

8. ABALONES

Overview of the Fishery

Seven species of abalone are found in California: red abalone, *Haliotis rufescens*; pink abalone, *H. corrugata*; green abalone, *H. fulgens*; black abalone, *H. cracherodii*; white abalone, *H. sorenseni*; pinto abalone, *H. kamtschatkana*; and flat abalone, *H. walallensis*. Threaded abalone, *H. kamtschatkana assimilis*, was once thought to be a separate species, but is now considered to be synonymous with the pinto abalone.

Archaeological evidence indicates that Native Americans fished extensively for abalone from coastal areas and the Channel Islands prior to European settlement of California. During the 1850s, Chinese-Americans began fishing commercially for intertidal green and black abalones. Fishermen worked shallow waters with skiffs, dislodging abalone with long poles tipped with wedges, and landing them with gaffs. This fishery hit peak landings of 4.1 million lb¹ in 1879, but was eliminated in 1900 by the closure of shallow waters to commercial harvest.

In the early 1900s, Japanese-American divers began fishing virgin stocks of subtidal abalone, first as free divers from surface floats and later, more successfully, as hard-hat divers. Landings peaked at about 3.9 million lb in 1935 and then declined to under 200,000 lb by 1942 as fishermen of Japanese heritage were moved to relocation camps during the early part of World War II (Figure 8.1 and Table 8.1). Commercial abalone fishing increased later in World War II when abalone was used as a source of war-time food. Landings rapidly increased between 1942 and 1951. Landings appeared relatively stable from 1952 to 1968, averaging about 4.5 million lb per year, but began declining rapidly in 1969. By 1996, the last full year the commercial fishery was open, landings had fallen to about 229,500 lb, only 4% of the fishery's peak landings of 5.4 million lb.

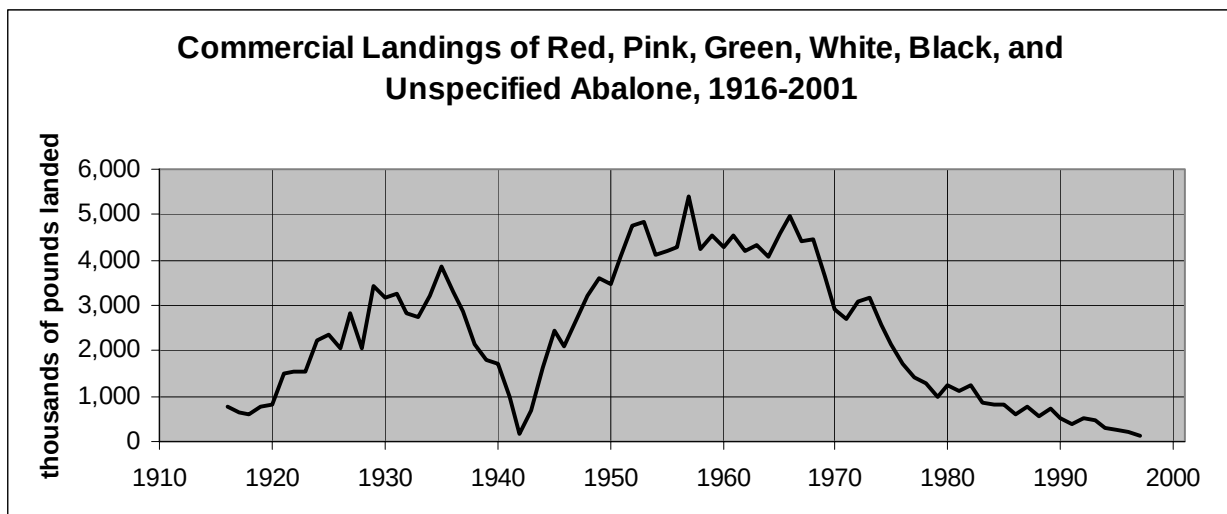


Figure 8.1. Annual commercial landings (pounds) of red, pink, green, white, black, and unspecified abalone from 1916 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1916-1983) and the DFG commercial landing receipt database (1984-2001).

¹ Unless otherwise noted, all weights include both shell and meat.

Abalone Serial Depletion

Five species of abalone were commercially fished: red, pink, green, black, and white. When combined, landing numbers from these five species give the appearance of a stable fishery; however, individual species landings actually increased and fell in a sequential manner (an occurrence known as serial depletion). The commercial abalone fishery south of San Francisco provides an example of serial depletion that was masked by combining landings for multiple species and multiple fishing areas. When the abalone landings are divided by species, a pattern of depletion over time becomes evident (Figure 8.2 through Figure 8.6, and Table 8.2). From 1952 to 1968, combined landings appeared stable because pink abalone landing decreases were offset by increases in red abalone landings. In 1971, pink abalone landings declined abruptly when pink abalone size limits were raised to protect stocks. This decline was offset by increases in green abalone landings, the result of a lower green abalone size limit. Red abalone landings began to decline in 1968, but the drop was masked by increased commercial fishing for green, black, and white abalones. Landings for these three species rapidly peaked and then declined in the 1970s. In the early 1970s, substantial increases in black abalone landings helped to maintain the appearance of stability in the abalone fishery.

