PRELIMINARY INVESTIGATION OF THE SOUTHEASTERN ALASKA ABALONE (Haliotis kamtschatkana)

PART I - EXPLORATORY DIVING

By Robert Livingstone, Jr.*

INTRODUCTION

For many years residents of southeastern Alaska have gathered sufficient abalone from the rocky shores of Prince of Wales and Baranof Islands for home consumption. In 1947, Dr. G. Dallas Hanna of the California Academy of Sciences, while making a species study, reported incidentally that abalone occur in considerable numbers along the shores of the outer islands.[1] Fairly extensive beds of abalone are also found in northern British Columbia along the rocky shores bordering the open ocean on the west coast of the Queen Charlotte Islands (Quayle 1940). All evidence at hand suggested that abalone were available along the west coast of Prince of Wales and Baranof Islands and that this region held promise for exploration. These reports, however, did not furnish sufficient information to establish definitely whether a commercial fishery is actually possible. In view of the need for off-season fisheries in southeastern Alaska, a survey was made by the U. S. Fish and Wildlife Service to determine if abalone existed in commercial quantities.

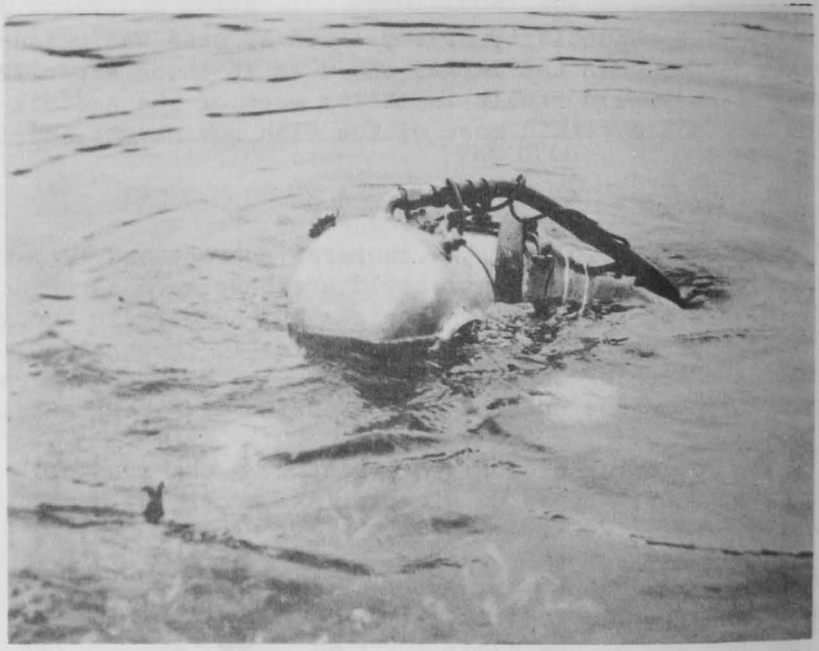

FIG. 1 - DIVER SEARCHING BOTTOM FOR ABALONE IN SHALLOW WATER.

For the explorations, a professional Alaska salmon-trap diver was employed, together with his 38-foot boat. The diving was carried on from September 15 to October 10, 1951. The work was confined to the waters of the west coast of Prince of Wales Island and the vicinity of Craig, Alaska (see fig. 2).

EQUIPMENT

The diving tender used on the survey was the 38-foot cruiser-type Lady Bess (see fig. 3), with a beam of 9 feet, draft of 4 feet,[2] and sleeping accommodation

*FISHERY METHODS AND EQUIPMENT SPECIALIST, NORTH PACIFIC FISHERIES EXPLORATION AND GEAR RESEARCH EXPLORATORY FISHING AND GEAR DEVELOPMENT SECTION, BRANCH OF COMMERCIAL FISHERIES, U. S. FISH AND WILDLIFE SERVICE, SEATTLE, WASHINGTON.

1/ DR. HANNA'S OBSERVATIONS WERE BASED ON LOW-TIDE COLLECTIONS, RECONNAISSANCE OF THE SUB-LITTORAL ZONE WITH A SKIFF AND AN UNDERWATER VIEWER, AND SURVEYS OF THE SHORES. IN ADDITION, HE EMPLOYED A SALMON-TRAP DIVER TO MAKE SEVERAL DIVES IN SELECTED LOCATIONS. (UNPUBLISHED MATERIAL GENEROUSLY FURNISHED THE WRITER BY DR. HANNA.)

2/ SHALLOW DRAFT IS ESSENTIAL TO WORK THE ROCKY SHORE AREAS INHABITED BY THE ALASKA ABALONE.

