

### Introduction

On August 4, 1958, the Oregon Fish Commission entered into a two-year agreement with two California fishermen to do exploratory work off the Oregon coast for red abalone (Haliotis rufescens). In August 1960 the Fish Commission renewed this contract for two years with one of these fishermen. The purpose of this report is to review results of exploratory work to date and consider the course of action to be taken when the contract expires in August 1962.

### History of Red Abalone in Oregon

In 1955, McCauley and Marriage <sup>1/</sup> reported the occurrence of red abalone in the Brookings area. This report constituted an extension of the known northern range of this animal at that time. In 1957, Richard Lyons, student at the Oregon Institute of Marine Biology, Charleston, Oregon, reported finding a red abalone at Sunset Bay near Charleston <sup>2/</sup>. This again extended the known northern range an additional 100 miles over that reported by McCauley and Marriage. Although it was known in 1953 (reported in the literature in 1955) that the red abalone occurred in southern Oregon, little significance was given to the fact. This was partially brought about by the reluctance of the Brookings residents to reveal information on where and how to find these animals. Thus the situation remained until 1958.

### Materials and Methods

On August 4, 1958, the Oregon Fish Commission entered into a contract agreement with two California fishermen, T. D. Revies and A. W. Nairn, to do exploratory work for red abalone. This work was to be done under the direct supervision of Fish Commission biologists and remuneration to the

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<sup>1/</sup> McCauley and Marriage, 1955, Res. Briefs (Fish Comm. Ore.) 6(4):4-13.  
<sup>2/</sup> Lyons, Richard B., 1957, The Nautilus 70: 109-111.

fishermen was to be by allowing them to keep abalone 8-inches in diameter and over for commercial sale.

These two gentlemen brought a diving boat and equipment up from California and started actively diving in the Brookings area in an attempt to locate commercial quantities of abalone. These people were furnished charts that had been blocked off into diving areas and report forms to fill out on each dive. In addition to this they were to supply us with: (1) size of each abalone taken; (2) weight in pounds round; (3) weight of processed meat; and (4) sex.

In addition to the work done by these people, commission biologists learned SCUBA diving and started intertidal exploration between Brookings and Coos Bay making observations on habitat and life history.

#### Contract Exploration

Contract exploration has been less than desired by the biologists. The area between the California border and Cape Ferello was explored from 0-90 feet. From Cape Ferello north to Mack Arch spot dives have been made in promising areas. The total time spent on the bottom looking for abalone during this period was 121 hours. In addition to this the people under contract have aided the biologists on intertidal exploration, furnished boats and equipment, and cooperated in every way possible.

The reason so little work has been done stems from a number of reasons. Winter storms started early in the fall of 1958 and necessitated an early termination of diving activities. Early in 1959, Mr. Reviea's brother-in-law withdrew his financial backing and equipment and Mr. Reviea withdrew from the entire operation. Mr. Wairn then assumed the contract responsibility and prepared to go ahead as best he could with limited funds. During the spring and summer of 1959 great quantities of earth were shoved into the ocean during highway construction between Gold Beach and Brookings. This

silted the ocean so heavily that diving was impossible because of the reduced visibility. Also, this work destroyed one known intertidal bed of abalone. During the summer of 1960 water conditions were less than favorable, however, Mr. Nairn was able to make a few dives as weather and time permitted. Early in 1961 Mr. Nairn purchased his own boat, however, because of limited funds he could devote only limited time to exploratory work during 1961. A summary of the contract work appears in Table 1.

#### Oregon Fish Commission Research

Research and exploration by Fish Commission personnel has been directed primarily toward: (1) biology of the species; (2) distribution; (3) habits and habitat preference; and (4) identification of associated plants and animals. This work has been accomplished by actively exploring the intertidal areas between Brookings and Coos Bay and limited observations of subtidal areas within this area. Examinations of gonads and stomach contents were also made in addition to observations on associated plants and animals.

