

INTERIM REPORT - ROCK CRAB SURVEY OF HUMBOLDT BAY

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In 1983 the National Marine Fisheries Service (NMFS) provided a set of "Fathoms Plus" rock crab pots for experimental fishing in Humboldt Bay. These were loaned to cooperating fishermen for their personal use, in exchange for boat time, labor, and use of traps for a bi-monthly structured survey. The survey was organized and conducted by the U.C. Cooperative Extension Sea Grant Program. This continuing 2-year survey has the following objectives:

- 1) Determine molt cycle to predict times of year during which crabs are of lowest quality (ie, not "filled out").
- 2) Determine molt increments of crabs. There are presently no size limits in the commercial fishery and it appears that an age-growth curve for the red crab (Cancer productus), the most common species, has not been developed. A growth curve for an oceanic population of the brown crab (Cancer antennarius) from San Luis Obispo County does exist, and information from Humboldt Bay can be compared with it.
- 3) Determine size at maturity for female crabs.
- 4) Determine "baseline" catch composition and catch rates in areas open and closed to commercial fishing prior to the development of a significant commercial fishery.
- 5) Determine patterns of movement for rock crabs, particularly between South Bay, which is closed to commercial fishing, and other sections of the bay.
- 6) Investigate the effects of claw removal on survival of crabs. (A portion of the commercial catch is declawed, and the clawless crabs are then returned to the bay).

The purpose of this interim report is to summarize the data collected during the first year of the survey. Only percentages and averages are reported; no statistical analyses have been performed. It is hoped that this interim report will answer some of the questions about rock crab fishing which have been received by the Cooperative Extension Sea Grant Program in recent months. It will also provide a basis for reviewing the current design and methods of the survey, so suggestions for changes can be received before the second year gets too far underway.

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## MATERIALS AND METHODS

Bi-monthly sampling of rock crabs at three stations in Humboldt Bay has occurred since January, 1984. Sample stations are located in South Bay along the west side of Southport Channel between buoys 6 and 8 (Station 1); in Central Bay along the east side of North Bay Channel approximately 1/4 mile north of Standard Oil dock (Station 2); and in North Bay along the west bank of Arcata Channel approximately 1 1/4 miles northeast of the Samoa Bridge (Station 3) (Figure 1). Depths are approximately 3.7 - 5.5 m (12 - 18 ft) at each location. South Bay is open to recreational crabbing only; Central Bay is open to both recreational and commercial crabbing; and North Bay supports a "depredation fishery" to remove rock crabs from oyster beds, in addition to sport and commercial crabbing.

Traps used were commercially-made "Fathoms Plus" plastic rock crab traps. These elliptical pots measure 91 cm (36 in) along the major axis, 71 cm (28 in) along the minor axis, and stand 30.5 cm (12 in) high. Two offset tunnels lead into the pots from the sides. Mesh size is 5 cm (2 in) square. During regular sampling the pots were baited with rockfish or skate carcasses and set overnight for 14 - 24 hours. The number of pots fished at each station fluctuated during the first two months from 3 to 11 while initial experience was gained with the number of crabs that could be expected per pot and the number of crabs that could be processed in a reasonable amount of time. Since May, six pots have been fished at each location on each date, although on two occasions one pot could not be retrieved.

Each crab collected on each sample date was measured at the widest portion of the carapace, sexed, and identified to species. Molt condition was recorded as well as female reproductive condition. Any missing or regenerated claws were also recorded. The first 1931 crabs were tagged with orange floy tags labelled "CDF&G EUREKA" and numbered consecutively. Tags were inserted along the posterior margin of the epimeral suture, which allows the tags to be retained when the carapace is molted (Carroll 1982).

## RESULTS

Molt cycle. During 1984, 55 of the 1931 tagged crabs (2.8%) were recovered. Of these, 9 had molted. One additional untagged crab, which was in the process of molting, was also recovered. Recovery dates and molt increments of the 10 crabs are listed in Table 1 and displayed in Figure 2. Please note that in the remainder of this report "red crab" refers to Cancer productus, "brown crab" to C. antennarius, and "yellow crab" to C. anthonyi.