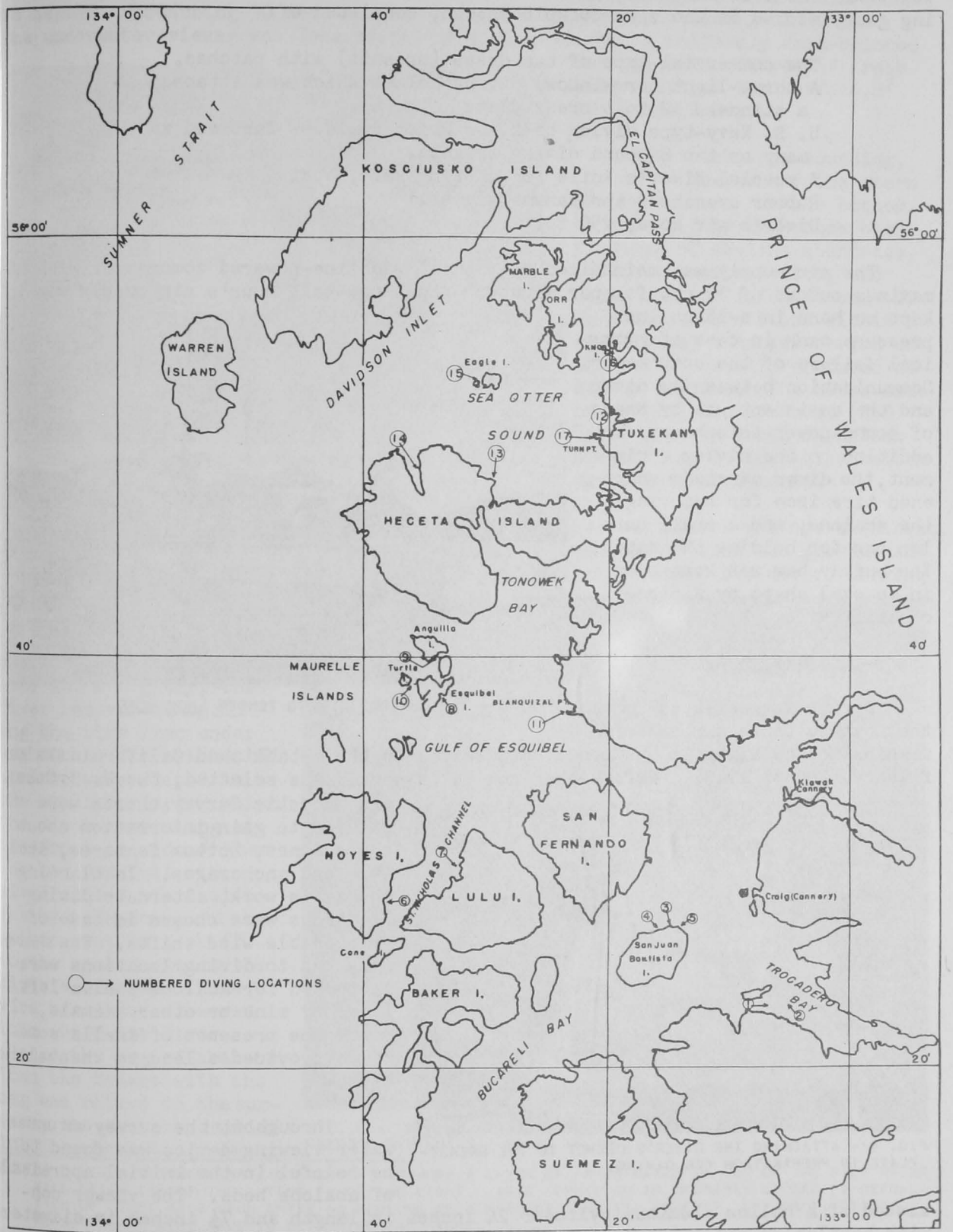

FIG. 2 - SECTION OF WEST COAST OF PRINCE OF WALES ISLAND EXPLORED FOR ABALONE.

for six. The crew was made up of the diver and his attendant (see fig 4). Diving gear, stored in the open cockpit astern, consisted of:

The commercial-type of tan dress (or suit) with patches.
A three-light (or window) diving helmet which was attached to a standard 12-bolt breastplate (fig. 4).
U. S. Navy-type diving belt, to which could be fastened as many as ten 8-pound diving weights.
A special diver's knife for cutting kelp, etc.
Rubber overshoes and canvas gloves.
Diver's air hose, 250 feet long.

The air supply was maintained by a small gasoline-powered compressor with a maximum output of 19 cu. ft. per minute. About one-half hour's air supply was kept on hand in a 15-gallon pressure tank in case of mechanical failure of the compressor. Communication between the diver and the assistant was by means of sound-power telephone. In addition to the diving equipment, the diver carried a sharpened tire iron for removing the abalone, and a small burlap bag for holding the catch. The burlap bag was kept open in an oval shape by a piece of stiff wire.

FIG. 3 - THE 38-FOOT DIVING TENDER LADY BESS.

