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**INVESTIGATION OF CLAM POPULATION AT
TOMALES BAY STATE PARK**

by

Jack L. Hiehle, State Park Wildlife Ecologist
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N1410
BIBKEY 66845

Two trips were made to Tomales Bay State Park to determine the clam resource, the pressure exerted on clamming, and possible management techniques that could be used on this area or any other clam beach in the State Park System.

The first trip was made on Sunday, May 14, 1972. This trip could be classed as a "postman's holiday", as I took my wife and eight-year-old boy to experience a day of clamming at a state park. Low water on this day was minus 2.0 at 7:15 a.m. Pacific Standard Time. We arrived at the park entrance at 7 a.m., Daylight Savings Time. There were about 25 cars lined up at the gate. A sign on the gate indicated that the park did not open until 9 a.m. Many of the people in line were very displeased with the closed gate, since they obviously arrived early to take advantage of the low tide. About five cars ahead of us in line, which had arrived earlier, got tired of waiting for the gate to open and went elsewhere. A few more cars lined up in back of us. Just before 9 a.m. the gate was opened and the people made a rush for the beach. Most of the clambers went to the cobble area just south of Hearts Desire Beach.

General Observations

1. Since the entrance gate to the park was located very near the park boundary, most of the visitors had to park their vehicles on the Pierce Point Road. This road is only a two-lane road with virtually no shoulder, so one lane became completely blocked. This left only one lane for cars bypassing the park, which created quite a hazard.
2. People digging clams did not seem to know one clam from another, or what species they were digging.
3. People tended to remove the cobbles to one side to dig holes and they did not spend much time in covering them up or replacing the cobbles. This would leave some of the undersize clams in a vulnerable condition to stingrays and other clam predators.
4. The cobble digging is a rough, slow process and the digger is somewhat limited in the amount of area he can dig before the tide comes in.
5. The type of mollusks present were littlenecks, Washingtons, gapers, soft shells and native oysters.
6. The main clams taken were littlenecks with Washingtons second and gapers third. A few soft shell clams were present. No one was noticed taking oysters.
7. At the height of the digging, about 150 clambers were in the immediate area in the cobbles south of Hearts Desire Beach.
8. The Washington and gaper clams were found mostly in the minus tide areas in the cobble area.

9. A number of dead littleneck clams filled with mud were dug.

10. Most people picked spots that did not appear to have been previously dug.

In about two hours digging, my wife, boy and myself dug the following clams:

Gaper Clams <i>Tresus capax</i>		Native Littlenecks <i>Protothaca staminea</i>		Washington <i>Saxidomus nuttalli</i>	
Length mm	Age* years	Length mm	Age* years	Length mm	Age* years
49	1	40	4	45	2
66	2	41	4	70	3
		42	8	70	5
		42	7	80	7
		43	4	94	7
		43	5	98	7
		44	4	99	6
		44	5	100	7
		45	4	102	7
		50	4	108	8

Our success was probably somewhat better than the average clammer at this area. (Just by luck.)

The second trip to the area was made on May 31, 1972. The tide was minus 0.8 at 8:38 a.m. Pacific Standard Time. At 8 a.m. Daylight Savings Time I met with Walt Dahlstrom, Marine Biologist from the Department of Fish and Game. Jim Neider, Ken Huddleston and Don Engler of the Department of Parks and Recreation were present and observed the operation for the first part of the morning.

Sample holes were dug in the cobbles south of Hearts Desire Beach, between Hearts Desire and Indian Beaches, at the north end of Indian Beach, and at the north boundary of the park. Samples were taken near the water and up on the beach. All clams were measured and aged. Tables 1 through 5 show the results of the check.

In addition to sampling the cobble areas for littleneck clams, a mud bed near Indian Beach was sampled and here four gaper clams were dug. The sizes and ages of these clams were 104mm - 5 years; 112mm - 7 years; 118mm - 6 years; and 126mm - 7 years.

One soft shell clam was dug in the cobble area, but no Washington or gaper clams were found in any of the cobble areas dug on May 31. It is possible that these clams would only be found in the minus tide areas.