At least some red crabs molted between January and March, in May, and between September and October. Notes made during the course of sampling indicated at least a few "recently molted" red crabs were caught on every sampling date, and commercial fishermen reported that at least some crabs weren't "filled out" during most months of the year. Commercial fisherman Jim Mindus believes he caught the most soft crabs in December and notes made during this survey indicate a peak of "recent molts" in January. However, based on so few recoveries, it is impossible to define a peak molting season for red crabs at this point.

Similarly, little can be deduced about brown crab molt cycles since so few molted crabs were recovered, and since two of these were at large for eight months. No molted yellow crabs were collected in this study.

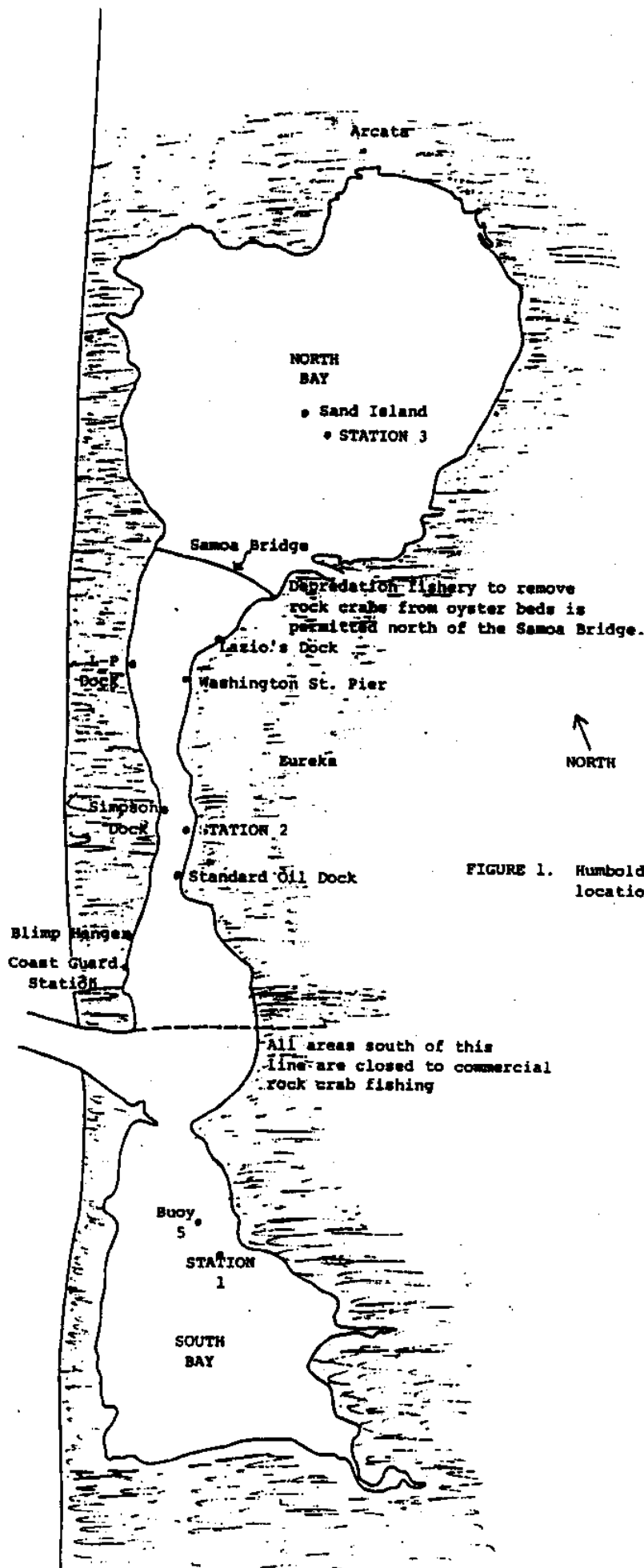


FIGURE 1. Humboldt Bay, showing locations mentioned in text.

