TRENDS IN THE SOUTHERN CALIFORNIA SPORT FISHERY

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ABSTRACT

We constructed a database for the Southern California commercial passenger fishing vessel (CPFV) fleet for the years 1959–1998 using the daily fish reports from the *Los Angeles Times*. This database includes information on number of fish caught by species, landing port, landing date, and number of anglers. Comparison of this database to the logbook database maintained by the California Department of Fish and Game shows high correlation.

Angler effort has been consistent throughout the time series at about 620,000 passengers per year. The annual fish catch averaged 4.25 million fish from 1963 to 1991 but has declined since 1992 to 2.5 million fish in 1998. The data show a decided decline in the CPFV catch of rockfish species since the early 1980s; a possible consequence of this decline appears to be a shift in effort toward less utilized species over the past decade, most notably ocean whitefish, California scorpionfish, cabezon, and more recently sanddabs.

The CPFV fishery not only provides a recreational opportunity to residents and visitors to southern California but also contributes to local economies. This fleet's catches, combined with those of private recreational anglers, are substantial enough to impact fish populations, particularly in regional areas. The database, which will be available on the NOAA-NMFS Southwest Fisheries Science Center Web site and updated regularly, provides a means of monitoring fisheries trends in real time.

INTRODUCTION

One of the difficulties in assessing fish stocks is obtaining time series spanning enough time to recognize long-term trends in abundance and to measure the effects of fishery regulations. The *Los Angeles Times* has carried a daily report of marine fish landings by commercial passenger fishing vessels (CPFVs) in Southern California for over 50 years. Although the central function of these reports is to encourage anglers to fish aboard CPFVs, the reports, if compiled into a database, could also provide a valuable tool for monitoring the fishery and the stocks on which it depends. The *Los Angeles Times* usually reports each day's landings for most fishing ports, the number of CPFVs reporting landings on that day, the total catch numbers by species or species group, and the total number of fishing passengers. In 1997 Charles Mitchell (of MBC Applied Environmental Sciences) was awarded a Saltonstall-Kennedy Grant (NA76FD0050) to enter 40 years of the *Los Angeles Times*' marine fish reports into a database to make this information available for fishery researchers in California. The Southwest Fisheries Science Center, National Marine Fisheries Service, assumed responsibility for updating and maintaining the database after Mitchell completed his grant project. Data are currently available for 1959 to the present. The database provides a data set for tracking trends in the abundance of fishes taken by the CPFV fishery in southern and central California and for following interannual and seasonal trends in recreational fishing effort. The California Department of Fish and Game (CDFG) maintains a similar database derived from logbook records begun in 1935 that also reports the catches of the CPFV fleet (Hill and Schneider 1999). A comparison of CDFG's logbook data with *Los Angeles Times'* reports over 6 years showed strong correlations between the two data sets for many of the more popular species within ports and years (Hill and Barnes 1998).

Our objective in this article is twofold: to describe major trends in recreational fishing in southern California as revealed by the *Los Angeles Times'* data set, and to describe the data set, identifying its strengths and limitations, so that fishery researchers and the public can use the data to better understand the dynamics of the resources and recreational fishing patterns in California waters. This database, which will be available on the NOAA-NMFS Southwest Fisheries Science Center Web site and updated regularly, provides a means of monitoring fisheries trends in real time.

Trends in the CPFV fishery are of consequence. Recreational fishing in California is a substantial business contributing over $173 million to the economy annually (Gautam 1996). A major segment of that industry is the CPFV fleet, which provides fishing experiences to millions of anglers in southern California

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(Young 1969; Gruen, Gruen, and Associates 1979). In 2001 the fleet consisted of 200 vessels licensed to operate in southern California.

METHODS

Properties of the Data Set

The database was generated by MBC Applied Environmental; microfiche records of the *Los Angeles Times'* fishing reports from the newspaper's archives were copied and the data was subsequently entered into the database. The daily information includes the date, landing code, local landing name, number of anglers, species code, number of fish caught for each species, and number of fish released for each species; there is also an appendix of species codes, *Los Angeles Times* names, common names, scientific names, and family groups. Presently, the data are for 1959–1998, except for a gap between June 1961 and April 1962 when the *Los Angeles Times* did not publish a fish report. The present database has been extensively edited since its initial production; numerous data entry and coding errors have been eliminated, species codes altered, and changes verified by returning to the original microfiche records. The edited data set was converted into Microsoft Access format.

The data set includes 1.23 million records, 147 species or species groups (e.g., rock cod or bass), with 27 ports represented from Ensenada, Baja California, in the south to San Simeon, California, in the north. The *Los Angeles Times* published its reports daily, with occasional minor gaps, including the one mentioned above.

