

3 Abalones, Haliotidae



Red abalone, *Haliotis rufescens*, clinging to a boulder.
Photo credit: D Stein, CDFW.

History of the Fishery

The nearshore waters of California are home to seven species of abalone, five of which have historically supported commercial or recreational fisheries: red abalone (*Haliotis rufescens*), pink abalone (*H. corrugata*), green abalone (*H. fulgens*), black abalone (*H. cracherodii*), and white abalone (*H. sorenseni*). Pinto abalone (*H. kamtschatkana*) and flat abalone (*H. walallensis*) occur in numbers too low to support fishing.

Dating back to the early 1900s, central and southern California supported commercial fisheries for red, pink, green, black, and white abalone, with red abalone dominating the landings from 1916 through 1943. Landings increased rapidly beginning in the 1940s and began a steady decline in the late 1960s which continued until the 1997 moratorium on all abalone fishing south of San Francisco (Figure 3-1). Fishing depleted the stocks by species and area, with sea otter predation in central California, withering syndrome and pollution adding to the decline. Serial depletion of species (sequential decline in landings) was initially masked in the combined landings data, which suggested a stable fishery until the late 1960s. In fact, declining pink abalone landings were replaced by landings of red abalone and then green abalone, which were then supplemented with white abalone and black abalone landings before the eventual decline of the abalone species complex. Low population numbers and disease triggered the closure of the commercial black abalone fishery in 1993 and was followed by closures of the commercial pink, green, and white abalone fisheries in 1996. Extremely low populations lead to the listing of white abalone as a federally endangered species in 2001 and black abalone were listed in 2009.

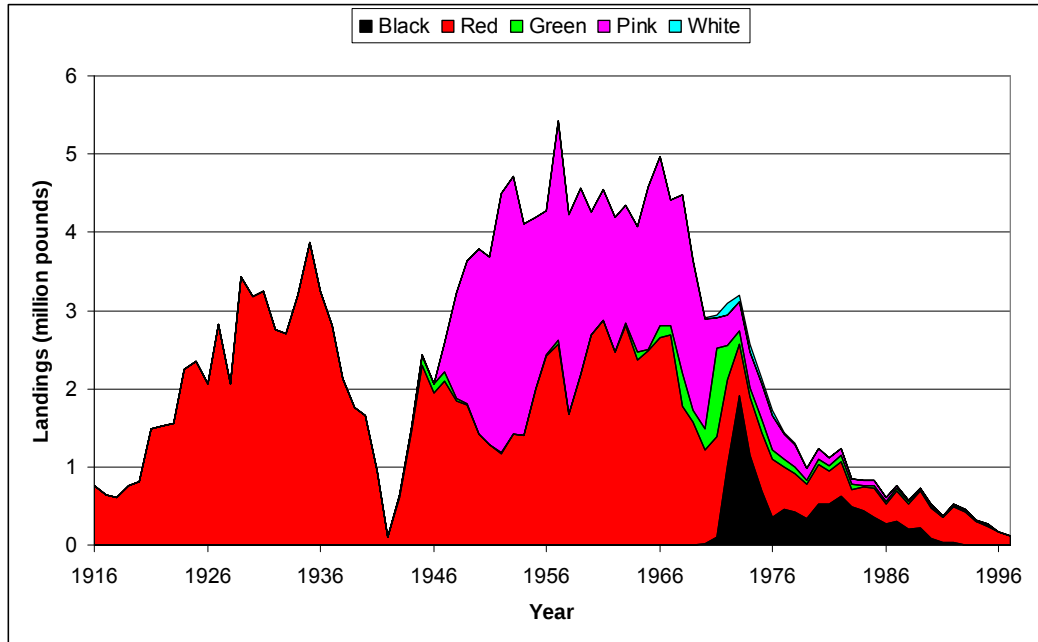


Figure 3-1. Abalone commercial landings, 1916-1997. Data source: Department catch bulletins (1916-1983) and Commercial Fisheries Information System (CFIS) data (1984-1997).

The northern California recreational red abalone fishery is the only abalone fishery currently open in California. In 2005, the California Fish and Game Commission (Commission) adopted the Abalone Recovery and Management Plan (ARMP), which governs the management of the recreational fishery and recovery of southern abalone stocks. This plan sets management guidelines and triggers for Total Allowable Catch (TAC) adjustments based on 3 criteria – density, recruitment, and catch-per-unit-effort (CPUE). Data for these criteria come from fishery independent dive surveys, fishery dependent creel surveys, and report card data combined with telephone surveys of fishermen.