TABLE 1. Molt increments of rock crabs from Humboldt Bay, 1984.

SPECIES	SEX	DATE TAGGED	DATE RECOVERED	CARAPACE WIDTH (mm)		% INCREASE
				PRE-MOLT	POST-MOLT	
RED	F	11 JAN 84	13 MAR 84	98	108	10.2
RED	F	13 MAR 84	1 OCT 84	99	121	22.2
RED	F	27 SEP 84	10 NOV 84	113	121	7.1
RED	F	-----	2 OCT 84	66	85	28.8
RED	M	11 JAN 84	13 MAR 84	139	149	7.2
RED	M	12 JAN 84	14 MAR 84	127	137	7.9
RED	M	11 MAY 84	20 MAY 84	111	141	27.0
BROWN	F	13 MAR 84	5 OCT 84	107	122	14.0
BROWN	F	13 MAR 84	7 OCT 84	88	108	22.7
BROWN	M	9 JAN 84	13 MAR 84	112	120	7.1

FIGURE 2. Time at large and percentage increase in carapace width.

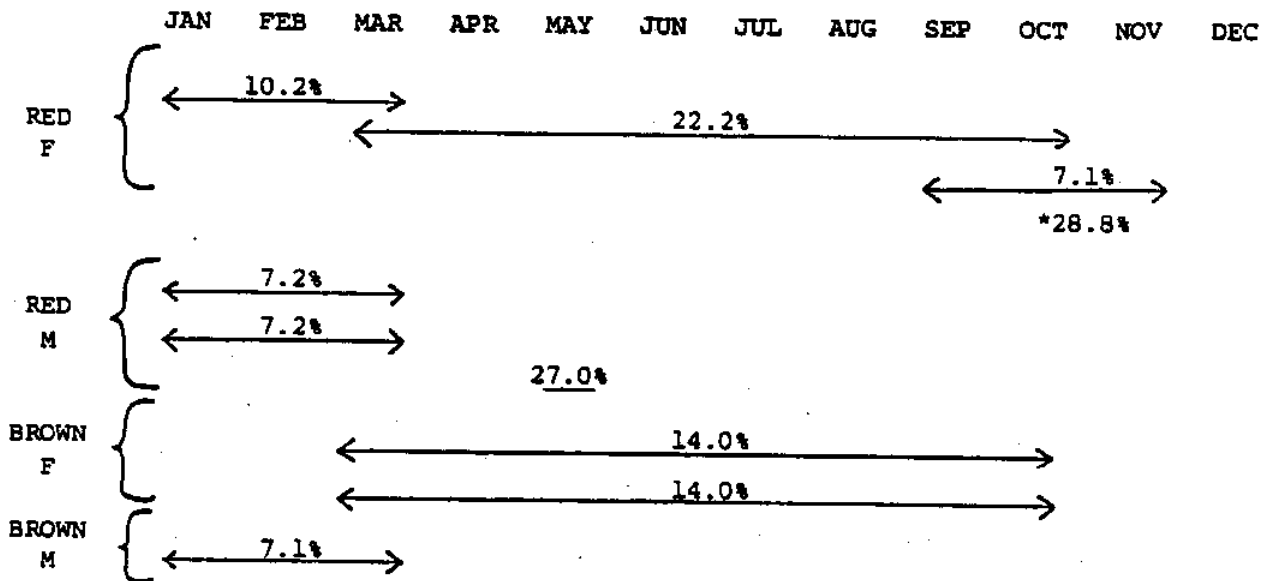


TABLE 2. Percentage of egg-bearing female crabs (and actual number in parentheses).

	RED CRABS	BROWN CRABS	YELLOW CRABS
January	.4 (1)	16.25 (4)	0 (0)
March	1.1 (3)	0 (0)	0 (0)
May	1.6 (2)	8.3 (1)	0 (0)
July	3.3 (7)	6.25 (1)	0 (0)
September	0 (0)	0 (0)	0 (0)
November	0 (0)	7.7 (1)	0 (0)

The presence of egg masses on female crabs is another indirect method of determining molt seasonality. Ovigerous red crabs were collected from January to July, with the greatest number of captures occurring in July (Table 2). Most of the ovigerous brown crabs were collected in January during this study, which corresponds to observations of commercial fishermen (both in the bay and offshore) who have noticed large numbers of them between December and February. However, some ovigerous brown crabs were also collected in the summer and late fall.