The reports sometimes distinguished between half-day and full-day trips, but this distinction was not included in the database. Multiday or long-range trips are not included in the fish reports. Therefore, effort calculations derived from number of anglers fishing are expressed as an angler trip, irrespective of trip length.

Common Names

The species names reported in the newspaper are common names and many species may have more than one common name, or a single common name may refer to more than one species and usages have changed over the years. For example, many large catches were recorded as "grouper." Three species of grouper—*Mycteroperca jordani*, M. *xenarcha*, and *Epinephelus niveatus*—are occasionally caught in southern California waters; however, each is considered rare (Miller and Lea 1972), and catches are usually of a single specimen. Fishers commonly refer to the rockfish bocaccio (*Sebastes paucispinis*) as salmon grouper, with the name frequently being shortened to grouper in the report. Thus, reports of "grouper" were assigned to bocaccio unless a specific type of grouper was actually named. Similarly, Hill and Barnes (1998) noted that yellowtail (*Seriola lalandi*) were reported by the *Los Angeles Times* but this species does not appear in logbook records for the ports of Avila, Morro Bay, and San Simeon. Yellowtail rockfish (*Sebastes flavidus)* are commonly caught in these ports, and the name is frequently shortened to "yellowtail" (and likely reported this way to the *Los Angeles Times*). Because *Seriola lalandi* seldom occurs north of Point Conception except occasionally during strong El Niño years, references to "yellowtail" from these ports were assigned to *Sebastes flavidus*. Many other instances of assigning common names to specific species exist in the data. In some instances we had to use group names like rockfish, rock cod, bottom fish, or bass because this was how the catch was reported.

We have assigned all of the common names to single species where possible, including multiple common names. This effort has included correcting obvious typos in the newspaper records. Many species are listed individually, for instance, albacore tuna (*Thunnus alalunga*), yellowfin tuna (*Thunnus albacares*), yellowtail (*Seriola lalandi*), bonito (*Sarda chiliensis*), and Pacific barracuda (*Sphyraena argentea*). Other species may be listed individually or included in a "group" classification; some examples would be kelp bass (*Paralabrax clathratus*), barred sand bass (*P. nebulifer*), and spotted sand bass (*P. maculatofasciatus*), which are sometimes lumped together as "bass," or individual *Sebastes* species, which may be reported individually as bocaccio, chilipepper, or widow rockfish or be lumped in group designations ("rockfish," "rock cod," "red rock cod," or "red snapper"). Group designations such as "rockfish," "rock cod," "red snapper," "red rock cod," "bottom fish," and "flatfish" are included as reported. We list "rock cod" and "rockfish" as they may represent primarily deep and shallow *Sebastes* spp., respectively, but it is by no means a hard and fast line that separates the two designations. "Rockfish" could quite possibly include other non-*Sebastes* species such as cabezon, ling cod, and ocean whitefish in some instances. "Bottom fish" should be considered a catch-all group of varied, less valued, but unknown species. Since the reports are an advertisement, the most desirable species are consistently reported by species rather than as a group. This makes tracking of the more desirable species an easier task and enhances the overall value of the database to researchers. In a database of this size the value is in the historical trends reflected in the catches, and the small errors in daily reports are assumed to be of minor import.

Geographical Distribution of Landings

The *Los Angeles Times* reported landings from 27 ports from 1959 to 1998 (fig. 1). In the early years, many of the northern recreational fishing ports either did not