* Clams aged by Walt Dahlstrom of the Department of Fish and Game.

TABLE 1

Size and Age* of Littleneck Clams
 Tomales Bay State Park
 May 31, 1972

Size mm	Age Class						
	1	2	3	4	5	6	7
13	2						
14	1						
15	1						
16	0						
17	2						
18	2						
19	3						
20	3						
21	4						
22	7	5					
23	4	2					
24	2	6					
25	4	11					
26		14					
27	1	13	1				
28	2	18					
29		9	1				
30		17	3				
31		5	5				
32		7	7				
33		2	4				
34		5	1				
35		1	4	2			
36			4	1			
37			2	1	1	1	
38			2	4	1		
39			2	1			
40				3	3		
41			1	1			
42				1		1	
43				1			
44							
45				1			
46						1	1
47							
48							
49							
50							
Total	38	110	41	17	5	3	1

Undersized clams

Legal Size

* Aged by annual rings - Further study may be necessary to determine accuracy of this method. (Possibility of false rings.)

TABLE 2

Littleneck Clam Census
Tomaes Bay State Park
May 31, 1972

Age Class* of Clams Dug

	<u>Age</u>							
	1	2	3	4	5	6		Total
Number	38	110	41	17	5	3	1	215
Percent	17.7	51.2	19.0	7.9	2.3	1.4	.5	100.

TABLE 3

Age Class* of Legal Sized Clams (37.5 mm or 1-1/2")

	<u>Age</u>							
	1	2	3	4	5	6	7	
Number	0	0	5	12	4	2	1	
Percent	0.0	0.0	12.2	70.6	80.0	66.6	100.1	

TABLE 4

Age Class* as Related to Size of Clams

<u>Size</u>	<u>Number</u>	<u>Age in Years</u>	<u>Percent</u>
0 - 21 mm	18	1 (or less)	100.0
22 - 28 mm	20	1	22.2
	69	2	76.7
	1	3	1.1
29 - 37 mm	41	2	49.4
	35	3	42.2
	5	4	6.0
	1	5	1.2
Under Sized	1	6	1.2
Legal Size			
38 mm +	5	3	20.8
	12	4	50.0
	4	5	16.7
	2	6	8.3
	1	7	4.2

* Aged by annual rings - Further study may be necessary to determine

Littleneck Clam Census
Tomaes Bay State Park
May 31, 1972

<u>Area</u>	<u>Estimated Elevation</u>	<u>Age Class</u>							<u>Number Legal Size</u>	<u>Percent Legal Size</u>
		1	2	3	4	5	6	7		
<u>Number of Clams</u>										
Hearts Desire Beach	0	13	33	13	4				5	7.9
	+2	6	6						0	0.0
Between Hearts Desire and Indian Beach	+1.8		11	6	2				1	5.3
Indian Beach	+ .5	5	9	7	7	3	1	1	10	31.3
	+1.5	2	8	4	0	2	1		2	11.8
	+2.0	6	5	3	2				2	12.5
North Boundary	+ .6	5	31	5			2		1	2.3
	+2.0		7	3	2				1	8.3

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Fish and Game Warden, Joseph A. Peelan, contributed the following records from his daily reports.

Clam Diggers Checked at Tomales Bay State Park

<u>Date</u>	<u>Clam Diggers</u>	<u>Date</u>	<u>Clam Diggers</u>
11-14-70	15	1-14-72	19
1-9-71	28	1-15-72	28
1-10-71	10	1-26-72	12
1-23-71	70	1-27-72	17
1-24-71	74	1-28-72	41
1-25-71	7	1-29-72	60
2-5-71	21	2-12-72	90
2-6-71	60	2-13-72	41
2-7-71	41	2-19-72	19
2-9-71	71	2-24-72	17
2-21-71	95	2-25-72	14
2-23-71	14	2-26-72	61
3-6-71	41	3-12-72	30
3-7-71	57	3-18-72	115
4-29-71	9	3-19-72	65
12-29-71	28		

Warden Peelan estimated the average bag of cockles per person at about twenty, just legal size and slightly over. Many people have complained to him of the shortage and small size.