Fishery independent dive surveys are conducted at eight index sites on a triennial basis. These surveys are the primary method for providing density and recruitment data for management. The main strategy for the ARMP is to prevent abalone densities from declining below the minimum viable population (MVP) level which could cause the fishery to collapse (see Abalone Life History section below).

Abalone cards were first implemented in 2000 as an enforcement tool designed to control the number of abalone taken in a day and for the season. Fishermen were required to record date, time, and county on a line for each abalone they caught and to return the card to the California Department of Fish and Wildlife (Department). In subsequent years the report card was modified to collect more precise location data and has become an important management tool to help monitor the fishery. Report card data combined with systematic telephone surveys from 2002 through 2009 provide an estimate of the total annual catch (Figure 3-2). The telephone survey provides

unbiased data on report card purchasers from those who do and do not return their abalone cards at the end of the season. The most recent catch data available are from the 2010 season in which an estimated 877,500 pounds (400 metric tons) of abalone were fished, the lowest recorded catch since the report card was introduced in 2002 (Figure 3-2). In 2007, the highest catch was recorded at 1,158,749 pounds (526 metric tons) of abalone landed in the recreational fishery. Overall, catch has remained stable at close to 1 million pounds (450 metric tons; approximately 267,000 abalone) per year since 2002.

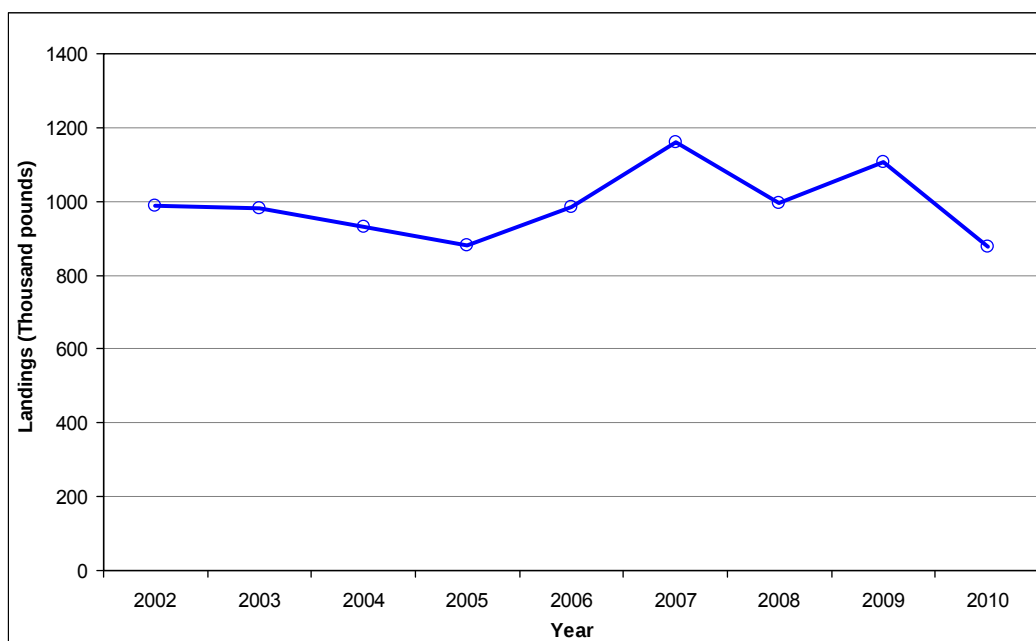


Figure 3-2. Red abalone recreational catch, 2002-2010. Data source: Department abalone report card database and telephone survey database.

Creel surveys are completed in alternate years and are used to collect CPUE data in the form of take per picker day or take per picker hour by fishing mode, as well as detailed catch location information and catch size frequencies. Variations from year to year in CPUE can be influenced by ocean conditions present during the survey periods. For management decisions, CPUE is compared statistically using blocks of several years in conjunction with CPUE from the report cards.

New regulations requiring the tagging of each abalone retained were implemented in 2008 to help reduce illegal take and ensure compliance with the daily bag and annual limits of 3 and 24 abalone, respectively. Also new as of 2008, report cards are required for everyone taking abalone, regardless of age (anglers less than 16 years of age do not have to purchase a sportfishing license), in order to provide more accurate take estimates. New regulations for 2012 include the requirement for each person taking abalone to retain separate possession of their abalone prior to tagging, and closure of the Fort Ross State Historical Park (Sonoma County) for the first two months of the season (April and May) each year to reduce effort.

