scomm

#17:17

MANAGEMENT APPROACHES FOR MARINE FISHERIES:

THE CASE OF THE CALIFORNIA ABALONE

by

Biliana Cicin-Sain, John E. Moore and Alan J. Wyner

UNIVERSITY OF CALIFORNIA
SEA GRANT COLLEGE PROGRAM

INSTITUTE OF MARINE RESOURCES
MAIL CODE A-032
UNIVERSITY OF CALIFORNIA
LA JOLLA, CALIFORNIA 92093

FERENCE 77-101

MANAGEMENT APPROACHES FOR MARINE FISHERIES:

THE CASE OF CALIFORNIA ABALONE

by

Biliana Cicin-Sain, John E. Moore & Alan J. Wyner*

with the assistance of

H. Kenneth Hibbeln, Maynard Silva, Art Quadraccia

This work is a result of research sponsored by NOAA, Office of Sea Grant, Department of Commerce, under Grant #04-6-158-44021 R/F-24A and funds provided by the California State Resources Agency. The U.S. Government is authorized to produce and distribute reprints for governmental purposes, notwithstanding any copyright notation that may appear hereon.

*Names of the authors are in alphabetical order and do not imply seniority of authorship.

IMR 77-101

Sea Grant Publication 54

JANUARY 1977

Institute of Marine Resources
Mail Code A-032
University of California
La Jolla, California 92093

APPROVED FOR DISTRIBUTION

John D. Isaacs, Director
Institute of Marine Resources

The University of California Sea Grant College Program attempts to foster discussion of important marine issues by publishing reports, sometimes dealing with controversial material. A balanced presentation is always attempted. When specific views are presented, they are those of the authors, not of the Sea Grant College Program, which does not take stands on issues.

ORDERING PUBLICATIONS

Copies of this and other Sea Grant publications are available from:

Marine Advisory Programs
Extension Wildlife and Sea Grant
554 Hutchison Hall
University of California
Davis, California 95616

Please include author, title and publication number.

PREFACE

> The old belief that there are as many good fish left in the sea as were ever taken out of it is no longer tenable, as old-established fisheries decline, weakened by over-fishing. To recover, the depleted stocks of fish must be rested, but, even then, the great catching power embodied in modern fishing fleets makes impossible any return to uncontrolled exploitation... The days of the marine hunter appear to be numbered and in his place must come the 'estate management' of highly regulated international fisheries and of course the marine farmers.[1]

While problems of resource depletion and hence the need for management vary greatly from fishery to fishery,[2] there is a growing recognition among both closely affected publics (i.e. fishery participants) and the general public that better management efforts are necessary to preserve threatened stocks of fish, and to protect the economic and social benefits derived from commercial and recreational fishing. The most recent example of this growing recognition is found in the Fishery Conservation and Management Act of 1976. This legislation extends United States jurisdiction to a 200-mile limit and establishes a national program for the conservation and management of the fishery resources of the United States. Its objectives are to prevent overfishing, to rebuild overfished stocks, to insure conservation, and to realize the full potential of the nation's fishery resources.

Methods of fishery management are numerous and vary according to the peculiarities of a particular fishery, its size, history, stage of development, methods of catch, etc. Nevertheless, in broad terms, three major approaches to fishery management may be catalogued: 1) methods which limit entry into the fishery (e.g. constraining the number of fishermen by some

means), 2) methods which control access to the resource (e.g. through the manipulation of fishing seasons, rotation of fishable areas, etc.), and 3) methods aimed at augmenting the resource (e.g. seeding, aquaculture, etc.). One should note that these methods are not necessarily exclusive of one another. Programs of limiting entry into a particular fishery, for example, may be complemented with a set of regulations limiting access to the resource and with a concerted scientific effort to artificially supplement the species -- either in a laboratory setting or under controlled natural conditions. The possible array of management options or combinations is vast, and compounds efforts to evaluate the potential effects of alternative management methods.

This report concentrates on the problems of managing the California abalone commercial and sport fisheries. While dealing with many policy-relevant issues, the report does not present a single, recommended management plan. Rather, it surveys the problems of the abalone resource, discusses the opinions that different affected groups have about the resource, and explores some of the consequences that may flow from different management approaches. Our goal is to provide information and analysis to policy makers, not to make policy.

To this end Chapter One presents a brief history of the development of the abalone fishery in California, describes some of the major characteristics of the industry, and reviews the methods which have been employed to regulate commercial abalone activity. A framework for evaluating fishery management plans -- with specific reference to abalone -- is offered in Chapter Two. In Chapter Three, data on what the various affected parties think about the abalone fishery and its management are presented; these

data result from extensive and varied interviewing. Chapter Four discusses the various political and administrative factors involved in developing an abalone management plan. This chapter uses legislation recently passed by the California legislature as a mini-case study. A final chapter gives a summary of the report and ends with some concluding remarks about the abalone resource and the possible impacts of different management options. Because of the special importance limited-entry plans are beginning to play in fisheries management, including the abalone fishery, the reader's attention is drawn to Appendix E where a survey of limited-entry plans worldwide is presented.

Any study that relies extensively on interviews and questionnaires incurs a debt to many respondents who cannot be identified individually. We hope that the commercial divers and processors, sport diving association officers and environmental group members who contributed their time to our project will recognize that this acknowledgement is directed to each of them.

While a smaller number of Fish and Game Commission and DFG officials were involved in this research effort, the imposition on their time was correspondingly greater. We would especially like to thank Richard Burge, Ed Greenhood and James Messersmith for their generous cooperation.

This research could not have been undertaken without the support provided by a California Sea Grant, nor completed without the assistance and collaboration of our Research Trainees -- Ken Hibbeln, Maynard Silva, and Art Quadraccia. Finally, the manuscript would not be available in legible form without the good work of our office manager, Phyllis Grifman.

Footnotes to Preface

1 Tony Loftas, The Last Resource (London: Hamish Hamilton, 1969), p. 53.

2 A good discussion may be found in J. A. Gulland, The Management of Marine Fisheries (Bristol: Scientechnica, 1974).

CONTENTS

List of Tables, Figures & Charts

Tables

Figures

Charts

Chapter 1

THE CALIFORNIA ABALONE FISHERY

Introduction

Abalone (genus Haliotus) is a single-shelled mollusk valued for the delicate flavor of its foot. Once it matures beyond the larval stage, the abalone settles to the ocean floor and -- dependent upon that singular, succulent foot -- remains essentially stationary for the balance of its life. In the eastern Pacific, various species of abalone are geographically distributed from Mexico to Alaska, but the most accessible and marketable species are concentrated in Mexico and California. Of the five species commercially harvested in California -- red, pink, green, black and white -- the depth of their location ranges from the intertidal zone (red, green and black) to as much as 200 feet (white).

History of the Fishery

The modern California abalone fishery was developed by Chinese laborers in the early 1850's.[1] Although limited to the intertidal zone by primitive techniques and gear, by 1879 they accounted for commercial landings in excess of 4 million pounds per year. By 1900 their success proved to be their undoing, as the coastal counties whose abalone resources were being depleted enacted ordinances prohibiting the sale of abalone gathered from the littoral zone. The Chinese were succeeded by Japanese divers whose virtual monopoly of hard-hat diving techniques enabled them to dominate the commercial fishery until World War II, when they were placed in detention centers inland. With access to marketable abalone dependent upon equipment that permitted their harvest in deeper waters, the number of commercial divers dropped, and so

did the size of their catch. By 1929 there were only 11 licensed commercial divers -- all of them Japanese -- and their catch in that year amounted to approximately 2 million pounds.

Since the California Department of Fish and Game (DFG) began to keep records of landings in 1916, the commercial abalone fishery has reflected three major trends: 1) a southward shift in the principal geographic loci of the commercial fishery; 2) episodic changes in the composition (by species) of the commercial harvest, and 3) a marked decline in total landings beginning in 1969.

The abalone fishery originated in Monterey, and was centered there until 1929, when it began a shift toward Morro Bay that culminated in 1940. Between 1940 and 1960 the "center" of the fishery was gradually dispersed from Morro Bay to Los Angeles, and thereafter increasingly concentrated in Santa Barbara. By 1974, landings in Santa Barbara accounted for nearly two-thirds of the total catch.[2]

The southward movement of the commercial fishery is attributable to a combination of harvesting pressures, legislative actions, and natural forces. The shift began as declining yields in the Monterey area prompted divers to range further south, where they discovered that the most abundant stocks of high quality red abalones were located along a 40-mile strip of the mainland coast between Cape San Martin and Cayucos. The commercial take from these beds reached a peak in 1945. As the yield from this source began to decline, an increasing number of divers began to harvest the less desirable pink abalones that had become accessible when the South Coast (from Point Conception to San Diego) and Channel Islands were opened to commercial diving in 1943. The entire north coast, from San Francisco to Humboldt Bay, was also opened

to commercial diving in 1943, but the catch was so modest and the public pressure to reserve this area for sport divers so great that the coast north of San Francisco's Point Lobos was closed to commercial divers in 1945 and it remains closed to date (1976).

The southerly shift of the commercial fishery was given added impetus in 1969 with a reduction in the legal size limit on the green abalones that are predominantly located in the south, and further reinforced by legislative actions in 1970 and 1971 that first permitted the drying and canning of abalones, and subsequently authorized their export. This opened a market for the previously discounted black abalones that were concentrated on the Channel Islands. At the same time the introduction of the speedier Radon-design boat made the Islands more accessible to commercial divers who might still be reluctant to risk the time and weather hazards entailed in crossing the channel to harvest the smaller blacks.

The present locus of the commercial fishery in Santa Barbara is in large part a result of its increased dependence upon abalone beds located off the Channel Islands. That dependence is in turn a function of depleted stocks on the mainland coast, and their depletion does not appear to be entirely a result of intensive commercial and sport diving. While the biological evidence remains a source of sometimes heated dispute, it seems that southern California abalones have become the victims of a kind of pincers action, attacked from the north by a resurgent sea otter population, and from the south by increasing numbers of sea urchins. The sea otter eats abalones, and the sea urchin competes with them for space and food. Moreover, any direct threat to the abalone population that may be posed by environmental degradation of the coastline south of Santa Barbara is compounded by its indirect effect on

the competition between abalones and sea urchins, as the latter are both more tolerant and mobile than abalones, and they grow faster.

As the preceding account indicates, changes in the central location of the abalone fishery have been interrelated with changes in the composition of the commercial harvest. Prior to 1945, the commercial catch consisted entirely of the comparatively larger and higher quality red species. By 1949, commercial landings were composed of nearly equal quantities of reds and pinks, and from 1950 to 1955, landings of pinks consistently exceeded landings of reds. The harvest of pink abalones reached a peak in 1952, when it exceeded the catch of reds by a margin of more than 2 to 1. As the accumulated stocks of legal-size pink abalones began to dwindle in 1955, the predominant catch alternated between reds and pinks until 1960. Thereafter -- with the exception of a three-year period between 1968 and 1970 -- landings of the faster growing reds have consistently exceeded the harvest of pinks, though landings of both species began to drop sharply in 1969. In that year the size limit on green abalones was reduced from 7¼ to 7 inches, and the catch of greens that had begun to achieve some commercial importance in 1964 enjoyed a temporary spurt until the windfall was exhausted in 1972.

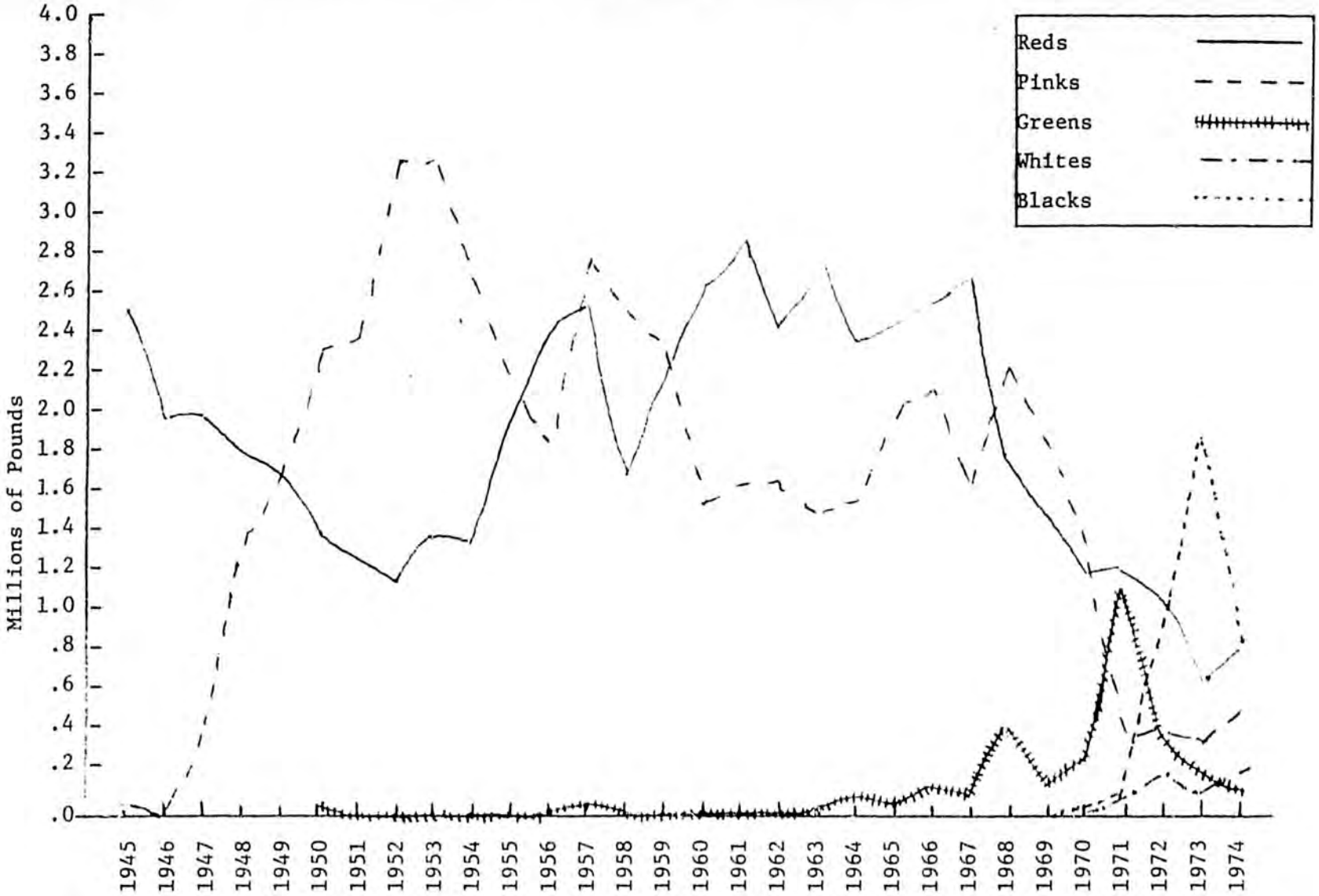
With the harvest of red, pink and green abalones dependent upon the annual growth of previously exploited stocks, an increasing number of commercial divers began to search out the less accessible white abalones that are concentrated in deeper waters off San Clemente Island and Cortez Bank. Although white abalones presently account for less than 10% of commercial landings, their total weight (in shell) has increased from a negligible 845 pounds in 1968 to an estimated 142,000 pounds in 1974, exceeding landings of green abalones by nearly 50% in that year.

The most recent and significant change in the composition of the commercial harvest was set in motion in 1970 and 1971, with the enactment of legislation permitting the drying, canning, and export of abalone. Beginning in 1971, landings of the smaller and lower quality black abalones soared from 15,000 pounds to a peak of nearly 2 million pounds in 1973, followed in the next year by the rapid decline (to 918,000 pounds) that accompanies the exhaustion of accumulated stocks.

Figure 1.1 summarizes the above discussion in graphic form. It should be noted that the data for this figure may not be altogether reliable with respect to the relationship between landings of pink and green abalones, as the landing tickets that provide the basis for DFG statistics sometimes fail to accurately distinguish species other than red.

Our summary of the shifting composition of the commercial abalone harvest traces a recurrent pattern of efforts to compensate for declining yields of the more desirable species by exploiting the virgin stocks of "new" species made accessible by legislative action, and marketable by the scarcity of high quality red abalones for the domestic market, or the opening of foreign markets for canned black abalones. By 1968 the skein had run out, and the temporary bonanza of smaller greens, the increased take of whites and the spectacular harvest of blacks only served to cushion the decline in total harvest that began the following year. From 1951 through 1968 total abalone landings never amounted to less than 4 million pounds; in 1957 they approached 5.5 million pounds, and as recently as 1968 they fell just short of 4.5 million pounds. By 1974 total landings had declined to approximately 2.6 million pounds, of which black abalones accounted for nearly 40%. (See Table 1.1)

Figure 1.1
California abalone landings by species, 1945-1974 (Pounds in Shell)



Source: Keith W. Cox, California Abalones, Family Haliotidae (state of California Department of Fish and Game, 1962), Figure 39, page 87, for the format and pre-1951 data. Richard Burge, Steven Schultz, Melvyn Odemar, Ibid., Table 1, page 21, for all data from 1950 to 1974. 1974 data in the table were projected from landings through June using 1973 landing rates.

Table 1.1

Annual Landings of Each Species (in millions of pounds shell weight) and Average Adjusted Price per Dozen Paid to Diver, Including and Excluding Blacks (1951-1974)

	Reds	Pinks	Greens	Whites	Blacks	Total	Av. Price /doz. Including Blacks($)	Av Price /doz. Excluding Blacks ($)
1951	1.28	2.40	--			4.08		
1952	1.17	3.32	--			4.78		
1953	1.41	3.30	--			4.72		
1954	1.39	2.70	--			4.10		
1955	2.00	2.19	--			4.19		
1956	2.42	1.85	.01			4.28		
1957	2.57	2.80	.05			5.42		
1958	1.68	2.55	--			4.22		
1959	2.18	2.38	--			4.56		
1960	2.69	1.57	--			4.21	5.45	5.45
1961	2.87	1.68	--			4.55	6.07	6.07
1962	2.46	1.72	--			4.18	6.21	6.21
1963	2.81	1.50	.03			4.33	6.50	6.50
1964	2.37	1.61	.10			4.08	5.98	5.98
1965	2.49	2.07	.01			4.58	6.23	6.23
1966	2.66	2.16	.14			4.96	7.28	7.28
1967	2.69	1.62	.11			4.42	7.82	7.82
1968	1.78	2.27	.43			4.47	8.42	8.42
1969	1.56	1.90	.16	.03		3.66	8.90	8.90
1970	1.19	1.41	.27	.01	.02	2.90	9.92	9.07
1971	1.28	.39	1.13	.04	.11	2.95	9.58	9.87
1972	1.10	.40	.42	.14	1.01	3.09	10.35	14.70
1973	.66	.37	.16	.08	1.91	3.19	7.39	15.07
1974	.76*	.52	.10	.14	.92	2.44	10.50	16.68

*Projected from landings through June using 1973 landing rates.

Source: Richard Burge, Steven Schultz, Melvyn Odemar, Draft Report on Recent Abalone Research in California with Recommendations for Management (State of California Department of Fish and Game, Operations and Research Branch, January 17, 1975), Table 1, page 21 for all catch weights. Price data derived from personal interviews with processors in Santa Barbara and San Diego.

If demand had at least remained constant during the period from 1969 to 1974, one would expect declining supply to be accompanied by rising prices. The average price paid to the diver for a dozen abalones did increase from $9.76 in 1969 to $15.51 in 1974, but the rate of increase departed very little from changes in the consumer price index. The adjusted price per dozen (in 1967 dollars) was $10.50 in 1974, compared with $8.90 in 1969. This modest real increase in the value of the catch can be explained by the increasing proportion of black abalones: excluding blacks, the adjusted average price per dozen increased from $8.90 in 1969 to $16.68 in 1974.

What accounts for the declining yields depicted in Table 1.1? The following five factors offer an answer.

1. The harvest of all presently marketable species has become dependent upon the annual growth of immediate sub-legal classes of abalone -- barring a quota-free reduction in size limits, the opening of the north coast to commercial diving, or dramatic changes in gear permitting the harvest of white abalones in deeper water, there is no prospect of further windfalls of accumulated stocks to augment the annual yield.

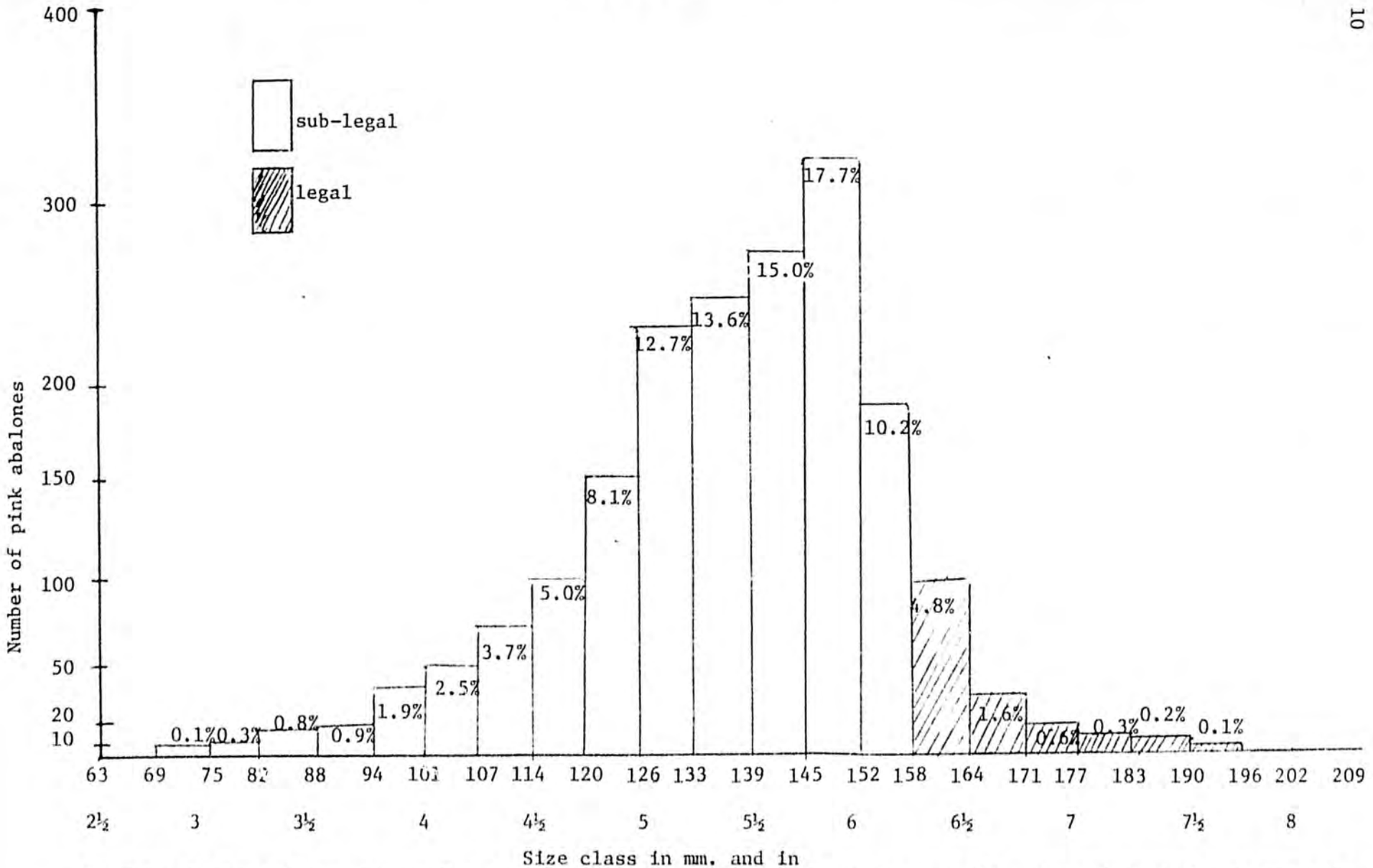
2. That annual yield is diminished by the mortality of abalones that are picked, measured, found to be short of the legal size limit, and thereupon replaced. Unless the abalone is free of injury from the bar used to pry it loose, the odds are that it will either bleed to death or become the victim of predators. In laboratory tests by the Department of Fish and Game, bar cuts as small as one-half inch in the foot of red abalones resulted in a mortality rate of nearly 60%; in the ocean, where abalones are subject to less favorable conditions in general and to predators in particular, DFG officials project a mortality rate approaching 100%.[3] The impact on annual yield of

picking and replacing sub-legal abalones can only be estimated, but samples of successively larger size classes indicate an anomalous drop in the population of abalones within ¼ inch of the minumum legal size (see Figure 1.2). In the absence of some interference with normal growth patterns, the number of abalones in the immediate sub-legal class (6 to 6¼ inches) should at least equal the number in the preceding class (5 3/4 to 6 inches). In fact, the population of immediate sub-legals shows a marked decline. This drop might be explained by the sport and commercial take of sub-legal abalones, but DFG surveys have led the agency to conclude that such illegal activities account for only a fraction of the loss.

3. The frequency with which sub-legal abalones are picked and replaced is thought to be a function of both the individual diver's experience and of the total number of divers competing for a diminishing annual yield of abalones. With respect to experience -- which enables divers to make reasonably accurate visual estimates of an abalone's size without prying it loose -- an analysis of the composition of licensed divers between 1973 and 1975 reveals that in any given year, over 30% were new to the fishery, and nearly 50% had less than two years' experience.[4] As to overall pressure on the resource, while the decline in total landings dates back to only 1969, the catch per vessel and permit holder began to decline much earlier: in 1955, 74 vessels and 294 permit holders (including both divers and crew) landed 4,185,875 pounds of abalone, for an average of 56,566 pounds per vessel and 13,424 pounds per permit holder; in 1965, 164 vessels and 686 permit holders accounted for 4,576,084 pounds of abalone, for an average of 27,903 pounds per vessel and 6,671 pounds per permit holder; by 1974, the respective averages for 212 vessels and 554 permit holders were 12,200 and 3,743 pounds.

Figure 1.2

Size-class structure for 1778 pink abalone tagged at China Point and Pyramid Head, San Clemente Island during 1973



Source: Richard Burge, Steven Schultz, Melvyn Odemar, IBId., Figure 4, page 50. The original figure has been modified somewhat.

Owing to the decreasing dependence of divers upon crew members, the deteriorating relationship between the number of commercial divers and the harvest of legal abalones has been even more pronounced than the preceding figures indicate. Both divers and crew members are required to obtain abalone fishing permits, but DFG records did not begin to segregate them until 1972. However, in a 1962 DFG bulletin devoted to California abalone, author Keith Cox estimated that only one-third of the 505 permits issued in 1961 were held by divers; in 1974, approximately three-fourths of 554 permits went to divers.[5]

4. Although the extent of impact on annual yields is again uncertain, there appears to be little doubt that the direct damage done to abalone stocks by commercial and sport divers has been compounded -- in some areas -- by the predation of sea otters, by the competition for food and space from sea urchins, and by the deterioration of coastal environments that had previously afforded a congenial habitat for abalone.

5. Whichever of the preceding factors may prove the greatest single threat to sustaining the annual yield of abalone, their combined impact may exceed their individual effect by reducing the density of certain beds to the point that recruitment is no longer adequate to replenish them.

As subsequent chapters will detail, there are substantial differences of opinion among affected interests with respect to the sources of declining abalone production, the nature of the problem posed by declining production, and the most appropriate measures for resolving "the" problem.

However "the abalone problem" may be defined, there is little disagreement that there is a problem, and that its impact is felt most keenly by the commercial abalone industry.

Table 1.2

Relationship Between Landings of Abalone (in pounds) and the Number of Vessels and the Number of Permit Holders

	Total Landings (pounds)	Number of Vessels	Number of Permit Holders	Pounds per Vessel	Pounds per Permit Holder
1955	4,185,785	74	--	56,566	--
1956	4,284,063	86	--	49,815	--
1957	5,421,914	94	--	57,680	--
1958	4,224,018	109	--	38,752	--
1959	4,561,827	98	352	46,549	12,960
1960	4,206,408	106	418	39,683	10,063
1961	4,553,766	124	505	36,724	9,017
1962	4,183,181	150	582	27,888	7,188
1963	4,343,879	128	532	33,936	8,165
1964	4,079,223	145	574	28,132	7,107
1965	4,576,084	164	686	27,903	6,671
1966	4,963,556	213	880	23,303	5,640
1967	4,421,581	206	853	21,464	5,184
1968	4,474,842	223	839	20,066	5,334
1969	3,658,078	213	840	17,127	4,355
1970	2,900,813	195	530	14,876	5,473
1971	2,945,318	191	486	15,420	6,060
1972	3,091,182	207	448	14,933	6,900
1973	3,193,160	212	487	15,062	6,557
1974	2,586,571	212	554	11,531	4,669

Source: Burge, Schultz, Odemar, Ibid., Table 2, page 22. 1974 figures are derived from Department of Fish and Game current statistics; Pounds per Permit Holder figures have been calculated by the authors.

While our discussion to this point has concentrated on the commercial harvest, it should be recognized that thousands of sport divers have an equally legitimate claim to the resource. Certain of the regulations that are summarized toward the end of this chapter were expressly designed to safeguard that claim (e.g., the smaller size limit on red and green abalones taken by sport divers); other regulations designed to prevent depletion of the resource have indirectly benefited sport divers (e.g., the closing of certain areas -- including the entire north coast -- to commercial diving). The effect of these regulations has been to minimize competition between commercial and sport divers by concentrating their efforts in different areas or at different depths, but attempts to compensate for declining commercial landings or increasing sport diving effort may jeopardize this modus vivendi.

Characteristics of the Industry

The core of the abalone industry in 1975 consisted of 383 divers, 123 crew members, and approximately ten active processors. Extrapolating from the characteristics of divers included in a random sample of 1975 commercial permit holders (see methodological Appendix A for detail) nearly 50% of them were introduced to commercial diving through their family or friends, and another 24% through their experiences as sport divers. They were attracted to the fishery primarily by the anticipation of economic benefits, and secondarily by the enjoyment they expected to derive from the environment in which they would be working. A typical diver spends 100 days each year fishing, and an additional 55 days in related activities (e.g. maintaining his equipment). He owns his own boat, which in a majority of cases has been designed expressly for abalone fishing, and from it takes an average of approximately 400 dozen abalones per year. He is most likely to sell all of

his catch to a single processor, owing to convenience, a long-standing personal relationship, or dependence upon the processor for advances and equipment. He derives an annual gross income from his sales of about $6,700.

Of course, any attempt to characterize a "typical" commercial diver obscures significant differences among individual divers. For example, the number of days per year devoted to diving ranged from 15 to 187; the annual catch from 1 to 3,240 dozen, and annual gross income from less that $1,000 to more than $20,000. While nearly two-thirds of the sample dove from their own boats, 23% relied upon other divers' boats, and 13% upon boats owned by processors. Although the majority of divers sell their catch to a single processor, almost 27% of them sell to more than one.

The most striking characteristic of the commercial diving population is a generally high rate of attrition that is especially pronounced among crew members and among divers with fewer than two years'experience in the fishery. Table 1.3 depicts annual attrition rates since 1972, when DFG began to distinguish between divers and crew.

Table 1.3

Annual Attrition Rates for Abalone Permit Holders, 1972-1975

	Composite attrition rate	Crew* members only	Divers only
1972 / 1973	41%	83%	26%
1973 / 1974	41%	76%	27%
1974 / 1975	50%	88%	34%

*The computation for crew members does not take account of 6 divers in 1972 and 5 in 1973 who renewed their permits after a one-year interval.

Attrition among divers is perhaps more notable for its principal source than for its overall level. Although our data do not enable us to discriminate the annual attrition of new entrants, a disproportionately high rate of turnover among divers with fewer than two years' experience can be deduced from the composition of 1975 permit holders. Of the 383 divers who were issued permits in 1975, 258 carried over from 1974. Of those 258, 208 had obtained permits in three or more years. That leaves only 50 "carry-over" divers in 1975 who had been licensed for two years or less. There were 102 new entrants in 1973 and 138 in 1974. Thus of 240 divers who first entered the fishery in 1973 or 1974, only 50 remained in 1975 -- an attrition rate among new entrants, over a two-year period, of nearly 80%.

Tracing the names of DFG permit holders from 1969 through 1975 yielded a list of just over 200 divers who constitute a relatively stable core -- 106 who have held permits for more than six years, and 102 who have held them for three to five years. The imposition of a $100 permit fee in 1970 was followed by a sharp decline in the total number of permit holders (including crew), from an average of 853 in the four preceding years to 530 in 1970. It seems reasonable to assume that most of those who continued to pay their fee year after year have more than a casual interest in commercial abalone diving. However, the fee is not so high as to discourage a significant number of either part-time or comparatively unproductive divers. This point is substantiated by the California Abalone Association's estimate that the 47 divers and 4 processors who comprised its membership in 1971 represented the harvesting capability of approximately 70 % of the abalone landings.[6]

With the volume of abalone landings diminishing and the ex-vessel price increasing, only a half-dozen firms process a significant volume of abalone (more than 80,000 pounds shell weight) on a regular basis. Although 17 firms obtained permits in 1975, seven of them did not process any abalone in that year. The remaining 10 were located in Half Moon Bay, Morro Bay, Santa Barbara, and San Diego, but two divers in Half Moon Bay held permits so that they could process their own catch, and the two processors in Morro Bay handled only a fraction of the total landings. This left three firms in San Diego and three in Santa Barbara processing 90% of the catch, with the Santa Barbara firms handling over two-thirds of it, and just one of them -- Pierce Fisheries -- receiving nearly half of the total catch.

Regulation of the Commercial Abalone Fishery

In 1945 the California legislature delegated regulatory powers over the abalone sport fishery to the Fish and Game Commission, but with a recent exception that is discussed in Chapter 4 (Assembly Bill 2224), it has retained regulatory authority over the commercial fishery. The following summary of measures employed to regulate the commercial fishery is presented in the order of their initial adoption.

Size Limits

Beginning in 1901, the legislature set a minimum size of 15 inches for all species, measured around the shell. Thereafter it established different limits for different species, and shifted the basis for measuring minimum size from circumference to maximum diameter. Through 1947 changes in size limits moved upward -- from 7 to 8 inches for reds, 6½ to 7¼ for greens, and 5 to 6 inches for blacks. (The limit for pink abalones remained at 6 inches until 1970, when it was increased to 6¼ inches.) In 1947 differen-

tial size limits were established for commercial and sport divers, reducing the sport limit on red and green abalones by 1 inch. Subsequent changes (since 1947), though apparently modest, may have had a substantial effect on the harvest of species whose accumulated stocks have been exhausted, or on the relationship between shell weight and marketable meat. These changes in size limits are indicated in Table 1.4.

Table 1.4

Size Limits for Commercially Harvested Abalones, 1947-1975

	Red	Pink	Green	Black	White
1947	8	6	7¼	6	
1955	↓	↓	↓	5	↓
1959	7 3/4	↓	↓	↓	↓
1969	↓	↓	7	↓	6
1970	↓	6¼	↓	↓	6¼
1972	↓	↓	↓	5½	↓
1975	↓	↓	↓	5	↓

Area Closures

The scope of areas closed to commercial diving has been as broad as the entire state (1907 and 1908), and as narrow as the few miles of coastline between San Simeon Pier and Cambria State Park (1937). However, the most significant changes have involved the alternate opening and closing of the north and south coasts, with the coast north of Point Lobos (in San Francisco) having remained closed to commercial diving since 1945.

Species Restrictions

In 1909 the commercial catch was restricted to red abalones; in 1911 it was extended to pink, green and black, and in 1955 to all species.

License and Permit Requirements

A commercial diving license was first required in 1909, and four years later a modest $10 fee was imposed. In 1939 commercial divers were also required to obtain a revocable annual permit. Apart from the imposition of a $100 fee for abalone fishing permits in 1970, the most significant change in licensing procedures occurred in 1972, when the Fish and Game Commission temporarily required a 10-month apprenticeship to qualify new entrants for a commercial diving permit. Confronted with a number of requests for exemption from this requirement by experienced divers who sought to enter the abalone fishery, the Commission experienced some difficulty in rationalizing the apprenticeship program. In June of 1972 it amended the requirement to enable "qualified divers" who had obtained prior authorization from the Commission to demonstrate their proficiency through a test administered by the Department of Fish and Game, and in December the specification of Commission authorization was eliminated. This marked the demise of the apprenticeship program. The remnants of this short-lived experiment include two classes of permits -- for crew members and abalone divers -- and a proficiency test for diver applicants who have not previously held an abalone diving permit.

Season Closures

Together with size limits, this is the most conventional device for enabling a fishery resource to replenish itself. It was first applied to abalone in 1911, for a 4-month period between March 1 and July 1. The closed season was reduced to three months in 1913 (February 1 to April 30), and to two months in 1921 (from January 15 to March 15). Revised in 1933 to extend "between January 14 and March 16," the latter closure remained in effect until 1970, when -- at the request of the California Abalone Association --

the closed season was broken into two periods coinciding with the months of February and August.

Processing and Export

The drying of California abalones was prohibited from 1915 to 1970, when the legislature authorized both the drying and canning of abalones. The following year it also eliminated all provisions attaching to the export of canned abalone, which (with the exception of trimmings) had been unconditionally prohibited from 1913 to 1971.