#### Biology of the Red Abalone in Oregon

The red abalone belongs to the Phylum Mollusca, Class Gastropoda, and Family Haliotidae. The red abalone is found from LaPaz, Lower California to Coos Bay, Oregon. In Oregon these animals are found from the intertidal zones to depths of 30 feet in rocky areas where an abundance of brown algae is found. The maximum observed size in Oregon was 12-1/2 inches, however, a shell measuring 13-5/8 inches was reported by a reliable source. The sexes are separate and spawning, from observation and gonad examination, takes place between late June and early October. Eggs and sperm are released into the water where chance union of the gametes occurs. After a 7-9 day free-swimming period <sup>1</sup>/<sub>1</sub> the young abalone settle to the bottom and take up

<sup>1</sup>/<sub>1</sub> Carlisle, John G., Jr., 1945, Science 102 (2657):56-57

Table 1. Summary of Work Done by Commercial Divers Under Contract.

Date	Number of Dives	Number of Abalone Harvested	Remarks
September 1958	18	6	These were exploratory dives in 0-90 feet of water.
October 1958	6	3	
June 1959	2	--	Reduced visibility from muddy water in 1959 stopped operations.
August 1959	1	--	
June 1960	5	46	Abalone were given away or consumed at home.
July 1960	8	32	
August 1960	10	24	" " "
September 1960	8	--	Observation and exploration only
June 1961	6	--	" " "
July 1961	8	--	" " "
August 1961	4	--	" " "
Grand Total	76 <sup>2/</sup>	111	

1/ Number of hours spent with biologists on intertidal and shallow sub-tidal search not entered here.

2/ This represents 121 hours of time on the bottom.

residence underneath rocks and boulders. When the young abalone attain a size of about 4 inches they move out from under the rocks and establish a "home spot" in a crevice or on a rock ledge or face. The growth rate of these animals at the present time is unknown. Once the home spot is established these animals appear to live there for a number of years. The home spot will be clean of all barnacles or other foreign matter and if located in a crevice the animal will wear a hole in its shell going in and out of the crevice as it grows and the opening remains the same size. The only time the animal is away from its home spot is at night when it moves out to forage on the brown algae. In night work we occasionally observe these animals moving about or on tops of rocks in the intertidal area where they are never seen during daylight hours. Stomach contents of animals that have recently fed invariably contain about 95% brown algae composed of bull kelp (Nereocystis luetkeana), palm kelp (Postelsia palmaeformis), and bladder kelps (Macrocystis integrifolia and M. pyrifera). The remaining 5% is typically composed of red and green algae and probably incidentally-ingested bryozoans.

The great majority of red abalone observed in Oregon exceeded 8 inches in diameter (legal minimum size). During the period of this work we were able to measure 217 legal-size abalone taken by the divers under contract, sports divers, and biologists' samples. These animals ranged from 8 to 12.5 inches, with a mean of 8.9 inches. During this same period we were able to obtain only 6 sublegal abalone ranging from 2 to 7.5 inches. This lack of, or inability to find, juvenile animals has been a source of some concern. However, in two areas near Brookings we found a fair population of adult abalone each spring. In these same two areas each fall there were no abalone to be found either subtidally or intertidally. At the present time, we do not know the source of this replacement population of adult animals.

Adult animals have been found from Brookings to Gold Beach in varying numbers. Individual adults have been collected or observed at Port Orford, Cape Arago, and Sunset Bay by biologists.

The sex ratio of animals examined (n=111) has been 1:1.05, females to males, or virtually 1:1. The round weight of the animals examined was 3-9 pounds with a mean of 4.75 pounds. Of the total weight of an abalone, 22-26% is marketable meat (the trim is also edible in chowders, smoked, or pickled, however, it is seldom used except by biologists). From our figures, it is estimated that the round weight of each abalone is composed of 30% shell and 70% foot and viscera.

#### Summary and Recommendations

Since August 4, 1958, both contract fishermen and Oregon Fish Commission biologists have conducted exploratory work along the Oregon coast between Brookings and Coos Bay for red abalone. Although the contracted fishermen have been beset by many financial problems and did not accomplish as much as expected, they have materially aided the Fish Commission in obtaining valuable information on the distribution and biology of this species in Oregon at a minimum cost to the state.

The staff recommendations are as follows: (1) the present personal-use regulations be retained; (2) no commercial fishery be allowed on red abalone until greater concentrations of these animals or more substantial juvenile populations are found; and (3) the contract agreement be terminated on August 4, 1962.

Mr. Nairn has reviewed this report and concurs in the recommendations. He expressed regret that he could not afford to expend more effort on the program.

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