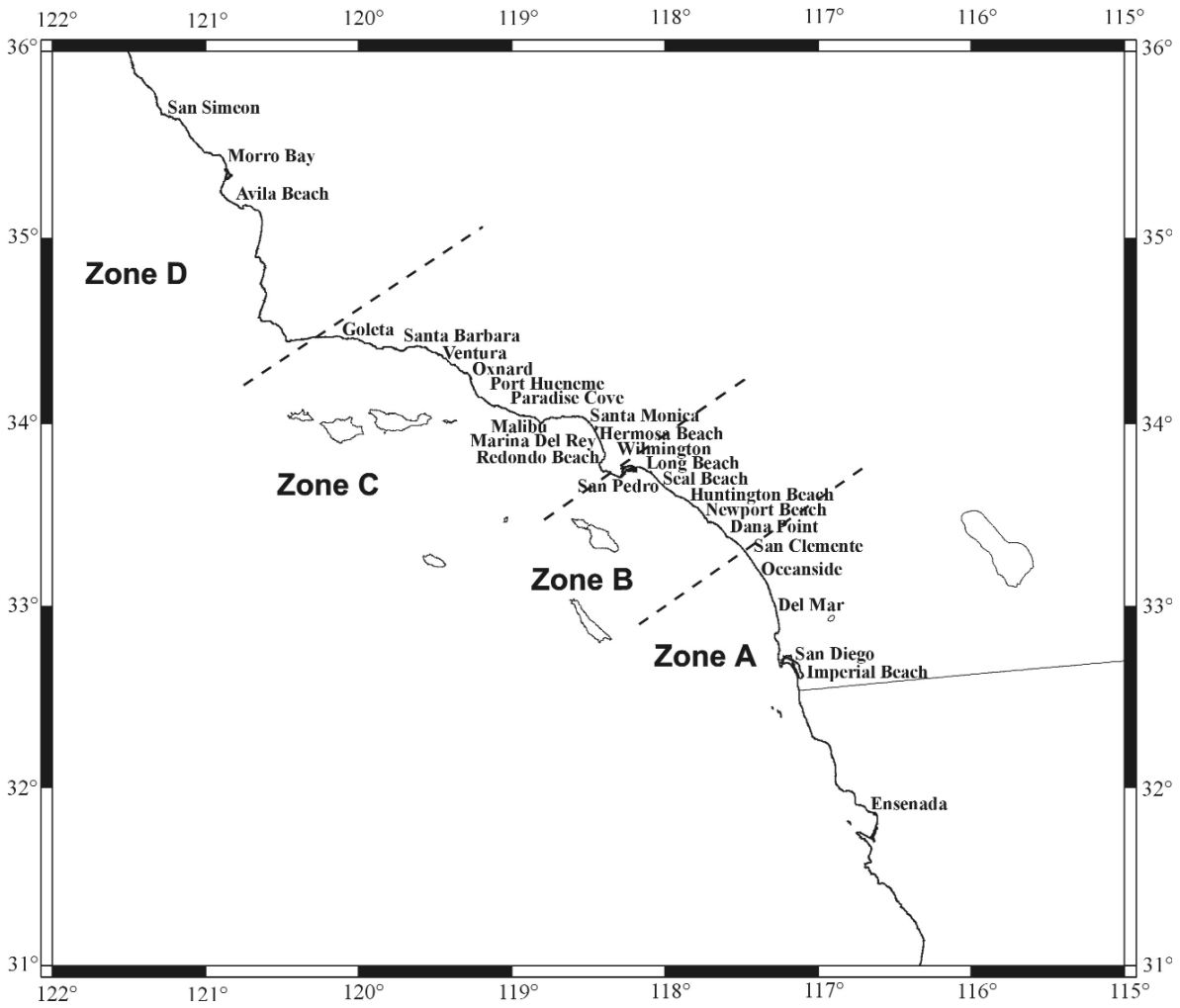

Figure 1. Area covered by the *Los Angeles Times'* marine fish report during 1959–98 showing the 27 ports from which reports are taken and the four geographical zones.

exist, did not report, or reported only intermittently. In addition, the consistency of landings reporting the catch varied among ports. In this article we group the data by four geographic zones (fig. 1). Zone A includes 5 ports from Ensenada to Oceanside, with fishing areas including the waters off northern Baja California, Mexico, and San Diego north to Oceanside, the southern region of the Southern California Bight. Zone B includes 7 ports from San Clemente to San Pedro, with fishing areas including the coastal waters off San Clemente, the flats off Huntington Beach and Newport Beach, waters off Long Beach, around the islands of San Clemente, San Nicolas, and Santa Catalina, and the central region of the Southern California Bight with occasional tuna trips into Mexican waters. Zone C includes 12 ports from Wilmington to Goleta, with fishing areas including the regions of Santa Monica Bay and Ventura flats, islands of Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel, and the northern portion of the Southern California Bight. Zone D includes 3 ports north of Point Conception, from Avila to San Simeon, with fishing areas north of Point Conception in coastal waters and on Santa Lucia Bank, and offshore.

Landings from zone D were not reported until 1964, and they became consistent by 1972 when they averaged about 600 reports annually, increasing to 1,000 annual reports for this zone from 1991 until the present. Zone A averaged 550 reports a year from 1959 to 1984, increasing to 1,200 a year from 1985 to 1998. Zones B and C, having the greatest number of ports and the highest population density, have averaged around 2,300 reports a year since the peak reporting years of 1967–68 when they averaged more than 3,000 reports a year. Pier and barge reports were included occasionally, until removal of the barges in the late 1960s. Between 27 September 1965 and 23 May 1985 the report did not include the total number of boats fishing but did include the total number of anglers.