Depth Restrictions

Some form of restriction on commercial harvesting of abalones in shallow waters extends back to the turn of the century, when county ordinances were adopted to foreclose the sale of abalones gathered in the intertidal region. In 1929 the state enacted legislation restricting commercial diving to waters 20 feet beyond the extreme low tidal line in District 7 (all of Mendocino and portions of Humboldt County), and in 1931 shifted to a vertical dimension with the prohibition of commercial diving in waters less than 20 feet deep in most of the Districts then open to commercial diving. The restriction was extended to all waters less than 20 feet deep from 1949 until 1974. when an exception was approved for certain of the Channel Islands, subject to recision by the Director upon finding that the resource is being endangered. While the present purpose of this 20-foot law is not altogether clear, it appears that the exception for the Channel Islands was facilitated by the absence of competition with sport divers in that remote location.

Gear Requirements

The de facto requirement of full deep-sea diving gear in waters more

than 20 feet deep was made de jure in 1943. In 1947 both commercial and sport divers were prohibited from taking abalone with any device more than 36 inches long. In 1954 gear requirements were specified to include a surface air pump operated from a boat, at least 100 feet of air hose, two baskets and a measuring device, all of which must be inspected and approved by the DFG.

Bag Limits

The only limit on the commercial abalone catch was applied to black abalones in 1974; it is unlawful to possess more than 20 dozen black abalones on any boat at any time. While this restriction could be viewed as a quota of sorts, it does not appear to be so intended, nor so perceived by commercial divers. The limit is near the maximum that a good diver might expect to harvest from legal beds, and it therefore helps to identify poachers who seek to make a big haul from areas that have been closed to commercial diving.

Recent Developments

In 1969 -- the year in which abalone landings began to decline so rapidly -- the owner/divers of one of the smaller Santa Barbara processing firms began an effort to organize the industry so that it could present a "uniform stand" on the various problems confronting it. Their organizational effort culminated in March of 1971 with the adoption of by-laws for the California Abalone Association (CAA). The principal objective of the Association is "to advocate equitable and sound regulation for the preservation, enhancement, and promotion of the industry."

The commercial divers and processors represented by the CAA contend that many of the regulations we have catalogued are inappropriate, and that as a whole they are inadequate to assure the effective management of the abalone

fishery. Dismayed by the initial unwillingness and subsequent inability of the DFG to do anything about the sea otter problem (owing to preemption by the 1972 Marine Mammal Protection Act), and frustrated by the collapse of the CAA-sponsored apprenticeship program, they still continued pressing their cause with the legislature, the DFG, and the Fish and Game Commission. In 1973 the Commission responded by directing the Department of Fish and Game to undertake an expanded research program that would provide the basis for management recommendations to be submitted by January of 1975. The resulting report and legislation will be explained in Chapter 4, following a discussion of alternative management concepts and differing attitudes toward the fishery in Chapters 2 and 3 respectively.

Footnotes to Chapter 1

1 Unless otherwise indicated, the material for this section is drawn from Keith W. Cox, "California Abalones, Family Haliotidae," Fish Bulletin No. 118 (California Department of Fish and Game, 1962).

2 Santa Barbara, 1,627,503 pounds; Los Angeles, 732,613; San Diego, 192,264 pounds; San Francisco, 40,045 pounds. California Department of Fish and Game: "California Marine Fish Catch" (1964-1972); "Statistical Report of Fresh, Canned, Cured, and Manufactured Fishery Products" (1973-1974); "California Fish Landings by Region--May, 1975."

3 Richard Burge, Steven Schultz, Melvyn Odemar, Draft Report on Recent Abalone Research in California with Recommendations for Management (State of California Department of Fish and Game, Operations and Research Branch, January 17, 1965), pp. 6-7.

4 Compiled from lists of divers and crew members supplied by California Department of Fish and Game.

5 Cox, op. cit., p. 80; 1974 data were calculated from information supplied by DFG.

6 Larry Pender, president of the California Abalone Association, in testimony presented to the California Fish and Game Commission. (State of California, Fish and Game Commission, Minutes, Meeting of November 5, 1971; mimeo).

Chapter 2

FISHERY MANAGEMENT PLANS: CRITERIA FOR EVALUATION AND THE CALIFORNIA ABALONE RESOURCE

Introduction

The state of California is the primary government involved in regulation of the abalone fishery. If an active role to preserve the fishery is undertaken by government, then the state legislature must pass legislation enabling or directing the California Department of Fish and Game to adopt an abalone management plan. Any such legislative or administrative actions must be consonant with the state Constitutional protection of the right to fish.[1]

The state legislature recently adopted AB 2224 which restricts the number of abalone diving permits issued in any one year. In this legislation, the Department of Fish and Game and the legislature made the specific finding that limiting permits was necessary "to protect and enhance the state's abalone resources."[2] However, passage of AB 2224 is not likely to end all discussion and consideration of problems in the abalone fishery, and this report therefore considers the full range of techniques available for abalone management.

The primary goal of this chapter is the presentation of an analytic framework for assessing the consequences of different abalone management plans.[3] Study of the abalone resource indicates the possibility of three distinguishable, but not necessarily mutually exclusive, approaches to abalone management: 1) Limiting entry to the fishery; 2) Controlling access to the resource; and 3) Resource augmentation. The chapter offers a

framework for evaluating the consequences of these three approaches, and provides a description of the main characteristics of each approach.

While this chapter presents a framework that encompasses all the salient and potentially feasible approaches to abalone management, subsequent chapters will present data which speak to many but not all of the consequences that flow from the different management options. Some of the data have been collected specifically for purposes of the current research, while other data will be abstracted from previous work. This report will concentrate upon what the various segments of the industry, sport divers, and government officials have reported to us about their perceptions of the feasibility and consequences of these different management options. As will hopefully become apparent in the context of this and following chapters, the consequences of some management approaches can only be estimated because of data limitations. These limitations stem from two sources. First, some raw biological and environmental data have not been collected at all, or not over long enough time periods to permit confident and universally accepted conclusions about the present condition of the resource and the factors responsible for it. Second, and most importantly, lack of experience in implementing abalone management plans precludes anything but estimates of some of the more subtle and difficult-to-measure consequences.

Framework

Chart 2.1 reflects the framework that guides this analysis of abalone management plans. The balance of this chapter will be devoted to a discussion of the factors that should be located within each cell in this chart. The objective of the present research is an assessment of the impact of different management plans according to five important criteria of evaluation:

Chart 2.1

Framework for Analyzing Fishery Management Plans

	Economic and Social Consequences	Biological Effectiveness	Political Feasibility	Administrative Feasibility	Legal Feasibility
Limit Entry to Fishery					
Control Access to Resource					
Augment Resource					

1) economic and social consequences; 2) biological effectiveness; 3) political feasibility; 4) administrative feasibility; 5) legal feasibility. Any proposed management plan must take into account the likely results of the plan in each of these five areas. To avoid confusion the variables just listed should be explained and their usage in this research clarified.

Economic and Social Consequences

The point of reference for our discussion of economic consequences will be the notion of efficiency, defined in terms of optimizing the overall relationship between benefits and costs. The principal criterion for our consideration of social consequences will be the concept of equity. Equity refers to fairness in the distribution of benefits and costs; alternative management plans may have different consequences for the several sectors of the abalone industry. Some people stand to gain from any management plan and others may lose. It is quite unlikely that all will benefit. For instance, a plan that may increase the profits of processors may also make it economically impossible for part-time commercial divers to recover their costs, let alone make a profit.

The category of equity also must consider the consequences of a management plan for the larger public, both the fish-consuming and non-consuming public. For instance, plans that result in economic benefit to a sector of the industry may cause the retail price and/or availability of the commodity to create a hardship or inconvenience for the public. While abalone is certainly not a staple food resource, and is therefore not a "necessity," the impact of an abalone management plan on those who consume the species must be evaluated. And if an abalone management plan causes a retail buying shift away from abalone, the resulting increase in demand on other commodities may have

an impact on the price of these other commodities -- and therefore their availability -- to non-abalone consumers. In similar fashion, any attempt to protect the abalone resource by controlling the range of the sea otter may impose constraints on the population that does not necessarily consume abalone but derives pleasure from the presence of the otter. The equities of these kinds of shifts should be examined.

Biological Considerations

Clearly, the biological effectiveness of any management plan must be closely examined. A management plan must be based upon data that identify the major characteristics of the resource -- growth patterns, reproduction, feeding, etc. -- and the relationship of the resource to other species. The relationship between the resource and its environment should also be considered. In this regard, the impact of such factors as water quality, weather, availability of food and intrusion by man must be known and understood. This data collection and analysis may then lead to a definition of the maximum sustainable yield for the resource. Included in the definition must be whatever opportunities exist for augmenting the resource by the use of techniques such as seeding and planting from hatcheries.

A primary rationale for a more extensive governmental role in abalone management is the enhancement of the resource itself. Any plan is suspect if it would not promote (or at least prevent a deterioration in) the availability of abalone.

Political Feasibility

A management plan emerges from a political process. No matter how well conceived and articulated a management plan may be, it must be politically acceptable. That is, the approval or at least acquiescence of enough influ-

ential political actors is required before anything can be promulgated. Key political actors may come from the ranks of legislators, Department of Fish and Game administrators, representatives of various affected interest groups, rank and file fishermen and consumers. A careful analysis of the socio-economic profile of a fishery can yield valuable data in its own right and also contribute to an assessment of the political process through which a management plan must traverse. All the affected groups should be identified and each of their roles in the use of the resource tabulated. Not only their roles are important. Since the perceptions each of the affected groups has of the resource, its problems and possible solutions will help shape their future actions, they must be studied as well.

Another important point to keep in mind is that perceptions of political feasibility will influence the development of any plan because those involved in the development process usually will realize that approval must be secured from other persons, i.e. legislators, top administrators, and certain interest group representatives.

Because of the variety of perspectives from which the many political actors view fishery management and the different "power bases" they have, it is quite likely that conflict will emerge over any proposed management plan. One of the key functions of the political process is to resolve such conflict -- not necessarily to everyone's satisfaction, but nevertheless to resolve it. The point to remember is that the political process for fishery management is a conflictual one.

Administrative Feasibility

As administrative feasibility is used in Chart 2.1, it refers to the problems of implementing a public policy. In the case of abalone, the California

Department of Fish and Game is the lead agency. The three aspects of administrative feasibility that are of concern in this research are: 1) intra-organizational (within DFG) consequences of a management plan; 2) inter-organizational consequences of a management plan; and 3) problems of enforcing a management plan. The particulars of any given management plan may impact the Department of Fish and Game differently. Some plans may necessitate internal adjustments of tasks, responsibilities, communication channels, or hierarchical relationships while other plans would permit continuation of the organizational status quo. Similarly, adjustments may be required in DFG's relationship with other organizations, including the legislature. And whenever a management plan is considered, one of the important issues that must always be raised is the enforcement aspect of the plan. Recognizing that all plans have enforcement problems, no plan is worth serious consideration if it permits too easy violation because of logistical or cost problems in enforcement.

Running throughout the considerations of administrative feasibility is the question of cost. Who pays for administration? Should the expense of any internal changes or enforcement efforts be carried entirely by the fishery be ag regulated? What part of the fishery -- those who actually take the resource, or those who process it or those who sell it or perhaps all of these parties? These and other administrative cost questions must be raised and answered when evaluating a management plan.

Legal Considerations

Regulation of offshore fisheries also involves some very important legal concepts and issues.[4] Jurisdictional lines between federal and state efforts must be legally drawn and the rights of the affected groups determined and

rationalized into a management plan. While not undertaking a full-blown legal analysis, it is important for this research to take into account the legal status of any abalone management plan. Not only does the California constitution protect the right to fish, but the federal constitution guarantees of due process and equal protection may also become relevant in any legal challenges to an abalone management plan.

Management Options

This section explains the three basic management options which can be used separately or in concert to manage the abalone resource: limited entry, controlled access, and resource augmentation.

Limited Entry

Limiting entry to a fishery represents a major and commonly advocated approach. The underlying rationale here is based upon the assumption that a resource can be spared further decimation and stocks replenished if there are fewer people taking it. For example, if the problem is defined as too many people seeking too few abalone, then one obvious type of solution is to reduce the number of individuals involved.

Several ways of limiting entry to a fishery have been identified and discussed previously in Chapter One. This section focuses on some of the major techniques of limited entry as they might apply to abalone. These methods are not mutually exclusive, but for purposes of illustration each will be discussed separately and with the assumption that all else remains constant.

1) License limitations -- Assuming there is no change in the effort of individual divers, limiting the number of licenses issued each year should further the objective of holding constant or reducing the total resource take.

This technique assumes that the amount of reduction in resource yield will be closely related to the extent of reduction of license holders from current levels. However, the further assumption is made that in time the total resource yield will increase because there will be a much larger percentage of sub-legal size abalone growing to legal size than under wide open licensing. These are some ways of limiting licenses:

1A) Buy-back -- If the goal is to reduce the number of divers, then the state and/or the industry could buy back a certain percentage of the outstanding licenses. Such a program would require purchase of not only the license but also equipment associated with diving. How much to pay, how many licenses to buy back and when, and how to prevent newcomers from taking the "buy-back's" place are all problems which must be addressed. The idea of buying back has a certain appeal to some who argue that such compensation is the only fair technique to employ if the number of licenses is to be reduced.

1B) Auction and lottery -- If a decision is made to limit the number of sport and/or commercial license holders to any specified number, and if anticipated demand for these licenses exceeds the limit, then one method to allocate licenses is to hold an auction and accept bids. In a bidding procedure a minimum bid would probably be specified along with rules on how to handle duplicate bids if the process is by sealed bidding. The license holders could also be chosen at random through a lottery. The actual selection would probably be conducted in public. Some prerequisites for participating in the lottery -- such as experience or availability of gear and vessel -- could be imposed. Auctions or lotteries could be held for both commercial and sport divers if it seemed necessary.

1C) Grandfather clause -- A commonly suggested technique of limiting

licenses is simply to issue new licenses to all those currently holding commercial diving permits. These people are then said to be "grandfathered" into the industry. From that point forward a decision can be made as to how much reduction in license holders is necessary and desirable; the reduction can be accomplished by normal attrition or by establishing criteria for license renewals.

1D) Point System -- The state of Alaska has a program of limiting the number of licenses it grants for salmon fishing. At the heart of the program is a procedure for allocating "points" to applicants based upon their previous participation in salmon fishing and the extent of their economic dependence upon salmon fishing (see Appendix E). Other criteria could be adopted, but any criterion will be subject to problems of operationalization. It is also clear that only a very careful and judicious weighing of reliable information about each individual applicant against the chosen criteria will produce an equitable outcome. There is no inherent reason why a point system could not be used in the abalone industry, but as in Alaska it would probably become quite controversial.

2) Apprenticeship -- In any occupation or profession apprenticeship programs may be used to limit and control the influx of new members into a labor force. Apprenticeships are designed to allow a specified number of newcomers to learn the trade and the rules of the game. An abalone apprenticeship program could limit the number of new divers by permitting only a predetermined number of new apprentices and by requiring passage of an examination before successful completion of the program. Additionally, the very existence of an apprenticeship program may have an inhibiting effect by discouraging some potential new divers. Apprenticeship programs, in

different forms, could be operated for sport as well as commercial divers.

3) Taxes and fees -- Monetary disincentives can be used in two ways to limit entry into the fishery. First, the cost of obtaining a license (the license itself and the "cost" of apprenticeship and training) can be set in such a way that many individuals become unwilling or unable to obtain a license. Second, to the extent a tax is placed on abalone landings and that tax can't be shifted by the diver to others then such a tax might discourage some from continuing commercial diving. In the recreational sector, taxes/license costs could be imposed at a level which would limit the number of sport divers who take abalone.

4) Leasing -- A variation on some of the above techniques of limiting entry calls for the leasing of specific, identifiable areas to individual divers for their exclusive use. Depending upon the way in which leased areas were delineated this might be a method to limit entry. The award of leases could remain fixed at a number that does not allow for any expansion in the number of license holders or calls for an actual reduction in number. Although leasing as a management option can be used to limit entry, it is also a way of controlling access to the resource.

Controlled Access

The second major management approach involves the control of access to the resource itself. Controlling access entails regulations which either prohibit or in some way direct and control where, when, and how abalone may be taken for either commercial or sport purposes or both. Contrary to limited-entry approaches, there is a long tradition of controlling access to fishing stocks in California and the nation. Most of these efforts have been relatively simple and usually related to a safety concern (i.e., not

taking certain species because of health problems) or a biological requirement of the species such as having a closed season during spawning periods. In an era when some species are being threatened with depletion, a stricter control over access has potential merits.

Following is a brief summary of the more common techniques used to control access and the way they have been or could be applied to abalone. For the most part they are self-explanatory, so detailed descriptions are omitted.

1) Quotas -- Current law places a limit on the number of abalones (of any type) a sport diver may take per day and a limit on the daily number of black abalones a commercial diver may take. As a control device these quotas could become more limiting. Daily catch limits could be extended to other species; or, rather than placing a daily limit on divers, a monthly or seasonal limit could be established for individual divers or for the entire aggregate of divers.

2) Size limits -- There are clearly established legal minimum sizes for abalone. For certain species these sizes differ for sport and commercial divers. The larger the minimum legal size the fewer abalone that will be taken.

3) Seasons and hours -- Adjusting the months during the year and hours during the day that abalone may be taken is another way to control access to the resource itself. Current rules prohibit taking abalone prior to one-half hour before sunrise or any time after one-half hour past sunset. Abalone may be taken every month except during February and August.

4) Gear -- By dictating the type of gear a diver may use it is possible to control his ability to reach the resource. Sport divers are currently prohibited from using scuba gear in certain areas, thus limiting their access

to only the very shallow waters. The prohibition on scuba gear also limits the number of sport divers because free diving is a much more rigorous sport than diving with scuba. All divers must use a bar of certain dimensions for prying loose the abalone. However, gear restrictions for abalone diving probably do not offer very much opportunity to seriously affect the resource.

5) Area -- Controlling access to certain areas is a technique that is now used and in principle could be extended if so desired. Commercial divers, for example, may not take abalone in less than 20 feet of water (with some exceptions around the Channel Islands). Black abalones may only be taken in certain specified areas. From the commercial diver's perspective, a very drastic current area-based regulation is the one which prohibits the taking of abalone for commercial purposes from Pt. Lobos to the Oregon border. This absolute closure of an area could be extended or modified. One such modification would be a system of rotating closed and open areas on a periodic basis related to resource availability. It would be possible to do this all along the coast or in selected sections of the coast.

Resource Augmentation

If a resource is being depleted or if the demand for it exceeds the available supply--and both conditions seem relevant to abalone--then an obvious avenue for exploration becomes resource augmentation. It is not technically or ecologically feasible to "artificially" increase the supply of all fish species. However, there are individuals and companies who are actively involved in abalone mariculture. Large-scale mariculture efforts with abalone are simply too new to offer a definitive conclusion about feasibility, but several promising efforts are currently underway.

The state of California is modestly involved in resource augmentation efforts. The Department of Fish and Game is conducting some experimental work to determine the feasibility of abalone resource augmentation. In addition to supporting some university research on the subject, the Department operates a lab for its own experimentation. Recently, the Department planted some very small abalones off the Orange County Coast in an artificially created habitat. This effort was supported by $5,000 appropriated by the Orange County Board of Supervisors. It will be a few years before the results of this and similar test plantings will be available.

The state has also cooperated with several mariculture ventures. For instance, California Marine Associates and Atlantic Richfield Oil Co. have recently begun an experiment to test the viability of growing abalone in special cages suspended below an oil platform in the Santa Barbara Channel. The California Fish and Game Commission, State Lands Commission, and the Coastline Conservation Commission all approved the necessary permits allowing this mariculture project to proceed. Project sponsors claim that within four years they will be producing 250,000 marketable abalone per year.

Complexity of Interaction Patterns

Having presented above both the criteria for evaluation and the management options, this concluding section will discuss some of the interactions within the criteria and within the options. Some attention will also be given to interaction between the criteria and the options. One fact will stand out -- the schema guiding this research and laid out in Chart 2.1 leads to very complex patterns of interaction for which thorough data are unavailable.

Criteria

The criteria of evaluation do not act in isolation, but instead are often

heavily dependent upon each other. The best example of this dependence in abalone management involves the criterion of legal feasibility. Notwithstanding a state constitutional provision protecting the right to fish, it is legally possible to place restrictions upon citizens who seek to take the state's fishery resources. Any such restriction, however, must be related to the resource itself and not be justified by reference to another public policy goal such as full employment or the well-being of a particular group of people. Therefore, any governmental regulation of abalone must ultimately rest its legal feasibility upon the finding of a biologically based rationale that preserves or enhances the resource.

Another illustration of the interaction of criteria occurs if political feasibility is considered. What is politically feasible is in great measure conditioned by legal constraints, economic consequences of a regulation or law, and the practicality of administering the policy. It makes no sense (from a political viewpoint) to propose a new policy that will have such adverse economic consequences for some people that necessary legislation could not be passed. The history of some recent legislation (AB 2880) dealing with abalone points the way certain divers and processors were able to secure legislative alteration of proposed regulations because the legislation would have increased their costs.

The criterion of biological effectiveness is also affected by political feasibility. How do we know what is biologically effective? Obviously, careful research is required, but there are opportunity costs and monetary costs associated with any research endeavor. Given limited resources, the Department of Fish and Game must set research priorities, and that means low priority items might not get funded. One decision rule that might guide the

Department in setting research priorities is the likelihood of successful legislation to deal with the research results. Sometimes the very act of undertaking research on a subject can create a political controversy. In either case, politics can influence research priority decisions and therefore politics interacts with the accumulation of biological information. An apparent example of this interaction comes from the controversy over the continued prohibition of commercial abalone activities along the coast north of Pt. Lobos. The commercial closure is predicated upon the belief that commercial activities would harm the available abalone stocks, but there is some disagreement about the condition of the resource in this vast area. Complete, definitive assessment of the abalone resource along this coastline is not available and the Department chooses not to invest in the expensive research required for such an assessment. Some would argue that the "unwillingness" to conduct the biological research stems from the Department's desire to avoid a reopening of the very emotional and political controversy over this closure.

Management Options

These examples of interaction within the criteria of evaluation can be amplified by examples of similar interaction within the management option category. The point to be emphasized here is that the three management options are not mutually exclusive and, in fact, aspects of all three options either are currently being practiced with respect to abalone, or are about to be implemented. At the same time that the number of commercial divers is being restricted to a fixed number (limited entry), there are also rules which govern the season, area, hours, size, gear, and type of abalone which may be taken (controlled access) and there are instances of state cooperation with resource augmentation efforts.

It is possible to use the management options in concert or separately. Access to the resource could be severely controlled, but no restrictions imposed on the number of divers allowed to take the resource. Or it would be theoretically possible to drastically curtail the number of commercial license holders, but reduce or eliminate the controls on access. The guiding principles in choosing which management options to stress are those criteria of evaluation which key decision makers find the most persuasive.

Criteria and Management Options

Understanding the way management options are affected by the criteria of evaluation is a prime objective of this research. Data which speak to these relationships will be presented in subsequent chapters, but some examples of possible interaction are appropriate at this point.

Attempts at resource augmentation clearly involve biological considerations -- can the abalone be grown under controlled ocean conditions and if so, then what is the best method? But any large-scale mariculture requires careful assessment of potential legal problems as well. Those who place the abalone on ocean bottoms must be able to prove legally that they introduced the abalone <u>if</u> they wish to retain exclusive right to harvest the resource. The need for legal proof of ownership obviously affects the way in which the management option of resource augmentation is approached.

Although it may be justified as a legally valid approach, many would take the position that sound public policy requires a careful assessment of the economic costs and consequences which might accompany resource augmentation. As we have seen in Chapter One, many divers do not make very large incomes from diving. A successful mariculture project, such as the California Marine Associates - Atlantic Richfield Oil venture mentioned earlier, might have a

profound impact in a downward fashion on the wholesale price of abalone if this one mariculture project can produce the number of abalone the sponsors predict. In other words, resource augmentation may raise equity questions -- e.g., should the state be cooperating with a mariculture program which if it is successful may create economic problems for independent divers?

Most of the rules which control access to the resource require careful enforcement for full effectiveness. The administrative consequences of access regulations must not be overlooked. If adequate enforcement of a regulation prohibiting the taking or possession of abalone in certain areas can be accomplished only with the addition of more law enforcement personnel and more or different boats, then the prospect of these added costs to the Department of Fish and Game might affect the actual adoption of the rules. Likewise, certain experimental programs of the Department which control access to the resource must be periodically evaluated to assess the validity of the programs' original assumptions. The internal administrative realignments necessary to make such evaluations, and their attendant costs, must be considered at the time an access rule is adopted. Clearly, controlling access may have significant administrative consequences.

As a final example of the way management options must be assessed with reference to the criteria shown in Chart 2.1, it should be emphasized that any attempt to limit entry will have consequences for all five criteria. For illustrative purposes, consider the potential consequences of a license limitation program. The political and legal feasibility of such a proposal will determine the program's specific details if, in fact, it can be adopted at all. Because a license limitation must be related to resource conditions and requirements, the biological data must be initially collected and analyzed

and some follow-up will be crucial in order to assess the resource consequences of the program. From a purely legal viewpoint the state may not be able to consider the economic viability of the industry or the economic or social impact on individuals as its rationale for a license limitation program, but as a practical matter these considerations are injected into projections of political and administrative feasibility.

Conclusion

This chapter has articulated the framework guiding the current research. Subsequent chapters will offer data and analysis which address most of the concepts and relationships presented herein.

Chart 2.2 attempts to summarize which data categories should be developed when considering a management plan. For example, what do we need to know about administrative feasibility? We need an understanding of the changes in internal organization, inter-organizational relations and enforcement practices brought about by a new management plan. While the data needs summarized in Chart 2.2 are probably not exhaustive, the chart represents an approach that, in our opinion, will not usually impose an undue analytic burden on those involved in the policy-making process.

One concluding point should be emphasized. A fishery management plan results from a series of choices in which trade-offs are made. Policy makers should make these choices as deliberately as possible, after careful evaluation of the criteria discussed in this chapter. Such an approach may help clarify the nature of the trade-offs and intended consequences of the plan; if unintended consequences can be minimized then so much the better. Data for this kind of effort may not always be available or complete, but the effort must be made.

Chart 2.2

Summary of Data Needs for Each Criterion of Evaluation

Economic and Social Consequences	Biological Effectiveness	Political Feasibility	Administrative Feasibility	Legal Feasibility
Composition, structure & profitability of industry; Level and sources of demand for commercial product; Identity and nature of non-commercial interests Prospective impact of plan (amount and distribution of benefits and costs) on: 1. Participants in Fishery 2. Broader Public Interests	Characteristics of Resource Ecology in Which Resource is Located Resource Augmentation Possibilities	Affected Groups Who Role Perceptions Key Political Actors: Who Influence Preference Prospects for Conflict Resolution	Administrative costs of: Internal organizational Changes Interorganizational Relations Enforcement	Statutes Constitutional Provisions Federal - Due Process Equal Protection State - Right to Fish

Footnotes to Chapter 2

1 Article I, Section 25 of the California Constitution reads:

> The people shall have the right to fish upon and from the public lands of the State and in the waters thereof, excepting upon lands set aside for fish hatcheries, and no land owned by the State shall ever be sold or transferred without reserving in the people the absolute right to fish thereupon; and no law shall ever be passed making it a crime for the people to enter upon the public lands within this State for the purpose of fishing in any water containing fish that have been planted therein by the State: provided, that the Legislature may be statute, provide for the season when and the conditions under which the different species of fish may be taken.

2 California Fish and Game Code, Section 8306.9, effective January 1, 1977.

3 A few of the sources that have been consulted for information on fishery management plans include:

F. T. Christy, Jr., "Alternative Arrangements for Marine Fisheries: An Overview," in J. Carl Mundt, ed., Limited Entry Into Commercial Fisheries, Proceedings of the Conference Held at Lake Wilderness Continuing Education Center, Seattle, Washington, September 12-13, 1974 (Seattle: Institute for Marine Studies, University of Washington, 1974), pp. 29-40;

J. A. Crutchfield, ed., The Fisheries: Problems in Resource Management (Seattle: University of Washington, 1965);

J. A. Gulland, The Management of Marine Fisheries (Bristol: Scientechnica, 1974).

4 For a good discussion of these issues and relevant court decisions, see H. Gary Knight and James P. Lambert, Legal Aspects of Limited Entry for Commercial Marine Fisheries (New Orleans: Louisiana State University Office of Sea Grant, 1975).

Chapter 3

ATTITUDES TOWARD THE ABALONE FISHERY AND ITS MANAGEMENT

Introduction

Evaluations of alternative methods of managing any fishery should take into account the interests and preferences of all fishery sectors and, ideally, those of the general public. This is so not only for reasons of political and administrative feasibility, (i.e., if a segment of a fishery is adamantly opposed to some policy proposal, its adoption and enforcement will -- at a minimum -- be difficult), but also for purposes of assessing the potential socio-economic impact of alternative management methods. Well-intentioned methods such as limited entry in certain fisheries could well result in a variety of unintended disruptive consequences: economically, for example, limited entry could be highly threatening to commercial fishermen whose livelihoods are dependent on open access to resource exploitation. Similarly, cultural dislocation and disintegration of long-standing fishery communities could ensue. For reasons such as these, it is important to learn the interests and perceptions of each segment of the fishery.

The first category of interests are found in what might be called "directly affected groups," those who are directly involved in the exploitation of the resource. For any fishery, these would include the following: 1) the commercial fishermen, who derive their livelihood from the resource, 2) the sport fishermen, who enjoy the opportunity and right to fish, 3) the onshore fish industry engaged in the buying, processing, and marketing of the fish product, and 4) public agencies engaged in resource management, such as state departments of fish and game.

In the second category, broader public interest concerns should be taken into account. For example, to what extent does the resource represent an important source of food protein which is readily available at reasonable prices to the consumer? What is the broad economic value of the fishery to the nation (e.g., how many people are employed in all of its facets, how far ranging is the distribution market?)? Is there competition for use of the resource habitat (e.g for navigation, dredging and filling operations, nuclear power plants, etc.)? Are any environmental and aesthetic values involved which merit protection for the enjoyment of future generations? These broader "interests" are much less tangible and readily identifiable than those listed under the first category. Hence, it becomes more difficult for decision makers to properly assess them unless some groups -- such as environmental groups -- become organized to articulate such interests.

In the particular case of the abalone fishery, public interest concerns do not loom paramount because of the relatively small size of the fishery, the restricted size of its market, and the "luxury" item character of the product.* Possibly the only public concerns that should be taken into account in this case are the ecological relationship of the resource to other species (e.g. the sea otter), and the views of non-abalone fishermen about the impact of abalone management on their fisheries.

Given the brief framework just developed, this chapter considers the attitudes and opinions of all segments of the abalone fishery and of other interested groups toward the resource, its problems, and its management.**

---

*Abalone is a relatively small but not insignificant fishery (2,587,000 lbs. were landed in 1974); its market range is basically restricted to California, while its high price (estimated at $6.50-9.00/lb. on sales to restaurants) has made it predominantly a luxury item.

**Because of time pressures we were not able to contact those who are engaged in the retail sale of abalone.

This chapter is divided into three sections. First, the total population of each fishery segment is briefly characterized. At the same time, basic methodological decisions about sampling these populations for this study are summarized. Second, the way different segments define the problems with the abalone resource and fishery is presented. Third, the preferences about resource management held by the various segments is offered. Because of their large impact on the resource and because they appear to be most directly affected by recent legislation, the discussion in each of the three sections emphasizes the commercial divers.

Description of Relevant Groups

Commercial Divers

Methodology. According to Department of Fish and Game records, 506 individuals were licensed to take abalone in 1975 (383 as divers, 123 as tenders). While these license holders live in different California communities south of San Francisco, a large proportion of them (48.4%) are centered in the Santa Barbara area (see Table 3.1). As explained earlier (see Table 1.3), there is a high degree of turnover in the fishery; in 1975, the attrition rate from the previous year was 50%.

Table 3.1

Residence of All California Abalone License Holders, 1975
(in percentages)

San Diego	Los Angeles	Santa Barbara Area[a]	Central Coast[b]	North Central Coast[c]
14.4	19.7	48.4	8.6	8.4

(N=506)

[a]Includes Ventura, Oxnard, and Simi.
[b]Includes Arroyo Grande, Morro Bay, San Luis Obispo, Cayucos.
[c]Includes Santa Cruz to San Jose to San Francisco.

In an effort to tap systematically the attitudes and opinions of this population, a random sample of divers* was selected for personal interviewing. The sample was stratified according to number of years of experience in the fishery to insure that all levels of experience and involvement in the fishery would be proportionately represented. Personal interviews with these divers were conducted by trained interviewers between April-July 1976. The number of completed interviews totalled 44 (80% response rate). (For a complete description of methodological procedures followed, please see Appendix A.)

Because of the high turnover in this fishery, an effort was made to contact those license holders who had dropped out of the industry to explore patterns and reasons for out-migration from the fishery. The universe of drop-outs was defined as those individuals who had held abalone permits (either as divers or tenders) in 1974 and who did not renew these permits in 1975 (N=262). A mail questionnaire and follow-up letter responses were sent to all these individuals (for a copy of the questionnaire, see Appendix D). As shown in Table A.3 in Appendix A, a large number (39.3%) of the questionnaires were undeliverable because respondents could not be located (moved, left no forwarding address, no longer employed at the location, etc.). Of those receiving the questionnaire, 29.5% responded.

Using the above data base,[1] this section now moves to a b ief description of the demographic characteristics of these divers, the prevalent patterns of recruitment into the fishery, their economic status, and predominant pat-

*The sampling was confined to divers following the advice of many in the fishery who suggested that divers (as compared to tenders) represented the core of the fishery and would be most knowledgeable about the resource and its problems.

terns of resource harvest. Because the sample was drawn randomly, the characteristics of the commercial divers described here should closely mirror those of the whole population (i.e., all current abalone divers). Throughout this discussion, the responses of the sample of current divers interviewed ("Divers") are occasionally compared to those of the drop-out license holders ("Drop-outs").[2]

Demographic characteristics. As may be seen in Table 3.2, current abalone divers are, on the average, a young group (median age is 32). This is no doubt related to the physical exigencies of this occupation. Fifty per cent are married, and a third of them have children. Residentially, they are scattered in different California coastal communities, over a third making their homes in Santa Barbara. This is a highly educated group, as 59.1% have been educated beyond the high school level.

Contrasting the demographic characteristics of the "drop-out" group to current divers (see also Table 3.2), we find that the "drop-outs" are slightly younger (their median age is 29), and appear to be more "settled" -- at least in family terms. 63.8% of the "drop-outs" are married, and 72% of these have children. Additionally, they are even more educated than the diver group with 77.8% of "drop-outs" having attended college. These differences suggest that reasons for leaving the fishery may potentially be related to family considerations and to the availability of other occupational opportunities.

Recruitment and tenure patterns. Commercial divers were asked how they originally got involved in the abalone fishery, what expectations they had at the outset, and how long they had been diving. (Q. 2,3,4)* In this regard,

*Throughout, refer to Appendices B and D for the text of the questions.

Table 3.2

Demographic Characteristics of Abalone Divers and of Drop-outs
(in percentages)

Residence

	San Diego	Los Angeles	Santa Barbara Area[a]
Divers (N=43)	16.3	18.6	46.5
Drop-outs (N=44)	4.5	31.8	31.8

	Central Coast[b]	North Central Coast[c]	Other
Divers	9.3	9.3	0
Drop-outs	9.1	15.9	6.8

Age

	Under 25	25-29	30-34	35-39	40-44	Over 44
Divers (N=44)	18.1	22.7	25.0	9.0	11.3	13.6
Drop-outs (N=46)	15.2	37.0	19.6	8.7	8.7	10.8

(Median Age)

Divers... 32

Drop-outs... 29

Marital Status

	Single	Married	Other
Divers (N=44)	36.4	50.0 (32% of those married have children)	13.6
Drop-outs (N=45)	26.7	66.7 (80% of those married have children)	6.7

Education

	Completed 8th Grade	Some High School	Completed High School	Some College	College Grad	Post Grad
Divers (N=44)	2.3	4.5	34.1	36.4	15.9	6.8
Drop-outs (N=45)	--	4.4	17.8	55.6	13.3	8.9

[a] Includes Ventura, Oxnard, and Simi.

[b] Includes Arroyo Grande, Morro Bay, San Luis Obispo and Cayucos.

[c] Includes Santa Cruz to San Jose to San Francisco.

46.5% entered the fishery through contact with family or friends, 34.9% through other diving activities (e.g. sport diving), and 16.3% through work in another fishery.[3] As to the reasons why they became abalone divers, 52.6% of the responses[4] mentioned potential economic benefits, 35.0% made references to enjoying the environmental aspects of the job, while 12.2% mentioned notions of freedom and independence. Most divers, in fact, combined all three of these aspects in their answers as the following typical responses indicate:

> Free lifestyle, own boss, adequate income, possible money bonanza...
>
> Like to combine making a living with what I like to do...
>
> Retirement within five years...looks like exciting life, romantic...Didn't see the problems at first...