Serial depletion also occurred by area. As nearshore areas were depleted, fishermen traveled to more distant locations for abalone, until stocks in most areas had collapsed. From 1952 to 1968, most red abalone were caught in central California. Catches declined on the central coast due to fishing pressure from humans and an expanding sea otter population. This decline caused the fishery to shift to the southern California mainland and to Santa Rosa, Santa Cruz, San Nicolas, and San Miguel Islands. The pink abalone fishery persisted for some time as fishing

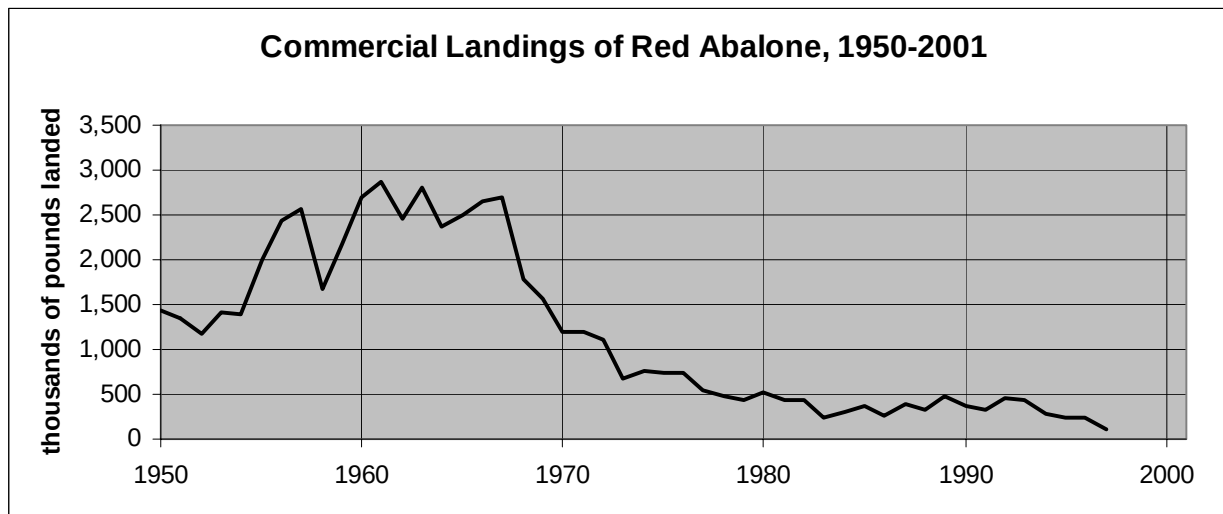


Figure 8.2. Annual commercial landings (pounds) of red abalone from 1950 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1950-1983) and the DFG commercial landing receipt database (1984-2001). Red abalone were required to be sorted and weighed separately beginning in 1950. Early landings of abalone from 1916 to 1949 primarily consisted of red abalone. The commercial red abalone fishery closed in 1997.

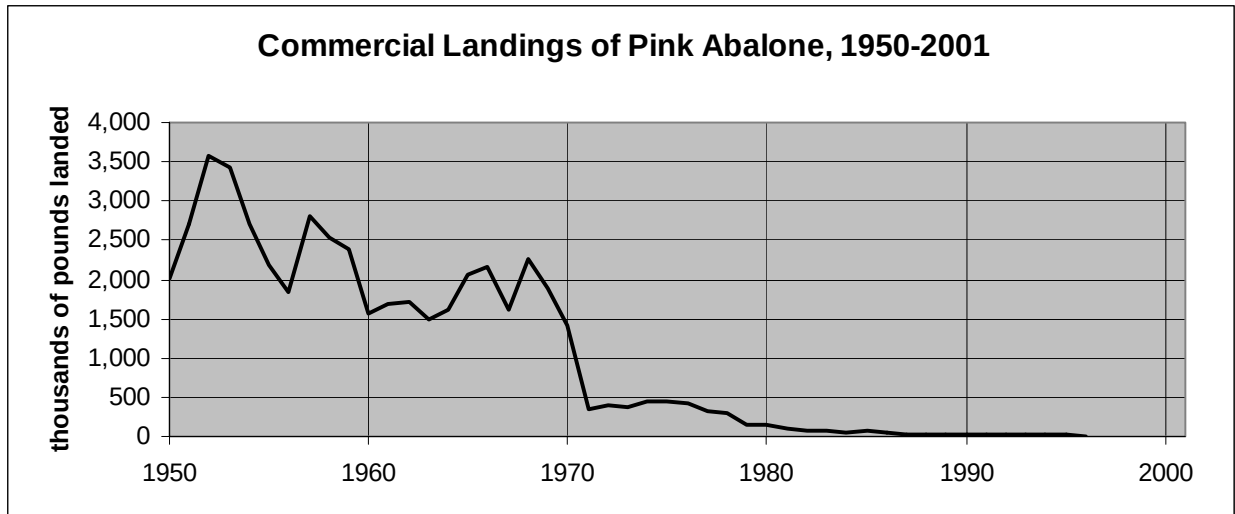


Figure 8.3. Annual commercial landings (pounds) of pink abalone from 1950 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1950-1983) and the DFG commercial landing receipt database (1984-2001). Pink abalone were required to be sorted and weighed separately beginning in 1950. Early landings of abalone from 1916 to 1949 primarily consisted of red abalone. The commercial pink abalone fishery closed in 1996.