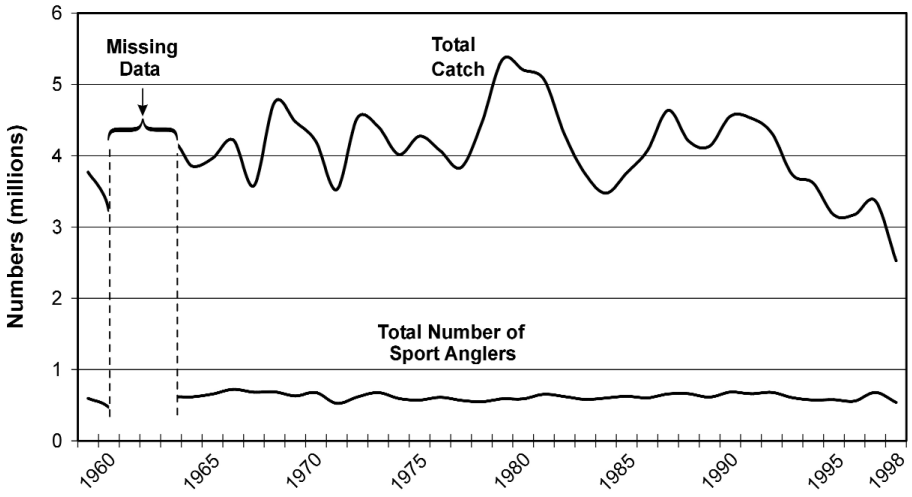

Figure 2. The total annual effort (angler numbers) and catch of all fish species reported in the *Los Angeles Times'* marine fish report for 1959–98.

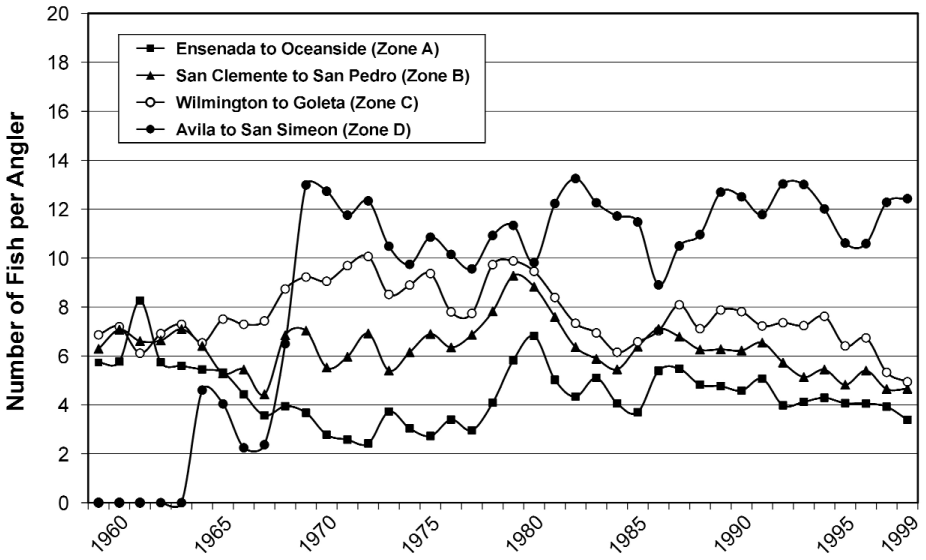

Figure 3. Annual CPFV catch per angler by geographical zone, 1959–98.

TRENDS IN THE CPFV FISHERY, 1959–98

Annual Number of Fishing Trips and Catch

A surprising feature of the CPFV fishery is that the total number of angler trips has remained relatively constant at about 620,000 angler trips per year over the 40-year time series (fig. 2). This is remarkable given the large increase in the coastal population of California over the same period. A partial explanation for the lack of growth in the average number of angler trips is that the percentage of the population that participates in recreational fishing is declining. It dropped from 6.5% to less than 5% from 1993 to 1998 (Milton 2000). The increasing popularity and availability of private boats may be the major area of growth in coastal fishing. In southern California, private boats in 1998 accounted for 45% of the recreational fishing effort as opposed to 23% for the CPFV fleet (NMFS 2000).

While the number of angler trips has remained relatively constant over the last 40 years, the number of fish caught is declining (fig. 2). The reported total annual catch varied around a mean of 4.25 million fish for the period 1963–91, but since 1992 the catch has been decreasing. In 1998 the annual catch was about 2.5 million fish, which is a 41% reduction from the long-term mean 1963–91 and the lowest value in the time series thus far. Considerably more fish are captured per angler trip in the northern ports (zone D) than in the more southern ports (fig. 3). Zone D anglers averaged 11.5 fish per angler trip during 1969–98 (earlier years were

TABLE 1
Top Ten Species Caught by CPFVs in Each Zone and Percentage of Total Catch for That Zone