PROCEDURE

Diving was selected as the most suitable exploratory fishing method since it has proven successful in the established California abalone fishery (Bonnot 1948). Before the area to be worked was selected, the U. S. Coast and Geodetic Survey charts were studied to gain information about shore lines, bottom features, shelter, and anchorages. In planning the day's work, alternate diving locations were chosen in case of unfavorable wind shifts. The shores adjacent to diving locations were inspected for abalone shells left there by mink or other animals, since the presence of shells sometimes provided a lead to the abalone beds.[3/]

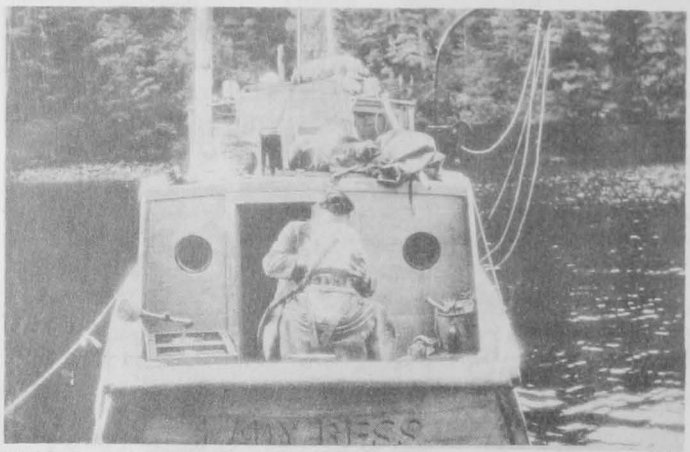

FIG. 4 - ATTACHING THE DIVER'S HELMET TO THE BREASTPLATE IN PREPARATION FOR DIVING.

Throughout the survey an underwater viewing device was found to be helpful in the initial appraisal of abalone beds. The viewer consisted of a hollow aluminum cylinder 24 inches in length and 7½ inches in diameter with handles on one end and a pane of glass sealed into the other. Use of the viewer gave a satisfactory examination of the bottom unaffected by surface disturbances (see fig. 6). This provided an idea of abalone density, the extent and type

3/ THIS METHOD HAD BEEN FOLLOWED BY DR. HANNA AND OFFERS CLUES AS TO THE WHEREABOUTS OF THE ABALONE CONCENTRATIONS.

of bottom, and the nature of kelp growths. On sunny days the bottom could be seen to depths approaching 30 feet unless suspended matter made viewing difficult. The underwater viewer was less effective when used over a uniformly dark-colored bottom, when a layer of fresh water covered the surface,[4] and on dark days.

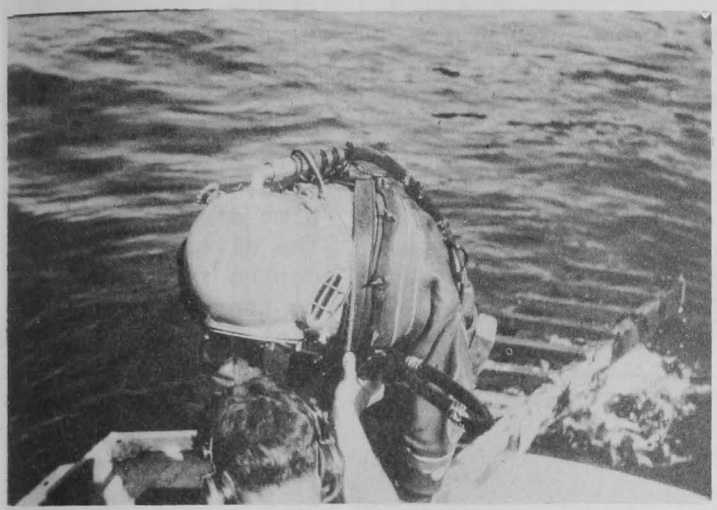

FIG. 5 - DIVER BEING HELPED OVER THE SIDE BY ATTENDANT.

After taking a sounding, the diver jumped off the stern of the tender. On the bottom, he reported by telephone his findings of abalone abundance, bottom characteristics, and other related information. If no abalone were found within a short time, a longer period on the bottom usually produced no better results. The diver made use of all the air hose (250 feet) at each location unless hampered by an irregular bottom or kelp entanglements.

Removal of an abalone from its attached position on a rock was not difficult. Ordinarily, the diver merely slid or twisted the abalone off with his gloved hand. This method worked particularly well on a boulder bottom where the diver, working in a semi-prone position, could use his hands to pull himself along. Occasionally, when an abalone stuck tightly, the diver removed it by sliding the tire iron under its foot. The catches of abalone were placed in the small burlap bag which the diver wore slung at his front or side.[5] When the bag was full, the diver called his assistant by telephone, and the author went in a skiff to the spot marked by the diver's bubbles. Here a wire basket was lowered into which the diver placed the bag of abalone. Then the basket with the bag was raised to the surface, the contents emptied into the basket, the empty