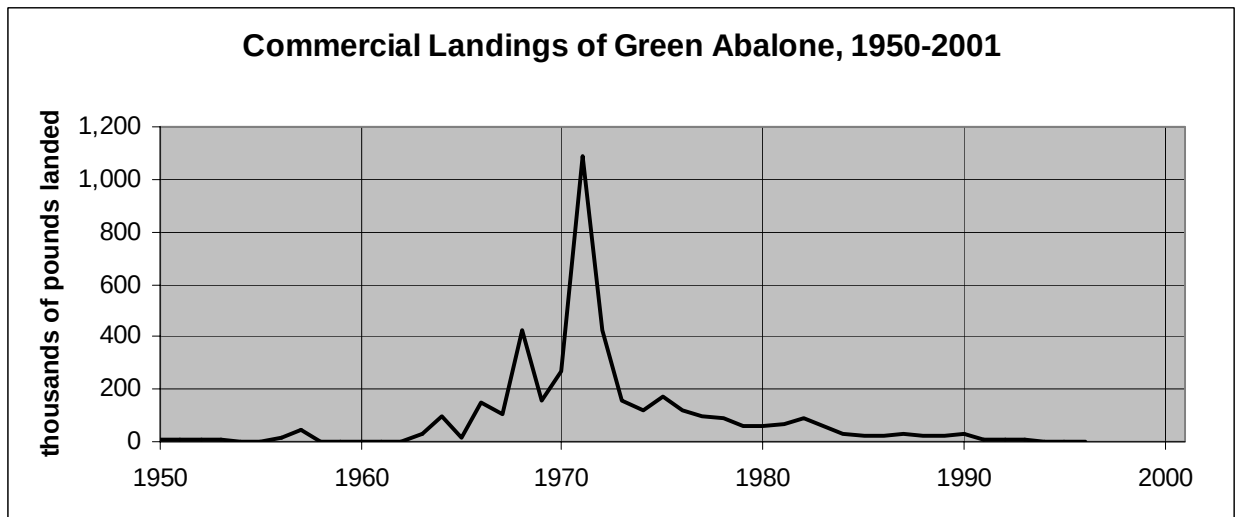


Figure 8.4. Annual commercial landings (pounds) of green abalone from 1950 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1950-1983) and the DFG commercial landing receipt database (1984-2001). Green abalone were required to be sorted and weighed separately beginning in 1950. Early landings of abalone from 1916 to 1949 primarily consisted of red abalone. The commercial green abalone fishery closed in 1996.

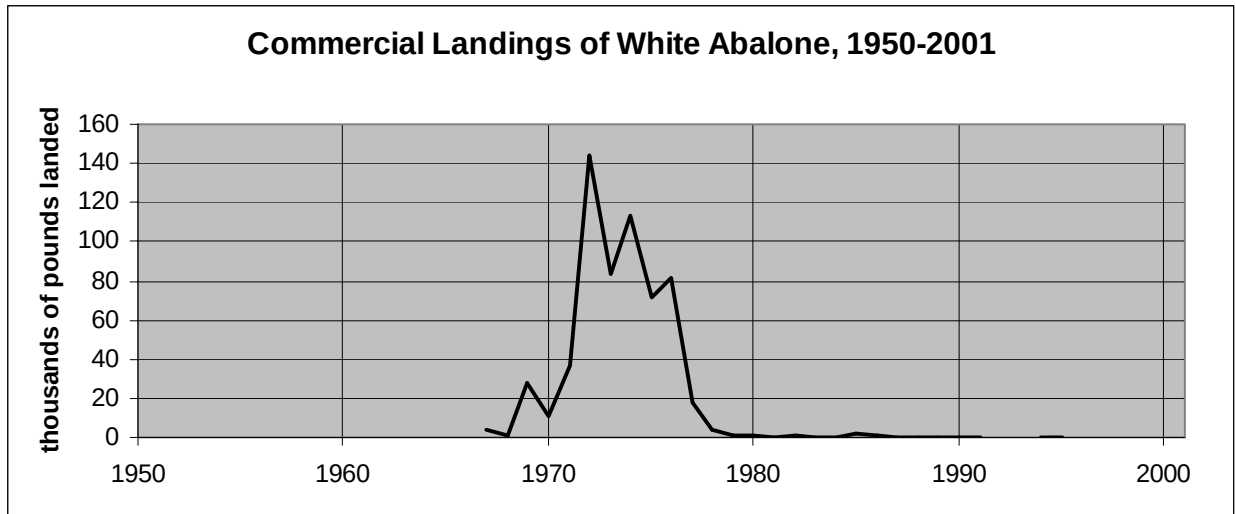


Figure 8.5. Annual commercial landings (pounds) of white abalone from 1950 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1950-1983) and the DFG commercial landing receipt database (1984-2001). White abalone were required to be sorted and weighed separately beginning in 1950. Early landings of abalone from 1916 to 1949 primarily consisted of red abalone. The commercial white abalone fishery closed in 1996.