Discussion: Littleneck Clamming

From general observation, it appears that the littleneck resource is the primary clam at Tomales Bay State Park, followed by Washington and gaper clams. This is due to the main habitat being more cobbly than sandy or muddy which favors the littlenecks.

With a size limit of 1-1/2 inches, there should be no danger of depletion of this clam, since this size represents clams about four years of age. (Table 3.) These clams should be capable of spawning during the second year when they are still undersize and protected. The success of clambers will be determined partly by their ability and know-how and partly by the pressure exerted on the legal size clams. Undoubtedly, this pressure has increased over the years and it is not as easy to pick up a limit of clams as it was in the past. It is believed that the competition for clams has definitely made the individual success go down.

The aging of littleneck clams on May 31, 1972 indicates that if the sampling is adequate and representative, there is a great difference in the numbers of various age classes. (Table 1.)

Table 2 shows that the two-year-old age class has the greatest number of clams, followed by three years, one year, four years, five years, six years, and seven years. It is possible that some of the one-year age class were missed due to their small size. Age information is needed for a number of years to get a good indication of what is happening and what can be expected in future years.

Barring some type of die-off, the two-year-old age class (Table 1), which represented 51.2 percent of all the clams aged, should provide good clamming in 1974 when the majority of these clams become legal size. Since no previous records are available, it is not known what type of season the three-year-olds (19 percent of all the clams) will provide in 1973. The one-year-old age class is quite disappointing and it would appear at this time that when this age class reaches legal size in 1975, they will not provide much of a bag.

However, depending on the pressure exerted on the resource, any one age class could provide a substantial part of the bag. For example, if the take in 1973 was disappointing, many of the clambers might not come back in 1974--the year in which it appears that the clamming should be good. This may also result in a better year in 1975 if the harvest in 1974 is light. Table 4 shows the age class of the legal size clams in 1972. Some years may be better growth years than others and it is possible that in some years the average legal sized clam may be only three years of age instead of four.

In aging the clams, there was some doubt if the annual rings actually represented years or whether some could have been false rings. The data collected indicated that the clams were not generally becoming legal size until four years of age. This is about a year or more older than normal in most other areas. If the aging is correct, it might mean that there is some condition in the habitat that is restricting growth. More information is needed on aging in this locality.

Harvesting pressure on the littleneck clams is rather apparent from the location of the beds to access. Indian Beach, which is about one-half mile from the access point, had more legal clams than on either side of Hearts Desire Beach which is close to the access point. (Table 5.) The relatively low count on the north boundary is largely unexplained, since it is more distant from access than Indian Beach. It is possible that the sample taking here was in an area already dug this year, a possibility that can always occur in making sample counts.

It also appeared that the higher up the beach dug the less legal size clams available. This would be an indication of pressure on the resource, since digging on the more frequent higher (low) tides would result in greater exploitation of the upper reaches of the clam beds.

It was brought out by Marine Biologist Walt Dahlstrom that the digging of clam beds is somewhat similar to cultivating a garden and it has beneficial results to the beds. A number of the tidal invertebrates, such as worms, crabs, shrimps, etc. are killed in the process of clam digging, but these add to the food chain and are replaced in time by more of their species.

Closing of an area to clamming for a year or so does not seem to be the solution to bettering the clam take. The clamming pressure on an area opened after a closure tends to negate any of the good a closure has on the area.

Discussion: Washington and Gaper Clams:

Washington and gaper clams are somewhat out of their best habitat in the cobble areas and are more at home in sand or mud. In the cobble areas they were only down about eight or ten inches, while in the sand or mud they would be down two or more feet.

The size and age of the Washington and gaper clams indicate that in spite of pressure exerted on them they are still surviving to seven or eight years.

There is no size limit on these clams, so when they are dug up in the cobble beds with the littlenecks they are taken, regardless of size. The ten limit of either species or in combination just adds that much more to the bag of a clammer.