Status of Biological Knowledge

Abalones are in the Phylum Mollusca, along with clams, snails and squid, and belong to the class Gastropod and the genus *Haliotis*. Abalone have only one shell, the same as other Gastropods, and have a spiral shell structure with open respiratory pores. The shells are composed of aragonite tiles with sheets of protein matrix between the tiles. Pinto abalone morphology is different north and south of Point Conception, with pinto abalone sometimes called threaded abalone south of Point Conception. Other abalone species have a single morphology throughout their distribution. Abalone are found on rocky intertidal and subtidal habitats along the California coast. Of the seven species of abalone found in California, two are commonly found in shallow water, the black in the intertidal and the green abalone. Red, flat, and pinto are found in the intertidal as well as shallow and intermediate depths down to at least 100 feet (30 meters). Pink and white abalone are the deepest living species down to 120 and 200 feet (37 and 61 meters), respectively. Flat, pinto, and red abalone are found in northern California while pink, white, green, and red abalone are found in southern California. Black and red abalone are found throughout California with only a few black abalone individuals found north of San Francisco.

Abalone Life History

Abalone are slow growing, long lived, herbivorous invertebrates. Tag recapture studies show it takes an average of 12 years for red abalone to grow to the minimum legal size of 7 inches (18 centimeters) in northern California. Studies suggest they live between 30 and 40 years. Abalone eat algae, preferring kelp and red algae, using their rasping tongue (radula) to scrape algae bits. In central and southern California the kelp is giant kelp and in the north is predominantly bull kelp. Kelp abundance is driven by water temperature which when high, such as during El Niño events, can lead to declines in algal food supply and slow growth. Wild red abalone mature at age 6 when they are approximately 4 inches (10 centimeters) in shell length.

Abalone shed their eggs and sperm into the water column where fertilization takes place. Fertilization success declines precipitously as the distance between males and females increases. When nearest neighbor distances increase as occurs with low density populations the chances of fertilization decline. Abalone populations which have low densities are in danger of collapse due to low fertilization rates, particularly if they are also subjected to additional mortality from fishing. The sex ratio is one male to one female. Embryos undergo cell division developing into blastula and gastrula before hatching into free swimming larvae. Larvae have yolk reserves (lecithotrophic) which fuel development and larval shell formation. After 5-7 days larvae settle and metamorphose into benthic juveniles. Juveniles settle out of the plankton at a tiny size, less than 0.02 inches (0.5 millimeters). The settling cue is crustose coralline algae which appears as pink paint on rocks under water. Newly settled larvae develop a gut and feeding structures and scrape bacterial films on coralline algae until they are able to eat the surface layer of fleshy algae at about 4 weeks. Larval dispersal is thought to be

minimal since the larval period is short and larvae are found in nearshore waters. Genetic analyses suggest that there may be some geographic structure to intertidal black abalone populations while less structure has been found in subtidal red abalone populations.

Mortality of larval and newly settled abalone in the first year is unknown but thought to be exceedingly high and may exceed 98 percent. As abalone get larger mortality decreases, becoming low for adults. Predation pressures on abalone decrease with increasing size. The one major exception is with sea otter predators which are capable of taking full grown abalone. Octopus, lobster, sea stars, crab, fish and other major abalone predators mainly take smaller abalone. Shell parasites such as the boring clam and sponge can weaken shells causing mortality, particularly in large, old abalone. Mortality may increase in winter months when storms can wash away weakened abalone that spend their energy combating shell parasites. Storms also rip out algae leading to poor food resources in winter and spring. Warm El Niño events can enhance abalone mortality by speeding up metabolism yet at the same time decreasing kelp resources, as warm water is nitrogen poor hindering kelp productivity. Ocean conditions in addition to temperature may also play a role in the survival of abalone. As ocean waters become more acidic, the ability of abalone and other shellfish to develop and maintain their shell can be hampered. Ocean acidification is likely to enhance mortality if it impacts larval development, shell thickness or hinders shell calcification.

Withering Syndrome

An infectious disease known as withering syndrome is a key factor contributing to abalone population declines and failed recoveries in California. In 1985, abalone fishermen at the Channel Islands began noticing black abalone falling off rocks in large numbers. The dying abalone had shrunken bodies and the term Withering Syndrome (WS) was used to describe the condition. Over the next decade, WS spread throughout the Channel Islands, to the mainland and up the coast, reaching San Mateo County in 1997. The pattern of spread strongly indicated that the condition was caused by an infectious disease, and the causative agent was subsequently identified as a previously unknown bacterial pathogen. The bacterium, named *Xenohaliotis californiensis*, grows within cells of the abalone gastrointestinal tract where it likely interferes with nutrient absorption.