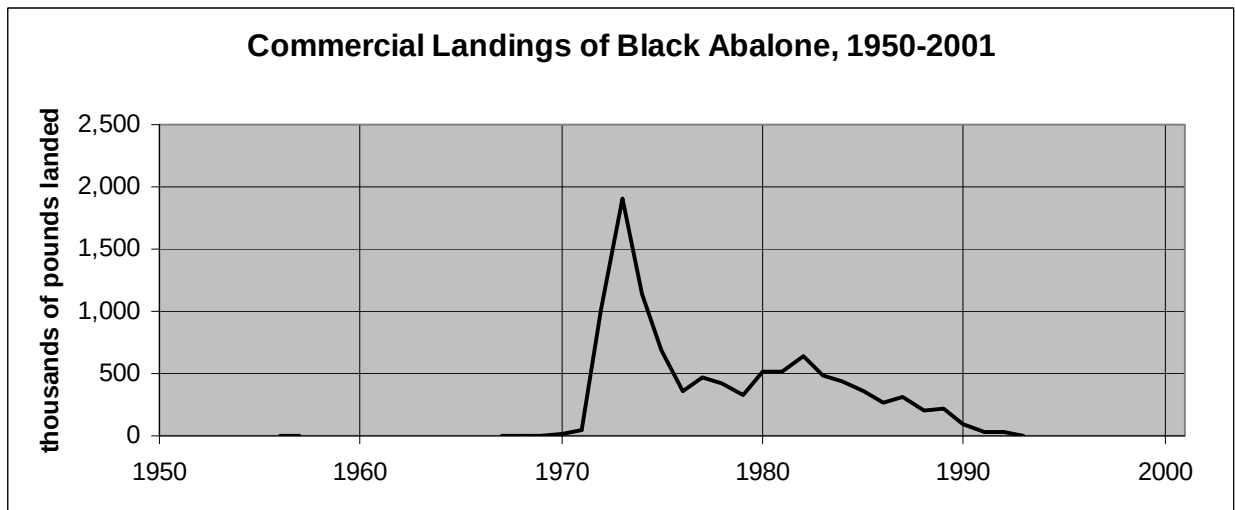


Figure 8.6. Annual commercial landings (pounds) of black abalone from 1950 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1950-1983) and the DFG commercial landing receipt database (1984-2001). Black abalone were required to be sorted and weighed separately beginning in 1950. Early landings of abalone from 1916 to 1949 primarily consisted of red abalone. The commercial black abalone fishery closed in 1993.

effort expanded into unfished areas. By the early 1980s, the commercial pink abalone fishery had expanded throughout the available range, but landings had dwindled to almost nothing. Green and white abalone landings were limited to specific areas, suggesting that these species were limited in distribution before they were fished. Overall, declines varied by area and species, but most landings had decreased to a level that caused serious concern by 1995.

Abalone Fishery Regulation Overview

Commercial take of abalone was first regulated in 1900 when shallow waters were closed to fishing. In 1901, a size limit of 15 in. circumference was instated for all abalone. A commercial fishing license for the take of abalone was established in 1909. These early regulations have been followed by various combinations of management measures, including landing requirements, restrictions on diving gear and other gear, size limits, open/closed seasons, and open/closed areas. In 1949, commercial abalone fishing was prohibited from Point Lobos (San Francisco County) to the California-Oregon border. The commercial black abalone fishery was closed in 1993, and the commercial fisheries for green, pink, and white abalones were closed in 1996. In 1997, fishing for all species of abalone was prohibited from San Francisco to the U.S.-Mexico border, effectively ending commercial fishing in California.

Recreational take of abalone first became regulated in 1911 when fishing seasons were established. In 1913 the first bag limit of 10 abalone was introduced for all species in southern California. A recreational fishing license requirement for the take of abalone was established in 1931. The black abalone recreational fishery was closed in 1993. In 1996, the recreational fisheries for green, pink, and white abalones were closed. By 1997 the entire recreational abalone fishery was closed south of San Francisco.

Commercial fishing was prohibited north of Point Lobos in San Francisco County in 1949. Since then, the northern California red abalone populations have supported a viable recreational fishery with the help of management measures including the prohibition of scuba or other underwater breathing devices, species-specific management (red abalone only), seasonal closure, strict take limits, and most recently, a take reporting system. Northern California recreational abalone fishermen have been limited to breath-hold diving (scuba is prohibited) since 1953, which protects deep-water stocks beyond the range of free-divers. In 1998 an abalone stamp was introduced to generate revenue for population assessments, management, and enforcement. In 2000 an abalone report card became mandatory to help control illegal take and to document catch and effort. An annual limit of 100 abalone was established for 2000. In 2002 the daily bag limit for red abalone was reduced from 4 to 3, and the annual limit was reduced from 100 to 24 per person due to concerns about the status of stocks. The red abalone season is open from April through June, and August through November.

Recreational abalone landings have been difficult to monitor without a state-wide, mandatory landing reporting system. One of the only sources for estimating recreational landings in southern California was the commercial passenger diving boat (CPDB) log book system, which provided only gross trends in the CPDB industry. These trends indicate that green and pink abalones dominated the diving boat catch before 1983. From 1986 to 1990 the number of pink abalone landings declined, leaving green abalone as the predominant species. Red abalone landings increased steadily during this time period, while small landings of black abalone and white abalone declined and eventually disappeared.

Creel and telephone surveys have been used in northern California to estimate annual harvest and effort by recreational divers. Between 1983 and 1989, estimates indicate that abalone divers harvested an average of 685,000 red abalone during 235,000 trips (or "effort days") per year. For 2000, preliminary estimates from

incomplete abalone report cards indicate that 728,000 red abalone were taken during 202,000 effort days by approximately 38,276 recreational divers. Ninety-six percent of abalone fishing effort occurred in Mendocino and Sonoma counties in 2000. Diver and shore-picker effort data from 1995 to 2000 show a pattern of serial depletion as abalone were taken from progressively deeper water and from more remote populations at Sonoma County and southern Mendocino county creel survey sites.

Status of Biological Knowledge

Abalones occur in the coastal waters of California from the intertidal zone to depths of 200 ft. The red abalone range extends from Oregon into Baja California, Mexico. Red abalone inhabit intertidal and shallow subtidal areas in northern and central California; however, they are exclusively subtidal in southern California, where they prefer cooler, upwelling locations along the mainland and the northwestern Channel Islands. Black abalone is found from Mendocino County, California to Baja California, Mexico, and is largely intertidal, extending to a depth of about 20 ft in southern California. Pink, green, and white abalones are associated with the warm, temperate waters south of Point Conception. Their range extends into Baja California, Mexico and the southeastern Channel Islands, although they are stratified by depth: green abalone is more abundant at shallower depths than pink abalone, and pink abalone occur at shallower depths than white abalone. White abalone occur at the deepest depths of all California species. They are often found on rocky substrata near the interface of sand and rock at depths of 75 to 200 ft, although they have been found as shallow as 25 ft. The less-common flat and pinto abalones are generally found north of Point Conception, where water temperatures are predominately cooler. Most California abalones are found in the boulder and rock habitat associated with kelp forests. Abalone abundance is highest where physical conditions allow good kelp growth and where drift kelp is available.