Molt Increments. Molt increments from red crabs ranged from 7.9 - 28.8% (Table 1). The two largest molt increments represent only one molt since one measurement was virtually instantaneous and the other crab was at large for less than a month. Brown crab molt increments ranged from 7.1 - 22.7%.

Size at Maturity. The size of the smallest ovigerous females can be a good indication of the onset of sexual maturity. Sizes of the 13 ovigerous red crabs ranged from 93 to 138 mm (3.7 - 5.4 in) and sizes of the 7 ovigerous brown crabs ranged from 103 to 133 mm (4.1 - 5.2 in).

Catch Composition: Species. Catches in Humboldt Bay were dominated by the red crab, which made up 82% of the 3,144 crabs examined during 1984. Brown crabs made up 16.5% of the catch, and yellow crabs made up 1.5% of the catch. Juvenile dungeness crabs, Cancer magister, were rarely caught during this survey. No smooth crabs, Cancer gracilis, were caught during this survey but at least one was collected during commercial fishing activities. Red crabs always dominated the catch, but the percentage of other species varied greatly from date to date and site to site.

Catch Composition: Sex. Catches were usually dominated by one sex (Table 3), suggesting that rock crabs may segregate by sex within Humboldt Bay. South Bay catches of red crabs were consistently dominated by females. North Bay red crab catches were strongly dominated by males in January, July, and September, while both sexes were caught in approximately equal number in March and November. Central Bay red crab catches consisted primarily of females in January, March, September, and November; they were dominated by males in May; and both sexes were caught in approximately equal numbers in July. Brown crab catches were also dominated by one sex on most occasions, usually following the pattern of red crab sex ratios.

Catch Composition: Size. Average carapace width of crabs collected in this survey is presented in Table 4. Average size of red and brown crabs was similar in North and Central Bays during all months, while the average size of red and brown crabs in North Bay was smaller than the size in other parts of the bay during most months. This was particularly apparent during September and November and may be due to a significant increase in the depredation fishery initiated in late summer.

Catch Rate. Average catch rates varried from 19 - 80 crabs per pot during this survey (Table 5). Catch rates were consistently highest in South Bay, and Central Bay catches were generally higher than North Bay catches.

TABLE 3. Sex ratios (male:female) of rock crabs caught in Humboldt Bay, 1984

		<u>SOUTH BAY</u>	<u>CENTRAL BAY</u>	<u>NORTH BAY</u>
JANUARY	Red	35:65	34:66	83:17
	Brown	40:60	39:61	22:78
	Yellow	0	60:40	70:30
MARCH	Red	-	43:57	48:52
	Brown	-	51:49	50:50
	Yellow	-	50:50	73:27
MAY	Red	37:63	61:39	-
	Brown	36:64	80:20	-
	Yellow	100:0	0	-
JULY	Red	27:73	48:52	86:14
	Brown	33:67	62:38	86:14
	Yellow	0:100	100:0	0
SEPTEMBER	Red	20:80	20:80	71:29
	Brown	47:53	35:65	71:29
	Yellow	100:0	0	0
NOVEMBER	Red	34:66	44:56	50:50
	Brown	29:71	21:79	58:42
	Yellow	100:0	100:0	0

TABLE 4. Average carapace width (mm) of rock crabs (male/female) caught in Humboldt Bay, 1984.