Length of time spent working in the fishery is abstracted in Table 3.3 for both the "diver" and "drop-out" samples. As this table reveals, there exist small differences between the samples on this variable.**

Table 3.3

Length of Time Spent Working in the Fishery for Abalone "Divers" and "Drop-outs" (in Percentages)

	Under 2 Years	2-4 Years	4-6 Years	6-8 Years	Over 8 Years
Divers (N=44)	27.3	20.4	15.9	4.6	31.8
Drop-outs (N=45)	26.7	37.8	8.8	4.4	22.1

** Considering the distribution of the "drop-outs" according to how long they had been in the fishery and recalling the high yearly attrition rate for the fishery as a whole (reported in Table 2.3), it is possible that our drop-out mail sample is biased toward the more "stable" and experienced fishermen. This is further suggested by the fact that 59.3% of the mail questionnaires sent to the "drop-outs" were returned as "undeliverable" (see Table A.3). Both of these considerations seem to indicate that the more "transient" element of the fishery is not properly represented in our "drop-out" sample. While this poses some questions as to the overall representativeness of our mail sample, the fact that the "drop-out" sample represents a "relatively stable" group -- one with considerable past involvement in the fishery -- possibly lends further weight and credence to the factors cited as reasons for leaving the fishery.

Patterns of harvest and economic status. Looking first at patterns of harvest, the median number of days spent diving per year is 99.7, while the median number of days spent on abalone-related activities other than diving (e.g., boat repair) is 59.7. The majority of divers (65.9%) dive from their own boats, 11.4% dive from a company boat, while 22.7% dive from boats belonging to other divers. Excluding the boat, the median price of abalone diving equipment is valued at $1,250. Most of the divers operate from the Santa Barbara Harbor and harbors located in the Greater Los Angeles area (45.5% and 32.6%, respectively).[5]

While the size of the catch varies greatly according to diver, the median catch reported is 200 dozen per year. A great proportion of the divers sell their catch to only one processor (69.8%), citing high prices obtained and other economic relationships (e.g., processor owns boat, loans, etc.) as major reasons for this selling pattern.

Divers were asked their income from taking abalone and their associated expenses. As may be seen in Table 3.4, the median annual gross income from the taking of abalone is $6,750.

Table 3.4

Gross Annual Income Derived from Abalone Taking for "Divers"
(in percentages)

Under $1,500	$1,500-2,999	$3,000-5,999	$6,000-7,999
22.7	11.3	11.3	13.6

$8,000-9,999	$10,000-13,999	Over $14,000
9.0	11.3	20.4

Median Gross Income	
$6,750	(N=44)

As these relatively low annual income figures suggest, a large proportion of divers (63.6%) have other sources of income in addition to abalone diving. Table 3.5 indicates the proportion of the divers' total net income which is derived from abalone taking.

Table 3.5

Per cent of Total Net Income Derived from Abalone Taking for "Divers"

76 to 100 %	48.8	
50 to 75 %	17.0	
Less than 50% annual net income	34.0	(N=41)

Among those divers supplementing their incomes from sources other than abalone diving, 32.1% are engaged in other fishery jobs (e.g. diving for sea urchins), 50.0% are engaged in non-fishery related jobs, while 14.3% derive additional income from sources such as pensions, welfare payments, or investments.

These economic data -- i.e. low median income, partial economic dependence on the fishery, and engagement in other employment -- suggest that a majority of participants in this fishery are receiving relatively low annual economic returns and many of them are not diving full time. These conclusions are supported by other data in the "diver" sample as well as by data in the "drop-out" sample. When asked whether they had ever considered leaving the industry, 65.9% of the current divers responded affirmatively. Major reasons cited for leaving included economic conditions (37.9% of all responses[6]), resource problems (17.2%), and the harshness of the environment and of working conditions (24.1%).[7] When asked what they would do for a living if they were to discontinue abalone diving, 46.1% mentioned other fish-

ing jobs, 43.5% referred to land-based non-fishing related jobs, while a remaining 10.2% referred to other diving jobs, unrelated to fishing (e.g. on oil rigs).

Those who leave the fishery (as represented by our drop-out sample) do so primarily for economic reasons, although, as mentioned, family considerations and other opportunities may be factors contributing to the economic reasons. As may be seen in Table 3.6, 44.2% of the reasons[8] given for discontinuing abalone diving referred directly to economic considerations, and an additional 22.9% to problems that are closely associated. Typical responses, in fact, interrelate economic problems and resource depletion, e.g.:

> The business is too small for the amount of commercial divers working this area. The abalone beds were getting thinner and we were getting more divers -- they start with blacks and sea urchins. I quit because I couldn't see a future in it. But I like it. You should give it back to the older divers that had it 6 years ago, the fishermen that grew up with it, they know how to take care of it.
>
> Not very many abalone left. Not enough money for this hard work and the danger involved. Long hours, costs a lot to stay in harbor. Overhead was a lot more than what I was making.
>
> Economic: fuel costs, availability to locate good beds of abalone that had not been destroyed.
>
> When I started diving the abalone were plentiful; in about 3 hours we would produce 30 to 40 dozen; then we averaged 10 dozen or more. In about 5 years we could only get 10 dozen about 10 times a year. I don't think we had 10 dozen in the last two years for a 6 hour day of diving.

The importance of economic reasons for leaving the fishery is enhanced when one considers the low median annual net income which "drop-outs" report for the last year they were diving: $2,500. Unfortunately, we have no data on other sources of income for these former divers during their last active year.[9]

Table 3.6

Reasons Cited for Discontinuing Abalone Diving Among "Drop-outs"
(in percentages)

Economic reasons	44.2	
Resource depletion/otter problems	22.9	
Health/age/injury factors	11.4	
Better occupation	9.8	
Family life	6.5	
Other	6.4	(N=62)*

*Includes multiple responses. Of 41 divers responding, 20 gave two reasons and one gave three reasons.

Upon leaving the fishery, the "drop-outs" become engaged in predominantly land-based jobs unrelated to fishing, as Table 3.7 indicates. The majority of these jobs are full-time (78.7%) and appear to bring higher incomes than those derived from abalone diving; "drop-outs" report a current median annual income of $10,400.

Table 3.7

Occupational Breakdown for "Drop-outs"
(in percentages)

Other fishery	15.2	
Other diving (non-fishing)	6.5	
On-land fishery-related (e.g., boat building, dive equipment, etc.)	8.6	
Other on-land jobs unrelated to fishing	65.2	
Retired/disabled	4.3	(N=46)

Although the majority of "drop-outs" have become engaged in land-based jobs, over half of them (55.6%) also report having considered returning to abalone diving (32.4% of these say, in fact, that they will seek a new li-

cense this year). An even greater proportion (81.6%) respond that they would return if certain conditions were to change, such as replenishment of the resource, improved economic conditions, containment of the sea otter, and opening of the north coast. It should be noted that responses given on this open-ended item were replete with detailed and highly specific suggestions on what ought to be done to enhance conditions in this fishery. The "drop-outs" apparently have some strong feelings about abalone diving and the resource.

While the preceding discussion presents an outline of the economic status of divers and "drop-outs", additional data are required before a comprehensive picture can emerge. As one example, the income data used here are for one year only. To make a fully accurate appraisal of income and fluctuations therein would require an average of several years.

Despite some data limitations a few conclusions are in order. First, most current divers are not getting wealthy from diving and neither are most of them relying on abalone diving as their sole source of income. Second, those divers who left the industry did so primarily for economic reasons and many of them are at least considering a return -- apparently in anticipation of better conditions.

Sport Divers

Identifying the universe of recreational fishermen who take abalone was somewhat difficult because anyone holding a California sport fishing license is entitled to take abalone.[10] Hence, we chose to contact the officers of organized sport diving clubs in California as a way of gaining an understanding of the attitudes and management preferences of the sport sector. Mail questionnaires were sent to a total of 116 sport diving club presidents.[11]

(For a copy of the questionnaire, see Appendix C.) Of these, 63 (or 54.3%) were returned. Six questionnaires (5.6%) were returned as undeliverable. Apparently, a few incorrect addresses had been supplied by the Councils. Many responses contained a substantial amount of information volunteered by the respondent in addition to the close-ended responses solicited in the questionnaire.

Our sample of sport diving club officers represents organizations which have been in existence for at least six years, with an average membership size of 49. This is an experienced group of divers who dive for abalone on a frequent (for an amateur) basis. On the average our respondents report taking 7.8 limits (5 per day) for abalone during 1975. Very few of the club officers report an interest in commercial diving -- only 14.3% (N=9) admit to having considered commercial diving.

In terms of demographic characteristics and socio-economic status, these sport divers represent an older, more educated and more affluent group than the commercial divers: their median age is 38, 84.1% of them have been educated beyond the high school level, and 66.6% make annual incomes of over $15,000. Table 3.8 summarizes these characteristics of the sport diving sample.

Because our sample is composed entirely of club officers, it may be that it is not representative of all sport divers. Most likely the sample has a disproportionate number of experienced, long-term divers who have a better-than-average knowledge of the abalone resource and its problems. From this standpoint, the sample should be able to provide responses based upon much more than the casual acquaintance with abalone that a newer diver might have. And, because the sample is by definition composed exclusively of the diving

club leadership, their views may be expected to have a higher degree of relevance to those engaged in formulating abalone management policy.

Table 3.8

Characteristics of the Sample of Sport Diving Club Officers

1.	Size of clubs: Mean = 49 members; Range = 5-300	(N=60)
2.	Years respondent has been diving: Mean = 12.7 years	(N=63)
3.	Average number of abalone dives per year: 14.5	(N=60)
4.	Number of limits respondent took last year (1975): Mean = 7.8	(N=61)
5.	Has espondent considered commercial diving -- yes: 9 14.3% no: 54 85.7%	(N=63)
6.	Median age of respondent: 38	
7.	Respondents having post-high school education: 84.1%	(N=63)
8.	Respondents making more than $15,000/year: 66.6%	(N=61)

Processors

Out of the total of seventeen processing permits issued by the Department of Fish and Game, only ten processors produced any abalone during 1975-1976. The inactive processors have quit production due to escalating ex-vessel prices and because of dwindling and inconsistent supplies of abalone. However, all seventeen processors plan on renewing their permits next year. For purposes of this study, six of the ten active processors were interviewed. These six account for the vast majority of all processed abalone in the state.

California abalone processors produced approximately 320,000* pounds of abalone steaks in 1975. Nearly 80% of this production was accomplished by the three processors located in Santa Barbara, with a single processor being responsible for 55% of the total domestic supply. Ninety per cent of the

*This figure does not include the amount of black abalone that is canned and exported.

supply was consumed in California, and an additional 990,000 pounds of abalone steaks were imported from Mexico into California. Hence, only 22% of the California market was satisfied by California abalone in 1975. The processors report that they are operating at about 25% of their full production capacity due to the dwindling supply of legal-sized abalone, and the situation has steadily worsened over the last five years.

Processors face uneven demand through much of the year as it is heavily influenced by tourism in San Diego, Santa Barbara, Los Angeles and San Francisco (see Figure 3.1). The flow of seasonal supply is also inconsistent, as it is interrupted due to wind and weather conditions affecting navigation of the small crafts and diver visibility.

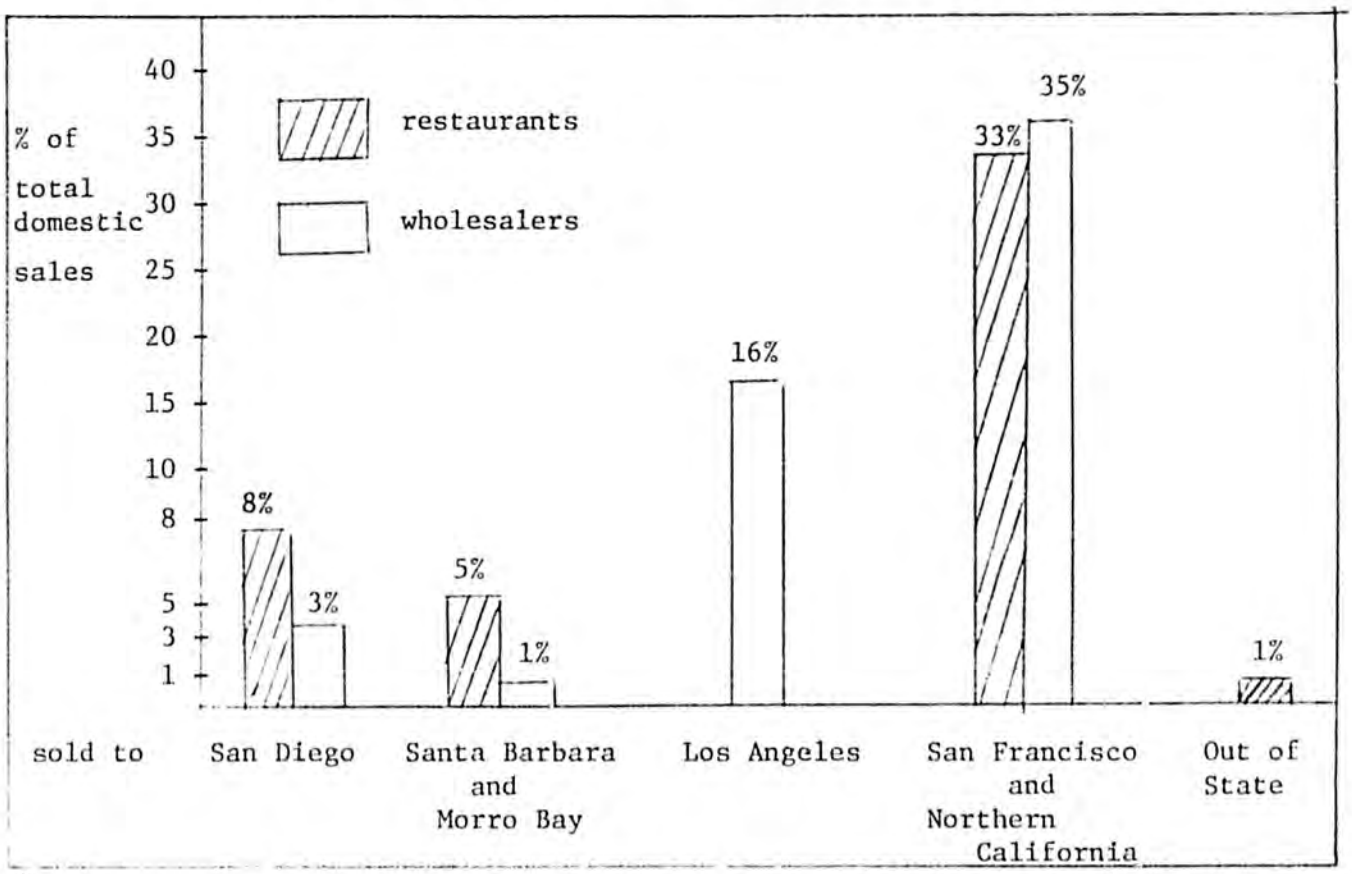
The price paid for abalone steaks varies according to the steak size, softness, and whiteness of color. The Sorenson or white abalone commands the highest price per steak pound as it is the whitest and softest of the gourmet class. A pound of top-quality abalone steak is sold to restaurants at an average of $6.50 per pound, although some restaurants pay up to $9.00 a pound when purchasing from a wholesaler. About 70% of the processor's selling price goes to the diver, 10 to 20% covers labor costs, and after paying for packaging, freight, and overhead the processor is left with about 6.5% net profit.

Processors generally buy abalone from their own group of divers. The top five processors in sales volume report buying from (on the average) 125, 35, 20, 8, and 6 divers, respectively.

This brief characterization of abalone processors makes it apparent that a relatively few firms dominate this part of the industry. The state of California provides the primary marketplace for their output except for the exported black abalones.

Figure 3.1

Domestic Sales of California Abalones by California Processors*



*Based upon interviews with six processors.

Resource Management

With respect to the management of the abalone resource, two particular groups stand out: the State Department of Fish and Game and the relevant committees in the state legislature. Because the Department of Fish and Game figures so prominently in the management of abalone, a brief description of its organizational structure seems appropriate at this point.

The Department of Fish and Game (DFG) is the dominant state agency in management of the state's fish and game resources. The DFG operates within laws delegating it certain powers and responsibilities and under general

policies set by the five-member Fish and Game Commission. The Director of DFG is appointed by the governor subject to confirmation by the state senate. In what seems to be an opportunity for confusion, the director is legally responsible for the Department's administration to both the commission and the governor. No clear demarcation of the director's dual responsibilities appears in law, so it is reasonable to assume that a de facto relationship based upon political exigencies develops between each director, governor, and commission. Because the commission is not permitted to regulate commercial fisheries without explicit legislative authorization, the Department assumes the major role in dealing with the commercial use of California's marine resources.

The state Fish and Game Code is quite diverse in its subject matter and approach to management responsibilities. Some laws mandate quite specific management provisions that DFG must follow while other code sections offer DFG wide latitude and discretion. DFG conducts research on its own as well as by contract. Taking fish or game requires a license, and under general requirements set out in the law DFG promulgates the exact terms and conditions under which licenses may be sold and used. DFG is also responsible for enforcement of the Fish and Game Code and its enforcement personnel are full-fledged peace officers with the power of arrest.

For administrative purposes the Department is organized into five regions, each with field personnel. Some Sacramento-based staff operations include the Marine Resources Branch, Anadromous Fisheries Branch, other similar branches, and the usual housekeeping offices to handle fiscal and personnel matters. In order to ascertain the attitudes and opinions of DFG personnel toward abalone management in general as well as to explore the ration-

ale followed in the recent enactment of AB 2224 (limiting entry into the abalone fishery), several informal in-depth interviews were held with DFG administrators. These were selected from all DFG sectors relevant to abalone management (e.g. Sacramento-based personnel dealing with policy development as well as field personnel concerned with data collection and the enforcement of regulations).

Several state legislature committees dealing with abalone regulations were also considered. During the 1975-76 regular session of the California legislature, jurisdiction over fisheries legislation had been transferred from one committee to another in the Assembly following a committee reorganization necessitated by the death of a committee chairman. Abalone-related legislation was first heard by the Assembly Committee on Resources and Land Use, while legislation introduced later in the session was handled by the Assembly Committee on Water. The Senate Committee on Natural Resources and Wildlife maintained jurisdiction over the abalone legislation during the entire session.

Public Sector Groups

As mentioned earlier, public interest concerns would not appear to be significant in the abalone fishery because of the limited size of the market and the costliness of the product. Nevertheless, a few groups not directly involved in the fishery are concerned with abalone management because of the impact some abalone management plans would have on the sea otter. These groups perceive efforts to protect abalone by containing or relocating the California sea otter population as a threat to the otter's well-being and perhaps survival. Informal in-depth interviews were thus conducted with spokespersons for the Sierra Club and the Friends of the Sea Otter.*

*These two groups were identified as being interested in the abalone resource following an extensive informal telephone survey of environmental groups.

The Sierra Club is a national organization, with a large percentage of California members, that works on a wide variety of environmentally related issues. Friends of the Sea Otter concentrates its efforts on the preservation and enhancement of the small band of surviving sea otters along the California coast.

Several other non-abalone organizations were contacted for their views about fishery management in general and abalone management in particular. These groups included the Tuna Research Foundation, Fisherman's Union of America-Pacific and Caribbean area, Fishing Marketing Association, Salmon Unlimited, California Commercial Fishermen's Association and California Seafood Institute.

Summary

This section has identified and described the groups that are relevant to abalone management. Keeping in mind the major characterizations of these groups, we can now turn to their definition of the problems confronting the abalone fishery and resource.

Definition of Problems in the Abalone Fishery

Commercial Divers

Almost all commercial divers perceive problems in the abalone fishery. When asked the simple question whether any problems existed, 93% responded affirmatively.

Divers were asked for their perception of the seriousness of different problems in two ways: first in an open-ended item which allowed the diver to volunteer a spontaneous response and second in a closed-end, structured item which confronted the respondent with a set of problems and asked him

to evaluate their seriousness. It is always useful to contrast answers obtained through these two methods as a check on the validity of close-ended items. As may be seen in Table 3.9 (where responses to the open-ended item are abstracted) and Table 3.10 (responses to the close-ended items), the ranking of problems is, by and large, very similar.

The responses to both the open and closed-ended items suggest that the most important problems are perceived to be an inadequate supply of abalone, sea otters, the taking of shorts, too many commercial divers and activities of inexperienced divers.[12]

For each problem mentioned, divers were also asked to indicate who should be most responsible for solving the problem; i.e., individual fishermen, state government, fishermen's associations, processors, or some other group. As may be seen in Table 3.10, there is clear indication that commercial divers look toward the state government as the major source whence solutions to problems in the fishery should emanate.

Table 3.9

Definition of Problems in Abalone Fishery Among Commercial Divers
(open-ended responses) (in percentages)

	(all responses)	(1st mention)
Too few abalone	14.4	20.5
Sea otters	11.1	15.9
No area rotation	11.1	9.1
Poor management practices	10.0	13.6
The taking of shorts, cutting	10.0	2.3
Too many divers	8.8	4.5
Inexperienced divers	6.6	2.3
Sport divers	5.5	2.3
No aquaculture	5.5	---
Other	17.0	29.5
	(N=92)*	(N=39)

*Reported aggregating first, second, third, and fourth responses. (Divers were allowed to mention a total of up to 4 responses. Of the 39 who responded to this question, 27 mentioned two problems, 18 mentioned three problems and 8 mentioned four problems.)

Table 3.10

Definition of Problems in Abalone Fishery and Attitudes on Who Should be Responsible for Solving these Problems Among Commercial Divers (in percentages)*

Problem	Problem rated as serious or very serious	Whose responsibility to solve problem					
		Individuals	State govt.	Fisherman's assoc.	Processors	other	DK
Sea otters	66.7 (N=42)	--- (N=35)	74.2	5.7	---	14.2	5.7
Inadequate supply of abalones	65.9 (N=44)	--- (N=28)	67.8	7.1	3.5	14.2	7.1
Pollution	57.5 (N=40)	--- (N=34)	76.4	---	---	14.6	8.8
The taking of shorts	53.5 (N=43)	29.4 (N=34)	55.8	8.8	5.8	---	2.9
Too many commercial divers	50.0 (N=44)	2.8 (N=35)	74.2	5.7	5.7	5.7	5.7
Poaching	38.1 (N=42)	20.7 (N=29)	65.5	6.9	3.4	3.4	---
The twenty foot law	36.4 (N=44)	5.7 (N=35)	77.1	8.5	---	5.7	2.8
Too many inexperienced commercial divers	34.0 (N=44)	12.9 (N=31)	61.2	9.6	6.4	6.4	3.2
Competition from sport divers	25.6 (N=43)	14.2 (N=28)	60.7	7.1	---	10.7	7.1
Legal size is too small	13.6 (N=44)	--- (N=21)	61.9	6.8	2.3	19.0	---
Legal size is too large	6.0 (N=44)	--- (N=23)	60.9	13.0	4.3	21.7	---

* Questions read: "Here is a list of problems that have been suggested by other people associated with the abalone industry. As I read each one, would you please first tell me whether you think it is: (1) a very serious problem, (2) a serious problem, (3) somewhat of a problem, (4) a minor problem, or (5) not a problem at all. Next, I would like to know who do you think should be most responsible for solving this problem: individual fishermen, state government, fishermen's associations, processors, or some other group.

Sport Divers

The majority of sport divers responding to the mail questionnaire also perceive that there are problems with the abalone resource (90.3%). In some ways the sport divers' definitions of problems in the abalone fishery parallel those of the commercial divers. As may be seen in Table 3.11 (open-ended responses) and Table 3.12 (close-ended responses), sport divers point to sea otters, inadequate supply of abalone, commercial diver activity, overfishing, and the taking of shorts as major problem areas. Sport divers tend to give greater importance to commercial divers as a major source of problems in the fishery than do commercial divers themselves. While the sport divers tend to view the commercial divers as a serious threat to the resource, the converse is not true. Referring back to Table 3.10, only 25.6% of the commercial divers cited "competition from sport divers" as a major problem.

Table 3.11

Definition of Problems in Abalone Fishery Among Sport Divers
(open-ended responses) (in percentages)

	(all responses)	(1st mention)
Commercial divers	22.1	22.2
Inadequate supply of abalone	18.9	27.8
Sea otters	14.7	18.5
Too many sport divers	9.4	9.3
Diver behavior	6.3	1.9
No area rotation	4.2	5.6
The taking of shorts	4.2	1.9
Enforcement problems	4.2	1.9
Other	16.0	10.9
	(N=95)*	(N=54)

*Reported aggregating first, second, third, and fourth responses. (Divers were allowed to mention a total of up to 4 responses. Of the 54 who responded to this question, 27 mentioned two problems, ten mentioned three problems, and four mentioned four problems.)

Table 3.12

Definition of Problems in Abalone Fishery Among Sport Divers
(closed-end responses) (in percentages)

Problem	Rating of Problem as "Serious" or "Very serious"	
Overfishing some specific areas	77.0	(N=61)
Commercial divers	69.3	(N=62)
Sea otters	55.5	(N=63)
The taking of shorts	51.6	(N=62)
Poaching	51.6	(N=62)
Commercial divers violating the 20-foot law	46.7	(N=62)
Pollution	43.5	(N=62)
Inadequate supply of abalones	40.0	(N=60)
Sport divers taking too many abalone	19.3	(N=62)
Sport size is too small	6.6	(N=60)
Sport size is too large	1.3	(N=60)

Processors

The six processors that handle most of the abalone market were asked to define the most pressing problems in the abalone fishery "from the perspective of the processor." Table 3.13 abstracts answers to this open-ended probe.

As Table 3.13 reveals, the problems mentioned most frequently by the processors do not differ substantially from rankings made by the commercial and sport divers. All three groups are concerned with an inadequate supply, sea otters, too many divers, and inexperienced and part-time divers. The processors, however, define these problems in somewhat different ways. Considering the problem of "inadequate supply of abalone," for example, a number of the processors defined this not in terms of depletion (i.e. insufficient numbers), but rather in terms of insufficient growth of the species because of such conditions as bad weather, pollution, and bed depths.

Table 3.13

Definition of Problems in Abalone Fishery Among Processors*

Inadequate supply of abalone	5
Sea otters	3
Inexperienced and part-time divers	3
Poor management/enforcement practices	3
Too many divers	3
Poachers and bootleggers	2
Size limit is too large in some beds	2
Mexican divers on Cortez	1

*Each processor was allowed to mention as many problems as he wished; most listed 3 or 4 problems.

In terms of poor management/enforcement practices, some processors pointed to the 20-foot law and suggested that the money spent on its enforcement would be better utilized by DFG in cracking down on bootleggers, poachers and divers taking shorts. A few processors saw the bootleggers' or "pirates'" disregard for the legal size of the abalone as a major source of problems; one processor estimated that between 30 to 50% of all the abalone taken was being sold directly to restaurants and private individuals, circumventing both the processors and the recording of DFG fish tickets.

Resource Management

Department of Fish and Game. As has been said before, the Department of Fish and Game is the primary abalone resource manager. Therefore, the way DFG defines problems with the resource is of major importance. The most concise statement of the Department's approach to abalone problems is contained in a report issued in January, 1975.[13] The report, known as the Burge report after its main author, represents the Department's conclusions about the

biological status of the resource. The following reasons were said to account for the decline in abalone yield:

1) excessive picking pressure on sublegal abalone

2) size limits on pink, white and green abalone are too large

3) inevitable decline from overabundance of resource in early 1950's, when commercial harvesting started up in a big way

4) sea otter foraging

5) environmental degradation

6) sea urchin competition with abalone

7) poor larval recruitment and/or inadequate habitat

8) closure of some fishing areas

9) illegal activity by some divers

Because so much emphasis was subsequently placed on number one in the above list, some elaboration is in order. The Burge report found a very high mortality rate when divers picked, measured, and replaced sublegal size abalone. The abalone were frequently cut, so that they bled to death or could not resecure a strong hold and were therefore subject to easy picking by predators. It is apparent in the report that this problem was of overriding concern in the Department's eyes. As the report's recommendations and subsequent legislation make clear, it was assumed that picking and replacement of sublegals were highly correlated with the total number of divers and an individual diver's experience -- it was the least experienced who were primarily responsible for the premature mortality. This viewpoint played a major role in developing a new management approach.

From DFG's viewpoint the problem can be summarized as a quite limited available resource caused by improper harvesting, the sea otter, pollution and additional relatively minor causes. All this is seriously aggravated

by too many commercial divers. The decline in abalone yield evokes memories within the Department of the demise of the California sardine industry. Overharvesting, thought to be the principal agent responsible for the loss of a commercial sardine fishery, is widely feared by those making policy decisions about abalone. The Department's primary goal is a biologically based resource preservation program. That is, the Department is not motivated to advance economic or social goals through its commercial abalone management plans.

The role of the sea otter as an abalone predator is the source of a continuing and contentious debate involving DFG, abalone divers and groups such as Friends of the Sea Otter. As we have seen earlier in this chapter, commercial and sport divers both define the sea otter as one of the key problems facing the abalone resource. DFG concurs, as seen in the Burge report and in comments by other Department personnel. DFG biologist David Zeiner finds the sea otter one of nine major reasons for the decline of the abalone:

> These otters have an insatiable appetite for shellfish, and with their average weight around 55 pounds, they eat one-fourth of their weight daily to sustain their high metabolism. They can reduce the abundance of shellfish by 80 to 90 per cent.[14]

Their migration, Zeiner continues, "becomes a threat to all shellfish, including the abalone."[15]

Daniel J. Miller, another DFG marine biologist, who holds the same evaluation of the problem as Zeiner, has authored a DFG proposal to the Federal Fish and Wildlife Service asking for state control over the otter (otters are now protected by the Marine Mammal Protection Act of 1972) with the intent of limiting the migration of the otter to Avila in the South and Half Moon Bay in the North.[16] The justification for this transfer of responsibility, Miller says, is that the Federal Government looks just to the survival

of the otter, where the state has the responsibility to protect and enhance all fisheries in California.[17]

Both the biologically based conclusions and the attitudes about the future of the sea otter held by many DFG personnel are strenuously contested by biologists associated with the Friends of the Sea Otter organization.

Legislature. It is apparent that fisheries management, and specifically abalone management, is not a high-priority topic in a legislature beset with issues such as capital punishment, tax reform, coastal development, educational finance reform, and all the associated budgetary matters. There are a few legislators from coastal districts who take an interest in fisheries problems, but on the whole the legislature is not deeply concerned about the topic. With this situation in mind, it can still be said that a few issues in fisheries management arouse some legislative interest.

As a result of our interviews in the legislature, it is apparent that the legislature defined the problem with abalone as one of overharvesting. Essentially, the legislature agreed with the way DFG defined the problem. That is, there are too many divers who are overharvesting the species, in part because of the high sublegal mortality rate caused by "inexperienced" divers.

Public Sector Groups

After interviewing several active members of the Sierra Club and Friends of the Sea Otter one must conclude that these groups define abalone problems quite differently from divers and DFG. The blame for resource depletion is laid on man only, as one respondent said, "It is man and man alone who bears this burden."

Not only do these groups deny a major impact by the sea otter on abalone,

but they argue strongly that the sea otter enhances the abalone habitat and therefore helps the abalone. This occurs, they assert, because the sea otter chooses sea urchins for the primary diet (with abalone a second choice), thereby reducing the urchins' supposedly damaging impact on kelp beds. It is these kelp beds that sustain abalone.

There is a clear indication from these groups that if a choice must be made between allowing the sea otter to survive and expand or seeing the commercial abalone industry disappear or be drastically curtailed, they would choose the former. In other words, if they are wrong and the sea otter does seriously damage the abalone resource, they would prefer the sea otter to the abalone. These opposing definitions and choices, of course, set the scene for potential conflict.

The several unions and associations included in this study were not at all active in recent abalone management policy development. Thus, their definition of abalone problems was not relevant at this point.

Conclusion

Some concluding remarks can be offered about the way different groups define the problems besetting the abalone resource. In the first place, all agree that there is a problem, and in a way all agree that the problem is that there is an inadequate supply of the resource to satisfy the potential demand. Those who take the abalone for commercial and sport purposes, those who process it, those who manage the resource and those public sector groups concerned about the relationship between abalone and the sea otter <u>all</u> agree that there are not enough abalone.

The question of <u>why</u> there are not enough abalone is a different matter -- on this point opinions vary a bit. Although not necessarily in the same

rank order, commercial and sport divers, processors and resource managers all point to sea otters, poor resource management, too many divers, too many inexperienced divers, and pollution as the major causes of dwindling abalone stocks. Environmental groups place the blame solely on the "greed" of the divers and they absolve the sea otter.

Thus, the problems are defined with some uniformity except for the obvious disagreement of the environmental groups. It should also be noted that there are differences of opinion over the order in which different problems contribute to a supply inadequate for the demand.

Abalone Management Preferences

Commercial Divers

Following the questions on problem definitions, commercial divers were asked their opinions on different management alternatives through a variety of open-ended and closed-end probes. First to be determined was the extent to which divers were aware of the existing range of management alternatives. When asked whether they were familiar with "any proposals that might be suggested to establish a management program to solve problems in the abalone industry," 77.3% responded affirmatively. Most divers volunteered very specific proposals related to limited-entry restrictions, limited access to the resource, and abalone replenishment.

Divers were also asked what they would do if they could "make up a management program to solve problems in the industry." Table 3.14 summarizes answers to this open-ended probe. As indicated in this table, limited entry, enhancement of the resource through seeding and aquaculture, and certain methods limiting access to the resource are the highest ranking management preferences.

Table 3.14

Management Preferences Among Commercial Divers
(open-ended responses) (in percentages)

	(All responses)*	(1st mention)
Limited entry into fishery	28.7	28.2
Augmentation of the resource (e.g., seeding, aquaculture)	20.5	23.0
Limited access to the resource (e.g., rotation, closures, quotas)	19.1	20.5
Stricter enforcement of regulations	12.3	7.6
Environmental control (e.g., pollution control, otter control)	9.5	10.2
Special administrative group (e.g., a committee for management policy made up of interest group representatives and DFG administrators)	9.5	10.2
	(N=73)	(N=39)

*Reported aggregating first, second, third, and fourth responses. (Divers were allowed to mention a total of up to 4 responses.)

Divers' responses to a structured closed-end item (see Table 3.15) generally mirrored the volunteered preferences found in Table 3.14. It should be noted that in the open-ended responses, the second most preferred management alternative was enhancement of the resource -- an alternative which was not included in the closed-end item. However, there appears to be strong and growing support for seeding programs among commercial divers, as subsequent discussion of their willingness to pay for such programs will suggest.

Looking at Table 3.15 more closely, we see that divers are most familiar with proposals dealing with limiting entry, rotation, apprenticeships, increased license fees, seasonal closures, and quotas. In terms of their evaluations of these proposals, divers are most favorably disposed toward limited entry (77.3% agree), area rotation (81.8% agree), and apprenticeship programs (61.4% agree). Divers oppose most of the other management proposals

Table 3.15

Management Preferences Among Commercial Divers
(Close-ended responses in percentages, N=44)

Proposal	Have heard of proposal	Opinion of Proposal					
		Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree	Don't know
Limiting the number of licensed divers	97.7	61.4	15.9 (77.3)	6.8	9.1	6.8 (15.9)	--
Rotation of open and closed fishable areas	84.1	59.1	22.7 (81.8)	2.3	9.1	6.8 (15.9)	--
Requiring new divers to serve a probationary period as apprentices	75.0	43.2	18.2 (61.4)	9.1	9.1	6.8 (27.3)	--
Increasing the license fee	86.4	6.8	20.5 (27.3)	6.8	9.1	56.8 (65.9)	--
Placing a quota on the number of abs taken by the industry as a whole	40.9	6.8	11.4 (18.2)	9.1	11.4	52.3 (63.7)	--
Placing a quota on the number of abs taken by any diver	65.9	6.8	9.1 (15.9)	11.4	13.6	56.8 (70.4)	--
Longer closed seasons	79.5	--	13.6 (13.6)	9.1	11.4	65.9 (77.3)	--
Placing a tax on the number of abalone taken	29.5	4.5	4.5 (9.0)	13.6	6.8	52.3 (59.1)	--
No change in present regulations	--	9.1	6.8 (15.9)	4.5	18.2	54.5 (72.7)	--
Limiting the number of vessels	20.5	10.2	12.8 (23.0)	28.2	7.6	38.4 (46.0)	2.5

suggested. In rank order they disagree with longer closed seasons (77.3% disagree), individual diver quotas (70.4%), increased license fees (65.9%), industry-wide quotas (63.7%), taxes on the catch (59.1%), and vessel limitations (40.9%).

Although they generally do not favor increasing license fees, commercial divers do appear to be willing to pay additional money to sponsor abalone enhancement programs. When asked specifically whether they would pay additional license fees for seeding purposes, 75.0% of the divers responded affirmatively. Table 3.16 indicates how much money divers would be willing to pay per year to sponsor such seeding programs.