Abalones live as long as 30 years. Growth is slow and highly variable; for example, 6 to 12 years are required to reach the minimum sport legal size (7 in.) for red abalone. Age at sexual maturity varies among species, ranging from 1 to 5 years.

Male and female abalones release their sperm and eggs into the sea at the same time (an event called "synchronous broadcast spawning"). The duration and timing of spawning varies by species (Table 8.1). A minimum density of spawners is essential for successful broadcast spawning. When only a few, widely-spaced animals are present, they can be too far apart for successful mixing of eggs and sperm; successful fertilization dramatically decreases when abalone are more than about 5 ft apart. Thus, when population densities drop below a critical threshold, population declines and local extinction can result despite the presence of actively spawning individuals. This explains why abalones are especially vulnerable to collapse at low densities.

Once fertilized, abalone eggs sink to the bottom and hatch into larvae. Larvae spend several days to a week in the water column, then settle to the bottom again, changing into juveniles when they encounter suitable habitat with encrusting coralline algae. Larvae are retained in the vicinity of appropriate habitat by the short larval period and by the dampening of local currents that occurs in kelp forest habitat. This limited dispersal reduces abalone larvae's ability to repopulate depleted areas.

Mortality rates for larval and juvenile abalone are very high. Studies in both southern and northern California have shown that major recruitment events (successful spawning, settlement, and survival of juvenile abalone to the adult stage) occur only occasionally.

Table 8.1. Abalone biological information summary				
Species	Current Range	Depth	Spawning season	Foods
Red	southern Oregon to Baja California, Mexico (considered absent from southern California mainland)	intertidal to 24 m	N. CA: Oct. - Feb. S. CA: year-round	bull kelp, giant kelp <i>Laminaria</i> , <i>Egregia</i> , <i>Pterygophora</i> , <i>Ulva</i>
Pink	Pt. Conception to Baja California, Mexico	lower intertidal to 60 m	March – November	<i>Plocamium</i> , <i>Eisenia</i> , <i>Macrocystis</i> , <i>Dictyopteris</i>
Green	Pt. Conception to Baja California, Mexico	low tide line to 18 m	early summer to early fall	<i>Gelidium</i> , <i>Pterocladia</i> , <i>Plocamium</i> , <i>Gigartina</i> , red algae, bull kelp, giant kelp
Black	Mendocino County, California to Baja California, Mexico	intertidal	late spring and summer	giant kelp, <i>Egregia</i>
White	Pt. Conception to Baja California, Mexico	25 to 60 m	late winter to early spring	<i>Laminaria</i> , <i>Agarum fimbriatum</i>
Pinto	Alaska to Baja California, Mexico	Shallow water in north; deep colder water in south	April to June	small algae
Flat	Oregon to San Diego, California	6 to 21 m	not known	not known

from the draft Abalone Recovery and Management Plan, 30 Dec. 2002 version

Very small juvenile abalone feed on bacterial and diatom films. Older juveniles and adults feed primarily on drift algae. Abalone feed preferentially on giant and other kelps (Table 8.1). Because abalone and sea urchins share a common food source, they compete for food and space.

Environmental conditions can have a profound effect on abalone habitat and populations. Storms can kill abalone, and limit distribution in areas of greatest storm exposure. El Niño events bring warm, nutrient-poor seawater northward along the coast, which is detrimental to kelp growth. When food availability is reduced, abalone growth rates can slow dramatically. In addition, red abalone experiences decreased settlement of larvae and recruitment of juveniles during El Niño periods.

Abalones, especially juveniles, are preyed upon by a wide variety of animals including crabs, lobsters, gastropods, octopuses, sea stars, sea otters, and fishes.

Larger abalones are partially protected from most of these predators by their size; however, the bat ray in southern California and the sea otter in central California prey selectively on larger abalone. Along the Central Coast, sea otters have removed most large, exposed abalone.

Withering syndrome, an abalone disease, is a major source of abalone deaths in some populations. This disease can severely impact abalones throughout large areas, as it did with black abalone at the Channel Islands. Research has been directed at developing resistant strains and treatment to protect stock in culture facilities.

Status of the Populations

The status of California abalone varies from fairly robust populations (red abalone in northern California) to near extinction (white abalone). The status of each abalone species is discussed below.

Red Abalone

Northern California - Red abalone populations in northern California have supported a viable recreational fishery for decades. While legal-sized adults (7 in.) are still relatively abundant, population and fishery data analyzed in 2001 revealed four trends that are of concern:

- Concentration of fishery effort and increased take
- Evidence of poor recruitment
- Declines in deep-water stocks
- Local depletion

Estimates of average take and effort for 1998 through 2000 have shown an increase compared to 1983 through 1989, with substantial concentration of fishery effort in Sonoma and Mendocino counties. This effort shift has been accompanied by a 25% increase in take. When poaching estimates (217,000 lb) are added to the estimated recreational take, the total take exceeds 1.7 million lb. This level of take approaches the average red abalone harvest in southern California, which was unsustainable and preceded fishery collapse.