		<u>SOUTH BAY</u>	<u>CENTRAL BAY</u>	<u>NORTH BAY</u>
JANUARY	Red	117/106	129/111	110/100
	Brown	96/91	115/102	86/90
	Yellow	0	137/124	98/96
MARCH	Red	-	123/113	120/106
	Brown	-	112/110	87/86
	Yellow	-	103/105	109/98
MAY	Red	138/123	143/112	-
	Brown	102/112	119/111	-
	Yellow	127/0	0	-
JULY	Red	135/118	138/117	127/110
	Brown	104/105	117/114	98/107
	Yellow	0/133	110/0	0
SEPTEMBER	Red	126/120	127/114	116/105
	Brown	111/113	105/106	87/94
	Yellow	104/0	0	0
NOVEMBER	Red	122/120	134/121	106/101
	Brown	109/104	103/105	86/96
	Yellow	143/0	125/0	0

TABLE 5. Average catch rate of rock crabs per pot (and number of pots) during 1984.

		<u>SOUTH BAY</u>	<u>CENTRAL BAY</u>	<u>NORTH BAY</u>
JANUARY	Red	58.7 (3)	40.8 (4)	18.8 (4)
	Brown	21.0 (3)	8.0 (4)	2.3 (4)
	Yellow	0 (3)	1.3 (4)	2.5 (4)
	TOTAL	<u>79.7 (3)</u>	<u>50.1 (4)</u>	<u>23.6 (4)</u>
MARCH	Red	-	24.6 (11)	29.5 (8)
	Brown	-	7.5 (11)	.75 (8)
	Yellow	-	.2 (11)	1.75 (8)
	TOTAL	-	<u>32.3 (11)</u>	<u>32.0 (8)</u>
MAY	Red	26.8 (5)	17.2 (6)	-
	Brown	2.2 (5)	4.2 (6)	-
	Yellow	.2 (5)	0 (6)	-
	TOTAL	<u>29.2 (5)</u>	<u>21.4 (6)</u>	-
JULY	Red	31.7 (6)	20.0 (6)	15.8 (5)
	Brown	2.0 (6)	2.7 (6)	3.0 (5)
	Yellow	.2 (6)	.2 (6)	0 (5)
	TOTAL	<u>33.9 (6)</u>	<u>22.9 (6)</u>	<u>18.8 (5)</u>
SEPTEMBER	Red	45.5 (6)	31.1 (6)	23.8 (6)
	Brown	2.8 (6)	6.7 (6)	1.2 (6)
	Yellow	.2 (6)	0 (6)	0 (6)
	TOTAL	<u>48.5 (6)</u>	<u>37.8 (6)</u>	<u>25.0 (6)</u>
NOVEMBER	Red	39.7 (6)	10.2 (6)	23.8 (6)
	Brown	7.0 (6)	19.5 (6)	3.1 (6)
	Yellow	.2 (6)	.2 (6)	0 (6)
	TOTAL	<u>46.9 (6)</u>	<u>29.9 (6)</u>	<u>26.9 (6)</u>

Movements. Movements of tagged crabs are summarized in Table 6. Four red crabs and one brown crab were recovered in Central Bay after being tagged and released in South Bay. All other crabs were recovered in the same portion of the bay in which they were tagged. A few crabs moved considerable distances in short times (eg., one red female moved over 4.8 km (3 miles) in six days), but most were recovered relatively close to their release sites. At least 18% of the crabs were recovered at their original release site, some after several months. Most recoveries were made by commercial fishermen and, since their activities were concentrated in Central Bay, most of the information on crab movements comes from this area. It would be unwise to draw any conclusions about crab movements in North or South Bays due to the low number of recoveries.

Missing and Regenerated Claws. In South and Central Bays the percentage of crabs missing one or both claws ranged from 5.6 - 14.6% (Table 7). In North Bay the percentage was consistently higher, ranging from 12.8 - 27.7%. It is likely that this high frequency is due either to movement of de-clawed crabs into North Bay from other areas or due to mechanical injury caused by oyster dredging, since entire crabs (rather than claws only) are removed in the depredation fishery. Crabs with obviously regenerated claws (usually about half the size of normal claws) were found in all samples, comprising 1.0 - 9.6% of the catch.