Table 3.16
Money Commercial Divers Would Be Willing to Pay for Seeding Programs
(in percentages)

Under $25	11.7
$25 to $75	11.7
$76 to $150	41.1
$151 to $250	11.7
$251 to $500	5.8
Over $500	5.8
Don't know	11.7
	(N=34)

It is our impression, though, that while divers are in favor of seeding programs, they would prefer that such programs be publicly sponsored by the state DFG rather than through private means. This is suggested by divers' reactions to plans recently announced by ARCO and California Marine Associates to begin farming abalone at an ARCO offshore oil platform in the Santa Barbara Channel. When asked about these plans, 44.1% of the divers reported their

awareness of some potential effects of these farming efforts. The majority cited potential detrimental effects (i.e., 53.3% referred to damage to the market, and 9.1% expressed fears of diver obsolescence) while only 6.8% cited potential benefits for the resource. This type of private attempt at resource augmentation clearly arouses some concerns among commercial divers. Typical responses are summarized below:

> When someone starts farming it's going to lower the price of abalone. If they're going to start farming, I'm going to start writing letters asking for a job because that's what I want to do!
>
> ...They'll make money and get us out of business.
>
> If farming abalone got big, it may lower prices and hurt me.
>
> The program will try to monopolize the industry. What happens to the small businessmen? They're not benefitting the reef as a system.

As demonstrated by the Burge report and by the passage of AB 2224, limited entry is no longer a remote resource management alternative. Therefore, the opinions of divers on factors which should be taken into account in allocating limited entry permits was ascertained. Table 3.17 presents the proportion of divers favoring different methods of allocating licenses. Respondents were asked to express their approval or disapproval of each item in Table 3.17. The top three factors are years of experience (68.2% in favor), economic dependence (54.5% in favor), and size of the catch (50% in favor).

In conclusion, then, commercial divers seem to be very knowledgeable and aware of a wide range of alternative methods of managing the fishery. As discussed earlier (Table 3.10), the majority point to the state government as the party that should bear the greatest responsibility for solving problems in the fishery. The management options most preferred by the divers -- limited entry, area rotation, and publicly sponsored abalone enhancement

Table 3.17

Commercial Divers' Preferences on Factors That Should Be Considered in Allocating Limited Entry Permits
(in percentages)*

Factor to be considered	Proportion in Favor
Number of years in the industry	68.2
Proportion of income derived from the abalone industry	54.5
Size of preceding year's catch or number of landings	50.0
Passage of a diver proficiency test	45.5
Economic hardship	34.1
Amount of money invested in equipment	15.9
Applicant's residence	13.6
	(N=44)

*These criteria are considered as providing a possible basis for a point system similar to that described for Alaska in Appendix E. In addition, two alternative allocative procedures were considered: license auction, favored by only one diver (2.3%) and allocation by lottery, favored by eight divers (18.3%).

programs -- are also methods that fall within the purview of the Department of Fish and Game. This apparent acceptance of the state's role in the management of the fishery, however, is tainted with a general sense of mistrust of DFG's management performance. When commercial divers were asked to evaluate the present management of the abalone fishery by DFG, a large proportion of the divers (65.0%) offered "poor" or "very poor" evaluations (Table 3.18). Moreover, some commercial divers (38.6%) reported that DFG enforces abalone regulations selectively -- in their opinion, to the detriment of the commercial diver. This generalized sense of mistrust, it would seem, may create problems for the enforcement of any new management methods adopted by DFG which do not conform to the preferences of the commercial divers.

Table 3.18

Opinions on DFG Management of the Abalone Fishery Among Commercial Divers
(in percentages)

Quality of Management		
Excellent	--	
Good	4.6	
Adequate	25.5	
Poor	41.8	
Very poor	23.2	
Don't know	4.6	(N=43)

Sport Divers

In keeping with their tendency to define problems with the resource largely in terms of commercial overfishing (too many divers taking too many fish) and in terms of improper diver behavior (taking shorts, poaching, 20 foot violation), sport divers tend to volunteer solutions which call for stricter enforcement of regulations. As may be seen in Table 3.19, the "stricter enforcement/stiffer penalties" option receives the highest rating.

Table 3.19

Management Preferences Among Sport Divers
(open-ended) (in percentages)

Stricter enforcement/stiffer penalties	58.0	
Contain sea urchins	11.6	
Catch quotas	7.1	
Aquaculture	6.2	
Change size limit	5.3	
Area rotation	5.3	
Moratoria	4.4	
Other	2.6	(N=117)*

*Total equals 100.5% due to rounding error. These responses were 117 preferences to eleven specified problems by 63 divers.

Additionally, sport divers were asked a set of questions dealing with specific regulations related to sport diving. The great majority of sport divers (88.1%) are opposed to opening up the area north of Point Lobos to commercial divers. A similar proportion (83.8%) also feel that prohibitions on the use of scuba gear by sport divers in the area north of Point Lobos should be maintained.

Much as the commercial divers, sport divers generally support resource augmentation efforts. 72.5% report that they would support a licensing plan which required a special abalone stamp if the money were earmarked for a seeding program. Most of the sport divers, though (66.0%) are opposed to the idea of any state lease of beds for commercial use which would prohibit access to sport divers.

Finally, in terms of their evaluations of DFG management of the abalone resource, sport divers report critical opinions -- although not to as great an extent as commercial divers. As may be seen in Table 3.20, 57.9% of sport divers rate DFG management as "poor" or "very poor". In a related question, 26.2% perceive that DFG is selective in the enforcement of regulations; most of these respondents suggested that DFG favors commercial divers.

As we saw earlier, those commercial divers who felt DFG enforced rules selectively said that commercial divers were the target of "special" DFG attention. Now some sport divers are suggesting DFG singles them out for "special" attention.

Table 3.20

Opinions on DFG Management of the Abalone Fishery Among Sport Divers
(in percentages)

Quality of Management		
Excellent	3.2	
Good	12.9	
Adequate	24.1	
Poor	46.7	
Very poor	11.2	
Don't know	1.6	(N=62)

Processors

As will be discussed in Chapter 4, some processors were influential in the passage of AB 2224 so it is not at all surprising that they report favoring limited entry provisions. The underlying expectations among processors seems to be that limited entry will increase the degree of "full-timeness" and "professionalism" in the fishery by eliminating part-timers. In turn, this will make the relations with divers easier and, in their opinion, improve the long-term supply of abalone.

The one management option which processors unanimously oppose is catch quotas, either for individuals or for the industry as a whole. Processors feel that quotas would tend to penalize the mainstay of the industry -- the serious and hard-working diver. Some processors also feel that the industry-wide quotas would not be biologically sound as the abalone would deteriorate and be wasted if not picked after reaching legal size.

Since it appeared that a limited entry bill (AB2224) would be adopted, processors were asked what future management efforts they would propose. As may be seen in Table 3.21, major future agenda items for processors in-

clude working for a seeding program and opening up the north coast for commercial use.

Table 3.21

Future Management Proposals Favored by Processors*

Seeding program	5	
Opening of north coast	4	
Size changes	2	
Limited entry for sport divers	2	
Elimination of 20-foot law	1	
Tariffs on Mexican abalone	1	
Rotation of areas	1	(N=6)

*Respondents could offer as many proposals as they wanted.

Unlike the commercial divers, the processors do not seem to be concerned with the potential effects of abalone farming by the ARCO oil platform. Most of them tend to view this effort as an experiment and tend to minimize its importance and potential consequences. Of course, if the experiment succeeds, they stand to gain some business.

In regard to evaluations of the Department of Fish and Game, most of the processors characterized their relationship with DFG as good. There were no serious criticisms of DFG offered by the processors.

Resource Management

Department of Fish and Game. Prior to holding public hearings and attempting to draft implementing legislation the Burge report represented both DFG's outlook on the problem of the abalone fishery and its views on required management of the resource.[18] What happened to the report will be discussed in the next chapter, but the report can be used here to illustrate how DFG

approached a new abalone management program.

The Burge report contains the following major management recommendations:

1) limit entry to the commercial fishery

2) shorten the commercial season to six months

3) reduce the size limits on pink, green, and white abalone

4) establish landing quotas for each type of abalone

5) shorten the season and reduce the multi-day trip limits for sport divers in Southern California

6) shorten the season and reduce the bag limits for sport divers in Northern California

7) increase DFG's role in abalone mariculture

8) increase the commercial diving permit fee to $200 per annum immediately and to $500 per annum in 1980

In keeping with the opinions of the divers, processors and public sector environmental groups, DFG ranks a limited entry program at the top of its suggested management changes. The proposals for change, however, go much further to include such new management programs as the establishment of quotas, shorter seasons, and changed size limits. The Burge report envisioned an extensive overhauling of abalone management, and it is therefore not surprising that it met with resistance.

Absent from the Burge report was a recommendation to open the coast north of Point Lobos. Because this possibility was suggested by processors and some divers, it deserves further mention at this point. While sport divers and shorepickers may take limited numbers of abalone, all commercial abalone activity has been prohibited (by law) along the entire coast from Point Lobos to the Oregon border since 1945. At a time now when the abalone yield is declining, it is not at all surprising that commercial divers and processors

have suggested elimination of this prohibition. DFG has chosen to not reopen the north coast issue at this time.

The original rationale for closing the north coast was a conclusion that the resource was simply not plentiful enough to support commercial activity. Apparently this was a conclusion initially urged on DFG by coastline residents, and confirmed by DFG's own research during the 1950's. A combination of a coastline that is quite rocky, cold water which results in slower abalone growth, abalone which are found mostly in a narrow band near the shoreline, and frequent inclement weather are also reasons cited as evidence that commercial activity is not appropriate north of Point Lobos.

However, controversy periodically arises over the adequacy of DFG's data about the north coast resource and its accessibility. Some claim that abalone is scarce only at those few selected spots with the easiest access and thus the most picking. Along many other areas, it is claimed, the abalone are present -- ranging in supply from adequate to overabundant. In recent times the Department has chosen not to invest the time and money that would be necessary for a thorough study of the north coast resource.

To even mention the possibility of reopening all or part of the north coast generates hostile reactions by those sport divers and local residents who currently enjoy exclusive access to abalone. Based upon interviews with DFG officials, it is apparent that their concerns influence the way DFG approaches the issue. Likewise, DFG recognizes that any commercial activity on the north coast must be monitored very carefully, including a close and continuous check on the status of the major abalone beds, the number of commercial divers working the area, and their total landings. These activities would impose a new administrative burden on DFG, along with the attendant costs.

Furthermore, it appears that DFG is convinced that the controversy likely to arise at a reopening attempt would make it impossible to secure the required legislation. Taken all together, these considerations have resulted in a departmental inclination to retain the status quo on the north coast.

Legislature. A genuine legislative concern about overharvesting a resource such as abalone is evident. During interviews, references to sardines and their disappearance were common, along with an expression of determination not to allow the abalone fishery (or any fishery) to suffer the same fate. However, the concept of limited entry as a fisheries management plan also evokes comment and concern. Limited entry, after all, is a serious governmental restriction upon an industry and as such it has the potential to touch off a philosophical discussion about the "proper" role of government in the economy. Any attempt to limit entry to all fisheries or even a few select ones would certainly produce heated controversy. And yet the legislature approved a limited entry bill for the abalone industry in 1976. All the parties to this legislation (AB 2224) -- DFG, processors, divers and industry lobbyists -- agreed that limited entry for abalone was necessary and that it was a special case not likely to set a precedent. Based upon this uniform opinion, the legislature avoided a serious consideration of the limited entry concept.

From a legislative viewpoint, abalone is not a compelling policy concern, but one on which the legislature is willing to act if DFG and the affected parties effectively present their case.

Public Sector Groups

None of the public sector groups interviewed for this study participated in the development of recent abalone legislation; although their views regard-

ing any implications that it might have for the sea otter are well known to policy makers in Sacramento and Washington. The environmental groups strongly advocate giving free rein to the sea otter, and if they are correct in their belief that the sea otter improves the abalone habitat, then their contention that abalone and sea otters can survive together has merit. But wich respect to the fishery (as distinguished from the species), one respondent argues, "abalone is a luxury product and not, therefore, an essential fishery." In other words, if there must be a choice between the sea otter and a viable commercial abalone industry, these groups will strive to secure a management plan that protects the sea otter. However, in previous policy statements the environmental groups have supported resource augmentation and area rotation as means to enhance the commercial take.

The several unions and fishermen's associations were asked for their views on limited entry as a general management plan. Opinion was split, with most respondents against the concept. One recurring complaint that led many to voice negative feelings about limited entry was the perceived inability of government agencies to fairly administer such a plan. None of those unions and associations interviewed felt that a limited entry program in abalone had an impact on them by way of a precedent. They all pointed to the differences between abalone and the fishery (ies) with which they were familiar and then argued that abalone was a special case.

Summary and Conclusions

Chart 3.1 provides a rough summary of the way different affected groups define the problems with the abalone resource and also shows their preferences for management of the resource. While much of what is in the chart is self-evident, several trends deserve special notice.

Chart 7.1

Summary of Problem Definition and Management Preferences by Affected Groups*

	Problem Definition	Management Preference
Commercial Divers	Inadequate Resource Otters Shorts Pollution Too many commercial divers Poor management practices	Limited entry - by number of divers and apprenticeships Resource augmentation No quotas Keep present seasons To tax on abalone take Area rotation
Sport Divers	Otters Inadequate resource Commercial divers Overfishing Shorts Poaching	Stricter enforcement/ stiffer penalties (against commercial divers and poachers) Contain otters Resource augmentation Keep north coast closed to commercial divers
Processors	Inadequate resource supply Otters Too many divers and too many inexperienced commercial divers Poor management/enforcement	Resource augmentation Open north coast to commercial divers No quotas
Resource Management	Too many divers and too many inexperienced commercial divers Improper harvesting Otter Pollution	AB 2224 ---→ reduced number of divers Shorter seasons Landing quotas Reduce some size limits Resource augmentation
Public Sector Groups	Divers - too many Inadequate enforcement	Give otter free range Resource augmentation Area rotation

*The entries in each cell are not in any particular order.

The first point that should be highlighted in Chart 3.1 is a fairly high degree of consensus on problem definition among divers, processors and resource managers. There are some important differences when it comes to management preferences, such as DFG's omission of area rotation and the strong desire of sport divers to keep the north coast off limits for commercial activity. Nevertheless, we found considerable support for the basic thrust ultimately embodied in the recently passed legislation (AB 2224).

Sea otters are clearly an important element in any listing of problems. All but the public sector groups see the sea otter as a negative factor contributing to a decline in the resource. What is interesting is that while commercial divers, processors and resource managers perceive the sea otter as a problem, they do not emphasize management preferences that might resolve the sea otter problem. To be sure, these groups would like to do something about the sea otter, but whatever their solutions to this problem might be they are not mentioned prominently in response to our questions. Despite their feelings about the problems caused by the sea otter, members of these groups apparently don't see any realistic opportunity to solve the problem so they turn their management preferences to other choices which stand a better chance of acceptance. Alternatively, it is possible to speculate that the reason that management preferences to "deal" with the otter were not prominently mentioned is that divers, processors, and resource managers do not really see the otter as an important contributor to the declining commercial fishery. In any event, attempts to contain or eliminate the sea otter will run head-on into conflict with key environmental groups and a difficult struggle can be predicted.

Resource augmentation stands out as a preferred approach by everyone

directly involved. To a certain extent, this management preference is a motherhood issue when it is stated in the abstract sense of simply increasing the supply of abalone through a seeding/mariculture program. However, conflict is likely to develop when any serious, large-scale effort is undertaken. For example, a full-blown seeding program may be accompanied by bottom leasing or area rotation plans and the details of any such plans may generate disagreement over locations, seasons, size of legal abalone from the seeding, etc. Likewise, we have seen in our data the beginning of controversy over the kind of abalone farming California Marine Associates and ARCO are starting in the Santa Barbara Channel.

Footnotes to Chapter 3

1 In addition to examining the attitudes and opinions of the abalone fishermen rank and file, efforts were also made to reach what might be called the fishermen leadership groups. Representatives of the California Abalone Association (a group of commercial divers organized since 1971) and the California Sea Food Institute were contacted and interviewed informally.

2 It should be noted that these two samples are not strictly comparable. First, the methods used to obtain information from each group were quite different: a personal interview in the "diver" case, a mail questionnaire in the "drop-out" case. Secondly, the "diver" sample includes divers only, while the "drop-out" mail questionnaire was sent to all divers and tenders who did not renew their 1974 licenses in 1975. Nevertheless, it is our impression that respondents in the mail questionnaire consisted mainly of divers, as all the questions pertaining to diving activities were answered.

3 The remaining 2.3% was in the miscellaneous category.

4 Adding up 1st and 2nd mentions.

5 Another 9.3% work out of Half Moon Bay, 7% from San Diego, and 4.7% from Morro Bay.

6 Adding up 1st and 2nd mentions.

7 Another 10.2% of responses dealt with factors such as other aspirations, wish for increased security, etc.

8 Adding up 1st and 2nd mentions.

9 In regard to other patterns of harvest, the "drop-outs" closely resemble the current divers sample, e.g. they report having dived a median number of 100 days per year; 62.8% dived from their own boat, 32.6% from other divers' boats, and 4.7% from a company boat; and 78.3% sold their catch to one processor only. The only basic differences between the two groups is the size of the catch reported. The median number of abalone dozens/per year reported by the "drop-outs" is 60 compared to a median of 200 for the "divers".

10 Another possible way of identifying abalone sport divers -- divers registered to purchase air -- also did not yield sufficient information as one could not assume that they would be interested in taking abalone.

11 The following clubs were contacted: 42 clubs belonging to the Central California Council of Diving Clubs (which includes clubs from Fort Bragg to San Luis Obispo), 56 clubs belonging to the Greater Los Angeles Council of Diving Clubs (clubs from Santa Barbara to Orange County), 10

clubs belonging to the San Diego Council of Diving Clubs, and 8 clubs belonging to the Valley Council of Diving Clubs (San Fernando Valley).

12 An inadequate supply of abalone, seen as the most pressing problem, is a problem caused by some combination of the other problems mentioned. In this sense the list of problems should be seen both as an indication of a perceived inadequate supply and as a presentation of the perceived causes of that inadequacy. It is interesting to point out the differences that do exist between the open and closed-end responses. In the open-ended question (Table 3.9) two problems not included in the closed-end item (Table 3.10) rank among the top problems mentioned -- i.e. no area rotation and poor management practices. This is symptomatic of the commercial divers' evaluations of state management practices -- a topic which will be treated below. Additionally, "Pollution" ranks as one of the most important problems in the closed-end item, while it is rarely mentioned in the open-ended responses.

13 Richard Burge, Steven Schultz, and Melvyn Odemar, "Draft Report on Recent Abalone Research in California with Recommendations for Management," Department of Fish and Game, Presented to California Fish and Game Commission, January 17, 1975. This section depends heavily on the Burge report.

14 David Zeiner, Oakland Tribune, February 25, 1976, p. 49.

15 Ibid.

16 Daniel Miller, Santa Cruz Sentinel, February 19, 1976, page 2, and The San Jose Mercury, April 19, 1976, page 13.

17 Ibid.

18 Burge, et al., op. cit.

Chapter 4

THE POLITICS AND ADMINISTRATION OF ABALONE MANAGEMENT PLANS

Introduction

A full understanding of how fisheries management plans are developed and implemented requires a careful assessment of relevant political forces. Management plans emerge from a political process in which different and often competing interests strive to advance their own objectives and viewpoints. Any potential management plan must be judged (in part) by its prospects of emerging from the political process. Some plans will so antagonize key actors in the political process that ultimate acceptance becomes impossible, while other plans take into account the potential reactions of those who make the final decisions. This chapter will show that politics -- thought of as conflict over the appropriateness of proposed policy -- plays an important role in the abalone fishery. It should be emphasized that in no way does our use of the term "politics" carry with it a negative connotation; politics is very much a part of any policy process, and the development of abalone management plans is no exception. The primary example of these political forces at work comes from the recent history of a bill designed to more closely manage the abalone industry.

AB2224: Politics and Legislation

During the 1976 session the legislature passed and the governor signed AB2224, a bill which marked a new departure in abalone management. The bill, introduced by Assemblyman Vincent Thomas, contains several major provisions:[1]

1) Prohibits the commercial taking of <u>any</u> species of abalone during February and August. (Since 1970 the law has prohibited taking

pink, red, green and black abalones during these two months.)

2) Increases the annual commercial abalone permit fee to $200 for divers and $100 for crew members.

3) Provides for the issuance of a commercial abalone diving permit in January, 1977 to only those who held one during 1976 and to an additional 5% (chosen by lottery) who can pass a proficiency test or who have held a diving or crew member permit in at least three years previous to 1976.

4) Requires a permit holder to land at least 10,000 pounds of abalone or make 20 landings in order to be eligible for a permit in succeeding years.

5) Directs the Fish and Game Commission to set the total number of abalone permits that will be issued once the existing number is reduced to 200 or by no later than January 1, 1981. As modified by AB2880, the number of permits established by the Commission may be fixed either above or below the 200 level.

6) All of the above provisions are in effect until January 1, 1981, unless the legislature changes the date in subsequent legislation.

This is essentially a limited entry law that restricts the number of commercial abalone licenses, does not provide for any "buy-back" program and uses a lottery to provide entry for those who are not grandfathered into the industry.

As discussed in previous chapters, AB2224 resulted from DFG's "Burge Report," which in turn was produced at the request of the Fish and Game Commission. So that they can be kept in mind during this discussion, the eight major recommendations in the Burge Report should be repeated:

1) limit entry to the commercial fishery

2) shorten the season to six months, to be split into equal segments

3) reduce the size limits on pink, green, and white abalone

4) establish landing quotas for each species

5) shorten the season and reduce the multi-day trip limits for sport divers in Southern California

6) shorten the season and reduce the bag limits for sport divers in Northern California

7) increase DFG's role in abalone mariculture

8) increase the commercial diving permit fee to $200 immediately and to $500 in 1980

Using authority to regulate sport fishing first delegated by the legislature to the Fish and Game Commission in 1945, the Commission responded to the Burge Report by changing the regulations for abalone sport divers, effective March 1, 1976. The daily bag limit was reduced from 5 to 4 statewide and the diver now must keep the first four abalone of legal size he takes. No longer can the sport diver keep looking for larger and larger-sized abalone and replace the smaller legals. The open seasons were also changed for sport divers. North of Yankee Point the open season is April 1 - June 30 and August 1 - November 30. South of Yankee Point the open season is March 14 - January 14, with the exception of the northeast side of Catalina Island where there is an area that is only open April 1 - October 1.

In the commercial sector, the report felt that the recommended changes would reduce the number of divers to approximately 70 within five years. Seventy was estimated to be an appropriate number of divers in relation to the resource available. The limited entry part of the report received the most emphasis.

Upon publication of the draft report, and before introducing implementing legislation to deal with the commercial fishery, Burge and his co-authors held public meetings in Santa Rosa, Santa Barbara, and San Diego. These very well attended meetings were designed to allow the affected parties an opportunity to hear about the report and offer comments; feelings often ran high as the more controversial parts of the report were discussed during the meetings. In Santa Rosa the sport divers -- who were clearly in a majority at this meeting -- were annoyed at the report's reduction in bag limits and the proposed shorter season, but apparently their greatest wrath was directed at DFG for "inadequate" enforcement of the law prohibiting commercial activities on the northern coast. Extensive illegal commercial activities were alleged.

Both the Santa Barbara and San Diego meetings were dominated by commercial divers and processors. Almost unanimously, those who spoke at these two meetings favored the general tone of the report with its emphasis on a greater degree of state management of the industry. Specifically, the concept of limited entry was endorsed. What aroused strong opposition were the proposals for shorter commercial seasons and a reduction in size limits. Both divers and processors argued that they simply could not stay in business if the season was shortened to six months as proposed. A complete shutdown of the industry was the predicted outcome of a six-month season. And in what seems like a reversal of roles, the commercial interests voiced disagreement with DFG's proposal to lower the size limit on certain types of abalone. The CAA argued that a reduction was unjustified on biological grounds, and processors especially were concerned about the inferior ratio of usable meat to shell weight in smaller abalones. The DFG size limit proposal was coupled with a quota on total landings, but the divers and processors did not believe that

adequate data were available to set appropriate and fair quotas. There were also intimations that not all landing information could be relied upon; that some "fudging" was occurring. In light of these alleged problems, the divers and processors argued for a more conservative approach than DFG.

Other major topics of concern at these meetings and in several follow-up letters were the sea otter and the status of commercial activity along the north coast. Not surprisingly, commercial divers and processors had very unkind remarks to make about sea otters. They strenuously argued for the development of a plan to "contain" the sea otters to their present feeding grounds along the central part of the coast. It was also clear from comments made at the Santa Barbara and San Diego meetings that opening the north coast for commercial activity was quite attractive to the divers and processors. They claimed that the resource in the north was adequate to support limited and carefully controlled commercial taking.

A formal position paper which made point-by-point comments on the Burge Report was prepared by the California Abalone Association (CAA).[2] As mentioned in Chapter 1, the CAA represented divers and processors who were estimated to account for over 2/3 of the abalone landings. After agreeing with the concept of limited entry and need for a moratorium on new commercial diving permits, the CAA paper suggested a few relatively minor deviations from the Burge Report approach to implementing the moratorium. With respect to other key parts of the Burge Report, they strongly opposed 1) shortening of the season to six months, 2) reduction in some size limits, and 3) landing quotas. The CAA also advocated several additional policy changes; these will be discussed in a subsequent section.

It was apparent from the meetings and correspondence that the DFG report

had been received with mixed reactions. On the major point of limited entry all involved parties seemed in basic agreement -- no easy task indeed. Controversy centered around the length of the season, quotas, the north coast and sea otters. After digesting the input, DFG officials modified their earlier recommendations and in cooperation with Assemblyman Thomas developed AB 2224 for introduction on April 28, 1975.

The bill was amended several times to accomodate some potential legal problems -- e.g. the original version did not contain a provision for any newcomers to the ranks of divers. After the bill suffered the usual delays for non-emergency legislation, it emerged from the legislature a little over one year after introduction. In the final analysis, the bill did not attract even one negative vote in either house (Senate: 35-0, Assembly: 65-0), but it also did not contain the features which the commercial interests felt were the most obnoxious parts of the Burge Report, and the issue of opening the north coast for commercial activity was never a part of the Burge Report or the legislation. In short, everybody got something.

Several tentative conclusions may be offered. First, DFG made an active effort to solicit comments on its management plan. Second, both sport divers and commercial interests took the opportunity and made their positions known loudly and clearly. Third, the interaction between DFG and the affected p[illegible] ties made a difference in the resulting legislation. Finally, because at the time of legislative decision making -- in committees and on the floors of both houses -- there was no opposition to DFG's modified proposal embodied in AB 2224, the bill drifted through without opposition.

Management Preferences and Politics

Having provided a brief case history of the enactment of AB 2224, we can now locate the resulting policies in the conceptual context outlined in Chapter 2, and relate them to the differing management preferences discussed in Chapter 3. This will help us gauge the relative political influence of the most directly affected groups in an effort to provide as accurate as possible a characterization of the political setting in which abalone management policies are determined. The present chapter will conclude with a discussion of some alternative management approaches.

In Chapter 2 we identified three distinguishable approaches to abalone management: limiting entry to the fishery, controlling access to the resource, and augmenting the resource. Prior to the adoption of AB 2224, the state had relied exclusively upon measures that controlled access -- size limits, restricted seasons and hours, gear restrictions, area closures, and quotas (bag limits) on the daily catch of individual sport divers. Responding to the Fish and Game Commission's request for a study of abalone management options, the Burge Report recommended an integrated program incorporating a combination of the three approaches we have identified: 1) limiting entry by specifying conditions that must be satisfied to renew or obtain a commercial diving permit; 2) imposing further controls on access by reducing the season for both commercial and sport diving and by establishing quotas on aggregate commercial landings as well as reducing the bag limits on the catch of individual sport divers; 3) augmenting the resource by intensifying efforts at abalone mariculture projects. The legislation that was ultimately enacted for management of the commercial sector adopted a modification of the first approach, omitted any changes in the second approach (with the

important exception of closing L.A. and Orange Counties for commercial divers), and made no tangible commitment to the third (although closing of L.A. and Orange Counties was viewed as a prerequisite to rehabilitating abalone stocks).

Management Preferences: Patterns of Agreement and Disagreement

Resource users. A comparison of abalone management preferences among the groups who are most directly affected reveals four distinguishable patterns:

1) universal support for limiting entry to the commercial fishery.

2) universal support for efforts to augment the resource, and willingness to pay additional fees that are earmarked for that purpose. This characterization excludes environmental groups, for whom this management option would not appear to be salient unless the manner in which it was implemented posed a threat to the well-being of the sea otter or its habitat.

3) a mixed picture of support and opposition with respect to controlling access. Apart from the proposal that sport divers be prohibited from "shopping" for larger specimens after they had reached the bag limit of legal abalones, none of the recommendations contained in the Burge Report was supported by all of the most directly affected interests (commercial, sport and environmental). The CAA and a majority of the individual divers and processors comprising our sample opposed all other proposals to further control access, including those associated with resource augmentation (i.e., bottom land leases for the mariculture of indigenous species), and even those that applied only to sport divers. The latter generally favored such proposals where they were directed at commercial divers and set no precedent that could be extended to sport divers (e.g., annual landing quotas as distinguished from a reduced and split season), but opposed them or sought to reduce their severity where aimed exclusively at sport divers.

Looking beyond the frame of reference established by the Burge Report, there were two additional proposals for controlling access that attracted widespread support among those interviewed. First, there was strong sentiment in favor of stricter enforcement of existing regulations--a call sounded most forcefully by sport fishermen who regard illegal diving activities as among the principal problems confronting the abalone fishery. A smaller but substantial number of commercial divers share this feeling, and so do the Friends of the Sea Otter: "It is clear that a larger budget and increased warden force are badly needed for better protection of the otter, its habitat, and the marine biological resources it must share with man."[3] Second, there was widespread support for the systematic rotation of open and closed fishable areas. Although this option was omitted from the formal recommendations of the CAA, it was the second most familiar proposal to our sample of commercial divers (following limited entry), and the one with which the greatest number agreed (81.8%). Rotation was also included in the commercial processors' proposals for future legislation, and recommended by sport fishermen in communications with the Director of DFG. Environmental groups have also expressed a favorable opinion on this management alternative, as long as it would not cause additional conflict with the sea otter.

4) a clearly defined and intensely contested disagreement between <u>all</u> abalone divers and environmental groups with respect to containment of the sea otter, and between commercial and sport divers with respect to opening the north coast to commercial diving. In both cases, the dispute extends beyond equity considerations to biological assumptions: does the sea otter consume enough abalones to significantly diminish their numbers, or does it indirectly enhance the resource by eating its competitors (sea urchins) and

improving the quality of its food source (kelp beds)? Are there sufficient numbers of accessible abalones north of Point Lobos to support a commercial fishery without decimating the stocks available to sport divers, will their quality consistently satisfy commercial standards, and are modern commercial diving techniques and gear capable of overcoming the obstacles posed by difficult weather conditions and a rugged bottom terrain? As the number and complexity of these questions indicate, there appears to be little prospect of moving toward a resolution of conflict on appropriate policy until there is a greater measure of agreement on factual assumptions.

Resource Managers. DFG scheduled three public hearings to afford interested parties an opportunity to comment on the recommendations presented in the Burge Report. Additional meetings were held with representatives of the commercial industry, several sport diving councils, and other interested organizations. The Department went into these encounters with an "all-or-nothing" policy package that implied a definitive analysis of the problems confronting the abalone fishery.[4] It emerged from them with recommendations for a more experimental approach that concentrated on what DFG believed to be the single most urgent problem: a high loss of sublegal abalone brought about by excessive picking pressure. As a first cut at controlling this problem, the Department recommended to the Fish and Game Commission that the commercial fishing effort be reduced "to a level that is adequate to harvest stocks and minimize handling mortality," and that pressure on the sport fishery be eased by shortening the season north of Yankee Point to six months, reducing the daily bag limit throughout the state to the first four legal-size abalone picked, and prohibiting the possession of more than two daily bag limits on declared multi-day fishing trips.

With respect to the commercial fishery, the Department's recommendations were treated as a prerequisite to future decisions on instituting size limit changes, landing quotas, and shorter seasons. The recommendations for the sport fishery were regarded as even more provisional:

> ...without control on effort, management schemes based solely on size limits and seasons will eventually fail to adequately protect the resource and provide a satisfactory take...Nevertheless, we feel (these) regulations are necessary to protect the stocks for the present time with the idea that in the near future a management plan can be devised to control and distribute effort and take on an area-by-area basis, and also resolve allocation problems between sport and commercial fishermen.[6]

Not all of the groups that would be affected by changes in the management of the abalone fishery agreed with DFG's definition of the problem, but they uniformly supported the principal method now proposed for attacking it -- limited entry to the commercial fishery. Although the Department's corollary recommendations for controlling access to the sport fishery had encountered considerable opposition, it was neither as intense nor as concentrated as the objections of the commercial industry to a shorter season and annual landing quotas.

Management Preferences: Levels of Support and Opposition

The path of public policy formulation is smoothed by consensus; where such consensus is weak or impossible to achieve, public policy is influenced by the level of support or opposition, and by the skill with which those positions are expressed. In the remainder of this section we will attempt to compare degrees of support for or opposition to abalone management alternatives among the groups that would be most directly affected, to characterize the effectiveness with which those opinions were represented, and to appraise the extent to which they were reflected in the revised recommendations of the Department of Fish and Game.

Owing to differences in the manner in which opinions were determined and in the specific questions asked, it is impossible to make strict comparisons of the intensity of management preferences. Referring back to the patterns of agreement and disagreement that we have delineated, the most consistent and reliable data are afforded by the structured interviews of a random sample of commercial divers. Using their responses as a kind of benchmark, we will derive estimates for the other groups from the most nearly comparable sources that are available.

Limited Entry. A moratorium on issuing permits to new divers was unequivocally supported by the California Abalone Association, agreed to by 77.3% of the commercial divers included in our sample, and either enthusiastically or cautiously endorsed by 5 of the 6 processors we interviewed. A comparable level of support from sport divers can be inferred from their strong tendency to define the abalone problem in terms of "too many commercial divers," which ranked first among their open-ended responses and second among closed-end responses. While neither the Friends of the Sea Otter nor the Sierra Club actively participated in the policy process that resulted in adoption of AB 2224, both groups have indicated that they "actively support" any limitation of fishermen numbers. Given the breadth of support for a policy of limiting entry, the only source of potential disagreement was the manner in which such a policy would be implemented.

Resource augmentation. With the exception of environmental groups who expressed no opinion, the breadth and level of support for this management option equaled or exceeded the consensus for limited entry. The CAA had already sponsored a modest seeding program in Santa Barbara, and concurred "almost completely" with the DFG concerning its mariculture recommendations.

(The reservation related to the proposal of bottom land leases.) Seventy-five per cent of commercial and 72.5% of sport divers indicated their willingness to contribute additional fees for seeding purposes, and 5 out of 6 processors included abalone seeding among the future management proposals they would like to see implemented.

Controlled access. We have already noted a mixed pattern of support and opposition with respect to the various measures proposed by DFG for controlling access. Our present concern is with the breadth and intensity of those positions, and the consequent latitude for reconciling or moderating them. Looking first at the three proposals for the commercial fishery -- a shortened and split season, reduced size limits, and annual landing quotas -- it is clear that all segments of the industry are strongly opposed to a shorter season. The CAA views this as a last resort that could only be justified by the failure of every other alternative. The commercial divers oppose it to exactly the same degree that they favor limited entry (77.3%), and the largest commercial processor asserts that a split six-month season in itself is enough to kill this fishery in the market.

The industry is equally unanimous in its opposition to a categorical reduction in size limits on pink, white, and green abalones: the CAA challenged both the recommendation and the data from which they were derived; commercial divers located "legal size too large" at the bottom of a list of eleven suggested problems (only 6% regarded it as serious), and processors were dismayed by the prospect of losing a year or more of breeding potential in return for a temporary increase in the supply of legal-size abalones that would show an inferior ratio of usable meat to shell weight. It should be emphasized, however, that these objections were directed at the DFG's recom-

mendation of a blanket reduction in size limits for the three species; selective changes designed to take account of a poor supply of food or genetic mutations in specific beds were supported by some processors and by the Santa Barbara-based, CAA-sponsored California Abalone Seeding Association.

Controlling access through annual landing quotas was also opposed by all segments of the industry, but with the exception of processors -- all but one of whom were flatly against either individual or industry-wide quotas -- the preponderance of opinion was neither as extensive nor as unqualified as it was to the preceding measures. The CAA joined 63.7% of commercial divers in opposing industry-wide quotas under present circumstances, but the Association left the door open for reconsideration of that position if accurate production figures were available for each species, if -- after a sufficient interval to determine the effect of limited entry -- those figures indicated that quotas for selected species were justified, and if size limits were not reduced. The existing limit on an individual diver's daily catch of black abalones was also cited as an alternative approach that had been worked out in cooperation with DFG. Perhaps the most significant exception to the industry's general position on landing quotas is to be seen in the CAA's statement that "a quota system concerning the commercial harvest of the north coast deserves the consideration of the Department of Fish and Game in order to utilize a vast resource which is at the present primarily wasted."[7]

The Burge Report's recommendations for further controlling access to the sport fishery included a statewide prohibition against exchanging smaller for larger abalones once the bag limit had been reached, a reduced season -- to six months in the north and to seven months in the south, and in the north only, a bag limit reduction from five to four abalones. Since our firmest

aggregate data come from the structured interviews of commercial divers, and since the commercial divers do not perceive competition from sport divers to be a very serious problem, our assessment of the uniformity and strength of opinions regarding management alternatives for the sport fishery is somewhat narrower and more impressionistic. The industry's limited concern with the sport fishery may be explained in part by the concentration of the commercial fishery in the south and of the sport fishery in the north; the comparatively greater concern of sport divers with competition from commercial divers in turn may be explained by sport divers' widespread perception of illegal commercial activities in the north. To the extent that the industry does express opinions about the sport fishery, these do not appear to be marked by a high level of intensity.