Recruitment events are necessary to ensure replacement of animals removed by fishermen and predators. Significant recruitment of red abalone (large numbers of animals measuring less than 4 in.) was last observed between 1986 and 1992 at Van Damme State Park in Mendocino County. Since 1992, the abundance of abalone between 2 and 5 in. has declined substantially at this location. Recent surveys at four other northern coastal sites (Point Cabrillo Reserve in Mendocino County, and Bodega Bay Marine Reserve, Salt Point State Park and Fort Ross State Park in Sonoma County) revealed few young-of-the-year (abalone less than one year old) and emergent (not hidden; seen without moving habitat or using lights) recruits. The reduced number of sub-legal animals implies poor recruitment over the last ten years. Given the slow growth rates of abalone, a successful spawn in any year would not reach sport-legal size (7 in.) for 6 to 12 years.

The prohibition of the use of scuba and surface-supplied air while taking abalone establishes a depth refuge for a portion of the stock, because free divers generally cannot dive deeper than 28 ft. However, declines in deep-water stocks are evident at two of four sites surveyed between 1986 and 2000. Decreases in deep-water stocks mean that “refuge by depth” may not provide sufficient population protection.

Catch and effort data provide evidence of depletion at heavily fished sites. Increased take of abalone from deeper water and from more distant locations resulted in a decline in the number of abalone taken per trip. At one heavily impacted location (Moat Creek in Mendocino County), the distance traveled from access points to take locations doubled for shore-pickers between the 1989 and 1994, and between 1995 and 2000. Aerial surveys completed between 1975 and 1985 showed a significant decline in the number of shore-pickers, while diving effort increased significantly. This represents a shift from intertidal to subtidal fishing as shallow stocks are depleted.

Central and Southern California - Based on long-term studies, the trend in red abalone abundance is one of decline in all locations surveyed except San Miguel Island. Stocks in key areas in southern California (Santa Rosa Island, Santa Cruz Island, and the California mainland) appear to have been eliminated, and stocks in the remaining areas show little evidence of recovery. In a 2001 survey at Santa Rosa Island and Santa Cruz Island, red abalone abundance (the number of abalone encountered by one diver per hour) ranged from 0 to 7.6 abalone at Santa Rosa Island, and 0 to 1.4 abalone at Santa Cruz Island. San Miguel Island is the only location in southern California that has a self-sustaining population.

In central California, which is occupied by sea otters, abalone populations are stable but do not provide fishable stocks. The red abalone population decreased by approximately 84% after the return of the sea otters. Abalone populations in central California “otter areas” appear sustainable, but have a lower average size of 3 in. (half that of abalone in areas devoid of otters).

North of the sea otter range in central California and at the Farallon Islands, abalone stocks are depressed. In a dive survey at Fitzgerald Marine Reserve in central California, densities of red abalone were 0.02 /m², which is one-tenth of the lowest density found in heavily fished areas off northern California. At the Farallon Islands, surveys in 2000 found that areas of historic high abalone abundance (based on commercial diver observations) had low densities.

Pink Abalone

The pink abalone was once common in southern California. Monitoring sites in the Channel Islands show that the abundance of pink abalone has declined since 1985. In timed swims conducted in 1996 and 1997, an average of 1 to 1.5 pink abalone per hour were found. Anacapa Island had the highest number of pink abalone of the five islands monitored.

Green Abalone

The green abalone was once common in southern California, particularly in the warmer parts of the southern California Bight (San Clemente, Santa Catalina, and Santa Barbara Islands; Cortez Bank; and along the mainland from the Palos Verdes

Peninsula in Los Angeles County, south). Green abalone were rare in surveys at San Clemente and Santa Catalina Islands from 1995 through 1999 and in 2001. Densities ranged from 0 to less than 40 abalone/hectare ($0.004/\text{m}^2$). Withering syndrome may have affected green abalone at these islands.

Black Abalone

The black abalone was an abundant species in California until the mid-1980s; it once occurred in such high concentrations that individuals were regularly observed stacked on top of one another. Due to population declines, the National Marine Fisheries Service designated the black abalone as a candidate for listing under the federal Endangered Species Act.

Withering syndrome spread throughout the Channel Islands and the remaining mainland populations of black abalone as far north as Pacifica in San Mateo County. At most locations, black abalone have virtually disappeared. At Point Arguello in Santa Barbara County, black abalone densities increased from 1992 to 1993; however, after withering syndrome was first observed in 1994, densities started to decline and remained at a low level (1,000 abalone/ha, or $0.1/\text{m}^2$) through November 2000. Densities at Point Arguello increased in 2001 to 2,500 abalone/ha ($0.25/\text{m}^2$), but this is far lower than historic population levels.

White Abalone

On 29 May 2001, the National Marine Fisheries Service listed the white abalone as a federally endangered species under the federal Endangered Species Act, making it the first marine invertebrate listed as a result of human harvest. Despite the fact that part of the white abalone fishery has been closed since 1977, densities have continued to fall. Current population estimates indicate that white abalone have declined by as much as 99% since the 1970s. An abundance estimate based on deep survey data from 1997 was 1,600 animals; in comparison, a conservative estimate of the former baseline white abalone population abundance derived from commercial landings data (1969-1978) is 363,000 animals.

Remnant populations of adult white abalone remain only at the deepest portions (greater than 108 ft) of their former distribution. Their distribution also appears to be limited to a narrow strip of habitat along the rock/sand interface of isolated boulders. There is no evidence of a significant recruitment event since the late 1960s or early 1970s. As the white abalone life span is estimated at about 35 to 40 years, the remaining individuals are likely approaching the end of their lives.

With densities too low for successful reproduction, and because of natural mortality, recovery of the white abalone is unlikely without significant human intervention. Other complications that may hinder or preclude recovery despite human intervention include reduced genetic diversity due to the small size of the gene pool, and outbreaks of withering syndrome.