Commercial Fishing. During 1984 over 5443 kg (12,000 lbs) of rock crabs were landed in the CDF&G "Eureka Area". According to Ron Warner of the Department of Fish and Game, there are 11 fishermen with permits to fish up to 25 rock crab pots each in Humboldt Bay but, in 1984, it appears that only two of the permittees actively fished. The major problem described by most fishermen is that of marketing the product.

The data previously presented in this report depict the gross catches per pot that a fisherman can expect. However, only the largest crabs can be marketed, so "commercial catches" will be considerably less than gross catches. During the summer and fall of 1984, commercial catches averaged 1.5 kg (3.4 lbs) per pot haul, which translates roughly into about 3 crabs per pot. The majority of these marketable crabs are greater than approximately 127-140 mm cw (5-5½ in). Most of the crabs are de-clawed and then returned to the bay. Only a small proportion are marketed whole. Catches are reported to the Department of Fish and Game as if the whole crab was landed in all cases, however.

Currently, a project is being conducted by H.S.U. fisheries students who are developing carapace width vs weight regressions for rock crabs as well as claw weight vs body weight regressions. These will be valuable for comparing the survey results, which are based on size, with the commercial crab landings, which are reported by weight.



TABLE 6. Recoveries of tagged rock crabs released in Humboldt Bay during 1984.

<u>RELEASE STATION</u>	<u>NUMBER RECOVERED</u>	<u>RECOVERY SITE</u>	<u>APPROX. DISTANCE BETWEEN SITES (mi.)</u>	<u>DAYS AT LARGE</u>
-----RED MALES-----				
1	2	Standard Oil Dock	3.1	10
2	1	LP Dock	1.25	51
2	1	Coast Guard Station	1.4	202
2	2	Washington St. Pier	1.2	33-44
2	3	Standard Oil Dock	0.3	10-147
2	3	Simpson Dock	0.4	7-63
2	4	Station 2	0	14-170
2	1	Unknown	?	120
3	1	Sand Island	0.3	21
3	3	Station 3	0	33-162
-----RED FEMALES-----				
1	1	Standard Oil Dock	3.1	6
1	1	Blimp Hanger	2.2	148
2	1	Coast Guard Station	1.4	11
2	7	Simpson Dock	.4	7-14
2	10	Standard Oil Dock	.3	4-203
2	1	Lazio's Dock	1.7	52
2	1	Station 2	0	29
-----BROWN MALES-----				
1	1	Standard Oil Dock	3.1	63
2	1	Standard Oil Dock	.3	52
2	2	Station 2	0	71-81
2	1	Unknown	?	140
-----BROWN FEMALES-----				
1	1	Buoy #5	.4	31
2	1	Blimp Hanger	1.1	207
2	1	Coast Guard Station	1.4	209
2	2	Simpson Dock	.4	7
2	2	Standard Oil Dock	.3	4-144

TABLE 7. Percentage of crabs with missing claws (and number of crabs).

	<u>SOUTH BAY</u>	<u>CENTRAL BAY</u>	<u>NORTH BAY</u>
<b>JANUARY</b>			
Missing 1 claw	9.6 (23)	7.0 (14)	18.1 (17)
Missing 2 claws	1.7 (4)	2.5 (5)	1.1 (1)
With regenerated claw(s)	2.9 (7)	1.0 (2)	6.4 (6)
<b>MARCH</b>			
Missing 1 claw	-	8.1 (29)	11.3 (29)
Missing 2 claws	-	2.2 (8)	1.5 (4)
With regenerated claw(s)	-	2.0 (7)	3.1 (8)
<b>MAY</b>			
Missing 1 claw	5.6 (8)	10.1 (13)	-
Missing 2 claws	0 (0)	1.6 (2)	-
With regenerated claw(s)	2.7 (4)	6.2 (8)	-
<b>JULY</b>			
Missing 1 claw	10.8 (22)	6.6 (9)	24.5 (23)
Missing 2 claws	1.0 (2)	2.2 (3)	3.2 (3)
With regenerated claw(s)	6.9 (14)	4.4 (6)	9.6 (9)
<b>SEPTEMBER</b>			
Missing 1 claw	12.4 (36)	9.7 (22)	20.0 (30)
Missing 2 claws	1.0 (3)	1.8 (4)	2.7 (4)
With regenerated claw(s)	5.1 (15)	3.1 (7)	3.3 (5)
<b>NOVEMBER</b>			
Missing 1 claw	6.0 (17)	11.7 (21)	0 (0)
Missing 2 claws	1.0 (2)	3.9 (7)	17.3 (28)
With regenerated claw(s)	4.3 (12)	2.8 (5)	7.4 (12)