Rank	Zone A	Zone B	Zone C	Zone D
1	Calico and sand bass (21%)	Calico and sand bass (29%)	All rockfish species (52%)	All rockfish species (80%)
2	Bonito (16%)	All rockfish species (22%)	Calico and sand bass (19%)	Calico and sand bass (14%)
3	All rockfish species (15%)	Bonito (17%)	Pacific mackerel (11%)	Lingcod (3%)
4	Pacific mackerel (12%)	Pacific mackerel (13%)	Bonito (9%)	Albacore (2%)
5	Pacific barracuda (11%)	Pacific barracuda (10%)	Pacific barracuda (3%)	Pacific mackerel (<1%)
6	Albacore (8%)	Yellowtail (2%)	Ocean whitefish (1%)	All salmon (<1%)
7	Yellowtail (8%)	Pacific halibut (1%)	Sculpin (1%)	Miscellaneous (<1%)
8	Yellowfin tuna (2%)	Sculpin (1%)	Pacific halibut (1%)	Pacific barracuda (<1%)
9	Sculpin (2%)	Ocean whitefish (1%)	Lingcod (<1%)	Bonito (<1%)
10	Skipjack tuna (2%)	Albacore (1%)	Bottom fish (<1%)	Pacific halibut (<1%)
	All others (3%)	All others (3%)	All others (2%)	All others (<1%)

not used because of reporting vagaries); zones C and B averaged 7.7 and 6.3 fish per angler trip, respectively, during 1959–98; and zone A anglers caught an average of 4.4 fish during 1959–98. These regional differences are due to differences in the target species (tab. 1). The farther north a port is, the greater the focus on rockfish species with large bag limits and high catch rates during much of the year. Rockfish species constitute 80% of the catch for ports in zone D. CPFVs in the two central zones, B and C, also depend heavily on rockfish, which rank second and first in their contribution to the total catch, respectively. However, they also target an assortment of coastal species such as bass, barracuda, bonito, mackerel, California halibut (*Paralichthys californicus*), and yellowtail, which even with liberal bag limits tend to have lower catch rates than rockfish. CPFVs in the most southern ports in zone A frequently expend a large fraction of their fishing effort on the highly desirable but more elusive tunas and yellowtail and have consequently lower catch rates compared to coastal species or rockfish throughout much of the season. In addition, vessels from southern ports often fish in Mexican waters, where the bag limits are less restrictive than California's for large pelagic species.

Seasonal Variability in Catch Rates of Common Species

Catches of various species fluctuate because species vary not only in their availability and abundance but also in their desirability to anglers. Boat captains plan trips to maximize catches of the most desirable of the available species, shifting their effort from one target species to another and creating seasonal patterns in the fishery unrelated to abundance. For example, in winter and spring, catches are resident cold-water species such as rockfish, but as the waters warm in the spring or summer, fishing effort shifts to summer migrants, as shown in Figure 4.

Environmental conditions play a role in the appearance of migratory species in the southern California sport fishery. The most noted influence has been El Niño or La Niña events with their resultant anomalously warm or cool sea-surface temperatures off southern California. There were 13 El Niño and 7 La Niña events during

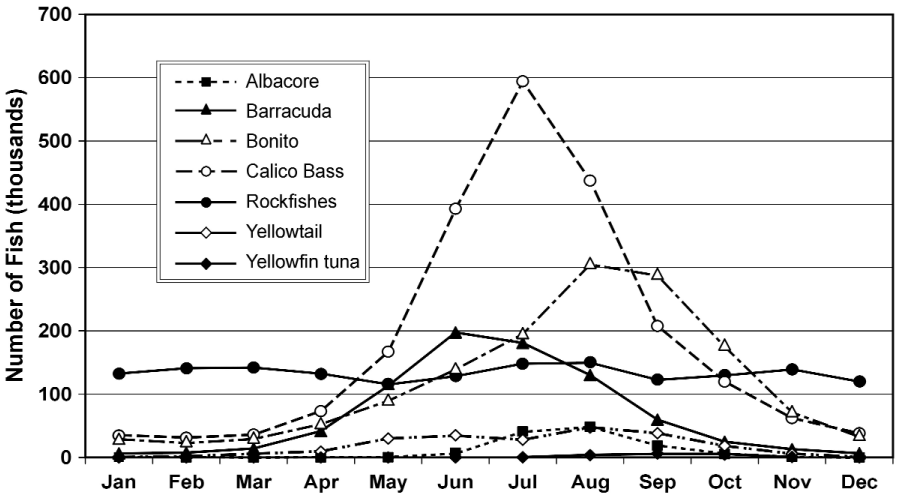

Figure 4. Average monthly CPFV catch, 1959–98, for several popular sport fish species or species groups.