All California abalone species are susceptible to the bacterial infection that causes WS. Whether an abalone that is infected succumbs to WS and dies depends on a variety of factors, such as abalone species and water temperature. Infected black abalone tend to show signs of the disease, i.e. body shrinkage and ultimately death, in both cool and warm water. Infected red abalone begin to succumb to the disease at temperatures of about 65°F (18°C) or higher, while infected green abalone remain healthy under those and even warmer conditions. The relative resistance of green abalone under typical southern California water temperatures may be playing a role in their apparently

increasing numbers at some Channel Islands locations while black and red abalone populations remain low.

The WS bacterium was identified in red abalone at the Farallon Islands in 2007 and at Bodega Head in 2010. Waters at these locations are sufficiently cool that none of the infected abalone showed any body shrinkage or other signs of WS. Similarly, red abalone at San Miguel Island, which experiences cooler waters than the other Channel Islands, exist even though the bacteria has been present for over twenty years. Although the bacteria will likely continue its northerly spread into the red abalone populations in Sonoma and Mendocino counties, expression of WS is expected to remain low to absent. Nevertheless strong El Niño events and eventual warming associated with climate change could result in future expression of the disease in abalone at these cool water locations.

Status of the Populations

Red Abalone

Northern California-Populations of red abalone, *Haliotis rufescens*, (Figure 3-3) in northern California support a popular recreational fishery. While landings (2002-2011) appear to be stable, recent declines in subtidal stocks have been recorded. Fishery independent dive surveys at index sites indicate a decline in the average density of abalone in Sonoma County in the southern portion of the fishery and low levels of recruitment. Fishery dependent creel surveys indicate reduced CPUE at some sites. In late summer of 2011, an unprecedented harmful algal bloom (red tide) lead to a die-off of invertebrates in Sonoma County and resulted in large numbers of dead abalone washing ashore. Surveys revealed an average of 24 percent of the abalone along transects in Sonoma County sites were dead. Abalone mortality was particularly high in the shallower waters (<30 feet or 9 meters) where recreational abalone divers fish for abalone.



Figure 3-3. Red abalone, *Haliotis rufescens*. Photo credit: A Maguire, CDFW.

The ARMP provides a management framework based on fishery independent and fishery dependent data. Fishery independent dive surveys and two sources of fishery dependent data (creel surveys and abalone report card data combined with a systematic telephone survey) are the primary data sources used to manage the recreational red abalone fishery. In the ARMP, catch reduction triggers are based on average abalone density (number along stratified random transects) at eight index sites in Sonoma and Mendocino Counties. These sites are surveyed using scuba on a triennial basis. If the average density of the index sites falls below the trigger of 0.42 abalone/square yard (0.50 abalone/square meter), the Department will recommend regulation changes to reduce the catch according to ARMP guidelines. The current

TAC is a guideline, rather than a fixed inseason quota which would cause the fishery to close if exceeded. The catch is calculated after abalone report cards have been returned.

Two sets of triennial surveys have been completed since the adoption of the ARMP. The overall density for the most recent set of surveys was 0.43 abalone/square yard (0.52 abalone/square meter) which is close to the trigger for reducing the catch. The average density at the four Sonoma County index sites 0.37 abalone/square yard (0.44 abalone/square meter) is currently below the trigger while the Mendocino sites are above the trigger. Therefore, the Department and the Commission may consider focused management for the Sonoma County area, in addition to catch reductions for the entire fishery. Zonal management would allow more precise control over the abalone catch to prevent large numbers of abalone from being taken from one site or zone depleting local abalone populations.

Creel survey data are collected as interviews with abalone fishermen when they exit fishing areas. There are more than 35 years of creel interviews which include: numbers caught, time used to catch abalone, and specific location of catch. The ARMP uses creel data to trigger dive surveys if sites show significant declines in catch-per-unit-effort or distance traveled for catch. Creel data from Fort Ross State Historic Park have been showing reduced average daily catches over the years, an indication of a decline in local abalone populations. In addition, Fort Ross also generally has the lowest densities of abalone observed during dive surveys. In response, the Commission voted to shorten the season by 2 months at Fort Ross starting in 2012. Shelter Cove and MacKerricher State Marine Conservation Area (Mendocino County) have low numbers of abalone caught per day but dive surveys are not planned for these sites as the success rate for fishermen is still relatively high at 2.4 abalone per day.