## DISCUSSION

It is not the intention of this interim report to draw any conclusions regarding rock crab growth, movements, catches, or the effects of claw-removal based on only one year's results. This section will be restricted to comparing the results to date with information from previous studies. It will also be restricted to discussing red and brown crabs, since so few yellow crabs were caught.

Molt Cycle. Red crabs were found to molt during almost all months of the year during this study. No discussions of molting in previous studies of Cancer productus have been found. However, since copulation can only occur immediately after females molt, observations of mating activity should provide the same information. Knudsen (1964) found copulating pairs of red crabs "at almost any time of the year, though they were numerous only in the summer and fall months". His study was conducted in intertidal areas of Puget Sound. Turner et al (1969) noted breeding activity from January through August, with a peak between April and June, around an artificial reef in Santa Monica Bay. It appears that molting and mating occur earlier in southern California than in Puget Sound, and the season in Humboldt Bay might be intermediate to those two areas. This possibility will be examined in detail during the coming year. Knudsen (1964) also collected ovigerous crabs in Puget Sound between October and June, with a peak between December and early April. Based on his data, it appears that eggs are extruded 3-4 months after copulation, and the eggs then hatch about 3 months later.

Carroll (1982) found that the highest percentages of molting brown crabs "generally occurred in autumn and early winter, although recently molted crabs were found throughout the year". His study was conducted on a population of brown crabs in the open ocean along the San Luis Obispo county coastline. He also reported that brown crabs extrude their eggs approximately 11 weeks after copulation and the eggs are then carried for 7-8 weeks before hatching. He found that 0.6-13.3% of the females were ovigerous during each sample period. While he did not comment on seasonality, his highest percentages were in January and February and August and September.

Molt Increments. No information on molt increments of red crabs from previous studies has been located. Carroll (1982) found that molt increments for brown crabs caught in the open ocean ranged from 13.1 - 27.7%. One brown crab in the present study increased only 7.1%, but the other two crabs were within this range.

Size at Maturity. Red crabs probably mature at sizes smaller than 93 mm (3.7 in), although no references concerning this could be found. The smallest ovigerous brown crab noted by Carroll (1982) was 73 mm (2.9 in), which is considerably smaller than the smallest ovigerous brown crab collected in this survey.

Catch Composition: Species. Red crabs are most abundant in bays and estuaries while brown and yellow crabs are most abundant on the open coast (Garth and Abbott 1980). This probably accounts for the predominance of red crabs in the Humboldt Bay fishery, while rock crab fisheries in central and southern California primarily catch brown and yellow crabs.

Catch Composition: Sex. Catches of both red and brown crabs were generally dominated by one sex in this study. Knudsen (1984) also noticed a strong segregation by sex for red crabs in intertidal areas of Puget Sound. From January through May males predominated intertidally while females were almost completely absent. From late May into June the sexes were nearly equal, and then females predominated from July to October. The number of males and females was again nearly equal in November and December. He suggested that "males and females may have a horizontal migration to the deeper water during periods of the year, or they may become inactive and extremely secretive and thus remain hidden within the (intertidal) habitat area".

Catch Composition: Size. The only information found on red crab sizes comes from studies by Miller (1978, 1979), who looked at the catches of variously designed traps under a series of fishing conditions in Departure Bay, British Columbia. In the first study his crabs ranged from 90-110 mm carapace width and in the second they ranged from 70-140 mm c.w., with a mode of 100 mm c.w. Brown crabs caught by Carroll (1984) ranged from 70-155 mm c.w. for males, with a mode between about 120-130 mm c.w. Females ranged from 10-145 mm c.w., with a mode between 110-120 mm c.w.