A captive rearing program is now underway. In 1999, 18 adult broodstock were collected from deep habitats and brought to two culturing facilities. Three of these animals have been successfully spawned, producing more than 100,000 juveniles. A significant portion of these cultured white abalone recently succumbed to withering

syndrome, although it is not known whether wild populations are also affected. Genetic, disease and legal concerns must be addressed before outplanting of cultured abalone

can begin. In July 2002, a federal recovery team was convened by National Marine Fisheries Service to manage recovery of white abalone.

Pinto Abalone

Pinto abalone are more common in northern California than in southern California. In 1970 this species comprised about 13% of the abalone landings. Today pinto abalone are very rare throughout northern California, making up less than 1% of the population. This species was not a major component of the commercial or recreational catch.

Flat Abalone

Little is known about flat abalone. In central California, abundances within sea otter range appear to have declined steadily since the 1970s, when 31% to 38% of abalone populations consisted of flat abalone. Recent surveys reveal that flat abalone currently comprise only 5% of the total population, which is now dominated by red abalone in deep crevice habitat. In northern California, flat abalone have always been rare, making up less than 5% of the population. Due to their small size, flat abalone is not usually targeted by the recreational fishery.

Management Considerations

The California Department of Fish and Game prepared a draft Abalone Recovery and Management Plan (ARMP) for all California abalones in 2002. The ARMP was mandated by the California Legislature (Fish and Game Code §5522). It provides a cohesive framework for recovery of depleted stocks in central and southern California, for the management of the existing northern California fishery, and for the management of any future fisheries. The draft ARMP was developed with the input of various constituents including: the Recreational Abalone Advisory Committee, commercial abalone fishermen, the ARMP Advisory Panel, and members of the general public. The Fish and Game Commission (Commission) is responsible for the management of abalone in California, and will adopt a final version of the ARMP. Once the ARMP is adopted by the Commission, it will guide abalone assessment, research, regulatory and enforcement activities.

The history of the California abalone fishery points to the need for defined recovery and management guidelines. Abalone species in central and southern California experienced stock collapse due to both natural and human-related causes, resulting in the 1997 closure of all abalone fishing in those areas. The only abalone fishery currently open in the state is the northern California red abalone recreational fishery.

The five formerly fished species in central and southern California (red, pink, green, black and white) are at risk of further population declines and, in one case, extinction. The white abalone has been listed as an endangered species under the federal Endangered Species Act, while the black abalone is a candidate for listing.

Without human intervention, and possibly even with it, these species may never recover.

For the only remaining abalone fishery (the northern red abalone), it is critical to maintain a sustainable resource. In the future, some of the depleted abalone species may recover to levels considered sustainable for fishing. Therefore, management guidelines such as those presented in the draft ARMP are needed for determining allowable take levels and for closing and reopening fisheries.

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Table 8.2. Commercial landings (pounds) of red, pink, green, white, black, and unidentified abalone, 1916-2001

Year	Unidentified abalone	Red abalone	Pink abalone	Green abalone	White abalone	Black abalone	Total abalone	Year
1916	762,001	-----	-----	-----	-----	-----	762,001	1916
1917	637,780	-----	-----	-----	-----	-----	637,780	1917
1918	602,919	-----	-----	-----	-----	-----	602,919	1918
1919	759,203	-----	-----	-----	-----	-----	759,203	1919
1920	806,716	-----	-----	-----	-----	-----	806,716	1920
1921	1,481,170	-----	-----	-----	-----	-----	1,481,170	1921
1922	1,523,394	-----	-----	-----	-----	-----	1,523,394	1922
1923	1,555,134	-----	-----	-----	-----	-----	1,555,134	1923
1924	2,241,812	-----	-----	-----	-----	-----	2,241,812	1924
1925	2,352,861	-----	-----	-----	-----	-----	2,352,861	1925
1926	2,060,770	-----	-----	-----	-----	-----	2,060,770	1926
1927	2,816,530	-----	-----	-----	-----	-----	2,816,530	1927

Table 8.2. Commercial landings (pounds) of red, pink, green, white, black, and unidentified abalone, 1916-2001