The most systematic representation of industry attitudes toward regulation of the sport fishery is to be found in the California Abalone Association's review of the Burge Report. Apart from endorsing the proposal that all legal abalones that have been picked by sport divers must be retained, the CAA favored a quite different approach that combines inhibitions to entry -- through stamps, tags, and nominal skill requirements -- with alternative measures for controlling access: increased size limits for sport fishermen and more stringent gear requirements. The CAA opposed reductions in the season or bag limits, and favored uniform policies for sport divers throughout the state.

Drawing upon testimony at public hearings and communications with the Department of Fish and Game, attitudes toward the Burge Report recommendations for the sport fishery may be summarized as follows:

1) There was no opposition among either sport or commercial divers to the proposal that all legal abalones picked be retained;

2) The most uniform and intense concern of sport divers was directed at proposals to reduce the fishing season. Although a majority did not insist upon retention of a full 10-month season, there was no consensus on how many or which specific months should be retained;

3) Apparently reflecting the greater interest expressed by sport divers on the central and north coast, the second most common and serious concern centered upon proposals that would permit more generous season and bag limits in the south, and draw the line distinguishing the two regions as far south as Point Conception;

4) Apart from the inequity of establishing different bag limits in the north and south, there was a mixed reaction from sport divers to the proposal that bag limits in the north be reduced from five to four -- some were adamantly opposed, others indifferent, and still others prepared to accept an even lower limit of three.

Management Policy Recommendations: The Burge Report Reconsidered

In view of the preceding assessment, a comparison of the proposals contained in the original Burge Report with the recommendations that were ultimately forwarded by DFG to the Fish and Game Commission is illuminating. Such a comparison could also be misleading, however, if it led to the conclusion that the Department simply acquiesced to the objections of one or more of the most directly affected groups. It must be remembered that the Department of Fish and Game is itself one of those groups -- it is the agency responsible for administering the policy of the state with respect to the abalone fishery, and as is made clear by the expectations of commercial divers and by the strong preferences of sport divers and environmental groups for stricter enforcement, it is to the state that the fishery looks for a resolu-

tion of its problems. In formulating policy recommendations the Department must be mindful of their consequences for its relationship with other agencies (such as the Fish and Game Commission and the legislature), of its internal organization, and of its enforcement capabilities. Having determined the measures that in its judgment would be the most effective in furthering the DFG's mandate to protect and enhance the state's marine resources, it must make an estimate of the likelihood that they will be accepted by the Fish and Game Commission and the legislature, and weigh the Department's capacity to implement them.

Differences between the Department's draft (Burge) report and its final recommendations reflect all of the foregoing considerations: challenges to the validity of its biological assumptions contributed to a shift in emphasis from an integrated final solution to an incremental approach that singled out the most promising first steps; indications of the breadth and level of support for or opposition to specific alternatives afforded clues as to which of them were most likely to be adopted, and which would maximize voluntary compliance upon implementation; reflection on the more intensive management role and enforcement effort that would accompany certain of the proposals included in the Burge Report or advanced by the industry served to further narrow the range of realistic options. With specific reference to the major alternatives that we have examined:

Limited entry. Whatever objections there might be to DFG's assumptions about the significance of damage to sublegal abalones by bar-cutting, everyone agreed that there were too many divers going after too few abalones. Whether the principal problem was defined as biological, economic or social, limiting entry to the commercial fishery was widely regarded as an appropriate response.

A consensus in favor of this approach augured well for its adoption by the legislature, and the simplicity of the method proposed to implement it (a moratorium on new entrants) required no changes in DFG's organization or mission. Furthermore, by reducing the number of licensed divers that DFG would be required to monitor, it was thought that this procedure could actually facilitate enforcement.

Resource augmentation. Limited entry was expected to eliminate the less experienced divers, and thereby reduce premature mortality from bar cutting. It was also expected to improve the economic well-being of the commercial divers who remained, and -- to the extent that commercial and sport divers were in competition with one another -- to improve recreational opportunities. But in the long run there would not be much prospect of significantly expanding recreational opportunities or satisfying a growing commercial market without substantially increasing the supply. Hence the widespread support and willingness to pay for abalone seeding projects. However, some important contingencies are attached to this approach: 1) it remains to be demonstrated that large-scale seeding programs are feasible, and if so, on what basis -- with open access to all sport and commercial divers, on bottom lands leased to a limited number of commercial divers (a potential restriction that has already been opposed by the California Abalone Association and that may conflict with the state constitution's guarantee of the right to fish), or for the even more limited purpose of rehabilitating areas that have been almost totally depleted; 2) any substantial expansion of resource augmentation efforts depends upon legislative action to acquire and appropriately channel the funds that commercial and sport divers have indicated they are willing to contribute for that purpose, and upon the provision of administrative

mechanisms for translating those funds into a vigorous program.

Controlled access. It should come as no surprise that all of the Burge Report proposals for controlling access to the commercial fishery were omitted from DFG's final recommendations, for each of them failed to clear one or more of the hurdles we have identified: a reduced season was intensely opposed by all segments of the industry, who regarded it as the death knell for a commercial fishery. The breadth and strength of this feeling promise a serious conflict when the proposal reached the legislature, and DFG would have a difficult time justifying such a drastic step when the effects of limiting entry were still unknown. A reduced size limit was similarly opposed by the industry, which buttressed its position with a detailed criticism of the data and assumptions on which the proposal was based. Since the recommendation for establishing landing quotas was primarily designed to forestall a "bonanza" harvest of the species on which size limits were reduced, rejection of the first proposal would eliminate the rationale for the second. Moreover, the imprecision with which the various species are differentiated on landing tickets would have compounded the enforcement problems posed by the industry's resistance to quotas, all of which may have dissuaded DFG from pressing its case for these interrelated proposals unless limited entry proved to be incapable of protecting the resource.

The experience of proposals to further limit access to the sport fishery is distinguishable in two respects: first, the breadth and intensity of reactions to these proposals were much less uniform than in the case of recommendations for the commercial fishery; and secondly, anticipation of the legislature's reaction did not figure in the process, since the Fish and Game Commission has been delegated authority to regulate the sport fishery. Given

these differences, it is not surprising to find that where objections were encountered, the tendency was to modify rather than to simply withdraw the original proposals: The season was reduced to seven rather than six months in the north and unchanged in the south, while the line distinguishing the two regions was shifted northward from Point Conception to Yankee Point (near Monterey). A longer season in the south could be rationalized in terms of better weather conditions, and -- therefore -- less likelihood of bar-cutting sublegal abalones during winter dives. Different bag limits in the north and south might be rationalized on a weight basis, since the most frequently harvested species tend to be smaller in the south than in the north, but on this point the Department responded to claims of inequity from northern sport divers by recommending a uniform lower bag limit of four abalones throughout the state. The prohibition against shopping for larger abalones once the bag limit has been reached was unopposed, and unchanged.

Political Effectiveness

To this point, we have been concerned with responses to DFG proposals that evoked a consensus -- one way or the other -- among all affected groups, or that met a mixed reaction from the one group that was most directly affected. We turn now to two proposals that originated with the industry rather than DFG, and that have generated an intense conflict among affected interests: containment of the sea otter and opening the north coast to commercial diving.

While it would be an exaggeration to hold these two concerns exclusively responsible for the low esteem in which the DFG is held by commercial divers, they appear to have become focal points for the commercial diver's belief that DFG is unresponsive to his problems. This would appear to be at odds with the industry's recent experience. Since 1969, when the CAA first became

active, a majority of the proposals that it has advanced or endorsed have been adopted: the size limit was reduced on green abalones and increased on pinks; the twenty-foot law was suspended on some portions of the Channel Islands; the season was changed to close the months of February and August (rather than mid-January through mid-March); the prohibition on the drying, canning and export of California abalone was repealed; experiments to determine the feasibility of abalone seeding were undertaken, and although the industry-sponsored apprenticeship program was short-lived, it proved to be the precursor of proposals to directly limit entry. Furthermore, as we have just seen, virtually all of the objectionable features associated with limited entry -- a shorter season, reduced size limits, and landing quotas -- were dropped from DFG's final recommendations to the Fish and Game Commission and the state legislature.

Despite the preceding record, the perceptions of many commercial divers are represented in the comment of one that "it doesn't seem like anything we say is passed, or if it is it's so greatly modified that it's not what we want anyway."[8] The apparent discrepancy between experience and perceptions could be a result of ignorance or forgetfulness of what has been accomplished, or a measure of the divers' frustration by at least two objectives that remain unfulfilled -- containing sea otters and opening the north coast.

Containing the sea otter. The sea otter controversy dates back to the early 1960's, when-- the industry contends -- it took nearly five years to convince the Department that the otter posed a threat to abalone stocks. Once persuaded of the threat, DFG was caught in a crossfire of opposing positions, with commercial and sport divers seeking containment of the otter, and the Friends of the Sea Otter and Sierra Club striving to protect their freedom

to roam and propagate throughout their natural range.

In 1972 state jurisdiction over the sea otter was preempted by the Federal Marine Mammal Protection Act. In subsequent years, DFG considered the creation of a sea otter refuge on San Nicholas Island. This option was originally supported but later discounted by the Friends of the Sea Otter, consistently rejected by commercial abalone fishermen, and ultimately dropped by DFG upon its identification of some harmful side effects. More recently, DFG requested that the Secretary of the Interior restore the state's authority to manage the southern sea otter. This request was vigorously opposed by the Friends of the Sea Otter, and as the likelihood increased that they would succeed in their effort to have the sea otter declared an endangered species, the Department withdrew its original request for full management authority in favor of a scientific research permit to determine the potential "relocatability" of the sea otter. While the Friends have endorsed a "pilot experiment to capture not more than 30 otters for translocation to the northern end of their present range," they have not conceded any justification for limiting the sea otter's range.

In pursuing their vision of the public interest, the Friends of the Sea Otter enjoy the advantages of a larger and more diversely composed membership, a sharpness of focus that enables them to concentrate on a single objective, and perhaps most importantly, a capacity to take advantage of a shift in the policy-making arena from Sacramento to Washington D.C., where they can capitalize on a national clientele and the sympathy of organizations like the Sierra Club. Having at last secured DFG's support of its efforts to contain the sea otter, the abalone industry finds itself little closer to achieving that objective, and not all of its members may appreciate the constraints

within which DFG must operate.

Opening the north coast. The political problem posed by the closure of the north coast is rather different from that posed by the sea otter. Experience with other proposals sponsored by the abalone industry indicates that DFG support is a necessary -- if not always sufficient -- condition of adoption, and DFG remains to be convinced of the advisability of opening the north coast to commercial diving. In 1951 the Department undertook a special study of the capacity of the north coast to support a commercial fishery. At that time it specified several requirements that needed to be satisfied before the question of competition with the sport fishery could even be entertained:

> There must be sufficient abalones in the area and these must meet required size and quality standards. Adequate and safe shelter must be available for the diving boats, the fishing area must be accessible to the fleet and the weather must be calm enough to permit diving sufficiently often to make the operation profitable. Water clarity (underwater visibility) and bottom terrain, while not as critical, must also be considered.[9]

Upon completion of its study in the mid-1950's, the Department concluded that "none of the north coast areas investigated met any of the criteria," and that the question of impact on the sport fishery was therefore academic. But circumstances have changed in two decades -- quality standards are not as high as they were when red abalones were still fairly plentiful, the Radon boat has somewhat reduced dependence upon stable weather conditions and nearby harbors, and dwindling stocks in the south have already forced divers to explore difficult bottom terrain. DFG is not unmindful of these changes, but even assuming (and it remains a big assumption) that the earlier criteria could not be satisfied, the question of competition with sport divers would no longer be academic, and the potential mobilization of thousands of sport

divers throughout legislative districts along the north coast cannot help but make DFG officials question the political feasibility of opening the north coast to commercial diving. Finally, uncertainty regarding the biological, commercial and political feasibility of this step would almost certainly dictate an experimental approach requiring an intensive managerial role to be played by DFG, and historically that agency has been more oriented toward protecting marine resources than toward systematically managing them for purposes of enhancing commercial benefits.

In sum, if the abalone industry is to succeed in its effort to open even carefully delimited areas of the north coast on an experimental basis, it must first enlist the support of an agency that has many reasons to be skeptical of such an effort, and then overcome predictable resistance from sport divers once the proposal reaches the legislature. (It will be recalled that 88% of the leadership of sport diving associations indicated their opposition to opening the area north of Point Lobos to commercial diving.) Perhaps the one thing that the industry has going for it, as far as the sport divers are concerned, is the prospect that close monitoring of legitimate commercial diving might limit the black-market activities that sport divers allege to be so extensive in the north.

Administrative Considerations

Beyond its historic orientation toward research and its statutory responsibility for protecting marine resources, DFG's response to abalone management proposals is influenced by manpower limitations and prospective enforcement problems.

Personnel

Apart from a small appropriation from the general fund that is earmarked

for non-game animals, the Department's revenues are derived from the sale of licenses, stamps, tags, and permits; from fines levied for violations of fish and game regulations, and from taxes imposed on the commercial catch. The bulk of its funds comes from sportsmen, and are designated for the protection and enhancement of sport fishing (and hunting).

Any change in management responsibilities that would require additional staff will also entail additional funds to employ them, and the source of those funds is not self-evident. Sport fishermen are not likely to favor the use of their license fees for the benefit of the commercial divers whom they view as competitors, and while industry members may be prepared to pay additional fees to support activities which they approve -- such as abalone seeding projects -- the closer supervision that accompanies more intensive management will not always be welcome. There remains the possibility of tapping the general fund, but that would substantially broaden the base of affected interests, and thereby increase the sources of potential opposition to any given management proposal.

Enforcement

To the extent that any management option involves closer supervision, it will require the diversion of existing staff or the provision of additional staff. However, some proposals may be intrinsically more difficult to enforce than others. Of the several management proposals that we have canvassed, the one that received most extensive support among commercial divers was the rotation of open and closed fishable areas. Because that approach may also be among the most difficult to enforce, it can be used as an example of the administrative consequences of a management plan.

The objective of area rotation is to afford selected abalone beds total relief from picking pressure, thus promoting spawning and recruitment while reducing the picking, replacement and frequent bar-cutting of sublegal abalones. But some enforcement personnel doubt that these assumptions would prove to be valid beyond the first closure, as they foresee redoubled pressure on the closed area once it is reopened. Area rotation would therefore require some limits on what could be taken from open areas to prevent serious overharvesting.

The feasibility of enforcing an area rotation program depends upon the degree of refinement sought. If the areas to be rotated are as vast as the entire north and south coasts (as one processor has suggested), then the provision of a substantial buffer zone between the two regions could make enforcement relatively easy. If, on the other hand, the areas were as precisely delimited as two nearly adjacent beds, enforcement could be extremely difficult: in the absence of natural boundaries it would be hard to distinguish closed from open areas, and even if this problem could be overcome, divers ostensibly fishing for urchins in areas closed for abalone could remove them to open areas, where they could be retrieved by a friend or by the same diver on the following day. And if, as many processors have suggested, area rotation is associated with opening selected portions of the north coast, with quotas to be established for specific beds, the problem of keeping divers within designated areas would be compounded by the need to monitor their take, and perhaps to limit the number of divers permitted to fish these areas.

DFG's awareness of the administrative problems that might accompany area rotation may help to explain that agency's apparent unresponsiveness to a proposal that is strongly supported by commercial divers, that has been sup-

ported in the past by environmental groups, and that in principal would not seem to be objectionable to sport divers. However, it should be noted that the industry has made little organized effort to press for adoption of this proposal -- it was not included in the CAA's formal response to the Burge Report, though the omission was reportedly an oversight -- and DFG could not be fairly characterized as flatly opposing the idea. Indeed, as noted earlier in this chapter, its recommendations for the abalone sport fishery anticipated a future management plan that would "control and distribute effort and take on an area-by-area basis, and also resolve allocation problems between sport and commercial fishermen."[10] Despite the problems that we have identified, enforcement of such a plan could be eased by the prior implementation of limited entry, which is expected to screen out the part-time commercial divers who have the least concern with preserving the resource, and the least incentive to police themselves.

Conclusion

In concluding this chapter it may be useful to identify three conditions that must be satisfied before policy preferences can be translated into governmental action. First, the policy-making process must be activated -- no matter how extensive the support for a given policy option, it will have no effect until a specific proposal is placed on the agenda of appropriate public agencies. Secondly (at least in democratic governments), it is necessary to demonstrate a consensus in favor of the proposal, or to reach a compromise that leaves no influential groups strongly opposed to it, or to balance a policy that is opposed by a particular group with a policy that it supports. Finally, funds, personnel, and organizational structures must be provided to effectively implement proposals that have cleared the first two hurdles.

Tracing the progress of recent abalone management proposals through this obstacle course, we find that limited entry stands at the point of implementation; and as the program is presently formulated, implementation requires no additional funds or personnel. Proposals for augmenting the resource through seeding projects have received universal support but await the funding, personnel, and organizational arrangements required for full-scale implementation. Proposals for further controlling access, on the other hand, have experienced mixed success; certain recommendations for the sport fishery have already been implemented. Other proposals, such as containment of the sea otter and opening of the north coast to commercial divers, have not yet resolved the sharp disagreements among contending interests that forestall implementation. Still other proposals, such as area rotation, have yet to be clearly placed on the policy-making agenda.

Recent experience with proposals to further control access to the resource appears to be most suggestive of the political and administrative context in which future abalone management options will be addressed. It is a context in which it is unlikely that consensus on procedure can overcome differences in objectives, as was the case with limited entry, and that will therefore require some hard choices as to which definitions of the abalone problem should receive priority. The nature and implications of these choices will be discussed in the final chapter.

Footnotes to Chapter 4

1 A companion bill(AB 2880) was introduced after AB 2224 had moved part way through the legislative process in order to 1) make minor technical changes in the language of AB 2224 2) close the coast to all taking from Palos Verde Point (Los Angeles County) to Dana Point (Orange County) for a five-year period, and 3) establish new regulations dealing with the taking and possession of black abalones near and around some of the Channel Islands.

2 California Abalone Association, "Review of the Abalone Research Report Prepared by Operations Research Branch and Marine Resources Region of the State of California Department of Fish and Game of 17 January 1975: Comments and Recommendations of the California Commercial Abalone Fishery;" undated, mimeo.

3 Letter from Friends of the Sea Otter to Charles Fullerton, Director, California Department of Fish and Game, January 7, 1976, p. 11.

4 "These measures are presented as an integrated program and their effectiveness requires that the concepts of the entire program be adopted and not be accepted or rejected on an individual basis." (Burge, et al., p. 5).

5 Richard T. Burge, "Abalone Management Report," presented to the California Fish and Game Commission on October 3, 1975; mimeo, p. 4.

6 Ibid., p. 5.

7 California Abalone Association, "Review of the Abalone Research Report...," op. cit., p. 18.

8 When commercial divers were asked to indicate whether they felt they were able to influence state government, 31% of the sample said they could, 31% said it depended on the situation, and the remaining 38% said they could not influence state government. And yet most commercial divers in the sample (70.5%) had attended one or more meetings devoted to discussions of problems in the abalone industry. Many divers try to influence policy, but there is not a widespread feeling of high efficacy.

9 Keith W. Cox, "California Abalones, Family Haliotidae," Fish Bulletin No. 118, (California Department of Fish and Game, 1962), p. 103.

10 Burge, "Abalone Management Report," op. cit., p. 5.

Chapter 5

SUMMARY AND CONCLUSIONS

Introduction

The first part of this final chapter is devoted to a summary of the ideas developed and presented in preceding chapters. This will be a short summary and does not pretend to capture the nuances of the previous material. By way of concluding remarks, this chapter tries to articulate some of the major issues that arise from the analysis of abalone resource management, the important policy choices that have been made and some trade-offs about which decisions must be made in the near future. Some specific policy actions are then suggested.

Summary

The world's fishery resources are not limitless and the growing recognition of this elementary fact has been the impetus behind a new surge in this country and elsewhere toward a more active governmental management of fishery resources. A management technique known as limited entry has attracted worldwide attention and actual implementation during the last few years. Essentially, limited entry refers to any one of several ways in which government controls the number of fishermen who are legally eligible to take a fish species (usually for commercial purposes). Experience with limited entry programs is too recent for a thorough evaluation of the consequences. What is disturbing is that very few limited entry programs have been or are collecting data that will allow measurement of program consequences. It is clear, however, that every limited entry program should be designed to fit the specific needs and conditions of each particular situation

-- blanket, universal rules will not work in all cases. Furthermore, limited entry programs in any one fishery may have impact on other fisheries and these consequences must be carefully considered. There are, in addition, some serious problems of administration that must be addressed in order to assure the equitable and efficient implementation of a limited entry program.

Probably the single most important generalization to be made about the abalone resource, and especially its commercial use, is that this decade has seen a drastic decline in its availability. Total commercial landings, and by all accounts individual recreational landings, have fallen off considerably. Among the more prominent reasons for the decline are the exhaustion of accumulated (virgin) stocks, the frequent picking of immediate sublegal size abalone and the resulting high mortality rate from bar-cutting, sea otter foraging, and the large number of divers who have been attracted to the commercial fishery in recent years. The combined impact of these forces has resulted in a serious decrease in the abalone harvest. Indeed, many formerly rich ocean beds are now barren.

It became apparent to many that some action was required if the resource were to be preserved in the area between Point Lobos and the Mexican border. Those engaged in the policy-making process had three basic management plans to consider: limited entry, limited access, and resource augmentation. While there is no reason why each of these basic types must be implemented separately, the interaction of the species' biological requirements with political and administrative constraints and realities dictated an abalone policy approach that leaned heavily upon limited entry for the commercial fishery.

The development of any abalone management plan, and especially its

successful implementation, depends upon the interaction of resource managers, affected interest groups and whatever public sector groups define abalone resource issues as relevant to their goals. To better understand the way these different parties define the issues and express their preferences for problem solutions, Chapter 3 concentrated upon data gathered from interviews with all segments of the industry, recreational users, resource managers and relevant public sector groups. There is a reasonably high degree of consensus on problem definition, but, as to be expected there are several differences when management preferences are stated. Reflecting the process of compromise that produced AB 2224, we found considerable support for the limited entry thrust of that recently passed law. It also appears that resource augmentation is something of a motherhood issue. Everyone wants to increase the supply of abalones; finding the money and scientific knowledge necessary to make a resource augmentation program successful may be a very different and difficult matter.

It is interesting to note that by the time the new legislation (AB 2224) was heard by relevant legislative committees, the process of compromise had managed to include only those features in the bill that would not receive strong opposition. Indeed, there was no visible opposition at all. With respect to future abalone management policy, there are some very clear areas of agreement and disagreement between the interested parties as well as some mixed reactions on a few possible policies. For those subjects of agreement -- such as the widely shared desire for resource augmentation -- the political process "simply" requires a coordinated campaign to secure the necessary money and talent. However, where there is disagreement over future policy -- such as the use of area rotation or containment of the sea otter -- the end result

will be determined by the relative political effectiveness of the affected parties. The role adopted by DFG in those policy areas where there is disagreement will be crucial. DFG is both affected by its clientele and in turn the Department has important impact on its clientele. Is is often very hard to know the net impact of DFG as a result of this two-way interactive process, but it is obvious that DFG's policy position will play a very important role in legislative considerations and the deliberations of the Fish and Game Commission. DFG is moving into a relatively new role as it becomes a more active, aggressive marine resource manager. As it moves into these uncharted waters it will automatically become embroiled in increasing political controversy as affected interests seek their own best position and also seek DFG's support.

To conclude this brief summary, it may be helpful to recount the current (as of January 1, 1977) status of abalone management in California. Although there is no need to repeat the details of AB 2224, some of its major provisions and intended effects should be remembered. The new law limits the number of commercial abalone divers by only granting renewed diving permits to those who currently hold a permit and to a very small number of new divers. By limiting the number of "permanent" commercial divers, and presumably making it difficult for part-time divers to satisfy minimum landing requirements, the anticipated decrease in picking pressure and bar-cutting mortality from inexperienced divers is intended to stabilize the declining resource base. In the sport sector, the open season has been reduced as has the daily bag limit. The north coast, the sea otter, area rotation and quotas are among the major issues left unresolved.

Another unresolved question is posed by legislative provisions for ad-

justing the total number of commercial abalone diving permits to the capacity of the resource. AB2224 and AB2880 provide a mechanism for limiting the number of commercial divers beyond the provisional target of 200 permits. The Fish and Game Commission is delegated responsibility for establishing the number of commercial permits to be issued at such time as the (then) current permits are reduced to 200, or in any event, no later than January 1, 1981 (at which time all of the limited entry provisions of AB2224 and AB2880 automatically expire, unless further legislation is forthcoming prior to 1981). A literal reading of both AB2224 and AB2880 indicates that if the number of then current commercial permits is either greater than or less than the number justified by the status of the resource, as determined by the Commission, then all commercial divers must take their chances in a drawing of qualified applicants, with qualification to be determined by either prior experience or passing a proficiency test. Requiring existing permit holders to compete in a drawing will undoubtedly generate considerable controversy. If it were not the intent of the legislature to require existing permit holders to be involved in the drawings (as has been suggested to us), then additional legislation seems necessary. This situation opens the possibility that the delicate balancing of interests that produced both pieces of legislation may slip into debate and disagreement.

Conclusions

The implementation of a limited entry program does not preclude additional measures for managing the abalone fishery, but the need for such measures hinges in part on the effects of limited entry. It is therefore important to obtain base-line data thatare as free as possible of controversy over factual premises. These data should refer to both the resource and

its users, including:

1) The designation of representative beds for a "before and after" census of abalone populations in the immediate sublegal size class;

2) The compilation of accurate records of effort and take by both species and area, perhaps employing a log-book system for commercial divers and a tag or report-card system for sport divers;

3) The collection of socio-economic data on commercial divers who fail to renew their permits after AB 2224 takes effect, in order to determine the size of their annual catch, how much time they spent diving, and why they dropped out.

While the impact of limited entry will provide a new frame of reference for assessing such management options as landing quotas and shortened seasons, there are other proposals that are largely independent of efforts to limit entry, including intensified seeding programs, opening the north coast to commercial diving, and containing the sea otter. These proposals are presently marked by varying degrees of controversy, but just as the prospects for avoiding controversy over the impact of limited entry will be affected by the quality and the extent of agreement on the data, prospects for reducing controversy over the latter proposals will depend heavily on opportunities for reducing uncertainty about the factual premises on which those proposals are based.

There appears to be little disagreement over the desirability of augmenting abalone resources through intensified seeding efforts, but it is by no means certain that such efforts will prove to be feasible under conditions that are mutually acceptable to commercial divers, sport divers, and the Department of Fish and Game and at the same time meet all legal requirements.

DFG officials do not foresee major gains from seeding efforts that are not accompanied by some form of controlled access, such as bottom land leases. Unless this position is reinforced by supporting evidence, consensus on the general policy is almost certain to give way to controversy over its specific implementation.

There is considerable scientific research as well as old-fashioned trial and error that will be necessary before seeding becomes a reality. It behooves DFG to make its position clear: Will it invest its resources in a large-scale seeding effort? Will DFG support only small-scale experimental efforts? Will DFG refuse to participate at all? The industry and the sport sector should get an answer so that they may proceed accordingly.

If more specific information may be needed to preserve agreement on the desirability of abalone seeding, it is certainly required to break down barriers to the serious consideration of proposals to open the north coast. But where a present consensus supports efforts to obtain better data with respect to seeding, the expectation of vigorous opposition to opening the north coast has precisely the opposite effect. Even the most tentative and experimental proposals for commercial diving north of Point Lobos will not reach the public policy agenda until they are supported by some evidence that conditions have changed significantly since that possibility was last rejected in the mid-1950's. But the issue is perceived to be so politically volatile that DFG is reluctant to initiate the necessary research.

As indicated by DFG's efforts to determine the feasibility of arresting the southward migration of the sea otter, that agency is prepared to undertake politically sensitive research if it perceives a serious threat to a resource. While much remains to be learned about the complex interrelation-

ship of abalones, sea otters, sea urchins and kelp beds, the Department does not appear to be over reaching the available evidence in assuming the incompatibility of sea otters and extensive abalone populations. It may be true that -- within the historic range of the sea otter -- abalone stocks would not have reached commercial numbers in the first place if the otter population had not been nearly extinguished, but it may also be true that the resurgence and spread of the sea otter contributed to the depletion of abalone stocks. For the time being, it appears that the formulation of appropriate public policy for dealing with this problem would be advanced if all of the contending interests would simply stipulate the impossibility of sustaining both an uncontrolled otter population and a viable commercial abalone fishery. The important question is not one of ascribing responsibility for this situation, but of determining what adjustment of more narrowly defined interests best represents the broader public interest.

Pending an estimate of the impact of limited entry and the clarification of factual premises about the feasibility of resource augmentation, of controlled commercial access to the north coast, and of stabilizing the perimeters of the sea otter's range, any assessment of political and administrative considerations is uncomfortably speculative. Having noted this substantial qualification, the range of public policy options may be summarized as follows:

1) What adjustment of competing interests can be achieved with nominal administrative and political costs? Here the answer appears to have been provided by the unopposed adoption of AB2224 and the nearly self-enforcing principle of limited entry that it embodies;

2) What further adjustment of competing interests might be achieved if

increased administrative and political costs were accepted? Here the range of alternatives appears to extend from substantial acceleration of abalone seeding projects through the rotation of open and closed diving areas to selective opening of the north coast to commercial diving;

3) What trade-offs, or mutually exclusive choices, may have to be considered if it proves to be practically infeasible to further reconcile competing interests, or if management agencies are unprepared -- for whatever reasons -- to assume responsibility for more intensive management of the abalone fishery?

The first possibility is most clearly illustrated by the conflicting objectives of the Friends of the Sea Otter and of commercial and sport abalone divers. Even if DFG experiments demonstrate the feasibility of containing the sea otter through capture and relocation, such a program would conflict with the stated intent of environmental groups to assure that the sea otter is allowed to roam freely throughout its natural range. And if it proves to be infeasible to capture and relocate the sea otter, then it appears that a hard choice will have to be made between the systematic elimination of migrating sea otters or tolerance of their progressive depletion of abalone stocks. A second, somewhat "softer" example of such trade-offs would be entailed in bottom land leases designed to preserve a commercial abalone fishery by substituting farming for hunting. If not precluded or made impractical by constitutional restrictions, this step would significantly alter the life style that has attracted so many divers to the commercial fishery.

We would be remiss if we failed to acknowledge the possibility that public policymakers may ultimately conclude that the political and administrative costs of attempting to adjust competing claims to the abalone resource

exceed the benefits to be derived therefrom by society as a whole, and that the Department of Fish and Game should restrict its activities to controls on access designed to preserve the resource (e.g. shorter seasons and more extensive area closures) without regard to their consequences for abalone divers. This would mean that, by default, there would be some winners (environmental groups) and some losers (commercial divers and processors, that segment of the retail market that could not be satisfied with Mexican imports, and to a lesser extent, sport divers), but it would not necessarily mean that policymakers had determined that the winners had a greater claim on the resource. Rather, it would reflect their conclusion that the "public interest" in adjusting competing claims did not justify the intensive management programs that would be required to achieve the adjustment.

One can make a prima facie argument that the state ought to adopt a laissez-faire approach to abalone management. This position advocates a hands-off policy which would result in a new balance being struck between commercial and sport divers and the resource. There would probably be fewer divers, smaller total harvest and more areas picked clean of abalone, but the species would survive because of its natural habits and the habits divers would acquire to protect the resource: "Let's keep government out of the picture and let the market place and condition of the resource determine how many divers and how many abalone will survive. In the end the result will be approximately the same and we would have been spared the expense and turmoil of arbitrarily imposed government standards."

Our answer to the above argument takes several tacks, all of which guide us to the same end -- we reject the laissez-faire approach for this industry at this time. First we conclude that the data base from

which the Department of Fish and Game works is incomplete but probably adequate as long as efforts to improve the data base are continued. Second, the Department of Fish and Game is charged with the responsibility of both protecting and enhancing the state's fish and wildlife resources. It has been argued that the result of a hands-off approach would be the elimination of the abalone industry and a drastic reduction in the sports take. While this position may be too extreme, it does suggest the possible severity of a government policy of doing nothing. For the Department to do nothing would probably require express legislative direction for inaction; it will not be forthcoming. Third, in extensive contacts with all segments of the industry, sports groups, administrative officials, and legislative personnel, only a handful even suggest the desirability of no action. It seems reasonable to us that the state continue its intervention in what has been essentially an unregulated industry. The important questions are, what action should be taken and by whom?

Immediate Policy Options

If we reject the extreme alternative of a laissez-faire approach, but at the same time acknowledge DFG's present lack of funds and manpower to do many of the things that various affected interests would like to see it do, what courses of action should be explored pending an assessment of the impact of limited entry?

Our answer to this question begins with a set of assumptions derived from the preceding analysis:

1) Both commercial interests and sport diving associations have volunteered to assist DFG in conducting further studies of the status of abalone resources;

2) Especially on the north coast, sport divers seek more rigorous enforcement of existing regulations;

3) There is strong support among both commercial and sport divers for a program of area rotation;

4) Virtually every group concerned with the status of the abalone fishery supports intensified seeding efforts.

On the basis of these assumptions, the following policy options merit serious consideration. Because they are nevertheless subject to some important contingencies, they are presented in the form of "if..., then..." propositions.

1) If supported by careful scientific surveys of abalone stocks on the north coast in areas jointly agreed to by sport divers, industry and DFG, and if selective openings thereof were accompanied by close DFG supervision of both open and closed areas, then sport divers might be prepared to accept a carefully delimited opening of the north coast to commercial diving. DFG supervision of the opened areas might include both overall landing quotas for specified beds and individual quotas for eligible commercial divers, with eligibility to be determined by drawing;

2) If carefully controlled openings of the north coast afford an alternative source of supply, then the commercial sector may welcome an area rotation program south of Point Lobos;

3) If funding problems can be resolved through some combination of tax surcharges on the commercial take, stamp or tag fees on the sport take, and county contributions from their share of license fee receipts, then the replenishment of closed beds south of Point Lobos could be accelerated through intensified seeding programs.

Specific Recommendations

As indicated by the many "ifs" that qualify the preceding discussion, there are no self-evident solutions to the problems confronting the abalone fishery. However, there appear to be some promising opportunities for policy innovation if steps are taken now to anticipate future problems, and to explore the feasibility of present policy options. We therefore submit the following recommendations:

1) As of this time the Department of Fish and Game should be prepared to begin collecting the base-line data that will permit a reliable assessment of the impact of limited entry. These data should include a census of representative abalone beds, the compilation of accurate records of effort and take, and the collection of socio-economic information about commercial divers who fail to renew their permits after AB2224 takes effect.

2) Within two to three years, arrangements should be made for a careful appraisal of the impact of AB2224 on the resource itself and on commercial and recreational users of the resource.

3) Prompt consideration should be given to the manner in which Section 8306.3 of the Fish and Game Code will be implemented. This is the provision requiring the Commission to determine the number of commercial diving permits, and this is the section that specifies the use of drawings after the Commission has determined the number of permits to be issued.

4) In conjunction with representatives of both the commercial sector and sport diving associations, research should be undertaken to determine the present capacity of the north coast to sustain a limited and carefully supervised commercial fishery. If possible, this research effort should include the designation of selected areas for experimental commercial diving,

with subsequent evaluation of its implications for the resource, for sport diving opportunities, and for profitable commercial activity.

5) Since the success of any program of area rotation and rehabilitation will depend equally upon voluntary cooperation by the majority of abalone divers and the ability of enforcement officers to apprehend the minority who do not cooperate, a joint project should be set in motion to determine the feasibility of distinguishing open and closed areas on the south coast, and the period for which closures should remain in effect. Participants in this project should include commercial and sport divers, abalone mariculture experts, and enforcement personnel from the Department of Fish and Game. In this regard, the already closed areas off the Los Angeles and Orange County coast would provide a good location for data collection, possibly for exploration of the biological feasibility, costs, and yield of abalone farming techniques similar to those that would accompany bottom land leases.

6) While we recognize the need to offer a recommendation with respect to the dispute over the sea otter,we must candidly admit our inability to present a very specific proposal. It does seem that one of the roles DFG might serve is as a mediator between the contending factions. Discussion, debate and research do not necessarily produce answers, but we must conclude that in the case of the sea otter's relationship to the abalone resource these will do no harm and might lead to better information and a narrowing of the gap between the positions taken by the factions involved. If DFG is to assume the role of mediator it must find a way of neutralizing its image with some of its constituents.

Certain of our recommendations call for cooperative undertakings. While these would by no means assure agreement on specific policies, they should

help to minimize factual differences, and perhaps serve to reduce discrepancies between the expectations of abalone resource users and the present capacities -- or disposition -- of abalone resource managers.

REFERENCES

"Abalone Fishing Ban." Australian Fisheries, XXXI (April 1972), 5.

Acheson, James. "Territories of the Lobsterman." Natural History Magazine LXXXI (April 1972).