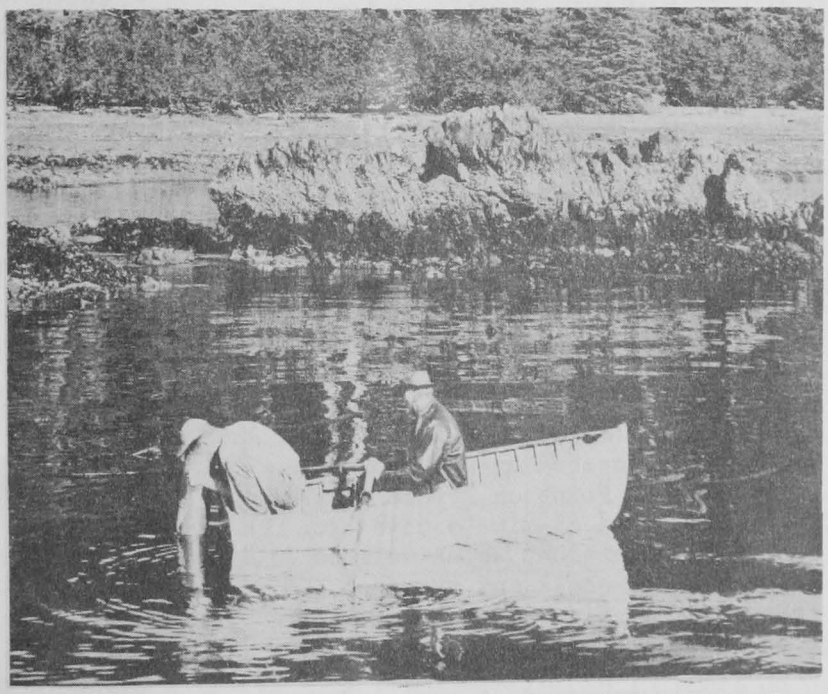

FIG. 6 - LOOKING FOR ABALONE WITH UNDERWATER VIEWING DEVICE BEFORE DIVING NEAR NOYES ISLAND.

4/ THE DIVER MENTIONED THAT IN SALMON-TRAP WORK A LAYER OF FRESH WATER ON TOP OF THE SALT WATER WILL OFTEN CHANGE THE INTENSITY OF THE LIGHT. THIS CONDITION IS PROBABLY CAUSED BY REFRACTION OF LIGHT RAYS UPON ENTERING MEDIUMS OF DIFFERENT DENSITY; HOWEVER, NO QUANTITATIVE MEASUREMENTS WERE MADE TO DETERMINE THE CAUSE.

5/ CALIFORNIA ABALONE DIVERS CARRY A NET BAG WHICH HOLDS ABOUT TWO DOZEN ABALONE. WHEN THE BAG IS FULL, THE DIVER SIGNALS HIS ATTENDANT WHO CLIPS AN EMPTY BAG TO THE DIVER'S LIFE LINE. THE DIVER THEN PULLS THE EMPTY BAG DOWN AND FASTENS THE BAG HOLDING THE ABALONE TO THE LIFE LINE WHICH IS HAULED UP TO THE TENDER BY THE ASSISTANT. (BONNOT 1948)

bag re-lowered to the diver, and the skiff rowed back to the diving tender. Finally, the abalone were weighed, measured, placed in burlap sacks, and lowered over the side of the tender until fully submerged.

RESULTS AND OBSERVATIONS

During the survey 17 dives were made, and the results from each dive are presented in table 1. The length of time spent on the bottom ranged from 17 minutes to 2 hours and 28 minutes, with an average time of 52 minutes. The diver operated in depths from zero feet to approximately 80 feet.[6] A total of 612 abalone were taken by diving, and the gross weight in the shell was 177.7 pounds.

FIG. 7 AN AREA OF ACTIVE WATER CIRCULATION. DIVE NUMBER 7 OFF LULU ISLAND.

The most productive dive (No. 7) produced 202 abalone which weighed 69.4 pounds in the shell and averaged 5.5 ounces each. This dive, lasting 2 hours and 28 minutes, was made approximately ½-mile southward of Point Marabilla on the western shore of Lulu Island in St. Nicholas Channel (see fig. 2). The main part of this abalone concentration was confined to a zone of boulders in 9 to 23 feet of water and generally shoreward of the holdfasts of kelp.[7] This finding is consistent with reports by Japanese fishermen that the abalone beds in northern British Columbia extend out as far as the kelp line (Thompson 1914).

Another fairly good bed of abalone was discovered on the west shore of Blanquizal Point on Prince of Wales Island, where a 65-minute dive (No. 11) produced 154 abalone which weighed 41.4 pounds in the shell and averaged 4.3 ounces each. Dives from areas other than those mentioned produced smaller or insignificant catches (see table 1).

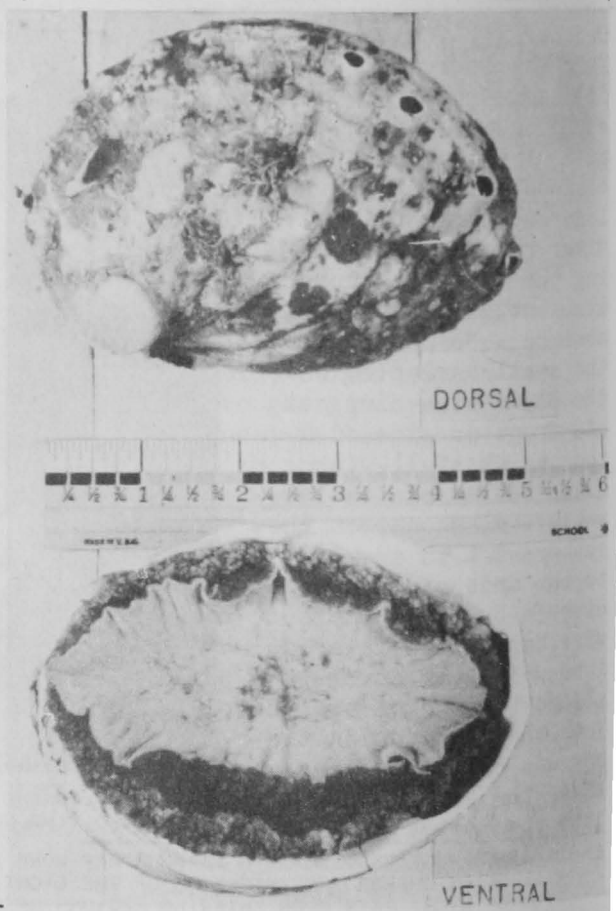

FIG. 8 - DORSAL AND VENTRAL VIEWS OF ALASKA ABALONE (RULER GRADUATED IN INCHES).