Year	Unidentified abalone	Red abalone	Pink abalone	Green abalone	White abalone	Black abalone	Total abalone	Year
1928	2,066,243	-----	-----	-----	-----	-----	2,066,243	1928
1929	3,438,858	-----	-----	-----	-----	-----	3,438,858	1929
1930	3,176,513	-----	-----	-----	-----	-----	3,176,513	1930
1931	3,262,166	-----	-----	-----	-----	-----	3,262,166	1931
1932	2,817,345	-----	-----	-----	-----	-----	2,817,345	1932
1933	2,756,188	-----	-----	-----	-----	-----	2,756,188	1933
1934	3,223,492	-----	-----	-----	-----	-----	3,223,492	1934
1935	3,870,921	-----	-----	-----	-----	-----	3,870,921	1935
1936	3,302,195	-----	-----	-----	-----	-----	3,302,195	1936
1937	2,863,175	-----	-----	-----	-----	-----	2,863,175	1937
1938	2,121,468	-----	-----	-----	-----	-----	2,121,468	1938
1939	1,804,440	-----	-----	-----	-----	-----	1,804,440	1939
1940	1,724,084	-----	-----	-----	-----	-----	1,724,084	1940
1941	1,002,330	-----	-----	-----	-----	-----	1,002,330	1941
1942	164,462	-----	-----	-----	-----	-----	164,462	1942
1943	680,274	-----	-----	-----	-----	-----	680,274	1943
1944	1,630,402	-----	-----	-----	-----	-----	1,630,402	1944
1945	2,429,312	-----	-----	-----	-----	-----	2,429,312	1945
1946	2,095,762	-----	-----	-----	-----	-----	2,095,762	1946
1947	2,669,285	-----	-----	-----	-----	-----	2,669,285	1947
1948	3,195,852	-----	-----	-----	-----	-----	3,195,852	1948
1949	3,599,998	-----	-----	-----	-----	-----	3,599,998	1949
1950	-----	1,431,071	2,019,710	9,958	-----	-----	3,460,739	1950
1951	-----	1,352,317	2,719,381	8,367	-----	-----	4,080,065	1951
1952	-----	1,182,022	3,587,636	4,186	-----	-----	4,773,844	1952
1953	-----	1,412,948	3,439,657	5,852	-----	-----	4,858,457	1953
1954	108	1,394,595	2,703,219	1,223	-----	-----	4,099,145	1954
1955	-----	1,996,511	2,189,039	1,225	-----	-----	4,186,775	1955
1956	-----	2,428,393	1,845,006	14,002	-----	660	4,288,061	1956
1957	-----	2,566,813	2,804,111	47,880	-----	1,950	5,420,754	1957
1958	-----	1,677,404	2,545,709	905	-----	-----	4,224,018	1958
1959	-----	2,180,658	2,375,531	560	5,075	-----	4,561,824	1959
1960	-----	2,693,857	1,572,096	455	-----	-----	4,266,408	1960
1961	-----	2,873,628	1,678,275	526	1,337	-----	4,553,766	1961
1962	-----	2,462,200	1,717,271	3,710	-----	-----	4,183,181	1962
1963	-----	2,807,920	1,502,639	33,319	-----	-----	4,343,878	1963
1964	-----	2,369,564	1,612,376	97,273	-----	-----	4,079,213	1964
1965	-----	2,490,875	2,071,242	12,129	438	-----	4,574,684	1965
1966	-----	2,656,408	2,162,941	145,420	-----	-----	4,964,769	1966
1967	-----	2,697,610	1,619,746	106,545	4,100	200	4,428,201	1967
1968	-----	1,776,054	2,270,108	427,135	845	700	4,474,842	1968
1969	-----	1,564,205	1,900,206	157,263	28,009	4,991	3,654,674	1969
1970	-----	1,194,788	1,408,921	270,200	11,212	15,327	2,900,448	1970
1971	-----	1,193,948	347,983	1,089,706	36,741	46,650	2,715,028	1971
1972	-----	1,104,462	403,709	424,808	143,819	1,014,892	3,091,690	1972

Table 8.2. Commercial landings (pounds) of red, pink, green, white, black, and unidentified abalone, 1916-2001

Year	Unidentified abalone	Red abalone	Pink abalone	Green abalone	White abalone	Black abalone	Total abalone	Year
1973	-----	663,919	371,352	156,804	83,112	1,912,519	3,187,706	1973
1974	-----	751,060	455,324	121,563	113,765	1,145,396	2,587,108	1974
1975	-----	742,769	458,235	170,927	71,821	684,793	2,128,545	1975
1976	-----	739,621	431,143	120,489	81,907	356,951	1,730,111	1976
1977	-----	537,450	318,494	97,457	17,603	463,301	1,434,305	1977
1978	-----	488,800	287,052	92,987	3,633	420,045	1,292,517	1978
1979	-----	439,476	156,491	61,166	502	331,489	989,124	1979
1980	-----	516,304	139,267	63,234	1,071	518,619	1,238,495	1980
1981	112	429,922	94,257	64,003	162	521,007	1,109,463	1981
1982	256	430,902	86,282	88,696	907	633,400	1,240,443	1982
1983	55	230,973	67,239	56,910	482	484,366	840,025	1983
1984	1,156	299,477	57,128	31,946	449	436,359	826,514	1984
1985	1,015	368,499	68,731	24,133	1,655	359,898	823,931	1985
1986	5,777	263,070	51,872	25,854	876	267,514	614,962	1986
1987	1,550	391,030	31,597	28,985	2	309,786	762,951	1987
1988	75	324,434	19,025	23,521	2	201,660	568,716	1988
1989	775	474,978	22,554	20,150	22	222,671	741,150	1989
1990	217	378,914	23,268	27,333	17	94,193	523,942	1990
1991	1,350	330,974	12,883	8,162	3	27,220	380,593	1991
1992	-----	448,593	18,229	10,304	-----	37,714	514,840	1992
1993	-----	428,518	19,932	10,858	-----	2,031	461,340	1993
1994	15	285,969	15,575	992	47	-----	302,596	1994
1995	-----	244,807	16,398	1,073	37	-----	262,314	1995
1996	67	229,252	4	56	-----	-----	229,379	1996
1997	-----	112,323	-----	-----	-----	-----	112,323	1997
1998	-----	-----	-----	-----	-----	-----	-----	1998
1999	-----	-----	-----	-----	-----	-----	-----	1999
2000	-----	-----	-----	-----	-----	-----	-----	2000
2001	-----	-----	-----	-----	-----	-----	-----	2001

----- Landings data not available.

1. Data sources: DFG Catch Bulletins (1916-1983) and DFG commercial landing receipt database (1984-2001).
2. Identification of abalone species landed was not required prior to 1950, however commercial abalone landings from 1916 to 1949 consisted primarily of red abalone.
3. The first reported landings for species other than red were as follows: green (1950), pink (1950), black (1956), and white (1959). Insignificant commercial landings of pinto and flat abalone (less than 100 pounds) were made in a few years, but are not included in this summary table.
4. The commercial take of black abalone was prohibited in 1993.
5. The commercial take of green, pink, and white abalone was prohibited in 1996.
6. In 1997, a moratorium was placed on the commercial take of all abalone.