The closing of the park until 9 a.m. in the morning cuts off some of the visitors from clamming at the lowest tides, which in turn might be the reason that the Washingtons and gapers are living to seven and eight years. Most of these clams are found in the minus tide areas.

Most of the clammers had very little knowledge of the species of clams they were digging. Little information is available from the Department of Fish and Game on the subject, other than in technical bulletins that have somewhat limited distribution. It is believed that our Department should provide some interpretive information about clams at this park, so that the visitors could be better informed. This informative material could help protect the resource and at the same time provide the general public with information on the subject.

Other Mollusk Resources:

In addition to the three species discussed previously in the report, there were two other species noted in the area. They were the native oysters and the soft shell clams. The native oysters seem to be a resource that was virtually untouched, probably due to the small amount of edible meat in each shell. However, if this resource was known by some people, they would be harvested in quick order. This oyster is also known as the "Olympic oyster", which is considered to be quite a delicacy.

Only one soft shell clam, measuring 30mm, was dug in the cobble bed area. It was aged at two years.

There may be additional species of mollusks in the area. There was a "Quarantine" sign for mussels posted at the park, which would indicate mussels were in the area.

Recommendations:

Clamming at Tomales Bay State Park is a valuable asset and more information should be obtained in order to properly manage this resource. The following should be a part of the workload program of the personnel assigned to this unit.

A. Determine the resource potential.

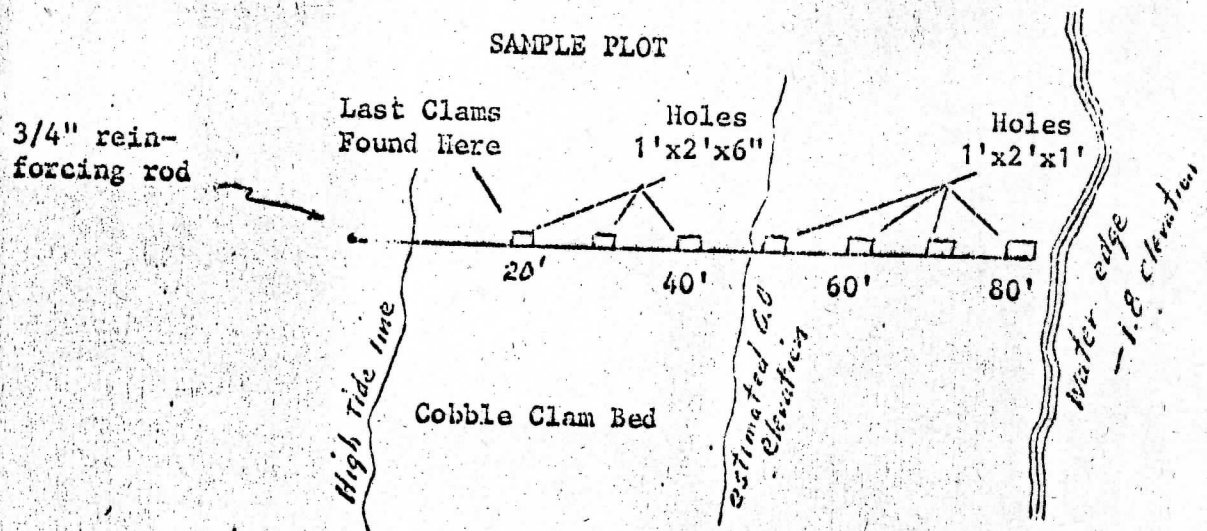
1. Map clam beds.

- a. Pace or measure the cobble and mud flat areas from the highest to the lowest water mark and indicate on a map. (Average length and width.)

2. Determine fishery resource.

- a. Establish five permanent plots in the cobble clam bed south of Hearts Desire Beach. A plot marker could be an inconspicuous 3/4" steel reinforcing rod located preferably above the high tide line. The plot could extend to the water's edge in a straight line perpendicular to the water line. The plot should start at

the water's edge. Dig a 1' wide by 2' long by 1' deep hole and repeat every 10 feet back until no clams are found. At approximately 0.0 elevation the depth of holes could be reduced to 6" (below removed cobbles). Record hole location and size, age and species of each clam found. All clams should be replaced in the hole after recording.