DEPTH OF ABALONE

Abalone were commonly found in the rocky shoal areas which are partially exposed on the minus tides of spring

6/ DEPTHS GIVEN IN THIS REPORT ARE BASED ON ONE ACTUAL SOUNDING AT THE TIME OF THE DIVE. APPROXIMATE TIDAL STAGE AT THE TIME OF EACH SOUNDING IS SHOWN IN TABLE 1.

7/ EXTENSIVE BEDS OF LIVE BULL KELP NEREOCYSTIS LUETKEANA WERE NOTED IN ST. NICHOLAS CHANNEL AND IN THE SHOAL AREAS BETWEEN HECETA AND TUXEKAN ISLANDS.

Table 1--Alaska Abalone Diving Record

Date	Location	Latitude N.	Longitude W.	Dive	Time on bottom	Depth*	Stage of tide	Abalone				Remarks
								Total No.	Total wt. (in shell)	Avg. length	Avg. wt. (in shell)	
					Min.	Feet			Lbs.	In.	Oz.	
9-17-51	Trocadero Bay	55°23'04"	133°07'08"	1	90	20	1/4 Flood	13	3.8	3.8	4.7	Abalone scattered. Boulder and sand bottom with sharp drop-off at 30 feet. Small amount of surge.
9-17-51	Trocadero Bay	55°23'00"	133°05'28"	2	45	40	High slack	0	-	-	-	One 4 3/4-pound rock scallop found on base of cliff. Mud and sand bottom. Patchy with eelgrass. Water turbid.
9-19-51	San Juan Bautista Island	55°27'08"	133°15'09"	3	17	45	1/4 Flood	0	-	-	-	Many clam shells and starfish. Generally sandy bottom with few scattered small boulders. Broadleaf kelp patchy.
9-19-51	San Juan Bautista Island	55°27'02"	133°15'11"	4	33	42	3/4 Flood	3	.8	4.0	4.4	Good showing of shells in edge of woods. Sandy bottom with rock ledge, eelgrass. Area easy to work.
9-20-51	San Juan Bautista Island	55°27'00"	133°14'38"	5	30	30	3/4 Ebb	5	2.7	4.7	8.6	Abalone on small boulder ledge. Sandy bottom in deeper water. Area easy to work except for few kelp entanglements.
9-21-51	Noyes Island	55°28'13"	133°38'18"	6	105	18	1/4 Flood	92	23.6	3.7	4.1	Fair quantity of abalone on band of boulders in shallow water. Many sea urchins. Broadleaf kelp and numerous hold-fasts of bull kelp.
9-22-51	Lulu Island	55°29'58"	133°32'30"	7	148	23	Low slack	202	69.4	4.0	5.5	Good showing of abalone on ledge of boulders. Many sea urchins. Slight tidal surge in shallow depths. Good visibility. Patches of broadleaf kelp on bottom.
9-24-51	Esquibel Island	55°38'09"	133°33'47"	8	46	12	High slack	28	9.1	3.9	5.2	Abalone scattered. Few sea urchins, numerous starfish. Rocky ledge with sand and scattered boulders. Easy to work.
9-24-51	Anguilla Island	55°40'00"	133°34'10"	9	38	26	Low slack	0	-	-	-	No shells in woods. Rock ledge with abrupt drop-off. Eelgrass in cove. Fresh water seepage running into cove. No surge here.
9-25-51	Turtle Island	55°38'45"	133°36'07"	10	34	16	3/4 Flood	42	8.4	3.3	3.2	Abalone scattered on boulder ledge in center of cove. Numerous sea urchins. Patches of eelgrass and broadleaf kelp. Slight swell.
9-25-51	Prince of Wales Island	55°37'22"	133°23'43"	11	65	12	3/4 Ebb	154	41.4	3.7	4.3	Abalone scattered. Eleven shells found in edge of woods. Boulder bottom. Numerous sea urchins.
9-28-51	Turekan Island	55°50'40"	133°20'35"	12	43	26	High slack	11	3.4	4.0	5.0	Few sea urchins. Limestone ledge with conglomerate. Broadleaf kelp in patches. Area quite sheltered.
9-29-51	Hecata Island	55°48'40"	133°29'40"	13	30	25	1/2 Flood	0	-	-	-	No shells in edge of woods. Bad entanglement of kelp slowed diver's progress. Area sheltered.
9-29-51	Hecata Island	55°49'18"	133°35'42"	14	28	20	1/4 Ebb	0	-	-	-	No sea urchins. Limestone ledge with few boulders. Bad surge in shallow depths.
9-30-51	Island westward of Eagle Island	55°53'15"	133°31'05"	15	73	24	3/4 Flood	37	7.6	3.3	3.3	Numerous sea urchins. Shells in edge of woods. Scattered boulders, white sand and gravel. Considerable surge in around 9 feet of water.
10-4-51	Knob Island	55°54'36"	133°19'55"	16	35	22	3/4 Flood	0	-	-	-	No sea urchins. Suspended matter made viewing difficult. Area sheltered.
10-7-51	Turekan Island	55°50'36"	133°21'33"	17	35	14	1/4 Flood	25	7.5	3.9	4.8	Many sea urchins. Extensive boulder ledge with sand in deeper water. Surge in whole area.
Totals or Over-all averages					14 hrs. 54 min.			612	177.7	3.8	4.6	