Catch Rate. Miller (1978, 1979) found that catch rates of red crabs increased with the size of trap used, the duration of fishing time (up to a "saturation point"), the exposure of bait, and the presence of triggers. Catch rates using a top-opening trap of a size similar to the side-opening traps used in this study reached up to 30 crabs/pot at the end of 12 hours of continuous fishing. Carroll (1982) notes changes in his brown crab catch per pot from month to month and year to year. Peak catches were about 15 crabs/pot during a 24-hr soak while average catches were closer to 5 crabs/pot. He used top-entry igloo crab traps (60 mm (24 in) diameter x 30 cm (12 in) height, 3 cm (1.2 in) mesh size).

Movements. Boulding and Hay (1984) looked at movements of red crabs in Grappler Inlet, British Columbia. They attached radio tags to two red crabs and tracked them for 13 and 23 days, respectively. The first crab travelled about 65 m (0.04 miles) and the second travelled a straight-line distance of about 300 m (0.19 miles). Neither crab left the inlet, each sometimes spent several days in one spot, and each occasionally travelled more than 50 m (0.03 miles) in a day. Neither even approached the maximum distance travelled by a red crab in this study of about 0.8 km/day (0.5 mile/day). It is very likely that a crab travelling this distance would have to somehow use the strong currents in Humboldt Bay to help it along. Knudsen (1964) noted that red crabs collected in the intertidal zone exhibited a negative rheotaxis in aquaria. They would move about randomly until a current was introduced, and then would begin moving in the same direction as the current. He concluded that this was the mechanism which governed their migrations into the tidal zone with the high tides and back into deeper waters as the tide receded. It may also account for long distances travelled horizontally along the main channels of Humboldt Bay.

Carroll (1984) found that most of the brown crabs in his study were recaptured in the vicinity of the release site during the first two months at liberty. Twenty-one percent of crabs at liberty from 2-18 months were found in adjacent areas up to 2 km (1.2 miles) away, while the remainder were still caught in the vicinity of the release site. Most crab movements occurred along a deep channel leading into Diablo Cove; however, there appeared to be no seasonal trends to indicate an annular migratory pattern. The greatest distance travelled by any crabs recaptured during his 6-year study was 7 km (4.3 miles). The time at large was not stated. He concluded that brown crabs "are capable of long-distance movements but often remain in the same area for several months, perhaps moving only short distances while foraging".

Missing and Regenerated Claws. No references regarding claw loss in rock crab species have been found. Several studies of combined claw and leg loss have been reported for dungeness crabs. Durkin et al (1984) found that 30% of dungeness crabs examined in the Columbia River estuary were missing claws or legs and 21% of the crabs had regenerating claws or legs. Cleaver (1949) found that 16 - 20% of the commercially caught dungeness crabs from the Washington coast had missing legs or claws and Ames (1980, reported in Durkin et al 1984) found that 17% of commercially caught crabs in Port Gardner Bay, Washington, had missing claws or legs.

Gray (1984) conducted a laboratory study of the effects of claw removal on survival and behavior of male red crabs. He found that there was 20% immediate mortality associated with improper removal of claws, but after these crabs died during the first 2 days, there was only one delayed mortality during the remaining weeks of the study. He also found no differences in growth rates between clawed and clawless crabs held under his experimental conditions. While it is likely that under field conditions rock crabs lacking claws would probably not fare so well, these results are consistent with those of Savage and Sullivan (1978), who found that survival rates of declawed stone crabs (Menippe mercenaria) in Florida were similar to those for stone crabs with two claws. A group of students in Dr. James Welsh's Fisheries 135 class at H.S.U. is currently investigating this further.

Commercial Fishing. Information is currently being solicited from southern California to compare commercial catch rates for rock crab species caught in that area with catch rates in Humboldt Bay. Information is also being solicited regarding rock crab fisheries which might exist in Oregon or Washington.

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