Aitchison, T., Blyth, H., and Hutton. G. "Fishermen Critical of Management Policies." Australian Fisheries, XXXV (January 1976), 15-6.

Alaska Commercial Fisheries Entry Commission. Limited Entry: Report to the Fishermen of Alaska. July 15, 1974.

-------. Costs and Earnings of Alaskan Fishing Vessels--An Economic Survey. September 10, 1974.

-------. 1974 Annual Report. January 15, 1975.

-------. Proposed Limited Entry Regulations for the Arctic-Yukon-Kuskokwim Area Salmon Fisheries. October 20, 1975.

-------. "Notice of Proposed Changes in the Regulations of Commercial Fisheries Entry Commission." October 16, 1975.

-------. "Memorandum to the Fishermen of Alaska." Undated.

Laws of Alaska. Amendment to AS16, Chapter 43: "Regulation of Entry into Alaska Commercial Fisheries." May 17, 1974.

-------. Register 52. "Title 20: Miscellaneous Boards and Commissions; Chapter 05: Commercial Fisheries Entry Commission." January 1975.

Alverson, Dayton J. "Science and Fisheries Management." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

Anderlini, V. "The Distribution of Heavy Metals in the Red Abalone, Haliotis refescens, on the California Coast." Archives of Environmental Contamination and Toxicology, II (1974).

"The Application of Oceanography to the Development and Management of Ocean Fisheries." University of Washington 50th Annual Meeting, Volume 5, 1972.

Asada, Y. "License Limitation Regulations: the Japanese System." FAO Technical Conference on Fishery Management Development. Vancouver, British Columbia, February, 1973.

Bell, W. F. "Management of Pacific Halibut." In A Century of Fisheries in North America, ed. by Norman G. Benson. American Fisheries Society, 1970.

Benson, Norman Gustaf, ed. A Century of Fisheries in North America. American Fisheries Society, 1970.

Bishop, Richard C. "Limitation of Entry in the United States Fishing Industry: An Economic Appraisal of a Proposed Policy." Land Economics, XLIX (November 1973), 381-90.

Bollen, A. G. "Problems in Achieving Uniform Fisheries Management." Australian Fisheries, XXXIV (December 1975), 10-11.

Borgeson, David P., ed. Status of Michigan's Fisheries Management. Michigan Department of Natural Resources, Fisheries Division, February 1972.

-------. Coho Salmon Status Report, 1967-68. Michigan Department of Natural Resources, Fisheries Division, February 1970.

Borthwick, W. A. "Managing Victoria's Fisheries." Australian Fisheries, XXXIV (December 1975), 8-9.

Browning, Robert J. "Washington Buy Back Off to a Ragged Start." National Fisherman, LVII (July 1976), 12A.

-------. "Washington's Governor Evans Signs Limited Entry Into Fisheries." National Fisherman, LVII (July 1974), 2A.

Brox, Otto. "Newfoundland Fishermen in the Age of Industry: A Sociology of Economic Dualism." Newfoundland Social and Economic Series, No. 9. University of Toronto Press, 1972.

Burdon, T. W. "Licence Limitation." Australian Fisheries, XXXI (January 1972), 22-4.

Burge, Richard; Odemar, Melvyn; Schultz, Steven. Draft Report on Recent Abalone Research in California with Recommendations for Management. State of California Department of Fish and Game, Operations and Research Branch, January 17, 1975.

-------. "Abalone Management Report." presented to the California Fish and Game Commission, October 3, 1975, mimeo.

Burke, William and Kasahara, Hiroshi. North Pacific Fisheries Management. Paper No. 2 in a series prepared for The Program of International Studies of Fishery Arrangements, Francis T. Christy, Jr., Director. Washington, D.C.: Resources for the Future, Inc., May 1973.

California Abalone Association. "Review of the Abalone Research Report Prepared by Operations Branch and Marine Resources Region of State of California Department of Fish and Game of 17 January 1975: Comments and Recommendations of California Commercial Abalone Fishery." undated, mimeo.

California Department of Fish and Game. California Fish and Game Code, Sections 8306.9, 8550-8555.

-------. "State Commercial Marine Landings." Marine Resources Leaflet.

California Fish and Game Commission. Minutes, Meeting of November 5, 1971, mimeo.

Campbell, Blake A. "Are Canada's Limited Entry Programs in the Salmon and Lobster Fisheries Successful?" Proceedings, Marine Fisheries Resources Conference, Portland, Oregon, December 12-14. Corvallis, Oregon: Oregon State University Press, 1972.

-------. "Limited Entry in the Salmon Fishery: The British Columbia Experience." Pacific Sea Grant Advisory Program, November 6, 1972. Centre for Continuing Education, University of British Columbia, 1972.

Christy, Francis T., Jr. Alternative Arrangements for Marine Fisheries: An Overview. Paper No. 1 in a series prepared for The Program of International Studies of Fishery Arrangements, Francis T. Christy, Jr., Director. Washington, D.C.: Resources for the Future, Inc., May 1973.

-------. "Controlling Waste in Fisheries." Resources (June 1975).

-------. "Fisheries: Common Property, Open Access and the Common Heritage." Pacem in Maribus, II. The Royal University of Malta Press, 1971.

Christy, Francis T. and Scott, A. D. The Common Wealth in Ocean Fisheries. Baltimore, Maryland: The Johns Hopkins Press, 1965.

Clark, C. "Beverton-Holt Model of a Commercial Fishery: Optimal Dynamics." Canadian Journal of Fisheries Research Board, XXX (November 1973).

Clark, N. E. "Licence Limitation--A Fisherman's View." Australian Fisheries, XXXV (January 1976), 13-14.

Commission on Marine Science, Engineering and Resources. Report of the Commission: Our Nation and the Sea: A Plan for National Action. Washington, D.C.: U.S. Government Printing Office, 1969.

Copes, Parzival. "Review of South Australian Fisheries." Fisheries Green Paper 1. Adelaide, Australia, January 1976.

"Copes' 'Green Paper' Proposes Reduction in Number of SA Rock Lobster and Prawn Boats." Australian Fisheries, XXXV (March 1976), 16-18.

Cox, Keith W. "California Abalones, Family Haliotidae." Fish Bulletin #118, Resources Agency of California Department of Fish and Game, 1962.

-------. Review of the Abalone in California. California Department of Fish and Game, 1960.

Crutchfield, James A. "An Economic Evaluation of Alternative Methods of Fishery Regulation." Journal of Law and Economy, IV (1961), 131-43.

-------. "Economic and Political Objectives in Fishery Management." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

-------, ed. The Fisheries: Problems in Resource Management. Seattle: University of Washington Press, 1965.

Crutchfield, James A. and Lawson, Rowena. West African Marine Fisheries: Alternatives for Management. Paper No. 3 in a series prepared for The Program of International Studies of Fishery Arrangements, Francis T. Christy, Jr., Director. Washington D.C.: Resources for the Future, Inc., 1974.

Crutchfield, James A. and Pontecorvo, Giulio. The Pacific Salmon Fisheries: A Study of International Conservation. Baltimore: The Johns Hopkins Press for Resources of the Future, 1969.

Crutchfield, James A. and Zellner, A. "Economic Aspects of the Pacific Halibut Fishery." Fishery Industrial Research, I. Washington, D.C.: U.S. Department of the Interior, 1961.

Economic Aspects of Fish Production. Paris: OECD, 1972.

Edwards, C. L. "Abalones in California." Annual Report of the Smithsonian Institution. Washington, D.C.: The Smithsonian Institution, 1913.

"Either You Are For or Agin Limited Entry, Says Alaskan." National Fisherman, (June 1976), 7A.

Fisheries of Canada. Canada: Department of Fisheries & Forestry.

"Fishermen Speak Out on Management Measures." Australian Fisheries, XXXIV (November 1975), 19.

"Fishing Laws: U.S. and Canada." Field & Stream, LXXVIII (April 1974).

Fogle, Ned F., Great Lakes Management Specialist, Fisheries Division, Department of Natural Resources, Michigan. Personal correspondence, October 13, 1975.

Freeman, Nancy. "Alaska's Limited Entry Plan Shows some Complications." National Fisherman, (February 1975), 15A.

Freeman, W. "The Abstention Doctrine." North Carolina Sea Grant Publication UNC-Sg-74-07. Grant #04-3-158-40, June 1974.

Gates, J. and Norton, V. J. "The Benefit of Fisheries Regulation: A Case Study of the New England Yellowtail Flounder Fishery." URI Marine Technical Report #21, 1974.

Gersuny, Carl and Poggie, John J., Jr. "A Fishermen's Cooperative: Open System Theory Applied." Maritime Studies and Management, XI (1974), 215-22.

Gertenbach, L. P. D. "License Limitation Regulations: the South African System." FAO Technical Conference on Fishery Management Development. Vancouver, British Columbia, February 1973.

Gordon, H. S. "The Economic Theory of a Common Property Resource: The Fishery." Journal of Political Economy, LXII (April 1954), 124-42.

"Group Backs Entry Rule." Anchorage Times, April 30, 1976.

Gruen, Claude, et al. "A Socio-Economic Analysis of California's Sport and Commercial Fishing Industries." Report to: The State of California Resources Agency. San Francisco: Gruen, Gruen & Associates, 1972.

Gulland, J. A. The Management of Marine Fisheries. Bristol: Scientechnica, 1974.

-------, ed. The Fish Resources of the Ocean. West Byfleet, England: Fisheries News Books, 1971.

Hay, John. The Run. New York: Ballentine Books, 1959.

Herrington, William C. "What Are the Real Objectives of Limited Entry?" Proceedings from the Marine Fishery Resources Symposium, Portland, Oregon, December, 1971. Corvallis: Continuing Education Publications, Oregon State University, 1972.

Hiebert, Robin Ann and Tussing, Arlon R., with Sutinew, Jon G. Fisheries of the Indian Ocean: Issues of International Management and Law of the Sea. Paper No. 5 in a series prepared for The Program of International Studies of Fishery Arrangements, Francis T. Christy, Jr., Director. Washington, D.C.: Resources for the Future, Inc., 1974.

International Commission for the Northwest Atlantic Fisheries. Proceedings: Third Special Meeting, October 1973; Fourth Special Meeting, 1974; and 29th Annual Meeting, June 1974. Dartmouth, Nova Scotia.

International Northern Pacific Fisheries Commission. "Annual Report 1970."

Knight, Gary H. and Jackson, Victor T. Legal Impediments to the Use of Interstate Agreements in Coordinated Fisheries Management Programs: State in the N.M.F.S. Region. New Orleans: Louisiana State University Office of Sea Grant, 1975.

Knight, Gary H. and Lambert, James P. Legal Aspects of Limited Entry for Commercial Marine Fisheries. New Orleans: Louisiana State University Office of Sea Grant, 1975.

Koers, Albert W. International Regulation of Marine Fisheries. West Byfleet, England: Fisheries News Books, 1973.

Loftas, Tony. The Last Resource. London: Hamish Hamilton, 1969.

Larkin, Peter A. "A Confidential Memorandum of Fisheries Science." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

"Legislation to Promote Misery: Restriction on the Oyster Fishing Industry." National Review, XXXVII (May 23, 1975), 561.

"Lobster is a Fisheries Disaster." Audobon, LXXV (June, 1973), 105-8.

McHugh, J. L. "Jeffersonian Democracy and the Fisheries." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

Magnuson. Fisheries Management and Conservation Act: A Report of Senate Committee on Commerce. Report #94-416. Washington, D.C.: U.S. Government Printing Office, 1975.

Marshall, Robert S. "Emotic Commitment to Fishing; A Sociological Exploration of Three New England Fishing Communities." Unpublished M.A. thesis, University of Rhode Island.

Meany, T. F. "License Limitation as a Fisheries Management Tool." Australian Fisheries, XXXIV (July 1975), 9-11.

"Mexican Abalone Fishery Threatened." Marine Fisheries Review, XXXVIII (April 1976).

Michigan Department of Natural Resources. Michigan's Great Lakes: Trout and Salmon Fishery. Fisheries Management Report No. 5, June 1973

-------. "Commercial Fishing Order Number 17." June 10, 1974.

-------. "Commercial Fishing Emergency Rule." July 9, 1975.

Michigan Department of Natural Resources. Warren W. Shapton, Chief, Bureau of Field Operations. Interoffice Communications: "Regulation of the Commercial Fishery for Chubs in Lake Michigan." December 18, 1974; "Allocation of Commercial Fishing Quotas on Chubs and Herring in Lake Superior." December 18, 1974; "1975 Commercial Fishing Licensing Procedures." December 30, 1974; "Procedures on Conversion of Gill Nets." May 30, 1974.

Michigan, 74th Legislature, Regular Session of 1968. "Enrolled House Bill No. 3917."

Miles, Edward. Organizational Arrangements to Facilitate Global Management of Fisheries. Paper No. 4 in a series prepared for The Program of International Studies of Fishery Arrangements, Francis T. Christy, Jr., Director. Washington, D.C.: Resources for the Future, Inc., 1974.

Miller, Daniel. Santa Cruz Sentinel, February 19, 1976.

-------. San Jose Mercury, April 19, 1976.

Morehouse, Thomas A. "Limited Entry in the British Columbia Salmon Fisheries." In Alaska Fisheries Policy, ed. by Arlon R. Tussing, Thomas A. Morehouse, and James D. Babb, Jr. Fairbanks, Alaska: Institute of Social, Economic and Government Research, University of Alaska, 1972.

Morehouse, Thomas A. and Hession, Jack. "Politics and Management: The Problem of Limited Entry." In Alaska Fisheries Policy, ed. by Arlon R. Tussing, Thomas A. Morehouse, and James D. Babb, Jr. Fairbanks, Alaska: Institute of Social, Economic and Government Research, University of Alaska, 1972.

Mundt, J. Carl, ed. Limited Entry into the Commercial Fisheries. Proceedings of the Conference Held at the University of Washington Lake Wilderness Continuing Education Center near Seattle, Washington on September 12 and 13, 1974. Seattle: Institute for Marine Studies, University of Washington, 1974.

National Advisory Committee on Oceans and Atmosphere. A Report to the President and the Congress. Washington, D.C., 1973.

"Native Federation Unit Supports Limited Entry." Anchorage Times, May 12, 1976.

"New Government's Policy Statement on Fisheries.' Australian Fisheries, XXXV (February 1976), 22.

"New Measures for Tasmanian Abalone Fishery." Australian Fisheries, XXXI (July 1972), 8.

Newton, C. H. B., Manager, Special Economic Programs and Intelligence Branch, Fisheries Operations, Department of the Environment, Vancouver, British Columbia. Personal correspondence, January 9, 1976.

Owen, R. S.; McLean, James H.; Meyer, Richard J. Hybridization in the Eastern Pacific Abalones. Bulletin of the Los Angeles County Museum of Natural History, January 15, 1971.

Owers, James E. "An Empirical Study of Limited Entry in Alaska's Salmon Fisheries." Marine Fisheries Review, XXXVII (June 1975).

Paulik, G. J. "Fisheries and the Quantitative Revolution." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

Guzman del Proo, Sergio A., Biologist from the Office of the Secretaria de Industria y Comercio, Institute de Pesca, Mexico City. Personal correspondence, January 19, 1976.

Rickey, Roy A., Chairman, Commercial Fisheries Entry Commission, State of Alaska. Personal correspondence, October 31, 1975.

Rogers, George W. "Fisheries Management: The Cook Inlet and Bristol Bay Cases." In Alaska Fisheries Policy, ed. by Arlon R. Tussing, Thomas A. Morehouse, and James D. Babb, Jr. Fairbanks, Alaska: Institute of Social, Economic and Government Research, University of Alaska, 1972.

Rothschild, Brian J. "The Need for Analysis on the Development of the United States Fisheries Policy." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

-------, ed. World Fisheries Policy. Seattle & London: University of Washington Press, 1972.

Royce, William F. "The Gap Between Theory and Policy in Fishery Development." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

"Rules for Entry to Southern Rock Lobster Fishery." Australian Fisheries, XXXIV (July 1975), 8.

Sanders, M.J. "The State View of Licence Limitation." Australian Fisheries, XXXIV (December 1975), 12-14.

Sanders, M. J. and Beinssen, K. H. "Licence Limitation in the Victorian Abalone Industry." Australian Fisheries, XXXI (March 1972), 25.

Scott, John A. "Status of Commercial Fishing." In Status of Michigan's Fisheries Management, ed. by David P. Borgeson. Michigan Department of Natural Resources, Fisheries Division, February 1972.

Shepherd, S. A., Senior Research Officer, Department of Fisheries, South Australia. Personal correspondence, January 1976.

Shepherd, S. A. "Competition Between Sea Urchins and Abalone." Australian Fisheries, XXXII (June 1973), 4-7.

Sinclair, Mary. Studies on the Paua, Haliotis iris Martyn in the Wellington District 1945-46. New Zealand: Victoria University of Wellington, June 30, 1963.

Skud, B. E. "Management of the Pacific Halibut Fishery." FAO Technical Conference on Fishery Management Development, Vancouver, British Columbia, February 1973.

Smith, V. L. "Economics of Production from Natural Resources." American Economic Review, LVIII (June 1968), 409-31.

"Something About Abalones." Overland (February 1928).

Stuster, Jack. "Some Social Correlates of Technology Among Commercial Fishermen." Paper presented at the meetings of the Southwestern Anthropological Association, April 15, 1974.

Stanistreet, H. K. "The Fisherman's Role." Australian Fisheries, XXXIV (December 1975), 15-18.

Sturman, M. A. Q. "Fisheries Management - Economic Considerations." Australian Fisheries, XXXI (January 1972), 17-20.

"Tasmania Fights Abalone Regulations." Australian Fisheries, XXXI (February 1972), 2.

Terry, William M. "Fisheries and the National Interest." In World Fisheries Policy, ed. by Brian J. Rothschild. Seattle & London: University of Washington Press, 1972.

"Test-tube Abalone." Sea Frontiers, XIX (May 1973), 148-53.

Tody, Wayne H. and Tanner, Howard A. Coho Salmon For the Great Lakes. Michigan Department of Conservation, Fish Management Report No. 1, February 1966.

Turvey, R. "Optimization and Suboptimization in Fishery Regulation." American Economic Review, LIV (March 1964), 64-76.

Tussing, Arlon R.; Morehouse, Thomas A.; Babb, James D., Jr. Alaska Fisheries Policy. Fairbanks, Alaska: Institute of Social, Economic and Government Research, University of Alaska, 1972.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Fishery Statistics of the United States, 1970. Statistical Digest #64. Washington, D.C., 1973.

-------. National Plan for Marine Fisheries (Final Draft). Washington, D.C., October 1975.

-------: Current Economic Division. Food ish Situation and Outlook--Annual Review 1971. Fish and Wildlife Service, Washington, D.C., May 1972.

U.S. Department of the Interior. Anadromous Fish Resources: Their Conservation, Development and Enhancement. Fish and Wildlife Service, Bureau of Commercial Fisheries, Bureau of Sport Fisheries and Wildlife. Washington, D.C., 1970.

"U.S. Fisheries: A View of their Status and Potentia.." Marine Fisheries Review, XXXIV (July, August 1972).

"U.S. Fisheries Today." Fish Boat, XVII (March, April 1972).

"Wealth of the Seas: Government Policy and the American Seafood Industry." Vital Speeches, XXXIX (August 15, 1973).

Zeiner, David. Oakland Tribune, February 25, 1976.

APPENDICES

APPENDIX A - Methodology

Sampling

Sampling Plan for Active Commercial Divers

The purpose for drawing this sample was to determine the characteristics (e.g. demographic, occupational and recruitment patterns, etc.) of active commercial abalone divers. We also sought their attitudes toward abalone fishery problems and alternatives for regulation, as well as their opinions of principal actors involved in managing this fishery.

The universe consisted of 383 divers licensed for 1975. A mail questionnaire to the entire universe was a possibility. However, while diver characteristics and reported behavior measures could easily have been collected by means of a mail questionnaire, our need for data on diver attitudes and perceptions of problems and solutions (on which little prior knowledge was available) recommended a personal interview approach combining closed-end responses with open-ended probes to maximize freedom of expression in diver responses.

Time constraints and economic considerations did not allow personal interviews with the entire universe; thus, a representative sample of 50 respondents was drawn using proportionate stratified random sample procedures. This sampling method, as Leege and Francis put it, offers the following advantages:

> ...1) as a stratified sample it is a highly efficient procedure, yielding less variance and permitting smaller sample sizes; 2) since the sample is porportionate to the universe within each stratum, the sample is highly representative; 3) ... and generalizations can be made about characteristics of the universe without the cumbersome procedure of weighting the values for each stratum... and; 4) since estimates of means, variances, and so on for each stratum are easily calculated, the design lends itself well to elaborated analysis of strata and subclasses.[1]

Identification of possible independent variables on the basis of which the strata would be established was accomplished by relying on the advice of knowledgeable informants. The most important variable identified by these informants was "years of diving experience"; we were repeatedly told to expect very important differences in the attitudes and behavior of divers with different years of diving experience. Divers were thus divided into different strata according to the number of years they had been diving. Using Department of Fish and Game records, the universe of 383 licensed commercial divers were divided into the following three strata:

Stratum #1: Divers with one to two years experience. This group accounted for 175 divers or 45.69% of the universe. Stratum sample size was therefore 45.69% of the universe, that is, 23 divers.

Stratum #2: Divers with three to five years experience. This group accounted for 102 divers or 26.63% of the universe, yielding a stratum sample size of 13 divers.

Stratum #3: Divers with six or more years experience. This accounted for 106 divers or 27.68% of the universe, yielding a stratum sample of 14 divers.

Respondents from each stratum were selected using a table of random numbers. Alternates were selected likewise.

Sampling Plan for Commercial Divers Dropping Out in 1974

The primary purpose for drawing this sample was to determine the reasons why divers leave the industry. This universe consisted of 262 divers and tenders who were licensed to dive or tend in 1974, but whose names did not appear on DFG lists of license holders for 1975.

Since the universe was small and the necessity for open-ended questions minimal, a mail questionnaire was sent to the entire universe.

Sampling Plan for Processors

A unique view of the character and problems of the fishery was expected to be expressed by abalone processors. Moreover, we had a special interest in determining this group's assessment of the political feasibility of alternative regulatory schemes. The universe consisted of 17 licensed processors of very diverse characteristics; sampling thus was not a consideration. One Santa Barbara processor alone accounted for approximately 55 per cent of all abalone processing and also for most of this group's political activity. This processor and two other processors located in the Santa Barbara area process approximately 80 per cent of the annual catch. Of the next four largest companies, three were located in San Diego and the fourth in Morro Bay. Owners or managers of these seven largest companies were personally interviewed using an open-ended format. All the remaining ten processors were restaurants processing for themselves or divers processing for a restaurant. Their activities were judged to be of marginal significance to the study; hence, these were not interviewed.

Sampling Plan for Sport Diver Groups

In addition to their special perspective on the abalone fishery, sport divers were expected to be an especially important political factor in abalone fishery regulation. The universe consisted of a large and not easily identifiable number of sport dive club members and nonaffiliated sport divers throughout California (anyone holding a California sport fishing license is entitled to dive for abalone).

Given the difficulties involved in reaching thi population of sport divers, we opted instead for tapping the attitudes and opinions of the lead-

ership of organized sport diver clubs. Four regional councils of dive clubs which geographically encompass most of California were identified. These councils had a membership of 116 individual clubs. Sampling was confined to the leadership of these clubs. As geographic dispersion and cost considerations prohibited personal interviews, a mail questionnaire, primarily utilizing a closed-end format, was sent to the presidents of all 116 clubs in the four councils.

Sampling Plan for Environmental Groups

Preliminary inquiries uncovered only two environmental groups exhibiting any awareness or interest in the abalone fishery, and that only from the narrow perspective of its relationship with the sea otter. These two groups, Friends of the Sea Otter and the Sierra Club, probably constitute the universe of relevant environmental groups. Personal interviews were conducted with leaders of both of these groups.

Sampling Plan for Legislators and Administrators

Reflections upon all of our evaluative criteria were desired from members of these groups. The universes consisted of legislators or aides of legislators who sponsor fishery regulation or sit upon relevant committees, and administrators of enforcement, marine research, statistics and policy formulation in the California Department of Fish and Game. Elite personal interviewing techniques requiring open-ended and largely unstructured questions were utilized.[2] As no generalizing about these groups was intended, respondents were selected according to their position in the relevant legislative and administrative hierarchies and, to some extent, according to their availability. All relevant administrators and legislators (or their aides) were interviewed.

Field Work

Commercial Divers

Selection and Training of Interviewers. The interviews of active commercial divers were completed by Sea Grant Trainees working on this project -- two graduate students in political science, one in economics and one in anthropology -- aided by two additional research staff members.

Prior to engaging in any field work all of those assigned to administer the commercial diver questionnaire went through several interviewer training sessions which stressed practical procedures and approaches. Additionally, all interviewers participated in administering a pre-test of the survey instrument.

Procedure for Completing Interviews. As it was expected that it would be difficult to reach this population (e.g. because of days spent at sea, instability of residence, lack of telephone, etc.), a variety of methods were utilized to promote a maximum response rate. First, an introductory letter, accompanied by a pre-addressed and stamped post card, was sent to the commercial diver sample. The post card requested the diver's current address, his or her phone number, and the easiest way to get in touch with the diver. Of the original sample of fifty to whom the introductory letter and post card were sent, thirty-one eventually returned the card complete with the requested information. This information was used to update the information garnered from the license lists maintained by DFG.

For local divers (i.e., the Santa Barbara area) having telephones, the interviewers were instructed to make at least three attempts to contact the divers by phone. The attempts to make phone contact were carried out at various times of the day and on different days. If the phone calls proved

fruitless, the interviewer would visit the residence of the prospective interviewee. If the diver was not at home, the interviewer was instructed to leave a note either with the diver's spouse/roommate or on the door of the residence. The note requested that the diver contact the interviewer via telephone. If, after repeating this procedure twice, no response was obtained, attempts at reaching the diver directly at his/her residence were abandoned.[3]

For local divers having no phone, interviewers made at least three attempts to contact the diver in person at his/her residence. If after three visits, made on different days and at various times of the day, no personal contact had been made with the prospective interviewee, the note procedure described above was followed.

Having been unsuccessful in contacting a diver at his/her place of residence, the interviewers would then try to contact the diver through processors or through other divers. If the processors or divers could not provide further information on how to contact the diver, that diver was removed from the sample and replaced with the first person on the alternates list. (See Sampling Plan for description of alternates selection.)

In the event that the processors or other divers could provide other information on the diver in question, the interviewer would follow-up on the new lead twice. If the interviewee still remained uncontacted, then that diver was replaced by the next diver from the alternate list.

For divers not living in the Santa Barbara area, the following procedure was followed. Prior to any trip to a distant locale, attempts were made to at least have three interviews scheduled. This was done by telephone. When an interviewer had at least three interviews arranged, then the trip was taken.

In the event that a distant diver did not have a telephone, the interviewer would make two visits to the individual's home. If contact was not established after the second visit, the interviewer was instructed to begin asking about the diver in question with other divers contacted and with processors in the area. If this did not produce results, i.e., an interview, then attempts at reaching the diver were postponed until a second trip to the area.

For divers still not contacted, and any divers added to the list as a result of replacement, a second trip was made to distant areas. The second trip was made by a different interviewer,[4] and the same procedure as on the initial trip was followed. If after the second trip, a diver remained uncontacted, that diver was removed from the sample and replaced by the next diver from the alternate sample.

Response Rate for Commercial Diver Interviews. Response rates for the sample of commercial divers are abstracted in Table A.1 below.

Table A.1

Response Rates for Commercial Divers

A.	Original Sample Drawn:	50
B.	Replacement:*	24
C.	Total sample (A+B):	74
D.	Interviewed:	44
E.	Not interviewed (C-D):	30

Reason for non-interviews:

F.	No longer diving	12
G.	Deceased/left no forwarding address/not located	7
H.	Inability to coordinate interview**	10
I.	Refused interview	1
Net sample (C-F-G):		55

Response rates

Total sample:	59.5%
Net sample:	80.0%

*All those divers who were no longer diving for abalone or whom we could not contact were replaced. From our original sample, one individual had died and several had left the area (for the merchant marine, the Fiji Islands, for the Philippines , for Hawaii, etc.), and many had left the fishery (one person was operating a fish market, some had become divers for other commercial enterprises, e.g.,on oil rigs, etc.). Six of the original 50 were just untraceable -- they left no forwarding addresses and no one associated with the fishery could provide any information on their whereabouts.

**We were unable to interview these 10 divers for various reasons. Some of the divers were living on their boats off San Clemente Island and were delivering their abalone to a pick-up boat; they rarely came to port. Others had no permanent address and were therefore difficult to reach. Several of the divers failed to keep appointments.

Sport Divers

Field work. As explained above (see Sampling Plan), a mail questionnaire was sent to the presidents of 116 sport diving clubs. Included with each questionnaire was an introductory letter, a stamped, self-addressed envelope for returning the completed questionnaire, and a card for the respondent to fill out and return when they had completed the questionnaire. A second follow-up questionnaire was sent to those not responding.

Response Rate. Response rates for the sport divers mail questionnaire are abstracted in Table A.2 below.

Table A.2

Sport Diver Response Rates

A.	Total sample:	116
B.	Incorrect address:	6
C.	Net sample (A-B):	110
D.	Questionnaire forms completed and returned:	63

Response rates:

Total sample	(D÷A)	= 54.3%
Net sample	(D÷C)	= 57.3%

Commercial Drop-out Divers

Field work. A questionnaire was sent to a sample of 262 ex-divers. (See description of Sampling Plan above.) Included with the questionnaire was a stamped envelope for returning the questionnaire and an introductory letter.

After a period of three weeks, we sent an additional questionnaire packet to all those drop-outs whose initial mailing had not been returned because of an incorrect address. In this second letter the drop-out was

asked to ignore the second mailing if he had responded to the first mailing. The second letter stressed the importance of input from affected publics.

Table A.3

Drop-out Response Rates

A.	Total sample:	262
B.	Incorrect address:	103
C.	Net sample:	159
D.	Questionnaire forms completed and returned:	47

Response rates:

Total sample (D÷A) = 17.9%

Net sample (D÷C) = 29.5%

Footnotes - Appendix A

1 David C. Leege and Wayne L. Francis, Political Research (New York: Basic Books, 1974), p. 126.

2 See Lewis A. Dexter, Elite and Specialized Interviewing (Evanston, Illinois: Northwestern University Press, 1970).

3 The process used for contacting divers was a composite of the methods reported in several survey methods books. E.g. Ibid.; Charles Backstrom and Gerald Hursh, Survey Research (Evanston: Northwestern University Press, 1963); and Earl Babbie, Survey Research Methods (Belmont: Wadsworth Publishing, 1973).

4 This was done to prevent bias entering into the data collection process as the result of one interviewer being responsible for administering all interviews in a distinct geographical region. See Babbie, op. cit., p. 182, for a discussion of this method.

Appendix B:

Commercial Fishermen Questionnaire

University of California, Santa Barbara 1976

Case # _____

Date _____

Time Start _____ Time Finish _____ Time Elapsed _____

Interviewer _____

Respondent's Name _____

Address _____ Telephone _____

We appreciate the cooperation and the time that you are giving us. As I explained earlier, we are doing a study of the abalone industry. As a commercial fisherman, we are interested in your opinions on problems and issues related to the abalone fishery. All your answers will be kept strictly confidential. The responses will be compiled statistically and no names or other personal information will appear in the final study. We really appreciate your cooperation.

Our questions cover several different kinds of things. It is not a test and there are no right nor wrong answers. Please feel free to stop and ask me questions at any time. I would like to start by asking you a few questions about your experiences as a fisherman.

UCSB 1976

COMMERCIAL FISHERMEN QUESTIONNAIRE

1. Are you now a diver?

   1. Yes _____
   5. No _____
   8. DK _____
   9. NR _____

   (IF NO) A. Why not?

2. About how long have you been abalone diving?

   _____Years _____Months

3. How did you originally get involved in the abalone industry?

(PROBE IF NECESSARY)

Through family? friends?

4. What were your expectations when you originally got involved in the abalone industry?

(PROBE IF NECESSARY)

Good living? exciting job?, etc.

5. Approximately how many days per year do you dive?

_____Days

6. About how many days per year do you spend on abalone-related activities other than diving?

_____Days

7. Do you usually work from: (READ CHOICES)

1. a company boat _____
2. boats belonging to other divers _____
3. your own boat _____
7. other _____
8. DK _____
9. NR _____

(IF OWNS BOAT, ASK A. AND B. AND GO TO Q. 9; IF NOT, SKIP TO Q. 8)

A. What type and length of boat is that?

_____Type _____Length

B. What is the approximate value of your boat?

_____Value

8. What type and length of boat is that?

_____Type _____Length

9. What is the approximate present value of your abalone diving equipment?

(PROBE IF NECESSARY)

Wetsuits, hose, compressor, bags?

_____Value

10. What kind of relationship do you have with the processors, that is, do you: sell to one processor only, sell to more than one processor, or what?

    1. sell to one processor only _____
    2. sell to more than one processor _____
    7. other (SPECIFY) _____
    8. DK _____
    9. NR _____

    A. Why do you have this relationship?

11. In your opinion, are there any problems in the abalone fishery?

    1. Yes _____
    5. No _____
    8. DK _____
    9. NR _____

    (IF YES) A. Which do you feel are the most pressing?

12. Here is a list of problems that have been suggested by other people associated with the abalone industry (HAND PROBLEM CARD). As I read each one, would you please first tell me whether you think it is (HAND CHOICE CARD) 1) a very serious problem, 2) a serious problem, 3) somewhat of a problem, 4) a minor problem, or 5) not a problem at all. Next, I would like to know who do you think should be responsible for solving this problem: individual fishermen, state government, fishermen's associations, processors, or some other group.

(READ EACH PROBLEM CHOICE. ASCERTAIN EXTENT OF PROBLEM, AND THEN ASK RESPONSIBILITY)

PROBLEM CHOICES	Very Serious	Serious	Somewhat	Minor	Not at all	DK	NR	(READ ALTERNATIVES) Individuals	State	Associations	Processors	Other (SPECIFY)	DK	NR
1. Too many commercial divers	1	2	3	4	5	8	9	1	2	3	4		8	9
2. Too many inexperienced commercial divers	1	2	3	4	5	8	9	1	2	3	4		8	9
3. Competition from sport divers	1	2	3	4	5	8	9	1	2	3	4		8	9
4. The taking of shorts	1	2	3	4	5	8	9	1	2	3	4		8	9
5. Sea otters	1	2	3	4	5	8	9	1	2	3	4		8	9
6. Pollution	1	2	3	4	5	8	9	1	2	3	4		8	9
7. Legal size is too small	1	2	3	4	5	8	9	1	2	3	4		8	9
8. Legal size is too large	1	2	3	4	5	8	9	1	2	3	4		8	9
9. The 20-foot law	1	2	3	4	5	8	9	1	2	3	4		8	9
10. Inadequate supply of abalone	1	2	3	4	5	8	9	1	2	3	4		8	9
11. Poaching	1	2	3	4	5	8	9	1	2	3	4		8	9
12. Other (SPECIFY)_____	1	2	3	4	5	8	9	1	2	3	4		8	9

13. Assume for the moment that it becomes necessary for state government to establish a management program to solve problems in the abalone industry, are you aware of any proposals that might be suggested?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. Can you tell me what they are?

14. Assume again that it was necessary to create some management program to solve problems in the abalone industry. If you could make up such a program, what would you include in it?

A. Why do you say that?

15. Here is a list of things that some people think should be done to solve problems in the abalone industry. (HAND RESPONDENT ALTERNATIVES CARD) As I read them, would you please tell me, for each one, whether you have heard of it or not, and then how you feel about it.
(AS YOU READ EACH ALTERNATIVE, ASK THE FOLLOWING QUESTIONS AND ENTER IN CHART BELOW)

A. Have you ever heard of this proposal?

(IF NO, GO TO NEXT ALTERNATIVE, IF YES, ASK B, THEN C)

B. How do you feel about this proposal, that is, do you strongly agree with it, moderately agree, are you neutral about it, moderately disagree, strongly disagree or what? (HAND CHOICE CARD)

C. Why do you say that?

15. (cont.)	HEARD OF: Yes 1	No 5	DK 8	NR 9	OPINION: Strongly Agree 1	Moderately Agree 2	Neutral 3	Moderately Disagree 4	Strongly Disagree 5	DK 8	NR 9	
1. Limiting the number of licensed divers.	1	5	8	9	1	2	3	4	5	8	9	Why?
2. Limiting the number of vessels.	1	5	8	9	1	2	3	4	5	8	9	
3. Limiting the size of vessels.	1	5	8	9	1	2	3	4	5	8	9	
4. Increasing the license fee.	1	5	8	9	1	2	3	4	5	8	9	
5. Placing a quota on the amount of abs taken by any diver.	1	5	8	9	1	2	3	4	5	8	9	
6. Placing a quota on the number of abs taken by the industry as a whole.	1	5	8	9	1	2	3	4	5	8	9	
7. Requiring new divers to serve a probationary period as apprentices.	1	5	8	9	1	2	3	4	5	8	9	
8. Rotation of open and closed (fishable areas).	1	5	8	9	1	2	3	4	5	8	9	
9. Placing a tax on number of abalone taken.	1	5	8	9	1	2	3	4	5	8	9	
10. Longer closed seasons.	1	5	8	9	1	2	3	4	5	8	9	
11. No change in present regulations.	1	5	8	9	1	2	3	4	5	8	9	
12. Other _____ _____	1	5	8	9	1	2	3	4	5	8	9	

16. There are various ways of limiting the number of fishermen involved in a fishery. I will read you a list of these alternatives. (HAND ALTERNATIVE CARD) Would you please tell me which of these alternatives you would most favor if a program limiting the number of divers was created for the abalone fishery?