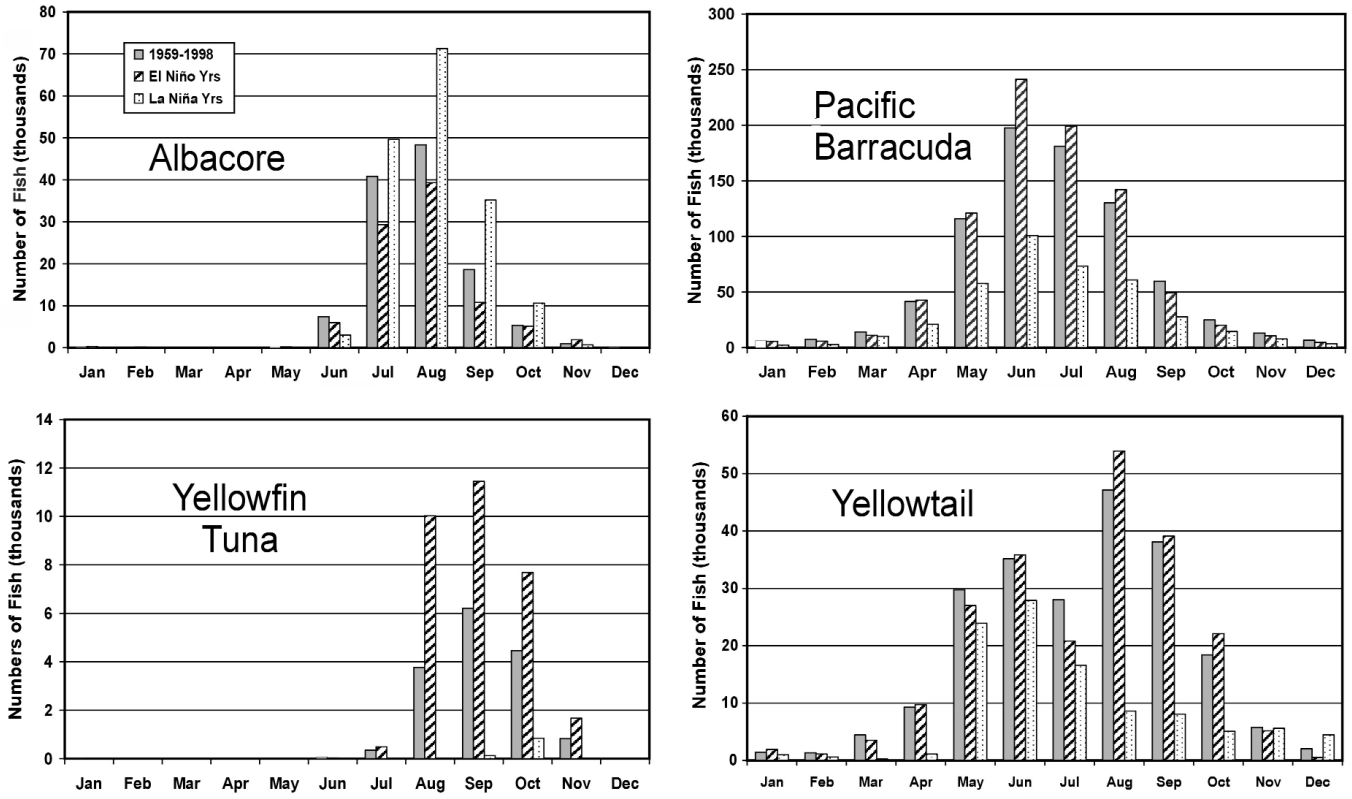

Figure 5. Average monthly CPFV catches of some migratory species, during 1959–98 and following El Niño and La Niña years.

1959–98. Figure 5 shows the average monthly catches of some migratory species as well as the averages for years following an El Niño or La Niña winter. For yellowtail, monthly catches during El Niño years do not appear to differ significantly from the 40-year average but appear significantly lower during La Niña years. Pacific barracuda show much the same trend as yellowtail. Albacore catches are affected by both events, with lower catches during El Niño events and higher catches during La Niña events. Yellowfin tuna, a tropical species, appear primarily in El Niño years and late in the season when waters have warmed to their maximum.

Angler Response to Reported Catch

The demand for fishing trips is tied to anglers' expectations of what will be caught on the trip (Center for Natural Areas 1980), and, of course, it is precisely for this reason that the *Los Angeles Times* publishes the daily catch. In order to see the effect of catch reports on passenger numbers or effort, we grouped the change in reported catch from one day to the next for albacore and yellowtail in zone A and plotted that against the change in passenger count for 1–3 days following the report (fig. 6). The change in catch was grouped as −100–100 fish, ±100–500 fish, ±500–1,000 fish, and ≥1,000 fish.