* BASED ON ONE ACTUAL SOUNDING AT TIME OF DIVE.

and summer. In British Columbia, the abalone are found from the zero-foot level down to a depth of several fathoms (Quayle 1940). A Ketchikan salmon-trap diver, who made several dives for Dr. Hanna in 1947, claimed that he had gathered abalone as deep as 6 fathoms and had seen them as far down as 15 fathoms.

TYPE OF BOTTOM

Best concentrations of abalone were found in areas where the bottom was covered with boulders of various sizes interspersed with stretches of clean gravel. The Alaska abalone apparently inhabits more open surfaces than the California species which are reported common in the interstices and on the undersurfaces of rocks (Bonnot 1940). No abalone were encountered where the diver reported bottoms of mud, sand, or shell.

SIZE OF ABALONE

In a sample of 345 shell lengths,[8] the size of abalone ranged from 1.9 inches (48 mm.) to 5.0 inches (127 mm.) and averaged 3.8 inches (97 mm.). One shell collected on the shore of San Juan Bautista Island measured 5.2 inches (132 mm.). Whole abalone weights varied from ½-ounce (14 grams) to 11.5 ounces (326 grams). The average weight of 356 abalone, including the shell, was 4.6 ounces (130 grams). It is pointed out for comparison that California abalone divers must abide by a law that sets a minimum size of 6, 7¼, and 8 inches, respectively, for the pink or black, green, and red abalones. (Bonnot 1948.)

A comparison of the Alaska and the California abalones, if based on shell measurements, is apt to be misleading. Table 2 shows that 12 Alaska abalone having 5-inch shell measurements had a gross weight of 8 pounds, while an equal number of California abalone having 6½-inch shell measurements had a gross weight of 26.7 pounds. The Alaska abalone, which had shell measurements 23 percent less than the California abalone, possessed a gross weight 70 percent less than the California sample. This disparity in weight is also reflected in the yield of the two varieties. Whereas the twelve 5-inch Alaska abalone yielded a foot-muscle weight of 3.4 pounds, the twelve 6½-inch California abalone yielded 11.8 pounds. No data are available to provide direct comparisons of gross weights and recoveries from Alaska and California abalones of equal shell measurements. It would appear, however, that the Alaska abalone possess a markedly lower gross weight and recovery weight in proportion to shell measurement than do the California abalone.

Table 2 - Size and Weight of Alaska and California Abalones[1]

No.	Type	Size	Total weight	Weight of Foot Muscle
		In.	Lbs.	Lbs.
12	Alaska abalone	3.0	1.5	.6[2]
"	" "	3.5	2.7	1.1[2]
"	" "	4.0	4.1	1.7[2]
"	" "	4.5	5.2	2.2[2]
"	" "	5.0	8.0	3.4[2]
"	California abalone	6.5	26.7	11.8
"	" "	7.0	31.1	12.7
"	" "	7.5	33.4	13.6
"	" "	8.0	35.6	14.5
"	" "	8.5	37.8	15.4
"	" "	9.0	40.0	16.3

1/ BOTH SEXES INCLUDED. CALIFORNIA DATA FROM BONNOT (1948).
2/ WEIGHT CALCULATED BY APPLYING 42 PERCENT RECOVERY RATE TO GROSS WEIGHT.

DISCUSSION AND CONCLUSIONS

In the area covered, diving did not locate sufficient quantities of abalone to warrant their commercial exploitation. It is possible that greater numbers of

8/ ABALONE WERE MEASURED THROUGH THE LONGEST DIAMETER OF THE SHELL WITH A SLIDING CALLIPER-TYPE MEASURER GRADUATED IN MILLIMETERS.

abalone occur along the seaward sides of the outer islands in this region; however, weather conditions would frequently make abalone diving in these areas hazardous or impossible. Even in California, abalone divers average only about 12 working days a month (Bonnot 1948).

When the underwater viewer could be used near the time of low water, better catches usually resulted because first-hand knowledge of the area was obtained prior to diving. At dive locations Nos. 6, 7, 11, and 17,9/ the underwater viewer could be used to ascertain bottom conditions before the dive was begun. Diving stations worked at higher stages of the tide made the use of the viewer less effective.