Southern California- Red abalone populations are at very low levels in most areas of southern California and offshore islands. At the close of the fishery in 1997, San Miguel Island was one of the few locations in southern California with red abalone populations, and continues to show signs of recovery fifteen years later. At the request of the Commission, the Department began a population assessment of red abalone at the island in 2006 to determine whether a limited-take fishery should be considered under the guidance of the ARMP. Three years of surveys from 2006-2008 resulted in 985 underwater transects in three geographical zones. A total of 15,624 abalone were counted resulting in densities between 0.0084-0.14 abalone/square yard (0.01-0.17 abalone/square meter). The overall density at the island for the three survey years combined was 0.11 abalone/square yard (0.13 abalone/square meter), which is below the minimum viable population level of 0.17 abalone/square yard (0.20 abalone/square meter) listed in the ARMP for recovered abalone populations and well below the level of 0.55 abalone/square yard (0.66 abalone/square meter) required for a sustainable fishery.

The size structure of the measured abalone compared to past surveys in 1997 and 2002 showed more individuals over the historical commercial size limits, indicative of individual growth. This is to be expected in a population that has been closed to fishing for over ten years. The distribution of abalone were patchy, with only 32 percent of the 12 square yard (10 square meter) transect segments having abalone and solitary abalone making up about 8 percent of the surveyed population. Two or more abalone were found in 23 percent of the segments accounting for 93 percent of the counted abalone. Given the overall density of the island, ARMP density requirements would not allow for a fishery to open.

Red abalone populations elsewhere in southern California are still depressed and occur only in localized areas along the mainland and offshore islands. Aside from San Miguel Island, higher densities have been found at Santa Rosa and Santa Cruz islands. At the west end of Santa Cruz Island, Department divers using a timed-swim survey found 7.8 red abalone per hour after nine hours of search time. Although this is a crude measure of abalone density, the results indicate how sparsely populated the other abalone populations are in southern California.

Pink Abalone

Populations of pink abalone, *Haliotis corrugata*, (Figure 3-4) are still depleted in southern California, and were identified as a “species of concern” by NOAA Fisheries Service in 2004. Department surveys conducted in 2007-2009 at the northern Channel Islands resulted in low counts of pink abalone for recovery index sites listed in the ARMP. For Anacapa Island, divers report finding 0.3 abalone per hour for 38 hours of search time, and at Santa Cruz Island, divers report finding 1.1 abalone per hour for 99 hours of search time. The east end of Santa Cruz Island appears to be the only location where small pink abalone aggregations occur. Given that both these islands once supported a major pink abalone fishery, the findings from recent Department surveys are not encouraging.



Figure 3-4. Pink abalone, *Haliotis corrugata*. Photo credit: D Stein, CDFW.

The Point Loma kelp forest, off San Diego, is one of the more densely populated areas for pink abalone on the mainland coast. However, these populations are still not near historical levels. Recent research reports an average density 0.014 abalone/square yard (0.017 abalone/square meter) for combined transect data from 2006 and 2007.

Green Abalone

Similar to pink abalone, green abalone (*Haliotis fulgens*) (Figure 3-5) were also identified as a “species of concern” by NOAA Fisheries Service in 2004. Recent

Department surveys from 2007-2009 at the northern Channel Islands resulted in very few green abalone. At Anacapa Island for instance, only 0.1 abalone were found per

hour and at Santa Cruz Island, only 0.03 abalone per hour were found. The counts are based on depth ranges for all abalone species, so it is possible that more green abalone may

have been found if more dives were conducted in only shallow water (less than 15 feet or 5 meters). Still, the fact that only seven green abalone were found for over 137 hours of dive time indicates the depressed status of green abalone stocks at the northern Channel Islands.

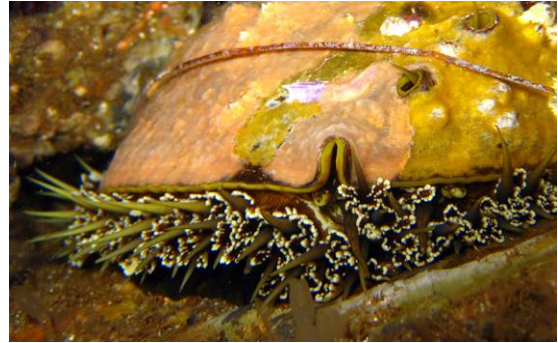


Figure 3-5. Green abalone, *Haliotis fulgens*. Photo credit: D Stein, CDFW.