When changes in yellowtail catches in zone A are slight (±100 fish), passenger counts remain static, but as reported catches increase or decrease from this level, passenger counts also increase or decrease (fig. 6a). The angler response to increasing catches was strongest on the day following the report's appearance in the newspaper, with the effect diminishing 2–3 days later. When yellowtail counts increased by over 1,000 fish from the previous day's catch, the average increase exceeded 400 anglers. When counts decreased, passenger counts also decreased, and, again, the response was greatest on the first day following the report. Thus, anglers are quick to respond to both increasing and decreasing catches of yellowtail. The angler response to changes in albacore catches in zone A is similar to that of yellowtail: increasing catches resulted in increased passenger count, and decreasing catches resulted in decreasing passenger counts (fig. 6b). However, unlike yellowtail, the angler response on the second and third days after a report was about the same as the first day after the report. Albacore trips are generally overnight trips, requiring two days to complete, whereas yellowtail trips require only one day. Thus, the difference in response between albacore and yellowtail trips may be due to differences in the extent of planning required. The magnitude of passenger change in albacore trips was only about 75% of that reported for yellowtail.

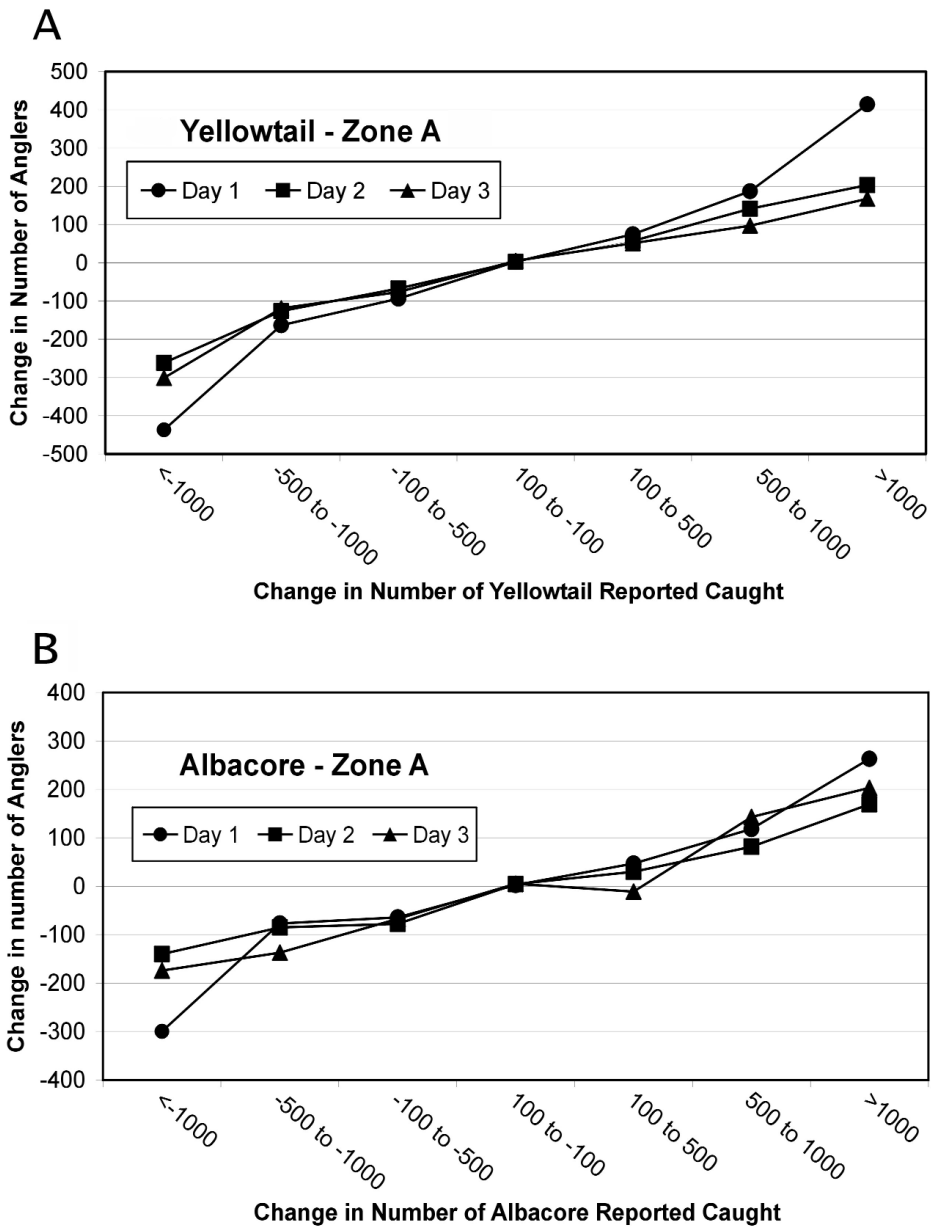

Figure 6. Angler response to reported changes in catch in zone A of (*a*) yellowtail (*Seriola lalandi*) and (*b*) albacore (*Thunnus alalunga*).