1. licenses allocated by chance through a lottery _____
2. licenses auctioned to the highest bidder _____
3. licenses given out according to a ranking system which takes into account such factors as years in the industry, proportion of income from abalone taking, investment in equipment, etc. _____
4. licenses given out only to those divers now holding them _____
7. Other (SPECIFY) _____
_____
8. DK _____
9. NR _____

17. Those people favoring some type of ranking system to limit the number of fishermen suggest several factors by which applicants should be ranked. If some type of ranking system were to be instituted here, would you please tell me whether you agree or disagree with the use of the following factors in ranking applicants for abalone diving permits. (READ ALTERNATIVES, FOR EACH ONE. ASK: DO YOU HAVE AN OPINION ON THIS BEING A FACTOR? IF YES, ASK IF THEY 1) STRONGLY AGREE, 2) AGREE, 3) INDIFFERENT, 4) DISAGREE, 5) STRONGLY DISAGREE)

	No Opinion	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
a) number of years in industry	0	1	2	3	4	5
b) % of income derived from industry	0	1	2	3	4	5
c) economic hardship	0	1	2	3	4	5
d) investment in equipment	0	1	2	3	4	5
e) where you live	0	1	2	3	4	5
f) size of total catch	0	1	2	3	4	5

(ASK A)

A. Can you think of any other factors that would be important for a ranking system in the abalone industry?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

B. (IF YES) What are they?

18. Have you ever discussed abalone regulations or management with anyone?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. With whom?

19. Have you ever discussed abalone regulations or management with a member of the Department of Fish and Game?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. Who was that? (PROBE FOR POSITION - warden?, biologist?)

20. Have you ever attended a meeting of a group or organization where problems in the abalone industry were discussed?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. Could you tell me who sponsored the meeting and what were the general problems discussed?

_____Sponsor

_____Issues

_____

_____

21. Have you ever brought problems concerning the abalone industry, either in person or by letter to the attention of any elected or appointed public officials?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. Who was that? (PROBE FOR TITLE)

22. If some important changes were suggested for the abalone industry, would you express your opinion on those changes to others?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. To whom?

23. Would you contribute money to support efforts to change abalone regulations by organizations such as the California Abalone Association?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) Approximately how much would you be willing to contribute to such an effort? (READ $ ALTERNATIVES).

1) $0-$50 ___ 2) $51-$150 ___ 3) $151-$250 ___ 4) $251-$350 ___
5) $351-$450 ___ 6) $451+ ___
8) DK _____
9) NR _____

24. Would you contribute some of your time to support efforts to change abalone regulations by organizations such as the California Abalone Association?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

25. Would you be willing to pay additional fees for your license if the money were to go into a program for the seeding of abalone?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) Approximately how much would you be willing to pay for such a program? (READ ALTERNATIVES)

1) $0-$25 ____ 2) $26-$75 ____ 3) $76-$150 ____
4) $151-$250 ____ 5) $251-$500 ____ 6) $501+ ____
8) DK _____
9) NR _____

26. What are your total annual expenses associated with the taking of abalone?

(NOTE SPECIFIC FIGURES GIVEN: Fuel, maintenance, etc.)

27. Looking at this card (HAND INCOME CARD), could you please tell me what your gross annual income from the taking of abalone was last year before subtracting any expenses? Just tell me the number under which your income falls, we don't need the exact figure.

(SEE ATTACHED SHEET)

28. Now thinking about your net income, about what % of your total net income comes from the taking of abalone? (EMPHASIZE NET)

_____ %

(IF LESS THAN 100%) A. What other sources of income do you have?

(SUGGEST SOME ALTERNATIVES: other job, investments, etc.)

29. Approximately what was your total abalone catch for last year?

_____(dozen)

A. We are interested in the makeup of your catch. As I read each species, can you tell me approximately what proportion of your catch was made up of that species?

1) Red_____
2) Pink_____
3) Black_____
4) Green_____
5) White_____
8) DK_____
9) NR_____

ATTACHED INCOME CARD

1. Under $1,000 a year
2. $ 1,000 to $ 1,499 a year
3. 1,500 to 1,999 a year
4. 2,000 to 2,999 a year
5. 3,000 to 3,999 a year
6. 4,000 to 4,999 a year
7. 5,000 to 5,999 a year
8. 6,000 to 6,999 a year
9. 7,000 to 7,999 a year
10. 8,000 to 8,999 a year
11. 9,000 to 9,999 a year
12. 10,000 to 10,999 a year
13. 11,000 to 11,999 a year
14. 12,000 to 12,999 a year
15. 13,000 to 13,999 a year
16. 14,000 to 14,999 a year
17. 15,000 and over a year

30. Have you ever considered leaving the abalone industry?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES, ASK A AND B. IF NO, ASK ONLY B)

A. Why have you considered leaving?

B. If you were unable to continue as an abalone diver, for whatever reason, what do you think you would do for a living?

31. How low would your income have to go before you would leave the abalone industry?

32. Would you characterize the present management of the abalone industry by the Department of Fish and Game as: (READ CHOICES)

a. excellent _____
b. good _____
c. adequate _____
d. poor _____
e. very poor _____

A. Why do you say that?

33. Some people say that the Department of Fish and Game is uniform in the enforcement of abalone regulations. Others complain that regulations are enforced selectively, favoring some individuals and groups. And others have not arrived at an opinion on this. How about you? Do you have an opinion on this?

1. Yes _____
5. No _____
8. DK _____
9. NR _____

(IF YES) A. Is enforcement uniform or selective?

1. Uniform _____
2. Selective _____
5. DK _____

(IF SELECTIVE, B & C) B. Who are those not uniformly treated?

C. Why do you say that?

34. Do you feel that most commercial abalone fishermen follow the Department of Fish and Game Code: (READ CHOICES)

1. always_____
2. most of the time_____
3. some of the time_____
4. hardly ever_____
5. never_____
8. DK_____
9. NR_____

Finally, I'd like to ask you a few questions about the way you feel towards state government -- the government that runs things in Sacramento.

35. About how much effect do you think that the activities of the state government have on your day-to-day life? Do they have a great effect, some effect, or none?

    1. great effect_____
    2. some effect_____
    5. none_____
    8. DK_____
    9. NR_____

36. In general, do you think your state government is run the way it should be or not run the way it should be, or is it somewhere in between?

    1. run the way it should be (ASK A) _____
    3. in between (ASK A) _____
    5. not run the way it should be (ASK A) _____
    8. DK _____
    9. NR _____

    A. Why do you feel that way?

37. Some people tell us that there is nothing they can do to affect what the state government does. Other people say they can influence what gets decided in this state if they want to. Still others say that sometimes they can affect what gets decided in this state. How about you? Do you feel that you can affect what the state government does, or not?

    1. Yes, can affect (ASK A) _____
    3. Sometimes, depends (ASK A) _____
    5. No, can't affect (ASK B) _____
    8. DK _____
    9. NR _____

    A. How can you have this effect?
    B. Why not?

Appendix C

Sport Diver Questionnaire

First of all, here are a few questions about your diving club.

1. How many members are there in your club? _____

2. In what year was your club founded? _____

3. In your estimate, about how many "limits" of abalone did the average member of your club take last year? _____

Turning now to you personally:

4. How many years have you been diving? _____

5. On the average, how many times a month do you dive for abalone? _____

6. About how many "limits" of abalone did you take last year? _____

7. Have you ever considered becoming a commercial abalone diver?

   1. Yes _____
   2. No _____

8. In your opinion, are there any problems with the abalone resource?

   1. Yes _____
   2. No _____

   (IF YES) A. Which do you feel are the most pressing?

9. Some people say that the list below represents the problems with the abalone resource. Could you please circle the number after each problem that indicates how serious (if at all) you think the problem is?

	PROBLEM CHOICES	very serious	serious	somewhat	minor	not at all	don't know
1.	Commercial divers taking too many abalone	1	2	3	4	5	8
2.	Sport divers taking too many abalone	1	2	3	4	5	8
3.	Overfishing some specific areas	1	2	3	4	5	8
4.	The taking of shorts	1	2	3	4	5	8
5.	Sea Otters	1	2	3	4	5	8
6.	Pollution	1	2	3	4	5	8

(9 continued)

PROBLEM	very serious	serious	somewhat	minor	not at all	don't know
7. Sport size is too small	1	2	3	4	5	8
8. Sport size is too large	1	2	3	4	5	8
9. Commercial divers violating the 20-foot law	1	2	3	4	5	8
10. Inadequate supply of abalone	1	2	3	4	5	8
11. Poaching	1	2	3	4	5	8

A. Are there any other problems that you might have heard of?

10. Do you have any suggestions for dealing with any of the problems just indicated in the previous question?

11. Do you think the other members of your club feel the same about these problems as you do?

1. Yes _____
2. No _____
3. Don't know _____

12. Some people have suggested that the area north of Pt. Lobos should be opened to commercial abalone divers. Others say that the area should remain off limits for commercial abalone divers. What's your opinion?

1. Keep area north of Pt. Lobos closed to commercial abalone divers _____
2. Open area north of Pt. Lobos to commercial abalone divers _____
3. Open area north of Pt. Lobos to commercial abalone divers under certain conditions _____

(Under what conditions?)

13. As you may know, sport divers diving for abalone north of Pt. Lobos may not use scuba gear. Do you feel this restriction should be maintained?

    1. Yes _____
    2. No _____
    3. Don't know _____

    (IF YES OR NO) Why is that?

14. Have you discussed problems with the abalone resource with:

	yes	no
1. other sport divers	___	___
2. commercial divers	___	___
3. member of Department of Fish and Game	___	___
4. other _____	___	___

15. Have you ever talked to or written to an elected public official about problems with the abalone resource?

    1. Yes _____
    2. No _____

    (IF YES) To whom?

16. If there were changes proposed in abalone regulations about which your club members felt strongly, do you believe the club would be willing to contribute <u>money</u> to the effort supporting your position?

    1. Yes _____
    2. No _____
    3. Don't know _____

17. If there were changes proposed in abalone regulations about which your club members felt strongly, do you believe the club would be willing to contribute <u>time</u> to the effort supporting your position?

    1. Yes _____
    2. No _____
    3. Don't know _____

18. Would you support a licensing plan which required a special abalone stamp if the money were to be used for improving the abalone resource through a seeding (artificial spawning) program?

    1. Yes _____
    2. No _____
    3. Don't know _____

19. Some people have proposed that the state lease certain beds to commercial divers from which sport divers would be prohibited from entering to take abalone. What is your feeling about this idea?

1. I support such an idea _____
2. I oppose such an idea _____
3. I am not sure _____
4. Other _____ _____

20. Has your diving club ever been involved (as an organization) in political activity regarding regulations affecting sport diving?

1. Yes _____
2. No _____
3. Don't know _____

21. Would you characterize the present management of the abalone resource by the Department of Fish and Game as:

1. excellent _____
2. good _____
3. adequate _____
4. poor _____
5. very poor _____

Why do you say that?

22. Some people say that the Department of Fish and Game is uniform in the enforcement of abalone regulations. Others complain that regulations are enforced selectively, favoring some individuals and groups. What do you think about this? Is enforcement uniform or selective?

1. uniform _____
2. depends _____
3. selective _____
4. Don't know _____

(IF "SELECTIVE," please answer A and B; IF "DEPENDS," please answer C)

A. Who are those not uniformly treated?

B. Why is that?

C. What does it depend on?

23. Do you feel that most sport divers who take abalone follow the Department of Fish and Game Regulations?

1. always _____
2. most of the time _____
3. some of the time _____
4. hardly ever _____
5. never _____
6. Don't know _____

In conclusion, we would like to ask a few questions about yourself. As we said in the cover letter, this information will be treated confidentially and will be used for statistical purposes only.

24. In what year were you born? _____

25. Where do you live? _____city

26. What is the last grade or year in school which you completed?

1. no schooling _____
2. finished grammar or elementary (1 to 8) _____
3. some high school (9 to 11) _____
4. completed high school (12) _____
5. some college _____
6. college graduate _____
7. postgraduate college _____

27. Would you please tell us what your approximate income is. Please circle the number of the category which shows your income for last year.

1. $ 0 to $ 4,999
2. 5,000 to 6,999
3. 7,000 to 8,999
4. 9,000 to 10,999
5. 11,000 to 12,999
6. $13,000 to 14,999
7. 15,000 to 17,499
8. 17,500 to 19,999
9. OVER $20,000

Thank you very much for your help. Please return the questionnaire in the enclosed, stamped, self-addressed envelope.

Appendix D

Abalone Diver Questionnaire

1. When did you last dive for abalone?

   _____month _____year

2. How long had you been diving before that?

   _____months _____years

3. On the average, about how many days per year did you dive?

   _____days

4. When you were diving, did you usually dive from:

   1. a company boat _____
   2. boats belonging to other divers _____
   3. your own boat _____
   4. other _____

5. When you were diving, what kind of relationship did you have with the processors? That is, did you usually sell to one processor only, usually sell to more than one processor, or what?

   1. usually sell to one processor only _____
   2. usually sell to more than one processor _____
   3. other (SPECIFY) _____

6. Thinking about the last year you were diving, do you remember what was your total abalone catch for that year?

   _____dozen

7. What was your net income from the taking of abalone for the last year that you were diving?

1. Under $1,000 per year ____
2. $ 1,000 to $ 1,499 ____
3. 1,500 to 1,999 ____
4. 2,000 to 2,999 ____
5. 3,000 to 3,999 ____
6. 4,000 to 4,999 ____
7. 5,000 to 5,999 ____
8. 6,000 to 6,999 ____
9. 7,000 to 7,999 ____
10. 8,000 to 8,999 ____
11. 9,000 to 9,999 ____
12. 10,000 to 10,999 ____
13. 11,000 to 11,999 ____
14. 12,000 to 12,999 ____
15. 13,000 to 13,999 ____
16. 14,000 to 14,999 ____
17. 15,000 to 17,499 ____
18. 17,500 to 19,999 ____
19. 20,000 or more per year ____

8. What were the major reasons why you stopped diving? (i.e., for health reasons? economic reasons? etc.) (PLEASE ELABORATE BELOW)

9. What are you doing for a living now?

_____(PLEASE BE SPECIFIC)

10. Is this a full-time or part-time job?

1. full-time ____
2. part-time ____

11. Approximately what is your net income from your current job?

1. Under $1,000 per year _____
2. $ 1,000 to $ 1,499 _____
3. 1,500 to 1,999 _____
4. 2,000 to 2,999 _____
5. 3,000 to 3,999 _____
6. 4,000 to 4,999 _____
7. 5,000 to 5,999 _____
8. 6,000 to 6,999 _____
9. 7,000 to 7,999 _____
10. 8,000 to 8,999 _____
11. 9,000 to 9,999 _____
12. 10,000 to 10,999 _____
13. 11,000 to 11,999 _____
14. 12,000 to 12,999 _____
15. 13,000 to 13,999 _____
16. 14,000 to 14,999 _____
17. 15,000 to 17,499 _____
18. 17,500 to 19,999 _____
19. $20,000 or more per year _____

12. Have you thought about going back to abalone diving?

1. Yes _____
2. No _____

(IF YOUR ANSWER WAS YES):

A. Are you planning on getting a new license in 1976?

1. Yes _____
2. No _____

(IF YOUR ANSWER WAS NO):

B. Why not?

C. Is there anything that would make you go back to abalone diving?

1. Yes _____ (PLEASE SPECIFY WHAT THAT IS) _____
2. No _____

In conclusion, we would like to ask a few questions about yourself. As we said in the cover letter, this information will be treated confidentially and will be used for statistical purposes only.

13. In what year were you born?

_____year

14. What is your marital status?

1. single _____
2. married _____
3. separated _____
4. divorced _____
5. other _____

(IF MARRIED):

A. Do you have any children?

1. Yes _____
2. No _____

(IF YES):

B. How many? _____

15. Where do you live?

_____town

16. What is the last grade or year in school which you completed?

1. no schooling _____
2. finished grammar or elementary (1 to 8) _____
3. some high school _____
4. completed high school _____
5. some college _____
6. college graduate _____
7. postgraduate college _____

17. Is there anything else that you would like to tell us?

Thank you very much for your time and cooperation.

APPENDIX E

Limited Entry and Fisheries Management

Of the major methods of fishery management, limited entry has recently received the most attention, and has elicited the most controversy. While there are various reasons for this controversy, one major element is the fact that limited entry represents an effort to restrict freedom of entry into an occupation noted for its strong tradition of independence.

This appendix focuses on limited-entry programs (and other ancillary management efforts) that have been adopted in different parts of the United States and in Australia, Canada, Mexico and New Zealand during the last few years. The discussion of limited entry provides a useful introduction to the overall problems of fishery management, and it bears particular relevance to the California abalone fishery in which a limited-entry program has been recently enacted. Working within limitations imposed by the available evidence, the effects of limited-entry programs throughout the world will be estimated in terms of their biological effectiveness, socio-economic impact, administrative costs, and legal and political implications. Not all of these factors can be evaluated in all cases. In a concluding section we will identify some of the considerations and data requirements common to all of the programs that we have examined and discuss their relevance to future management planning.

Most observers agree that the root cause of fishery conservation problems lies in the common property nature of fishery resources. Large numbers of fishermen compete for shares of a fish stock which everyone owns, and yet which no one in particular owns. As Copes states, "No individual fisherman has the power to manage the resource and no one has a direct inducement to conserve the resource... Thus, unbridled competition among fishermen inevitably leads to excessive exploitation of the stock."[1] Open access to the exploitation of this common property resource tends to result in "a long-run tendency for fishermen to achieve no more than a marginal income. Good incomes are obtained usually only during the initial development phase of the industry. In a mature open entry fishery only the man with exceptional skills or exceptional luck does noticeably well."[2]

Limited entry has often been proposed as a major method to solve these problems of unbridled competition for a common property resource. De facto, limited-entry practices have actually been employed for a long time to restrict competition in fisheries. As Herrington aptly points out,

> There are innumerable situations both international and domestic where limitations on entry have been attempted... to reduce competition between the fishermen of different countries, or between different regions or ports of the same country. The attempts of Great Britain, the Netherlands, and others, to secure control of the North Sea herring fishery, are national examples. The 200-mile plus claims of some countries are moves to limit international entry...[3]

De jure efforts to limit entry into fisheries are of much more recent vintage. With the exception of Japan (1893) and South Africa (1953), it has actually been only in the last 15 years that limited-entry programs have been enacted in various parts of the U.S. and abroad.[4] Starting with the limiting of entry into the Australian rock lobster industry (1963), other limited-entry programs have been enacted in Canada (1968), Michigan (1970), Mexico (1972), Alaska (1973), Washington (1974), California (1974), Ohio (1974), and New Zealand (pending in 1976).[5]

Unfortunately, few empirical, evaluative data appear to be available on these limited-entry experiences. A search of the relevant literature produces mostly descriptive accounts of the programs established and summaries of relevant legislation. The few evaluations of limited entry that have been performed rely for the most part upon impressions of administrators and key industry spokesmen. By and large, few systematic data collection efforts have taken place.

The lack of adequate evaluative data is unfortunate, particularly in view of the fact that the Regional Fishery Management Councils (currently being established under the Fishery Conservation and Management Act of 1976) will have to enact management plans (which may include limited-entry provisions) for fisheries threatened with resource depletion. Empirical evaluation of the consequences of limited-entry programs already in effect would, of course, be of great value for the councils. The lack of evaluative empirical studies is due, in part, to the recent enactment of most existing limited-entry programs. Yet, it is also our impression that no systematic evaluative component has been built into most of these programs and that very limited baseline data -- on the basis of which future changes may be

judged -- have been established.[6] We expand on this point at the end of the appendix after a brief description of existing limited-entry programs. These programs are discussed in chronological order of implementation.

Australia

Entry into a number of Australian fisheries has been limited for some time. License limitations were first introduced in the Western Australia rock lobster fishery in 1963 and have since been applied in the rock lobster fisheries in South Australia, Victoria, and Tasmania, the prawn fisheries in Western Australia, South Australia, and Southeastern Queensland, and the abalone fisheries in Victoria, Tasmania, and South Australia.[7]

Notwithstanding the relatively long-term existence of these limited-entry regulations, it does not appear that they form part of a coherent management framework for regulating Australian fisheries. In fact, most authors tend to view these license limitations as interim measures pending research and investigation into alternative methods of management.[8] Discussions of fishery management methods and their consequences currently pervade the Australian fishery journals.[9] Extensive debate and meetings among all segments of the industry have highlighted the need to establish coherent management programs.[10]

The major method employed to limit entry in Australian fisheries has been the freezing of the number of licenses. In regard to the abalone fisheries (on which most of our information on limited entry in Australia is based) the initial allocation of permits was accomplished by "grandfathering" all divers engaged in the abalone fishery. (That is, allocating licenses only to those who had already been diving.)[11] It would appear that these measures have been successful in reducing the number of divers exploiting

abalone. "In South Australia, for example, where the number of divers was 80 when license limitations initially were imposed, as divers left the industry or became incapacitated, this number was reduced to 35. The same process seems to be operative in Victoria and Tasmania."[12]

Determining methods for the subsequent allocation of licenses (after initial license freezes) has proved to be a problem in the abalone fisheries as well as in other fisheries in which licenses have been limited. This is, in fact, the major topic of concern in current fishery management discussions in Australia -- one in which deep cleavages among different segments of the industry are evident.[13] In South Australia, a system of relief abalone divers has been introduced to replace any licensed diver who is too sick to dive. This has allowed the gradual introduction of new divers into the industry when new licenses become available. "In 1974, for example, a decision was made to admit 10 new divers into the fishery. A notice was published and this drew 90 applications. New permit holders were chosen on the basis of criteria such as previous experience and local residence. A similar process is also followed in Victoria."[14]

In Victoria, New South Wales, and South Australia, personal licenses are issued to divers and are not transferable. In Tasmania, on the other hand, permit holders are allowed to sell their licenses (current price appears to be approximately $8,000 Australian dollars). It should be mentioned that the question of license transferability is also a highly divisive issue among different segments of the Australian fisheries; some sectors of the industry are seeking the adoption of salable licenses in other states as a means of revitalizing the industry.

Besides limited entry, other management methods used to regulate abalone

fisheries in various Australian states include the assignment of licenses to specified fishing zones, relatively high prices for annual licenses ($200-250), medical examinations, and size or combined size and weight limitations.

Evaluation of effects. Unfortunately, data on the effects of limited entry into different Australian fisheries are largely unavailable. As a recent Green Paper on the status of South Australian fisheries suggests, "Research in the areas of economics and resource management in the Fisheries Department has been almost non-existent...new systems of data collection need to be introduced, tapping information directly from industry, as well as from internal administrative units..."[15]

The few evaluative references to limited entry which may be found in the literature suggest that while license freezes may serve to stabilize the fishery in the short run, in the long run, license limitations must be accompanied by other, complementary methods. As T. F. Meany reports:

> A decision to introduce license limitation has the effect of freezing the number of licenses at a given level. The result...is to introduce a period of stability to the fishery particularly in fisheries where the number of boats has been building up rapidly...
>
> Introduction of license limitations can lead to a period of profitable operation for those boats that are already in the fishery. This happened in the Western Australian rock lobster fishery. Between 1962-63 (when license limitation was first introduced) and 1968-69 the average gross income for boats increased by about 12 per cent a year while average costs increased by only about 5 per cent a year. This was achieved simply because of rising rock lobster prices and despite an overall drop in the average catch per boat. Had license limitation not been introduced, the profitability of the fishery would have attracted a greatly increased number of boats and the profitability would have been considerably reduced.
>
> It was largely the apparent success of license limitation in this particular fishery which led to its adoption in other fully exploited fisheries in Australia. But in none of these fisheries has its success been as evident as in the Western Australian rock lobster fishery.[16]

Meany goes on to warn that a license freeze in the long run, though, may

not prevent an increase in fishing effort from occurring. This is simply because there may be continuing innovations (e.g., electronic gear) which will make the operation of individual boats more efficient. Thus, a limited-license scheme may in the long run have the same results as an open-entry scheme in that any potential profit might be lost due to over capitalization. A possible solution could be to so restrict the fishery that no changes at all can occur, that is, no replacement of boats, no innovation of gear, etc. "Where this has been tried, though, it has resulted in the grandfathering system" whereby the end result is a "fishery of old boats crewed by old men." Meany thus advocates that "there must be some mechanism for continually reducing the number of boats in a fishery as efficiency increases. It is also evident that in a limited license system few fishermen will withdraw voluntarily. The solution therefore is to either force them out or to buy them out."[17] He concludes by advocating the establishment of a management system stressing "buy-back" provisions and the imposition of royalty fees on the fish catch.

The inadequacy of the license limitation method when it is unaccompanied by other management provisions is also forcibly stressed by other segments of the industry, such as the fishermen themselves. In the words of Mr. Stanistreet, (manager of the Mallacoota Abalone Fishermen's Cooperative) "...a management policy which does not provide any avenue for fishermen to get out of a fishery except by way of going broke, with loss of boats, experience, and capital to the industry, is no management at all; it takes no account of people as human beings but only as numbers in some kind of management chess game..."[18]

In conclusion, if any lesson may be gleaned from the Australian experi-

ence -- taking into account, of course, the dearth of evaluative data -- it would be the need to establish coherent, flexible, and comprehensive fishery management plans which address all aspects as well as all stages of fishery management. It is obvious from this limited-entry experience (as well as from others) that any license limitation plan -- while possibly successful at the outset -- must be constantly monitored and evaluated, and, possibly, supplemented with other methods. Establishing proper data-monitoring techniques must thus be an eminent concern. The Australians themselves are now examining comprehensive fishery management options through extensive discussion and debate among all segments of the industry. It would behoove American fishery management experts to closely follow the current Australian debate for several features of the Australian case make it relevant to the U.S. As in the U.S., management solutions in Australia must address the type of problems peculiar to a federal system, e.g., fishery management practices in Australia vary greatly from state to state, there are serious problems in defining state vs. federal jurisdiction, and fishermen must hold both federal and state licenses to fish in particular areas.[19] Additionally, problems of competition between professional and "amateur" fishermen appear to be particularly acute in Australia,[20] as is the case in many American fisheries. Thus, for example, novel methods of involving all segments of a fishery in the formulation of management policy being developed in Australia could possibly serve as a model for institutionalizing the representation of different types of fishery participants in U.S. regional fishery management councils (e.g.,the 1975 Amendment to the Fisheries Act in Victoria which calls for the direct representation of commercial fishermen and fish marketeers).[21]

Canada[22]

Canada has two major limited-entry programs in effect; one controlling entry into the salmon fishery in British Columbia, the other controlling entry into the lobster fishery in the Atlantic Coast Maritime Provinces.[23] The former is by far the larger and more important.

The Canadian "Salmon Vessel Licence Control Program" (enacted in 1968 in British Columbia) is a somewhat unusual method of limiting entry in that limits are being placed on the number of vessels rather than on fishermen. The program was implemented in four phases:

1) Phase 1: in 1969 the number of vessels fishing for salmon was limited basically to those vessels which had:

-- fished for salmon in 1967 or before September 1968.

-- or were under construction before September 1968.

Moreover, vessels were separated into 2 categories; "A" category vessels were those landing more than 10,000 lbs. of salmon, "B" category vessels were those landing less than 10,000 lbs. of salmon. The provision was made that only "A" category vessels could be retired and then replaced with new vessels. This plan met with a great deal of opposition from fishermen's associations (e.g., the United Fishermen and Allied Worker's Union), who favored control on the number of fishermen rather than on the number of vessels. Opposition from other commercial fishermen (fishing for species other than salmon) was successful in changing the plan so that a vessel participating in any fishery in 1967 or 1968 was entitled to obtain a salmon vessel license in 1969.

2) Phase 2 of the program implemented in 1970 contained four basic features:

a. Salmon vessel fees were increased (to $100 for vessels under 10 tons

and to $200 for vessels over 10 tons).

b. "B" category licenses were given a maximum license of 10 years.

c. Vessels owned by fish processing companies were frozen in number to a fixed percentage of the total fleet.

d. Money from increased Salmon license fees was used to buy-back category "A" Salmon vessels out of the industry.

Provisions for less expensive licenses and special buy-back provisions were made in 1971 for native Indians threatened with exclusion from the fishery because some fish processing companies decided not to finance a number of fishermen, many of them Indian.

The government program of buying back certain vessels was administered by a special committee composed of members of the Department of Fisheries and industry representatives. A major problem faced in the buy-back program resulted from vessels being offered for sale to the government which were not salmon vessels but which had been given the privilege of purchasing salmon licenses because they fished commercially for other species. Once the vessels were sold, the selling fishermen were able to build new fishing vessels for other than salmon fishing under a boat building subsidy plan which provided for 35% of the total cost of building. Thus a buy-back program designed to help salmon fishermen was being used for financial gain by non-salmon fishermen who wanted government aid to build a new boat. As this became a major problem, the method of appraising non-salmon vessels was changed by deducting the amount it would cost to convert and equip the vessel for salmon from its estimated appraised value.

In 1973, as the price of salmon licenses escalated, the cost of the boats became prohibitive and a moratorium was placed on the buy-back program. Dur-

ing the three years the program was in effect, 361 vessels were purchased at a cost of 5.6 million dollars.[24] (These vessels were sold at auctions with the stipulation that they could not be used in any fishery in British Columbia; many of these vessels ended up in U.S. fisheries.)

3) Phase 3 of the program, started in 1970, called for establishing a set of minimum quality standards on salmon vessels. Although the quality standards established were quite low, a high proportion of vessels failed to comply when inspected. Because of this high failure rate, coupled with the physical difficulty of inspecting, the actual enforcement of the regulation on quality standards was delayed until 1973.

4) Phase 4 of the program -- which began in 1973 -- concerns the incorporation of other management methods used in conjunction with the vessel license limitations. These include gear and area regulations as well as efforts to augment the species through the construction of salmon hatcheries and spawning channels.

Evaluation of effects. The primary consequences of the vessel limitation program appears to be a reduction in the number of vessels and an increase in their total value, as data in Table E.1 indicate.

It is not clear, however, that the reduction in the number of vessels has been accompanied by a reduction in fishing effort. In fact, there appears to have been an increase in overall tonnage and use of sophisticated fishing technology. This has probably increased rather than decreased fishing effort. Attrition has not occurred in active, high capacity vessels, but among part-time, sportsmen, and marginal commercial participants.[25] A basic problem here has been that small gillnet or troll vessels have been bought and retired from the fishery and replaced or "pyramided" into larger

purse seiners. As Chris H. B. Newton (Department of the Environment, Vancouver) puts it, "If no action were taken and economic forces were allowed to continue in the fishery, then perhaps within 10 or 15 years, the fleet would consist mainly of purse seiners using a technology far beyond comprehension today and probably resembling the San Diego tuna fleet."[26]

Table E.1

Number of Salmon Licenses Issued,
Compared to Number and Capitalization of Vessels That Fished
(British Columbia)

Year	Number of[1] Vessels Licensed for Salmon	Number of Vessels Fishing Salmon	Value of Vessels Fishing Salmon ($,000)	Per cent of total value of vessels attributed to increase in license value compared to 1967 (%)
1966		6,575	60,643	
1967	7,639[2]	6,639	68,068	
1968	7,548[2]	6,603	73,466	1.9
1969	6,931	6,157	80,110	6.9
1970	6,601	6,201	89,193	10.1
1971	6,285	5,900-6,000 Est.	90,000-91,000 Est.	14.4
1973[3]	5,594	5,222	n.d.	n.d.

SOURCE: Proceedings, Marine Fisheries Resources Conference, December 1971, p. 109.

[1]Includes many vessels that take out salmon licenses but do not fish salmon.

[2]These vessels did not all take out salmon licenses in 1967 or 1968, but under control regulation, if fished any species of fish, were eligible for salmon license after 1960.

[3]Data reported in J. Carl Mundt, ed. Limited Entry Into Commercial Fisheries (Seattle: Institute for Marine Studies, University of Washington, 1974).

The following comment by Maury P. Houghton (Department of the Interior, Vancouver) describes some of the economic effects of the program:

> The average annual gross earnings of the fleet up until 1972 varied between $35 and $45 million. In 1972 we had a record of $52 million; in 1973 the gross production to the salmon

> fishermen in British Columbia jumped to $130 million. Overnight many fishermen were making big money and the mad rush was on for capital investment. The number of new and expensive boats that entered the fishery and are in the throes of entering the fishery is fantastic. The capital involvement in 1968 was $93 million or $94 million, I would say in 1968 dollars it would now be almost double that amount.
>
> In addition, the value of the licenses started to escalate. In the beginning of 1974 I stated that the value of the license was $1,000 per ton. At the end of the year it was somewhere between $5,000 and $6,000 per ton. If you owned a 20-ton seine boat, that would put the value of the license at $100,000.
>
> If you want to buy into the fishery now, you have to pay for the boat and you have to pay that additional cost for the license as well. Those fishermen who are in the fishery who still have retained their original boats would object strenuously to any action to remove the value of this license. It is a capital gain for them. One would have to pass some type of legislation that would stop this tremendous escalation in the price of the ticket of entry. It is just impossible for a young person to get into the fishery today. It really is a rich man's game.[27]

The increase in fishermen incomes occasioned by the limitation program also appears to have had some detrimental spillover consequences in other fisheries. As Newton states,

> The initial objective of the program was to raise the average incomes of fishermen to the regional average. In 1973, this objective was over-accomplished. In fact, some of the incomes generated in 1973 have been so spectacular that other fisheries have been severely dislocated in terms of obtaining crews. Nobody wants to go halibut fishing in the Bering Sea when incomes for three months on a salmon purse seiner are five times greater.[28]

Native Indian fishermen, too, appear to have been detrimentally affected by the limited entry regulations. While some of the Indians understand the program well and fully participate in its objectives, others have difficulty in understanding the concept.

> The temptation to sell a non-operating fishing boat for a price that does not reflect the value per ton of license for that vessel is too much. The Indian is selling his license and privilege

> to fish, mistakenly thinking it is only his boat that has been sold. To deny him his only means of livelihood when he has sold his license, creates a hardship.[29]

In an attempt to prevent the loss of native Indians from the fishing fleet, the government has set up a special fund to maintain Indian participation at the level it was prior to the implementation of the program (Indians comprised 15% of the fleet in 1968 and less than 10% in 1974).

A final problem besetting Canada's limited entry program concerns the increased control of the fishing fleet by the processing companies. While the government attempted to confine processors' ownership to 12% of the fleet at the outset of the program, the increased value of the salmon license privilege has caused the fishermen to turn to the companies for financing as a means of buying an "A" license. It is estimated that processing companies now hold more than 43% of the catch via mortgages, financing, employment of fishermen and boats.[30]

In summary, then, while it is difficult to make any definitive conclusions about the effects of limiting entry in Canada (a comprehensive report has not yet been prepared),[31] preliminary observations suggest that a number of unintended consequences may be taking place. In regards to biological preservation, it does not appear that the program has been effective inasmuch as fishing effort has not been decreased. In terms of socio-economic impact, while it is clear that the regulations have been advantageous for those already in the industry, they may have been detrimental for individuals in other fisheries and for some in the Indian sectors. The Canadian case thus points to the need for considering the interconnection among fisheries whenever limited entry schemes are contemplated. Data on interfishery mobility patterns is thus essential to monitor potential spillover consequences

in other fisheries. Furthermore, the equity of creating a tremendous capital gain for license holders through the imposition of limited-entry needs very careful assessment.

Michigan

Beginning in the 1820's and continuing until the mid-1960's, the Great Lakes fisheries resources were aggressively pursued and exploited by generations of commercial fishermen.[32] In the early 1960's approximately 900-1,000 commercial fishing licenses were issued annually. By the middle 1960's, it became obvious that the popular use of non-selective gear (i.e., gillnets) by the commercial fisherman was having a profoundly detrimental effect on the fishery resources of the delicate Great Lakes habitat; by 1967, stocks of coregonoid fishes such as whitefish, chubs, and herring were fast becoming depleted, and perch, walleyes, and sturgeon were seriously threatened. Thus, legislation was enacted in 1968 granting authority to the Director of the Department of Natural Resources to limit the number of commercial fishermen and to apply direct controls over the harvest of fish from that part of the Great Lakes in Michigan jurisdiction. In 1970, a number of management methods was adopted, including limited entry, and a Zone Management Plan which applied direct controls over the areas and depths that could be fished, species that could be caught, and type of fishing gear permissible for use.

