RESULTS

Between April 1, 1979, and March 31, 1980, 113 low tide days between 0.0 or less occurred. Clammer counts and interviews were conducted on 72 (64%) of these days. A total of 1,330 persons were interviewed during this time, with an average of 18.5 ± 4.43 interviewed per day. Some days drew more clammers than others; clammer counts ranged from a few people on the beds to as many as 102. Weekend tides showed an average of 22.3 ± 7.25 clammers interviewed per day (out of 32 low tides sampled), and weekday tides showed an average of 15.5 ± 4.43 interviewed per day (out of 40 tides sampled). The author believes that the above averages represent a good approximation of average daily attendance on low tide days. This belief is supported by tunrover count figures that show that only 4% of the total clammers counted would have come and gone before the initial counts were undertaken. The number of perosons counted but not interviewed during initial counts at low tide is 14% of the 1,116 total.

Clammers have, on the average, 3.4 hours of clamming time available per low tide on the clam beds. Clammers spent an average of 1.86 hours clamming per day. Interview data showed that 1,330 clammers spent 2,483.25 hours clamming during the study to obtain a total of 24,714 clams. Clammers took an average of 9.95 clams per hour, which is approximately 18.5 clams per person per day.

Estimated total clammer pressure on low tides between April 1, 1979 and March 31, 1980, is 3,888.33 hours. Total harvest during this time is estimated at 38,675.25 clams.

A total of 15 species of bivalves were taken by clammers during this survey, with four of these species making up 95% of the total catch (Table 1). The species taken most often was the Common Littleneck *(Protothaca staminea)*. A total of 16,688 Common Littlenecks were taken, making up 67% of the total catch. The next most abundant bivalve was the Washington Clam *(Saxidomus nuttalli)*; 5,789 Washingtons were taken, comprising 23% of the total catch. The third and fourth most abundant clams were the Gaper *(Tresus nuttalli)* and the Goeduck *(Panopea generosa)*, respectively. A total of 817 Gapers was taken, comprising 3% of total catch, and a total of 536 Goeducks taken, comprising 2% of the total catch.

Table 1. Species and numbers of clams taken, their areas of origin, and approximate size ranges.

SPECIES	LEGAL LIMIT	TOTAL NUMBER TAKEN	CLAMMING AREAS (*See Figure #1 - Map*)										LENGTH RANGE*
			3	5	6	8	9	10	11	12	14	15	
Common Littlneck *Protothaca staminea*	50++	16,668	-	369	224	12,723	-	200	2,778	156	-	218	40 - 60 mm
Common Washington *Saxidomus nutalli*	10	5,789	-	166	199	3,025	6	133	1,690	351	64	155	60 - 100 mm
Gaper *Tresus nutalli*	10	817	-	350	34	271	1	6	29	55	12	59	80 - 150 mm
Geoduck *Panopea generosa*	3	536	-	18	2	94	-	24	241	12	67	78	100 - 180 mm
Bay Mussel *Mytilus edulis*	25 pounds	284	-	-	58	226	-	-	-	-	-	-	70 - 100 mm
Bent-Nose and White Sand *Macoma natusa* and *secta*	0	196		21	15	49	-	-	12	67	-	32	40-60, 70-90 mm
Basket Cockle *Clinocardium nuttalli*	50++	164	2	25	14	78	-	-	11	31	-	3	50 - 80 mm
Purple Clam *Nuttallia nuttalli*	0	139	-	1	57	44	-	-	37	-	-	-	60 - 90 mm
Thin-Shelled Littleneck *Protothaca tenerrima*	50++	57	-	2	-	14	-	-	7	26	3	5	65 - 110 mm
Rough-Sided Littleneck *Protothaca laciniata*	50++	51	-	1	1	33	-	-	5	2	3	6	50 - 80 mm
Straight Horse Mussel *Modiolus rectus*	25 pounds	4	-	-	-	-	-	-	-	-	-	4	70 - 120 mm
Rough Piddock *Zirfaea pilsbryi*	0	3	-	-	-	-	2	-	-	-	-	1	60 - 120 mm
Sickle Razor *Solen sicarius*	20	3	-	-	-	-	-	-	-	1	-	2	80 - 125 mm
Bodega Tellen *Tellina bodegensis*	0	2	-	2	-	-	-	-	-	-	-	-	45 - 55 mm
California Mussel *Mytilus californianus*	25 pounds	1	-	-	-	-	-	-	1	-	-	-	80 - 130 mm

\+ Legal size limit of 1½" diameter (mm)
++Littlenecks and Cockles - limit 50 in combination

*Length range taken from Mclean's Marine Shells of So Calif.

