

natural mortality rates (Table 2). The mean of these approaches imply a natural mortality rate of approximately 0.25 yr^{-1} for females and 0.3 yr^{-1} for males, but these methods may produce highly uncertain values of M (Pascual and Iribarne 1993). Therefore, sensitivity to the assumed values of M is explored when applying the assessment model.

Fisheries History

Historically, the recreational sector has been the main source of cabezon removals. Cabezon have been a very minor component of the catch in commercial fisheries for more than a century (Jordan and Everman 1898). The earliest modern commercial fishery information (O'Connell 1953) indicates that a small amount of cabezon was being sold in fish markets in the San Francisco area by the 1930s with incidental take recorded back to 1916. However, it was not until the 1990s that a truly directed commercial fishery for cabezon was established in the waters of California and Oregon.

The most significant change in the fishery for cabezon has been the development of the live-fish/premium commercial fishery that, in addition to cabezon, targets several other nearshore fishes (CDF&G 2002). This fishery started in southern California in the late 1980s and spread northward during the late 1990s to Oregon (Starr *et al.* 2002). Fishermen routinely obtain much higher prices for fish brought back to markets alive. Cabezon are not subject to barotrauma because they lack a swim bladder and are usually found in shallow nearshore waters accessible to many fishers. These traits make cabezon an ideal target for both the live-fish and recreational fisheries. Gears that take cabezon include hook and line and pot/trap type gears, as they are successful at bringing up fish with relatively little damage. Cabezon continues to be an important component of the live-fish fishery, even with increased restrictions on the live-fish catch, especially as the allowable catches of other marketable groundfish species have been reduced.

Fisheries Management

The Pacific Fishery Management Council (PFMC) and NOAA Fisheries have management responsibility for the groundfish species included in the Groundfish Fishery Management Plan (FMP) out to the boundary of the 200-mile Exclusive Economic Zone (EEZ). Many nearshore species, such as cabezon, that fall primarily within the 3-mile limit of states' waters are also included in state-specific Nearshore Fishery Management Plans (NFMP). NFMPs are currently being developed and implemented in California and Oregon in response to the increased commercial take of the live-fish fishery (CDF&G 2002)

No management regulations existed for cabezon before 1982 when a size limit (12-inches) was set for recreationally caught cabezon off California (see Appendix A for a complete list of California regulations). This limit was raised to 14-inches in 2000, and extended to include commercially retained fish. It was increased further to 15-inches in 2001. Recreational bag limits have been 10fish/day in California since 2000. Cabezon are currently included in the California recreational regulatory complex Rockfish, Cabezon, and Greenlings (the RCG complex) and subject to seasonal closures for recreational fishers. Oregon imposed a 16-inch commercial size limit and a 15-inch recreational size limit for cabezon in 2001. Oregon has a 10fish/day bag

limit for cabezon and greenling combined. California and Oregon are proposing slot limits for cabezon; cabezon must be between 15–22 inches in California and 15–19 inches in Oregon to be retained. There is no size limit in Washington and recreational fishers are limited to 15 bottom-type fishes daily.

Historically, commercial landings of cabezon were monitored as part of a mixed group called “Other Fish”. This group of species includes sharks, skates, rays, grenadiers and other groundfish. This group has been defined historically as groundfish species that do not have directed or economically important fisheries. The coastwide ABC for this entire group of species was 14,700mt during 1999–2002 (5,200mt for the Eureka, Monterey and Conception INPFC areas and 9,500mt for the Columbia and Vancouver INPFC areas). In California, the cabezon fishery is independently monitored and regulated by analyzing two-month cumulative trip limits. In 2004, the season closed on 4 September when the annual commercial allocation of 75,600 pounds was reached before ends year.

Assessment Data Sources

Data for species managed by NOAA Fisheries and the Pacific Fishery Management Council are collected by both federal (and/or quasi-federal) and state agencies. This can complicate analysis because several agencies may collect the same types of data. Where this occurs, the analyses below are based on those data that are most likely to be informative regarding changes in population size.

Removals

Whenever possible, removals are characterized as landed catch plus fish released and presumed dead. Historical catches (prior to 1980) are reconstructed from historical documents, and reported and inferred relationships among fishing sectors. This is a change from the approach of inferring historical catches from state reports or backward projections of more recent catches as was done for the 2003 assessment.

Recreational Fishing History in California

Recreational fishing in California became popular in the late 1890s, but was limited to mostly big game fishes (tuna, marlin, and swordfish) and wealthy participants (Holder 1914). There remained in California limited recreational fishing opportunities to most people before 1920. Private boat access to nearshore fishes increased after 1920 (Croaker 1939), but it was not until Commercial Passenger Fishing Vessels (CPFVs) began operating in earnest off southern California in 1928 that the general public gained extensive accessibility to many nearshore fishes (Scofield 1928; Young 1969). Both barges – large, flat, open-spaced ships – and more traditional CPFV boats comprised the fleet. There were 15 barges and 20–30 boats off southern California in 1928 (Scofield 1928). The period 1929–39 saw a rapid increase in the popularity of CPFVs (Fig. 4; Croaker 1939), which also spread northward to central and northern California. By 1932, sportfishing in Monterey was very popular, with cabezon a major target species (Classic 1932). Pier and shore fishing modes also provided major recreational fishing outlets during this time of increased CPFV activity (Scofield 1928; Croaker 1938; Baxter & Young 1953; Young 1969). In all modes, most fishing occurred during the summer and autumn months, with some fishing extending into spring (Fry 1932; Baxter & Young 1953). CPFV captains have been required to submit logbooks detailing catches since 1936 (Croaker 1939; Baxter & Young 1953;