Contrasting to the northern Channel Island surveys, Department surveys in the same timeframe at Santa Catalina Island are showing results indicative of limited green abalone recovery. Surveys conducted around the island resulted in 2.4 abalone per hour for 33 hours of search time, and in a few localized areas around the island had densities of abalone upwards of 1.5 abalone/square yard (1.8 abalone/square meter). In addition to higher abundances, green abalone are being found in a wide range of size classes, indicating multiple years of recruitment. Similar observations are being made on the mainland near San Diego where recreational divers and fishery scientists are observing aggregations of green abalone. Although these recent findings are encouraging, managers should be highly cautious since the reported high densities are mostly localized and do not reflect the overall population numbers, which are still nowhere near historical levels.

A recent Department study showed even more good news for green abalone regarding WS, an endemic abalone disease that contributed to the population collapse in southern California. The study found that green abalone are more resilient to the disease given an increase in water temperature where it would affect other abalone species, further suggesting that green abalone would make an excellent target species for recovery actions in southern California.

Black Abalone

Populations of black abalone, *Haliotis cracherodii*, (Figure 3-6) currently remain very low throughout southern California after a drastic decline due to fishing and WS. The continued low populations resulted in the listing of the species as a federally endangered species by NOAA Fisheries Service in 2009. Since then, NOAA Fisheries Service has also proposed designation of critical habitat for black abalone. The critical habitat designation covers 242 square miles (390 square kilometers) of rocky habitat for black abalone along the California coastline from the mean high water line down to 20

feet (6 meters). The critical habitat designation area generally spans from Del Mar Landing in northern Sonoma County down to the entrance to Los Angeles Harbor, including all of the offshore islands. Most recently, NOAA Fisheries Service has convened a panel of experts as the black abalone recovery team to begin formulating a recovery plan for the species.



Figure 3-6. Black abalone, *Haliotis cracherodii*. Photo credit: D Stein, CDFW.

Although black abalone populations in southern California have been protected from fishing since 1993, there are only a few areas that have shown some evidence of recovery. San Nicolas Island is one area that has exhibited recovery over the past 10 years. Island wide density estimates have increased by 2.5 times during the period between 2001 and 2008 based on long term population monitoring sites. Despite the evidence of recovery at San Nicolas island and at a couple of sites in the northern Channel Islands, the rest of the southern California continues to exhibit very low populations of black abalone.

White Abalone

White abalone, (*Haliotis sorenseni*) (Figure 3-7) the first marine invertebrate to be federally listed as endangered, still remains at very depressed levels of population throughout the Southern California Bight. Since its listing in 2001, the empanelled White Abalone Recovery Team has developed a recovery plan to guide recovery of the species to the point of delisting. A captive rearing program for white abalone continues, however, few new broodstock have been added to the program since the initial collection in 1999. Since then, broodstock have been slowly succumbing to various mortality causes (disease, age, harmful algal bloom events). Captive bred offspring have not been out planted yet due to disease and other concerns.



Figure 3-7. White abalone, *Haliotis sorenseni*. Photo credit: D Whitting, NOAA Fisheries Service.

Remnant populations in the deeper portion of the species depth range at offshore banks have been steadily declining since population assessment monitoring began in 2002. White abalone total abundance and density at one offshore bank has declined by approximately 78 percent between 2002 and 2010.

Management Considerations

Northern California Red Abalone

Like many other abalone species, the red abalone has several characteristics which limit its ability to withstand fishing pressure. Tagging studies estimate it takes 12 years to reach the legal size limit of 7 inches (18 centimeters) and 5 or 6 more years to grow another inch. When abalone densities drop too low, the expectation for unsuccessful reproduction is compounded, thus increasing the risk of population collapse.

Size limits allow abalone a number of years to reproduce before being vulnerable to the fishery and in the case of red abalone we estimate there are 5-6 years of reproduction prior to entry into the fishery. While this may support reproduction there are problems with inexperienced pickers and divers removing abalone that are under sized. Abalone have no blood clotting mechanism and undersize abalone might not survive cuts caused during removal. This incidental mortality may decrease the benefits of the size limit that is designed to allow smaller abalone to reproduce for a number of years, prior to being fished. Smaller abalone produce fewer eggs and sperm than larger ones as gonad size increases exponentially with shell length. As legal size abalone are harder to find, wardens have observed people removing more abalone to find legal size abalone. Intertidal surveys at heavily used sites revealed few abalone of any size, suggesting in some cases people may not be obeying the size limits.

The prohibition of scuba or surface supplied air sources is thought to be an instrumental regulation in sustaining abalone populations in northern California. This management measure is unique to northern California as the south allowed scuba in the past. This regulation creates a reserve in deeper water since most fishermen do not free dive deeper than 28 feet (9 meters). Abalone populations in deeper water remain relatively undisturbed and this measure is thought to promote reproduction at levels high enough to sustain the fishery in shallow water.