In regard to the limited-entry program, a ceiling was first put on the number of licenses that could be issued by considering the number of persons already holding licenses, the number of licenses required to harvest the fish known to be harvestable, the capacity of boats being used, and the number of people who could economically and profitably engage in commercial fishing. License allocation criteria were determined primarily on the basis of the

fisherman's past fishing history (years of 1967, 1968, and 1969); the fisherman must have fished a required number of days, dependent upon gear type, in at least two of these three years. Additional criteria considered were the kind, nature, and condition of boats and gear, and the quantity and kind of fish catch. When the program was initiated, all those who could meet the minimum requirements of the criteria were grandfathered into the permit system. These limited-entry provisions were successful in reducing the number of commercial fishermen from a total of 300 in 1969 to 188 in 1970.[33] Between 1970 and 1974 another 20 fishermen dropped out, some as a result of the 1970 closure due to mercury in fish, and some due to financial problems. In 1976, because of the significant decline in the chub stocks in Lake Michigan, chub fishing was closed, resulting in 25 chub fishermen being put out of business. The current number of commercial fishermen licensed to fish in Michigan waters now stands at 143.

The limited-entry provisions and other aspects of Michigan's fishery management practices have met with a great deal of opposition from commercial fishermen.

> Opposition to these controls has crystallized in the form of court challenges to the Director's authority, flagrant violations of rules, and undying dispute of the biological data supporting the controls. This opposition has met with equal resistance on the part of the biologists in their efforts to effect meaningful controls over harvest. As a consequence, administrative and management commitments by the regulatory authority have been out of all proportions to the benefits derived from commercial fishing.[34]

Evaluation of effects. According to data provided by the Michigan Department of Natural Resources, the fishery management procedures introduced since 1970 have not been uniformly successful in reversing the depletion of valuable fish stocks. The controls have prevented further deterioration in

some stocks (e.g., whitefish) and have protected hatchery-planted salmonid fishes. Other stocks, however, have continued to decline and may not recover in the future; the lake herring, for example, is nearly extinct in lakes Huron and Michigan and herring production in Lake Superior has fallen from seven million pounds in 1961 to 700,000 pounds in 1971.[35] The chub fishery, as mentioned, was closed in 1976. In biological effectiveness terms, it thus appears that for some species management efforts may have been introduced too late or that factors other than overfishing (e.g., pollution) may have been causing the decline.

In terms of socio-economic impact, it would appear that limiting entry may have occasioned economic hardship and cultural dislocation among Michigan's commercial fishermen when one considers that the number of fishermen declined from 300 in 1969 to 143 in 1976. Unfortunately, data on the fate of these fishermen and their current patterns of income and employment do not appear to be readily available.

Additionally, the Michigan cases raise some equity questions as to who should properly bear the administrative costs of running and enforcing a regulatory program; costs are currently being shouldered by the state taxpayers. The costs of commercial fisheries management, administration, and law enforcement in Michigan currently exceed license revenues by 15 to 1. At the same time, nearly 75% of the fish that is caught in Michigan is exported out of the state. Thus, as Scott notes, "Citizens of Michigan are realizing only small returns for their large investment in commercial fisheries."[36]

Mexico[37]

The Mexican abalone fishery has been subject to regulation since 1972 as a result of resource depletion.[38] The abalone resource -- which is ex-

ploited by a number of authorized cooperatives -- is now managed through a variety of complementary methods:

1. Limited entry: There is a limited number of cooperatives authorized to dive for abalone in particular fishing zones. No new cooperatives have been authorized to exploit abalone since 1972.

2. Offseasons: In order to protect the abalone's spawning season, the offseason (which had been the winter months) now extends from July 1 to August 31.

3. Quotas: Maximum catch quotas were fixed in the fishing zones operated by each fishing cooperative; no cooperative can exceed the fishing limit recommended by the National Fishing Institute. With the yearly application of fishing quotas, the cooperatives have found themselves obliged to refrain from increasing the numbers of boats and divers which operate in their zones and have even reduced their numbers in some instances in order to guarantee the permanent employment of the fishermen for the duration of the fishing season.

4. Cultivation measures: Some experimental transplanting of young abalone has been accomplished in the laboratory. The total number until now has not exceeded 10,000 young.

5. Scientific monitoring: Statistical control of monthly fishing attempts has been initiated in each cooperative, which together with the catch figures, allows an approximation of the rate of catch per attempt. Additionally, a new system of monitoring samples from the abalone unloaded from commercial vessels in the principal fishing grounds has been in effect for three years. Its purpose is to gather monthly information as to the average size of the abalone caught and its distribution by species, sex, and other characteristics.

Evaluation of effects. Unfortunately, no evaluative data on the biological effectiveness and socio-economic impact of these management efforts appear to be available. A recent article on the status of Mexican abalone, however, suggests that authorities may be having problems in enforcing these regulations.[39] According to this report, almost 40% of the abalone currently harvested in one of Baja California's most productive abalone grounds are below the legal size. This situation is exacerbated by the Mexican fisherman's tradition of shelling abalone at sea in order to transport more of the meat in their small boats. This makes scientific monitoring and enforcement exceedingly difficult; as one Mexican biologist stated, "...to try to control the size of harvested abalone by the size of its meat is like attempting to infer the length of a fish by weighing its fillets."[40]

Alaska[41]

The Alaskan experience with limited entry is of great interest to other states considering limited entry efforts for at least three reasons: 1) the complexity of the system established to allocate a limited number of licenses to individual fishermen, 2) the comprehensive data-gathering efforts which were made prior to the establishment of license limitations, and 3) the political and legal conflicts which have surrounded this fishery management effort, and which are still not totally resolved to date.

The Alaskan limited entry law was passed in April 1973 and established the Commercial Fisheries Entry Commission -- a quasi-judicial body empowered to monitor all of the commercial fisheries of the state. Its mission is to stabilize the fishing effort at an optimum level for proper fisheries management and still allow fishermen to realize a reasonable economic return. To date, 19 salmon fisheries throughout the state have been brought under

the limited-entry program. The Commission is now in the process of limiting the five remaining net fisheries in the Arctic, Yukon, Kuskokwim areas. All other fisheries of the state are being monitored and limitation will be implemented in those fisheries when indicated.[42]

Eight of the salmon fisheries brought within the restrictions of the limited entry program have been designated as "distressed" fisheries, and the remaining 11 as "other designated fisheries." In both types of fisheries, a limit has been put on the maximum number of fishery participants. For the "distressed" fisheries, however, there is also a reduction scheme in effect in the form of a voluntary buy-back system somewhat similar to Canada's. The number of licenses to be issued in both types of fisheries has been set equal to the highest number of licenses that landed fish in the fishery in any year between 1969 and 1972.

Perhaps the most interesting aspect of the Alaskan limited-entry program is the method utilized to allocate the limited number of licenses. Allocation of licenses is made on the basis of a 40-point system which takes into account two basic criteria: 1) the individual's economic dependence upon the fishery, and 2) the extent of his past participation in the fishery. Economic dependence is determined by consideration of: a) percentage of income derived from fishing, b) reliance on alternative occupations and availability of alternative occupations, and c) investment in vessels and gear. (1971 and 1972 were chosen as the base years to measure a fisherman's eligibility in terms of economic dependence.) Past participation was determined on the basis of the number of weeks that were fished in the years 1969 to 1972, with a small bonus for participation in 1965 through 1968. Also, points were awarded for crew membership and provisions were made for military

service, illness and other unusual circumstances. It should be mentioned, in addition, that after initial allocation licenses are transferable to other individuals -- Alaskan as well as non-Alaskan -- at a price that is determined by buyer and seller without governmental involvement. (The issue of transferability, it is reported, was the biggest stumbling block in getting the legislation enacted; fishermen supported the program providing that there was absolutely free transferability.)[43]

The establishment of this complex license allocation system in Alaska was accomplished after what appears to be a very thorough research effort, one unequaled in the other limited-entry cases that we have examined. A variety of different types of data was collected and analyzed to establish maximum and optimum levels of gear and to assess the potential effects of alternative methods of allocating licenses.[44] The maximum number of entry permits in each fishery, for example, was determined by synthesizing the following types of information: "fishery profiles" (which collated all existing research on each fishery), computer runs on fish ticket counts by gear card number and Alaska Department of Fish and Game number, license registration figures, and the informed opinions of biologists in the field. To determine the level of optimum numbers for each fishery, officials also conducted a survey of operating costs, in addition to studying biological data. About 520 commercial fishermen were sampled to determine how well they were doing in the fishery. One of the conclusions of this study was that the average operator in 15 of the 18 salmon fisheries sampled made less than $5,250 adjusted gross income per year. This is below the federally defined poverty level.

Additionally, efforts were made to assess the effects of using alterna-

tive criteria for allocating licenses. To analyze the effects of the income dependence standard, for example, officials developed a fisherman's history file based on an analysis of fish tickets between 1969 and 1972 and, moreover, conducted a survey in cooperation with the Internal Revenue Service in which 1,500 tax returns from relevant fishermen were examined for the years 1971 and 1972.[45] This summary information by fishery provided a range of income for each fishery which could be compared to non-fishing occupational income. Information on investment in vessels and gear (another criterion of economic dependence) was obtained from Coast Guard tapes on vessel ownership, while availability of alternative occupational opportunities was derived from appropriate census data. The type of data described above were then combined and analyzed to determine more systematically the different weights and points that should be assigned to different allocation criteria.

The kinds of data collection and analysis techniques utilized in the Alaska case thus appear to be much more thorough and comprehensive than those used in other cases, even though some of the necessary evaluative information still seems to be lacking (e.g. data on interfishery mobility). Moreover, efforts are currently being made to monitor the level of activity and the level of effort in fisheries not currently subject to license limitations so that trends can be identified and "with some luck and skill a limit applied to the number of units of gear when it is appropriate and needed and not when it gets out of hand so that we would face excess gear and a buy-back situation."[46]

The Alaskan case exemplifies some of the political and legal conflicts which may accompany efforts of limiting entry into fisheries. Previous efforts to limit entry in Alaska failed to pass constitutionality tests in the

courts, primarily because they discriminated against non-residents.[47] Subsequently, in 1970, the Alaska Constitution was altered by initiative to allow for limited-entry legislation. This measure passed by a three-to-one vote, which gives some indication that people in Alaska were more than willing to support the proposition. In 1972 the Legislature appropriated funds for a comprehensive study of alternative methods of limiting entry. The limited-entry law passed in April of 1973 incorporated the main findings of this study commission. This law has met both legal and political challenge. To date, the law has been challenged and upheld in the State Superior Court. That ruling has been appealed to the State Supreme Court and written briefs for both sides have been filed.[48] Additionally, an initiative petition calling for repeal of the limited-entry law has resulted in the issue being placed on the November (1976) ballot.

Groups backing the continued application of limited-entry provisions and thus opposing the initiative (e.g. the Alaska Federation of Natives' Human Resources Committee, the Kodiak Area Native Association) have emphasized the need for limited entry because of the "depleted nature of the salmon fisheries," and "the low family income prevalent in most of Alaska's salmon fisheries (below federal poverty level)." These groups also point to the "Boldt decision" (which awarded 50% of the Washington salmon harvest to native Indians signatory to an 1857 treaty) and the claims that it "will affect literally hundreds of Washington fishermen who will look north to Alaska's already unhealthy fisheries -- if limited entry is lifted."[49] Groups leading the opposition to the limited-entry program, on the other hand, have emphasized their protest against government's intrusion into economic affairs. The following comments in a letter to the editor from a Kodiak

fisherman exemplify this view:

> ...Many of us opposed to limited entry believe the government has no business regulating the Economics of the fishing industry by limiting the number of boats so fishermen can be "guaranteed" a good income. There are no guarantees in the fishing business -- if a fisherman wants a guarantee, he's ready for a beach job and a time clock. If there is a poor run of fish, then we all probably have to rely on another fishery or alternate job, but if there is a fair season then the good fisherman and the average fisherman who works hard will make a living, and the poor fisherman will drop out, just like in most other businesses. That's where the free enterprise system must remain. We fish year-round in Kodiak, and we need the freedom and the flexibility to move from fishery to fishery -- that's our security. We don't want to get boxed in by expensive permits and red tape. This summer in Alaska, for example, some areas are facing poor salmon predictions, but those fishermen no longer have the option of shifting to more productive areas...[50]

Despite the election in November 1976, the ultimate resolution of this political conflict probably does not rest solely with the Alaskan voters, but also will depend on the policy actions of the North Pacific Regional Fishery Management Council currently being created following the mandate of the Fishery Conservation and Management Act.

Evaluation of effects. Given the recency of the Alaskan limited-entry program (enacted in April 1973 and actually implemented in 1974), no comprehensive evaluative data are available on the extent of success of this management effort. However, informal evaluation by Roy A. Rickey, Chairman of the Commercial Fisheries Entry Commission, suggests a guarded optimism. He says,

> Alaska's limited entry program has been successful in the salmon fisheries in stabilizing the amount of gear at approximately the 1970 level. (The maximum number of units of gear in each fishery was set at the highest gear level year between 1969 and 1972, depending on the fishery.) The limited entry program has prevented increasing numbers of units of gear from causing the economic and biological situation to worsen. It will not necessarily better either situation until such time that the gear levels can be reduced from the maximum level to the optimum or desired level. This will be done through a voluntary buy-back system which may take several years before a benefit is realized.[51]

Washington

While the State of Washington has had experience with limited-entry programs in a number of smaller fisheries,[52] it has only been very recently that limitations have been imposed in the very valuable salmon fisheries. In 1974, a moratorium on salmon vessel licenses was imposed as an interim measure until a full limited-entry system (currently being developed) is implemented by January 1977. These limitations were finally passed in 1974, after they had been introduced and defeated yearly in the legislature since 1965. The Boldt decision earlier that year (U.S. v. Washington), which held that treaty Indians must be allowed unrestricted access to 50% of all the state's harvestable salmon, played a major role in legislative approval. For the first time, commercial fishermen did not mount any real campaign against limited entry.[53]

This interim program has two basic features: 1) a moratorium on salmon vessel licenses, and 2) a buy-back program. Between 1975 and 1977, only those salmon vessels that had held licenses and had actually made salmon landings between 1970 and 1974 would receive licenses (with the exception of vessels built or bought between 1973 and the date of the Act). Provisions are also made for the allocation of special permits to allow vessels to make a single landing in Washington of salmon caught outside of Washington's waters.

In addition to the moratorium, the State has also implemented a federally financed buy-back of excess vessels and gear. To date, 56 small boats -- almost all of them gillnetters -- have been bought for a total of $758,000. These boats were recently sold at an auction returning a total of $364,000 to the state. A condition for these sales was that none of these vessels could ever be used again for commercial fishing of any kind in Washington

waters. It was expected prior to the auction that Treaty Indians would buy the boats and refuse to sign the pledge not to use the auctioned craft in Washington; this potential confrontation, however, did not take place.[54]

Evaluation of effects. The moratorium limitations are so recent that no data are readily available on the current level of effort in the industry. Moreover, a true and comprehensive limited-entry program has yet to be established. The potential enactment of limited-entry regulations (either by state action in 1977 or by the newly created Regional Fishery Management Councils) will have to address several factors or problems peculiar to the Washington case. Given Washington's location and the nature of the salmon fisheries, it is difficult to define to what extent and over what salmon stocks the State of Washington can exercise control. In terms of state jurisdiction, there is, first of all, an interstate compact with Oregon which effectively prevents the state from taking unilateral action over the fisheries on the Columbia River. Secondly, the International Pacific Salmon Fisheries manages the pink and sockeye salmon for a good share of the season. Thirdly, the Boldt decision leaves the management of a portion of the fishery up to the Indian tribes themselves. In addition, legislation enacted at the time the Pacific Marine Fisheries Commission was created provides that the State of Washington (unlike Oregon, for example), cannot regulate its citizens in offshore waters more rigorously than citizens of other states. Thus, the state has no control over the fair share of the resources which is harvested beyond three miles of Washington's shores.

Limited-entry regulations in Washington will also have to address problems peculiar to the salmon fisheries, in particular, the importance of the large and ever-increasing sports catch, and the wide variation present in

fishing seasons according to the type of gear used.

California

Limited-entry regulations were enacted in October 1974 as emergency protective measures in two small California fisheries -- the herring fishery and the herring roe fishery.[55] A maximum number of permits has been established in both fisheries in order to prevent overharvesting. The process of allocating licenses in the herring fishery is somewhat unusual as it involves a lottery procedure. All qualified fishermen (i.e., who own a boat and gear capable of taking herring, who have been inspected by the Department of Fish and Game, and who have an agreement with the processor to buy the herring) are entitled to have their names included in a lottery for the available permits. Issuance of a permit for one year, though, does not in any way ensure that the permittee will receive a permit the following year; every herring fisherman must undergo the lottery procedure yearly. In the herring roe fishery (where the roe is harvested from seaweed), all qualified fishermen are allowed to submit sealed bids on the royalty per ton they are willing to pay for the taking of herring roe. Although permits have consistently been awarded to the highest bidders, the Fish and Game Commission is empowered to take account of other factors in making its selection. As in the herring fishery, fishermen must go through this allocation process each year. In both fisheries, the permits are revocable and non-transferable.

In addition to limiting entry, the herring fishery is also managed by a quota system which sets a maximum tonnage which may be taken each year. This is monitored by the Department of Fish and Game which keeps daily catch logs. Once the maximum has been reached, the fishery is closed. Permits are also valid in specific areas only (Tomales, Humboldt, and San Francisco

bays).

Evaluation of effects. Again, owing to the recency of enactment of this legislation, no evaluative data are yet available, although the Department of Fish and Game monitors the resource to determine the quotas each year.

Ohio

The state of Ohio has a multi-species fishery composed of six to eight species of fish, primarily walleye, perch, white bass, and channel catfish.[56] This is also a multi-gear fishery (e.g., seine, gillnet, trap-net, trotline). In 1974, there were between 300 to 400 fishermen in the state, about a third of which were full-time fishermen. A variety of fishery management measures (including limited entry) were enacted into law in September 1974.

Allocation of licenses under the new limited-entry program was made by "grandfathering" all those individuals or corporations which had held a commercial fishing license during the preceding year. Additional licenses (if available) may be granted to individuals who meet the following criteria: two years of commercial fishing experience, 90 days-residency in the state of Ohio, and the posting of a $1,000 performance bond.

Other fishery management methods enacted in 1974 in conjunction with limited entry include a quota system, payment of royalties, and increased license fees. The Division of Wildlife may establish species catch quotas to prevent overexploitation of particular species. Quotas must be allocated equitably between sports and commercial interests, as well as between the different gears within the commercial industry. Fishermen must also pay royalties to the state on the four major target species landed in Ohio: walleye, perch, white bass, and channel catfish. Finally, license fees have been greatly increased (a trap-net license, for example, now costs $800 per year

rather than $80, a license for a large gillnet vessel now costs $600 rather than $60 and so on).

It appears that the primary impetus behind the Ohio legislation was not, as in many other cases, related to biological preservation, but rather it was primarily motivated by socio-economic criteria. It appears that the legislation was fully supported by all sectors of the industry as well as by the sport fishermen. In the words of Ray Full, president of the Ohio Fishermen's Association, "...we are looking toward our modified type of Limited Entry with some degree of enthusiasm; hopefully it will help the industry economically. It will make the individuals who are in the industry on a part-time basis determine whether they wish to stay in and become full-time fishermen or go to some other line of endeavor."[57] Limited entry is thus seen as a possible means of cutting out the weekend commercial fishermen, producing a better annual economic return for the full-time fisherman, and thus attracting full-time young people into the industry.

Evaluation of effects. There are no data on whether economic efficiency has, in fact, been improved, or whether there have been any unforeseen side effects.

New Zealand

Although legislation is currently pending in the legislature, New Zealand has not yet formally enacted limited-entry regulations.[58] Nevertheless, it has utilized a variety of interim management methods to conserve its fishery resources.

The New Zealand abalone (paua) fishery -- which had always been a free and open fishery -- recorded the highest number of landings and the largest number of fishermen ever in 1971. In that year, a special Select Committee on fisheries was established to consider methods of conserving these taxed

stocks. In 1973, a quota was introduced to try to ease the take of abalone by licensing 7 exporting firms which were permitted to export a set amount of canned bleached abalone (1,000 green tons). In addition to the imposition of this quota, a closed season of four months (February to May) was declared.

Ministry of Agriculture and Fisheries officials report that since the quota was enforced, it has done much to relieve the strain on the abalone fishery. It has had the advantage of allowing processors to pick their divers and to limit the numbers of divers. Additionally, the quality of divers has improved. The stability created by the export quota has also allowed processors to establish an integrated network supplying the majority of paua to a single processing unit. This has meant a considerable increase in product quality. Now that there is a known annual turnover, marketing has also improved considerably.

While it has served to stabilize the industry temporarily, the export quota has a number of drawbacks as a management tool. Although it sets an "ideal" amount of catch for the whole fishery, it cannot protect specific local fisheries from large-scale temporary increases in divers during "bonanza" situations such as may be occasioned by long periods of unseasonably fine weather. Thus, the New Zealand legislature is currently in the process of considering the creation of a Fisheries Licensing Authority which would be empowered to limit entry into a number of "restricted" fisheries. Fisheries can be declared "restricted" to maintain the fishery at the level of optimum economic yield. This Authority would be empowered to limit the number of divers in either the total fishery or the local fisheries; to limit the size of the catch or to set national or local quotas on the amount taken. Passage of this legislation appeared imminent in 1976.

Conclusion

Our review of a number of experiences with limited entry should warn against the drawing of facile or hasty conclusions about the effects of this type of fishery-management program. Although all limited entry programs strive to control the total effort expended in a fishery, every program must be tailored to the distinctive characteristics of each fishery. Limited entry methods are also seldom employed alone, but rather tend to be used in conjunction with other regulatory techniques. The success of any limited-entry scheme, thus, may well depend upon the combination of management techniques being utilized in a particular case. Moreover, as we have discussed, most limited-entry programs are relatively recent and there is a general lack of empirical evaluative data. Thus it is not appropriate for us at this point to attempt any definitive conclusions about the effectiveness (or lack thereof) of particular limited-entry experiences.

Keeping these caveats in mind, our review of these limited-entry experiences nevertheless suggests two major points of potential value to policy makers considering any management plan: 1) the need for collecting proper baseline data prior to the establishment of a management program and the desirability of introducing an evaluative component into any fishery management legislation, 2) the need to consider a set of factors which may prove problematic in the implementation of any management program. These are discussed in turn.

As government officials prepare to enter a new age of increased government intervention in the management of natural resources (i.e., The Fishery Conservation and Management Act), it would well behoove them to recall some of the lessons which were learned so belatedly and in such a costly fashion

in other domestic policy areas. Namely, one of the major lessons learned from the efforts to introduce broad-scale social action programs in the last decade is that appropriate evaluative assessment components must be incorporated whenever new programs are introduced. Otherwise, there are no means of scientifically judging the extent to which a program is reaching its intended objectives and whether unintended effects are occurring. Rather, evaluation becomes a political football -- one group's impressionistic assessment being just as good as any other's.

Most fisheries management programs have a variety of objectives -- e.g., biological preservation, increased economic efficiency, preservation of the nation's recreational and aesthetic natural resources, protection of the fishermen's livelihood and life style,etc. To assess whether any or all of these goals are being fulfilled, and at what costs, baseline data on biological, economic, social, and political indicators must be gathered at the outset of the management effort. Subsequent gathering of data on the same indicators should allow for the systematic measurement of changes resulting from the management program. This is necessary not only for purposes of judging program effectiveness, but also -- as we have seen in the Australian case -- for purposes of program modification and improvement. Specifying the types of data that must be gathered is not as easy as it may sound. As Rickey points out, "Some of the conceptual decisions on how to limit fisheries are relatively simple compared to the task of gathering the information necessary to make those decisions."[59]

Our review of limited-entry experiences suggests some of the considerations which should be taken into account before a management program such as limited entry is enacted, and some of the data which needs to be gathered

for purposes of program monitoring and evaluation. The Canadian case, for example, suggests that limitations placed on one fishery -- while enhancing that particular fishery -- may have detrimental effects on other fisheries. The interconnection among fisheries should thus be considered, and data on interfishery mobility should be gathered. The cases of Michigan and Mexico speak of problems in administration and enforcement. Questions of who benefits from and who pays for the administration of common property natural resources must be carefully weighed. Problems of enforcement must be anticipated. Scientific monitoring of fish effort and catch must be tai lored to the peculiarities of each fishery. There is a need here for carefully documenting the harvesting patterns and methods of each fishery as well as the informal cultural norms which underlie fishing practices.

The Alaskan case suggests the need for carefully assessing the potential human impact of any management program through the collection and analysis of appropriate data on the fishermen's socio-economic and residential status, the availability of other occupational opportunities, and other factors. It also suggests that considerations of constitutional rights such as equal protection should be addressed. The Washington case highlights the many administrative considerations which fishery management efforts must address as well as the types of data that need to be collected on this question. In the case of the Washington salmon fisheries, for example, existing laws and regulations governing such matters as fishing seasons, limited-entry provisions, gear limitations, landing patterns, etc. must be coordinated with different entities -- e.g., with different gear types within the salmon fishery, with other fisheries related to salmon, with bordering states which share in the fish catch, with Indian tribes, with existing interstate compacts and with inter-

national agreements. Both the Alaskan and Washington cases also point to the need for considering and assessing the interests of all fishery participants -- sport fishermen, full-time and part-time commercial fishermen, as well as processors. Systematic opinion surveys represent one method of gathering such information.

It should be kept in mind that the type of considerations mentioned here only highlight some of the complexities involved in achieving equitable and coordinated management of valuable fishery resources.

Footnotes to Appendix E

1 Parzival Copes, "Review of South Australian Fisheries," Fisheries Green Paper 1, Adelaide, Australia (January, 1976), 3-4.

2 Ibid., 5.

3 William C. Herrington, "What are the Real Objectives of Limited Entry?" Proceedings from the Marine Fishery Resources Symposium, Portland, Oregon, December, 1971, p. 100.

4 Japan has a very unusual system of regulating its coastal fisheries, the so-called "fishing-rights fisheries". In these fisheries, monopolistic and exclusive rights are granted to engage in fishing certain areas of public waters (akin to property rights for those holding licenses). See Y. Asada, "License Limitation Regulations: The Japanese System," FAO Technical Conference on Fishery Management Development, Vancouver, British Columbia, 13-23, February 1973; and L. P. D. Gertenbach, "License Limitation Regulations: The South African System," FAO Technical Conference on Fishery Management Development, Vancouver, British Columbia, 13-23, February 1973.

5 Limited entry has also been an important topic of discussion in Maine where a bill limiting entry into the lobster fishery was recently defeated by the legislature.

6 Alaska may be a possible exception to this general rule. See discussion below.

7 T. F. Meany, "License Limitation as a Fisheries Management Tool," Australian Fisheries, XXXIV, 7 (July 1975), 9.

8 See, for example, W. A. Borthwick, "Managing Victoria's Fisheries," Australian Fisheries, XXXIV, 12 (December 1975), 8-9.

9 Among others, see:

"Rules for Entry to Southern Rock Lobster Fishery," Australian Fisheries, XXXIV, 7 (July 1975), 8.

"P. Copes' 'Green Paper' Proposes Reduction in Number of SA Rock Lobster and Prawn Boats," Australian Fisheries, XXXV, 3 (March 1976), 16-18.

"New Government's Policy Statement on Fisheries," Australian Fisheries, XXXV, 2 (February 1976), 22.

N. E. Clarke, "Licence Limitation--A Fisherman's View," Australian Fisheries, XXXV, 1 (January 1976), 22.

M. J. Sanders, "The State View of Licence Limitation," Australian Fisheries, XXXIV, 12 (December 1975), 12-14.

10 "Fishermen Speak Out on Management Measures," Australian Fisheries, XXXIV, 11 (November 1975), 19.

11 This description of limited entry in the abalone fishery is based on:

"Tasmania Fights Abalone Regulations," Australian Fisheries, XXXI, 2 (February 1972), 2;

M. J. Sanders and K. H. Beinssen, "Licence Limitation in the Victorian Abalone Industry," Australian Fisheries, XXXI, 3 (March 1972), 25;

"Abalone Fishing Ban," Australian Fisheries, XXXI, 4 (April 1972), 5;

"New Measures for Tasmanian Abalone Fishery," Australian Fisheries, XXXI, 7 (July 1972), 8.

12 Personal communication with S. A. Shepherd, Department of Fisheries, South Australia, January 1976.

13 See, for example, H. K. Stanistreet, "The Fisherman's Role," Australian Fisheries, XXXIV, 12 (December 1975), 15-18.

14 Personal communication with S. A. Shepherd, op. cit.

15 Parzival Copes, op. cit.

16 Meany, op. cit., 9-11.

17 Ibid.

18 Stanistreet, op cit., 15.

19 See, for example, A. G. Bollen, "Problems in Achieving Uniform Fisheries Management," Australian Fisheries, XXXIV, 12 (December 1975), 10-11.

20 See, for example, T. Aitchison, H. Blyth, and G. Hutton, "Fishermen Critical of Management Policies," Australian Fisheries, XXXV, 1 (January 1976), 15-16.

21 See discussion in Borthwick, op. cit., 8.

22 The following description of Canadian limited entry programs is based on:

Blake A. Campbell, "Limited Entry in the Salmon Fishery; The British Columbia Experience." Pacific Sea Grant Advisory Program, May 1972, PASGAP-T-72-001;

Thomas A. Morehouse, "Limited Entry in the British Columbia Salmon Fisheries," in Arlon R. Tussing, Thomas A. Morehouse, and James D. Babb, eds., Alaska Fisheries Policy (Fairbanks, Alaska: Institute of Social, Economic and Government Research, University of Alaska, 1972);

Blake A. Campbell, "Are Canada's Limited Entry Programs in the Salmon and Lobster Fisheries Successful?" in Proceedings, Marine Fisheries Resources Conference, Portland, Oregon, December 12-14, 1971 (Corvallis, Oregon: Oregon State University Press, 1972);

J. Carl Mundt, ed., Limited Entry Into Commercial Fisheries, Proceedings of the Conference Held at the Lake Wilderness Continuing Education Center, near Seattle, Washington, on September 12-13, 1974 (Seattle: Institute for Marine Studies, University of Washington, 1974).

23 An analysis of the lobster limited entry program may be found in Campbell, "Are Canada's Limited Entry Programs in the Salmon and Lobster Fisheries Successful?" op. cit., 110-111.

24 Mundt, op. cit., 28, 54.

25 See Morehouse, op. cit., 392; and Mundt, op. cit., 44.

26 Mundt, op. cit., 33.

27 Ibid., 29-30.

28 Ibid., 33.

29 Ibid., 32.

30 Morehouse, op. cit., 403, 415.

31 Personal communication with Mr. C. H. B. Newton, Fisheries Operations, Department of the Environment, Vancouver, British Columbia, January 9, 1976.

32 Description of the Michigan case is based on the following sources:

Personal communication with Ned F. Fogle, Fisheries Division, Department of Natural Resources, Michigan, October 13, 1975;

John A. Scott, "Status of Commercial Fishing," in Status of Michigan's Fisheries Management, David P. Borgeson, ed., Michigan Department of Natural Resources, Fisheries Division (February 1972), pp. 27-32;

David P. Borgeson, Coho Salmon Status Report, 1967-1968, Michigan Department of Natural Resources, Fisheries Division (February 1970);

Wayne H. Tody and Howard A. Tanner, Coho Salmon for the Great Lakes, Michigan Department of Conservation, Fish Management Report No. 1 (February 1966);

Michigan Department of Natural Resources, Michigan's Great Lakes; Trout and Salmon Fishery, 1969-72, Fisheries Management Report No. 5 (June 1973);

State of Michigan 74th Legislature, Regular Session of 1968, Enrolled House Bill No. 3917;

Department of Natural Resources Fisheries Division, Commercial Fishing Order Number 17 (June 10, 1974);

Warren W. Shapton, Chief, Bureau of Field Operations, Michigan Department of Natural Resources, "Regulation of the Commercial Fishery for Chubs in Lake Michigan," (December 18, 1974); "Allocation of Commercial Fishing Quotas on Chubs and Herring in Lake Superior," (December 18, 1974); "1975 Commercial Fishing Licensing Procedures," (December 30, 1974); "Procedures on Conversion of Gill Nets," (May 30, 1974); Interoffice Communications.

Department of Natural Resources, Fisheries Division, "Commercial Fishing Emergency Rule," (July 9, 1975);

Ned F. Fogle, Fisheries Division, Department of Natural Resources, Michigan, "Answers to G. Sheppard's Letter," 1970.

33 Personal communication with Mr. Fogle, op. cit.

34 Scott, op. cit., p. 28

35 Ibid., pp. 28-30.

36 Ibid., p. 31.

37 The following description of limited entry in Mexico is based on personal communication with Sergio A. Guzman del Proo, Biologist, from the Office of the Secretaría de Industria y Comercio, Instituto de Pesca, Mexico City, Mexico, January 9, 1976.

38 According to the FAO's "Yearbook of Fishery Statistics," abalone catch figures for the period from 1960 to 1973 were as follows:

Year	Catch	Value	Price
1960	6.0[1]	--	--[2]
1961	6.4	--	--
1962	7.1	--	--
1963	8.3	$2,231	--
1964	7.6	2,038	--
1965	7.8	2,108	--
1966	6.7	1,806	$6.45
1967	6.4	1,852	6.76
1968	8.2	2,380	7.00
1969	6.9	2,004	6.91
1970	6.7	1,847	6.60
1971	6.4	1,902	6.56
1972	5.4	2,333	10.60
1973	4.7	1,992	9.96

[1] 1,000 metric tons

[2] Data prior to 1966 not available.

(cited in "Mexican Abalone Fishery Threatened," Marine Fisheries Review XXXVIII, 4 (April 1976 35). Similar, but not entirely comparable data are reported in the communication from Sergio Guzman del Proo, op. cit. It should be noted, however, that in both cases there is no reference to effort, so that it is difficult to establish a trend solely on the basis of these data or to determine the extent of the decline.

39 Ibid., 35-36.

40 Ibid., 36.

41 Major sources consulted on the Alaskan case include:

Commercial Fisheries Entry Commission, "Memorandum to the Fishermen of Alaska," Juneau

Commercial Fisheries Entry Commission, 1974 Annual Report (January 15, 1975)

Commercial Fisheries Entry Commission, Proposed Limited Entry Regulations for the Arctic-Yukon-Kuskokwim Area Salmon Fisheries (October 20, 1975)

Laws of Alaska, Amendment to AS16, Chapter 43: "Regulation of Entry Into Alaska Commercial Fisheries," May 17, 1974

Commercial Fisheries Entry Commission, Costs and Earnings of Alaskan Fishing Vessels -- An Economic Survey (September 10, 1974)

Commercial Fisheries Entry Commission, "Notice of Proposed Changes in the Regulations of Commercial Fisheries Entry Commission," (October 16, 1975)

Register 52, "Title 20: Miscellaneous Boards and Commissions; Chapter 05: Commercial Fisheries Entry Commission," (January 1975).

Commercial Fisheries Entry Commission, Limited Entry: Report to the Fishermen of Alaska (July 15, 1974)

James E. Owers, "An Empirical Study of Limited Entry in Alaska's Salmon Fisheries," Marine Fisheries Review, XXXVII, 8 (June 1975), 22-25

B. J. Rothschild, World Fisheries Policy (Seattle and London: University of Washington Press, 1972)

George W. Rogers, "Fisheries Management: The Cook Inlet and Bristol Bay Cases," in Tussing, et al., op. cit.

Thomas A. Morehouse and Jack Hession, "Politics and Management: The Problem of Limited Entry," in Tussing, et al., op. cit.

42 Personal communication with Roy A. Rickey, Chairman, Commercial Fisheries Entry Commission, State of Alaska, October 31, 1975.

43 This point is discussed in Mundt, ed., Limited Entry Into Commercial Fisheries, op. cit., p. 9.

44 This discussion is based on the comments by Allan Adasiak, Executive Director, Alaska Commercial Fisheries Entry Commission, Ibid., pp. 12-16.

45 See Owers, op. cit.

46 Mr. Adasiak's comments in Mundt, op. cit., p. 15.

47 Mundt, op. cit., p. 57.

48 Personal communication with Mr. Rickey, op. cit.

49 See "Native Federation Unit Supports Limited Entry," Anchorage Times, May 12, 1976; "Group Backs Entry Rule," Anchorage Times, April 30, 1976.

50 "Either You Are For or Agin Limited Entry, Says Alaskan," Mail Buoy Section, National Fisherman, LVII, 6 (June 1976).

51 Personal communication with Mr. Rickey, op. cit.

52 E.g., Oysters, subtidal hardshell clams, geoduck clams, and herring, see discussion in Mundt, op. cit.

53 Robert J. Browning, "Washington's Governor Evans Signs Limited Entry Into Fisheries," National Fisherman, LV, 3 (July 1974), 2A.

54 Robert J. Browning, "Washington Buy-Back Off to a Ragged Start," National Fisherman, LVII, 7 (July 1976), 12A-13A.

55 California Department of Fish and Game, California Fish and Game Code, Sections 8550-8555.

56 Description of the Ohio case is based on the comments delivered by Mr. Russell Scholl, Fish Management Supervisor, Division of Wildlife, State of Ohio, and by Mr. Ray Full, President, Ohio Fishermen's Association, at the Conference on Limited Entry, reported in Mundt, ed., op. cit.

57 Mundt, op. cit., pp. 38-39.

58 Data on New Zealand are derived from in-house materials provided by R. Cooper, Fisheries Management Division, Ministry of Agriculture and Fisheries, Willington, New Zealand, March 19, 1976.

59 Personal correspondence with Mr. Rickey, op. cit.