The denser abalone beds were found in the inside passages close to the ocean or in areas where either surge or tidal currents provided a constant exchange of water. Abalone were commonly found in and near colonies of sea urchins. One of the Laminarian algaes (referred to in table 1 as broadleaf kelp) often carpeted the bottom, and some abalone were found adhering to this kelp. Areas in which the diver reported an unusual abundance of starfish yielded few abalone. There is evidence from California that the smaller abalone are sometimes preyed on by starfish (MacGinitie and MacGinitie 1949).

A number of conditions that made diving difficult in this region should be noted. The very irregular bottom encountered in shoal areas made it difficult to find sufficient swinging room for the diving tender while at anchor. Kelp entanglements often slowed the diver's progress because he either had to cut the kelp or crawl through it, running the risk of fouling his air line. Bottom surge disturbed the diver, but in most locations this was not serious. Strong tidal currents caused excessive strain on the air hose making it harder to pull slack.

SUMMARY

A diving exploration for abalone was made from September 15 to October 10, 1951, in southeastern Alaska off the central west coast of Prince of Wales Island to determine the availability and abundance of abalone for commercial use.

The waters off the west coast of Prince of Wales Island were selected for exploration because available information indicated that commercial quantities of abalone might be found in this region. A commercial salmon-trap diver and his 38-foot boat were employed. Seventeen dives were made at various locations, usually where there was protection from the weather. No dives were made in waters off the exposed ocean beaches, but weather conditions much of the year would make diving for abalone in these areas hazardous or impossible.

Commercial quantities of abalone were not found in the areas investigated. Abalone beds were found in areas where the bottom was covered with boulders that would be partly exposed on the minus tides. The best concentrations of abalone were in areas having active water circulation and extensive kelp beds.

The size of individual abalone was small, averaging 3.8 inches in length and 4.6 ounces in weight. The average weight of the foot muscle was 1.8 ounces. The gross weight and the recovery weight of the Alaska abalone in proportion to shell size appears to be much smaller than for the California abalone.

9/ THIS DIVE WAS NECESSARILY HALTED BECAUSE OF WEATHER CONDITIONS. THE DIVER'S CATCH OF 25 ABALONE IS NOT BELIEVED TO BE REPRESENTATIVE OF THE NUMBER OF ABALONE SEEN PRIOR TO THIS DIVE.

LITERATURE CITED

BONNOT, PAUL
1940. CALIFORNIA ABALONES. CALIFORNIA FISH AND GAME, VOL. 26, NO. 3, PP. 200-211.

1948. THE ABALONES OF CALIFORNIA. CALIFORNIA FISH AND GAME, VOL. 34, NO. 4, PP. 141-169.

INO, TAKASHI
1951. AMERICAN HALIOTIS KAMTSCHATKANA AND THE FAR EASTERN HALIOTIS KAMTSCHATKANA. BULLETIN OF THE BIOGEOGRAPHICAL SOCIETY OF JAPAN, VOL. 15, NO. 1 (APRIL), PP. 39-41.

MACGINITIE, G. E., AND MACGINITIE, NETTIE
1949. NATURAL HISTORY OF MARINE ANIMALS. MCGRAW-HILL BOOK COMPANY, INC., P. 376, NEW YORK.

QUAYLE, D. B.
1941. THE EDIBLE MOLLUSCS OF BRITISH COLUMBIA. PROVINCE OF BRITISH COLUMBIA, REPORT OF PROVINCIAL FISHERIES DEPARTMENT FOR 1940, J83-J85.

THOMPSON, WILLIAM F.
1914. REPORT ON THE ABALONE OF BRITISH COLUMBIA (HALIOTIS GIGANTEA CHEMNITZ). PROVINCE OF BRITISH COLUMBIA, REPORT OF THE COMMISSIONER OF FISHERIES FOR 1913, R126-R130.

PART II - TECHNOLOGICAL STUDIES ON HANDLING ABOARD SHIP AND PREPARATION ASHORE, AND ACCEPTABILITY OF THE COOKED PRODUCTS

By C. J. Carlson* and J. A. Dassow**

INTRODUCTION

In conjunction with the experimental diving and beach survey work (Part 1), very preliminary studies were carried out on the handling of the abalone aboard ship, methods of preparation ashore, and general acceptability of the cooked products. These data are necessary to provide information on the practicability of abalone fishing operations and marketing.

HANDLING ABOARD SHIP

The limited diving operations and survey of the beaches (Part 1) indicated that daily deliveries of abalone from the fishing grounds to the processor were not feasible. Therefore, in order to permit utilization of any abalone resource, practical methods of handling aboard ship must be developed to insure delivery of good-quality abalone to the processor or marketing center. The conditions involved during the fishing operations and the distance of the fishing grounds from processing centers seemed to indicate that proper methods for handling abalone would involve holding and delivery in the live state.

Since the primary purpose of the abalone investigation concerned the diving operations and the survey of fishing grounds, it was not possible to fully investigate the various methods of handling live abalone. Tests were carried out, however, on holding the live abalone in burlap bags. These bags, containing the live abalone, were suspended from the sides of the boat in the sea water during the fishing operations. Whenever the boat was under way, the sacks were placed on deck and kept moist with sea water.

* CHEMIST, ** CHIEF, FISHERY PRODUCTS LABORATORY, TECHNOLOGICAL SECTION, BRANCH OF COMMERCIAL FISHERIES, U.S. FISH AND WILDLIFE SERVICE, KETCHIKAN, ALASKA.