- b. Calculate total number of clams and number of legal sized clams in the bed by dividing the square feet of plot area into the total square feet of clam bed and multiplying by number of clams found. (Should be done by clam species.)
- c. Make up a table of age class of clams uncovered by species in the cobble areas.
- d. Conduct sampling every six months (preferably during the good low tide months of December and May or June.
- e. As time permits, establish similar permanent plots in other important clam beds, such as the one north of Indian Beach.

B. Clam Fishery Take*

1. Estimate number of clam diggers for one year. Randomly select sampling days according to various stages of low tides, regardless on what days of the week they fall.
2. Determine fishing success - number of clams by species for how many hours of effort by area or clam bed.
3. Determine size and age of gaper and Washington clams taken.

* Fish and Game Warden Peelen has offered to help on getting data on number of clams diggers and species taken.

C. Determine how fast clams are growing. (To be done time permitting.)

1. On an established permanent plot, mark clams with a waterproof felt pen. This can be done by marking the outer edge of the clam and indicating the month and year on the center of the shell. 7-2 would indicate July, 1972.
2. In a year's time try and relocate clams and see if the growth corresponds to the annual growth rates.
3. A special plot could be fenced and signed indicating that a study on clams was being made. (No Harvesting of Clams)

D. There is some doubt whether the park gate should be closed to 9 a.m. on especially low tides that come on weekends. On the few days that a minus 1 or greater tide falls on a weekend, the gate could be left open or opened early enough to take advantage of the low water.

If studies indicate that the clamming is going downhill due to over-harvesting, then it would be possible to use a closed gate to hold down the pressure. With as much information as we have at this time, it does not seem warranted.

If and when the gate control is used, the gate should be down the entrance road beyond the checking station turnaround, so the cars would not block the Pierce Point Road and could still turn around and come out. A sign explaining the reason for the late opening should be at this gate.

Since the clam beds are below the mean high tide line, the beds are actually not on state park property so, legally, our people have no jurisdiction of people clamming, other than regulating access.

E. There is a need for an interpretive display showing:

1. Various species of clams.
2. Current regulations.
3. Simple life history, ecology and habitat.
4. Importance of properly covering undersize clams.
5. Information concerning marked clams.
6. Information concerning quarantine.

It is estimated that the amount of manpower needed to carry out the above recommendations would be as follows:

A - 1 - a	2 men	2 half days (one time only)	2 days
2 - a and e	2 men	4 half days (each year)	4 days
b and c	2 man days for report (each year)		2 days
B - 1,2,3	Done on 4 half days on low tides		2 days*
C -	1 man - 1/2 day to mark		
	1 man - 1/2 day to check		1 day

* This work could be done partly as an extra function of checking people coming into the park and the Fish and Game Warden could be of great assistance in collecting the data.

JLH

M-SP-1/9

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Date: April 10, 1972

TO: (Contributing Manager) James Tryner

Chief, Resources Mgm't & Protection
Title and Unit

FROM: (Originating Manager)

Name, Signature

Superintendent, District 2
Title and Unit

The assistance of your unit is required, as indicated below. The box immediately below indicates the formal designation of the required work and the Program Cost Center to which your effort should be charged.

FRAMEWORK	CODE	TITLE
Component	5	Cooperations
Project - prime	2 2 3	Golden Gate
Project - sub	3 7	Tomaes Bay
Activity Group	3	Management & Protection of Resources
	1	Environmental Management
	0	

DESCRIPTION OF NEEDED SERVICES

Examine clam population to determine if apparent depletion is due to overtake, environmental deterioration or other factor. And if management principles can be applied which could change or improve the situation.

Check if description continued on reverse:

PARTICIPANT'S JOB COMPLETION PLAN

Job assigned to: Jack Hiehle		Estimate	Actual
Specific instructions: Evaluate clam population situation and make suggestions for management.	Start date	5/1/72	
	Due date	5/31/72	6/23/72
	Total hours	24	49

I agree to provide the indicated services in accordance with the stated completion plan.

RECORDED