Eight new Marine Protected Areas (MPAs) which prohibit the take of abalone, as well as other species, were established in May 2010 at sites between Point Reyes and Point Arena in Marin and Sonoma Counties. The newly closed areas may have reduced the abalone catch by 15,000 abalone based on 2009 abalone card data (approximately 9 percent of the catch for the area). Abalone card data for 2010 showed little evidence for a shift in effort to open sites. Two small MPAs established earlier at Del Mar Landing and Gerstle Cove (both in Sonoma County) continue to protect abalone populations. Studies are needed to determine the value of MPAs compared to adjacent fished sites as a source of larvae and adults. One area that is now an MPA was a “de facto” reserve when held as private property near Point Arena. This area once opened to the public for 6 years was heavily fished and Department data indicates abalone of all size were illegally taken.

Violations of abalone regulations continue to be a great concern because of the apparent magnitude of the problem and the difficulty in accurately assessing the impact

on the fishery. A newly adopted tag system was developed for abalone which wardens believe has greatly increased compliance with abalone regulations. The recent implementation of an Automated License Data System will also help improve control over the illegal purchase of multiple cards reducing violations of annual take limits. Wardens commonly encounter people violating regulations and although the magnitude of the illegal catch is not known, it is believed to have a significant impact on red abalone populations.

Southern California Red Abalone

As part of the adoption of the ARMP in 2005, the Commission initiated a process to provide information to consider opening a limited fishery for red abalone at San Miguel Island. The fishery consideration process involves the Department, a constituent advisory group that developed fishery management options, a technical panel that developed stock assessment models, and a review committee that provided a review of the stock assessment work. The process has provided the Commission with four fishery options, stock assessment information and supplementary modeling work to assess the conservation risk associated with conducting a limited fishery. At its February 2013 meeting, the Commission decided not to move forward with a fishery at San Miguel Island.

The process has provided an opportunity for the Department and the Commission to explore different ways to manage an abalone fishery. This process was a collaborative venture that was developed together with the Department's constituents. Involving constituents from the outset is intended to reduce disagreements in the recommendations from various stake holders. This will help inform the Commission when deciding whether to conduct a fishery or not, and, if a fishery is allowed, what type of management to use. The San Miguel Island process has set an example for future fishery consideration processes as other abalone species stocks begin to recover.

Northern California

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Further Reading

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Abalone commercial landings (pounds), 1916-1997.							
Year	Black	Red	Green	Pink	White	Unspecified	Total
1916	0	762,003	0	0	0	0	762,003
1917	0	637,773	0	0	0	0	637,773
1918	0	602,918	0	0	0	0	602,918
1919	0	759,203	0	0	0	0	759,203
1920	0	806,714	0	0	0	0	806,714
1921	0	1,481,178	0	0	0	0	1,481,178
1922	0	1,523,402	0	0	0	0	1,523,402
1923	0	1,555,142	0	0	0	0	1,555,142
1924	0	2,241,792	0	0	0	0	2,241,792
1925	0	2,352,896	0	0	0	0	2,352,896
1926	0	2,060,778	0	0	0	0	2,060,778
1927	0	2,816,576	0	0	0	0	2,816,576
1928	0	2,066,243	0	0	0	0	2,066,243
1929	0	3,438,848	0	0	0	0	3,438,848
1930	0	3,176,544	0	0	0	0	3,176,544
1931	0	3,250,016	0	0	0	0	3,250,016
1932	0	2,750,048	0	0	0	0	2,750,048
1933	0	2,700,096	0	0	0	0	2,700,096
1934	0	3,200,064	0	0	0	0	3,200,064
1935	0	3,870,944	0	0	0	0	3,870,944
1936	0	3,250,016	0	0	0	0	3,250,016
1937	0	2,800,000	0	0	0	0	2,800,000
1938	0	2,121,459	0	0	0	0	2,121,459
1939	0	1,750,000	0	0	0	0	1,750,000
1940	0	1,650,006	5,152	0	0	0	1,655,158
1941	0	950,006	0	0	0	0	950,006
1942	0	100,000	0	0	0	0	100,000
1943	0	600,006	46,144	0	0	0	646,150
1944	0	1,449,997	59,136	336	0	0	1,509,469
1945	0	2,298,464	126,112	4,704	0	0	2,429,280