One test was carried out using three bags of abalone: the first bag contained 4 pounds of live abalone; the second, 13 pounds; and the third 40 pounds. (The bags when full hold about 50 pounds of whole abalone.) Under the conditions indicated, the abalone in the bags containing 4 and 13 pounds of shellfish remained alive for 5 days but were inactive at the end of this period. This applied only to the uninjured abalone; those with a cracked or broken shell or with torn muscle died rapidly and lasted only up to 2 days. Most of the abalone in the largest bag, containing 40 pounds, were dead after 2 days except for the top layers. Those in the top layers lasted about 5 days. The lower layers of abalone apparently died of suffocation. Because of the non-rigid construction of the bags, the abalone packed into a compact mass, and only the top layers of shellfish were able to get enough sea water circulation for survival. It is possible that a rigid slatted box container would prove more feasible for holding the live abalone.

PREPARATION ASHORE

Fresh samples of the abalone collected during the diving operations were shipped alive in burlap bags by airplane to the Ketchikan Fishery Products Laboratory for preparation and cooking tests. The burlap bags and contents were held in sea water during the fishing operations and prior to loading aboard the airplane.

At the laboratory, the contents of the shells were removed by use of a stiff-bladed knife. The viscera were stripped from the muscle portion, which was then ready for trimming and cleaning. Data on sizes and component parts of the abalone are shown in table. The muscle represented about an average of 42 percent of the weight of the whole abalone. The amount of trimmed edible meat obtained was about 35 percent of the weight of the whole abalone.

Sizes and Weights of Component Parts of the Alaska Abalone

Location of Fishing Grounds	Number of Abalone	Size Range	Average Weight of Muscle	Component Parts in Percent of the Whole Abalone		
				Muscle	Viscera	Shell
		Inches	Ounces			
Kelly Cove	48	2.0-4.8	1.9	45	30	25
Lulu Island	64	2.2-5.2	1.9	39	32	29
Blanquizai Point	117	2.2-5.0	1.7	42	30	28

NOTE: SAMPLES WERE OBTAINED FROM THREE FISHING GROUNDS OFF THE WEST COAST OF PRINCE OF WALES ISLAND, ALASKA.

Samples of the whole muscles were soaked in each of several dilute solutions of (1) baking soda, (2) salt, and (3) vinegar, and in fresh water in order to find an easy method of removing the black pigment from the edges of the meats. The common practice of the homemaker in Alaska is to soak the abalone meats in fresh water. No improvement was noted over this method by the use of dilute solutions of baking soda, salt, or vinegar.

The cleaned and trimmed abalone meats were tenderized by pounding and were further dressed for the preparation of cooked dishes. Difficulty was encountered in cutting some meats into steaks because the foot of the abalone had apparently assumed the contour of the object to which it had been fastened. In California a method (Bonnot 1948) is used whereby the cleaned and trimmed muscle is allowed to relax on a smooth wet surface before the steaks are cut. It is entirely possible that this procedure might also work for the Alaska abalone.

COOKING TESTS

Cooking tests with the trimmed abalone meats showed them to be quite acceptable when prepared as chowder, fried steaks, or fritters. The laboratory taste

panel showed a slight preference for the fried steaks. In general, the meats were very tender and mild in flavor. However, the meats were small in size and presented a ragged appearance. The raggedness was caused by the pounding of the raw meats necessary to make them tender. Perhaps improved methods of pounding or tenderizing the meats would eliminate this problem.

SUMMARY

Alaska abalone were held alive up to 5 days in burlap bags containing about 13 pounds of the whole shellfish (total capacity of bag was 50 pounds) when placed in sea water while suspended over the side of the fishing vessel.

Abalone with cracked or broken shells did not remain alive longer than two days when held in burlap bags immersed in sea water.

In the preparation of the meats, soaking of the muscles in fresh water aids in removal of the black pigment. Soaking in dilute solutions of baking soda, salt or vinegar was of no advantage over soaking in water.

The average weight of the meats (whole muscle) was 1.8 ounces or about 42 percent of the weight of the whole abalone.

LITERATURE CITED

BONNOT, PAUL
1948. THE ABALONES OF CALIFORNIA. CALIFORNIA FISH AND GAME, VOL. 34, NO. 4 (OCTOBER), PP. 141-169.

PACKAGING FROZEN FISHERY PRODUCTS

The low temperatures which are required for proper storage of frozen fishery products and frozen foods in general will cause extreme desiccation or drying out unless special preventive precautions are taken. The humidity of the air in a frozen-storage room is quite low. On the other hand, the air immediately surrounding the frozen food is practically saturated with moisture. The dry air in circulating through the room will pick up any moisture that is available. Any exposed or improperly packaged food products in the room will thus lose moisture, in the form of water vapor, and will rapidly develop a dry, spongy, and discolored surface. The tissues become tough due to denaturation or irreversible changes in the protein. This condition is known as "freezer burn." The package is of prime importance in order to prevent this drying. Care is needed to package the food properly in containers which have a very low or, ideally, a zero rate of water-vapor transfer, so as to keep the moisture where it belongs--within the package.

--Fishery Leaflet 324