Clammers concentrated their efforts in only 10 of the 21 arbitrarily numbered sections (Figure 1), with area #8 having 38% of the total 1,330 clammers utilizing the bay for the whole year. Area #8 was also the most productive section, with 33 clams per clammer per day, and a catch rate of 16.6 clams per clammer hour. Area #11, adjacent to area #8, had 650 clammers or 19% of the total clammers. Clammer success in this area was third overall, with 15.9 clams per clammer per day and 7.4 clams per clammer per hour. Another area adjacent to #8, area #10, produced 20.2 clams per clammer per day, and 8.5 clams per clammer per hour. This area had the second best overall catch rate, despite this fact, this area was only clammed by 18 clammers during the year.

DISCUSSION

This report, is intended to provide a good data base for continued study of the Morro Bay clam beds. Considerable effort was given to assure accurate clammer counts and interviews. Much effort was also expended to interview as many clammers as possible. The estimation of average daily attendance could have been better substantiated with more turnover counts, and with the use of total initial count numbers instead of the total number interviewed.

Overall catch rate was 9.95 clams per clammer hour with a range of 37 to 1. Differing bag limits, and accessibility of each clam species probably account for the wide range. It appears that experienced clammers tended to target on desired species such as the Common Littleneck, Washington, Geoduck, or Gaper, and thus reach near bag limits of those target species. Clammers with less experience tended to take a variety of species with less overall quantity.

The Common Littleneck and the Washington both appear to be abundant in areas #8, #10, and #11. These areas are easiest reached by boat or by a long walk, and appear to be the most popular areas for clamming; 66% of total clamming effort was expended in these areas, with a catch rate of 13.1 clams per clammer hour (Table 2). Much of this part of the bed is utilized by the Johnson Morro Bay Oyster Company, for planting oyster spat.

Table 2. Number of clammers interviewed, area clammed, and catch rate

Area *(See Figure #1 - Map)*	Total Clammers Interviewed	Total Clammer Hours	Clams Per Clammer	Clams Per Hour	Total Clams per Area
3	2	1.5	1	1.3	2
5	152	222	6.3	4.31	955
6	59	99.5	10.24	6.1	604
8	502	955.75	33	16.6	16,557
9	7	3.75	1	1.9	7
10	18	41	20.2	8.5	363
11	302	650.75	15.9	7.4	4,811
12	130	218.5	5.38	3.2	700
14	28	63.5	5.3	2.3	149
15	130	227	4.3	2.4	556
TOTALS	1,330	2,483.25			24,714

Areas #5, #12, and #15, are the easiest areas to reach on foot, and 27% of total clamming effort was expended there. The catch rate in these areas was only 3.3 clams per clammer hour, clearly not as productive as areas #8, 10, and 11 (although 43% of all Gaper clams taken were taken from area #5). Better habitat for bivalves, such as composition and slope of substrate, could possibly exist in areas #8, 10, and 11, and thus explain the catch rate difference compared to other areas. Bivalve ecology would be a good topic for future studies of the Morro Bay and flats.

The mud flat area, with its varied flora and fauna, is an excellent example of an estuarine ecosystem. This area supports a wide variety of wildlife and also accomodates many uses by man. Commercial uses of the mudflats include the aforementioned oyster beds, and pumping for mud shrimp, which are used as bait. At the present time, there is no commercial clamming allowed on the mudflats (sport and commercial clamming are both under the jurisdiction of the California Department of Fish and Game). Recreational uses are numerous, and include fishing, duck hunting, birdwatching, and boating, as well as clamming.

It is estimated from this survey that approximately 2,078.5 clammers visited the clam beds between April, 1979 and March, 1980, expending 3,888.3 hours of total clamming pressure, and taking 38,674.25 clams. How well the present clam population can withstand this pressure, or increased pressure, can only be answered by continuing periodic surveys and making comparisions with this baseline survey. Clamming is an inexpensive, healthful, rewarding and muddy experience in Morro Bay, and should remain so for years to come with wise management of the watershed, marine resources, and water quality.

LITERATURE CITED

California Department of Fish and Game. 1974. The Natural Resources of Morro Bay. Coastal Wetlands Series #8.

Edell, Thomas M. 1977. "Survey of Clamming Effort and Total Catch of Pismo Clams *(Tivela stultorum)* at Pismo Beach". Sr. Project. California Polytechnic State Univ.

Fitch, John E. 1953. Common Marine Bivalves of California. Calif. Dept. of Fish and Game. Fish Bulletin #90.

McClave, James T., and F.H. Dietrich II. 1979. Statistics. Dellen Publishing Co.

McLean, James H. 1978. Marine Shells of Southern California. Natural History Museum of Los Angeles County.

Morns, Robert H., D.P. Abbott, and E.C. Haderlie. 1980. Intertidal Invertebrates of California. Stanford Univ. Press.