Abalone commercial landings (pounds), 1916-1997.							
Year	Black	Red	Green	Pink	White	Unspecified	Total
1946	0	1,950,010	119,168	0	0	0	2,069,178
1947	0	2,100,000	109,312	376,096	0	0	2,585,408
1948	0	1,849,994	19,936	1,351,168	0	0	3,221,098
1949	0	1,799,997	10,080	1,818,208	0	0	3,628,285
1950	0	1,411,692	12,798	2,355,770	0	0	3,780,260
1951	0	1,283,695	4,621	2,399,530	0	0	3,687,846
1952	0	1,173,586	1,684	3,323,619	0	0	4,498,889
1953	0	1,411,949	5,852	3,301,549	0	0	4,719,350
1954	0	1,394,485	721	2,704,211	0	0	4,099,417
1955	0	1,996,511	1,255	2,188,139	0	0	4,185,905
1956	0	2,424,393	14,004	1,845,006	0	0	4,283,403
1957	0	2,569,025	47,880	2,803,059	0	0	5,419,964
1958	0	1,677,404	905	2,545,709	0	0	4,224,018
1959	0	2,180,658	560	2,375,534	0	0	4,556,752
1960	0	2,693,857	455	1,572,096	0	0	4,266,408
1961	0	2,873,628	526	1,678,275	0	0	4,552,429
1962	0	2,462,200	3,710	1,717,271	0	0	4,183,181
1963	0	2,807,921	33,319	1,502,639	0	0	4,343,879
1964	0	2,369,574	97,273	1,612,376	0	0	4,079,223
1965	0	2,490,875	12,129	2,072,642	438	0	4,576,084
1966	0	2,656,408	144,207	2,162,941	0	0	4,963,556
1967	0	2,691,610	106,545	1,619,126	0	0	4,417,281
1968	700	1,776,054	427,135	2,270,108	845	0	4,474,842
1969	4,791	1,564,205	157,263	1,903,026	28,009	0	3,657,294
1970	15,327	1,194,788	270,200	1,408,921	11,212	0	2,900,448
1971	106,401	1,283,567	1,125,620	386,141	43,395	0	2,945,124
1972	1,014,892	1,104,462	424,828	403,709	143,819	1,868	3,093,578
1973	1,912,949	663,919	156,804	371,352	83,112	5,008	3,193,144
1974	1,145,396	751,060	121,563	445,325	113,765	7,885	2,584,994
1975	687,428	742,769	170,927	458,235	71,821	7,290	2,138,470
1976	356,751	739,621	120,498	431,143	81,907	2,907	1,732,827
1977	463,301	537,450	97,457	318,494	17,603	1,841	1,436,146

Abalone commercial landings (pounds), 1916-1997.							
Year	Black	Red	Green	Pink	White	Unspecified	Total
1978	419,976	489,147	93,042	287,335	3,648	1,877	1,295,025
1979	330,928	439,469	61,327	156,383	502	3,898	992,507
1980	518,538	516,731	63,181	138,907	1,076	556	1,238,989
1981	520,948	430,315	63,950	94,127	167	140	1,109,647
1982	633,307	431,285	88,645	86,178	908	267	1,240,590
1983	484,310	231,210	56,861	67,152	482	102	840,117
1984	436,294	299,759	31,910	57,030	449	1,236	826,678
1985	359,835	368,782	23,952	68,623	1,654	1,022	823,868
1986	267,542	263,302	25,750	51,830	876	5,824	615,124
1987	309,727	391,278	28,965	31,539	2	1,550	763,061
1988	201,604	324,635	23,498	19,003	2	75	568,817
1989	218,489	469,407	19,723	22,469	22	775	730,885
1990	91,379	379,143	27,089	23,226	17	217	521,071
1991	26,226	328,466	8,154	12,780	4	1,350	376,980
1992	37,696	452,901	10,296	18,210	0	0	519,103
1993	2,032	428,216	10,011	18,409	0	0	458,668
1994	0	309,478	1,682	15,765	33	38	326,996
1995	0	244,988	1,586	17,654	38	68	264,334
1996	0	165,486	0	0	0	6	165,492
1997	0	112,323	0	0	0	0	112,323

Data source: Department catch bulletins (1916-1983) and CFIS data (1984-1997).

Red abalone recreational catch, 2002-2010.		
Year	Number	Pounds
2002	264,000	990,000
2003	262,000	982,500
2004	248,000	930,000
2005	235,000	881,250
2006	263,000	986,251
2007	309,000	1,158,749
2008	265,000	993,750
2009	295,000	1,106,250
2010	234,000	877,500

Data source: Recreational red abalone report card database and telephone survey database.