Long-Term Trends in Abundance or Availability of Key Species

Total annual catches of four popular coastal species are shown in Figure 7. Large intra-annual fluctuations appeared in catches of both kelp/barred sand bass and Pacific bonito, and Pacific barracuda has been showing a steady increase since the early 1980s, following a large drop in the late 1960s; yellowtail remained fairly constant throughout the 40-year series until jumping in 1997 from around 50,000 fish to over 400,000 fish. Since kelp and barred sand bass are resident species, catch fluctuations probably reflect relative abundance, although susceptibility to capture of kelp bass may be influenced by the density of kelp forests that varies intra-annually. Bonito, barracuda, and yellowtail are all seasonal migrants into southern California waters, so their catches may reflect not only population size but also the extent and timing of their annual migration into southern California waters. However, the steep and persistent decline of bonito catches suggests that a major decline in abundance has occurred.

In the past several years many species within the rockfish complex (*Sebastes* spp.) have been classified as overfished (MacCall et al. 1999; Ralston 1999). The total

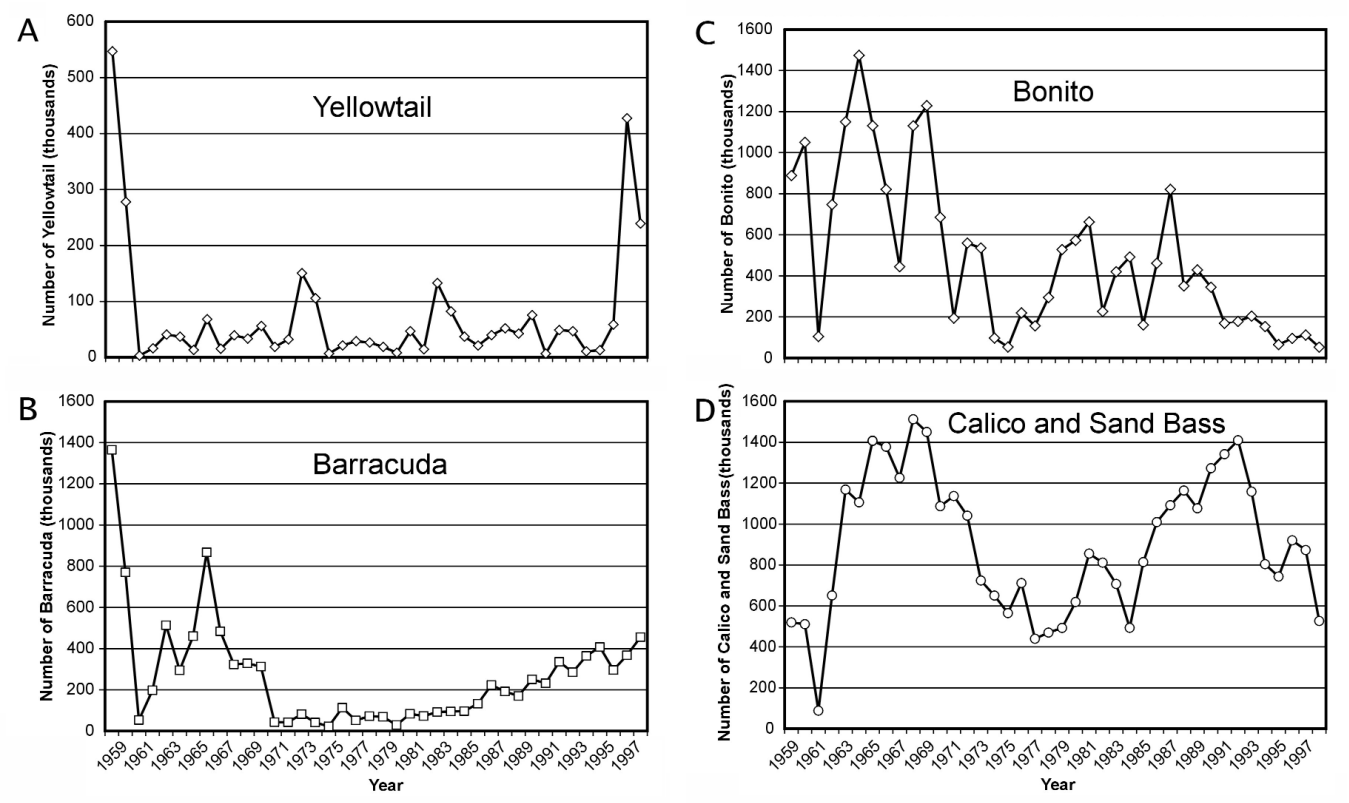

Figure 7. Annual catches of some popular coastal species targeted by CPFVs during 1959–98.

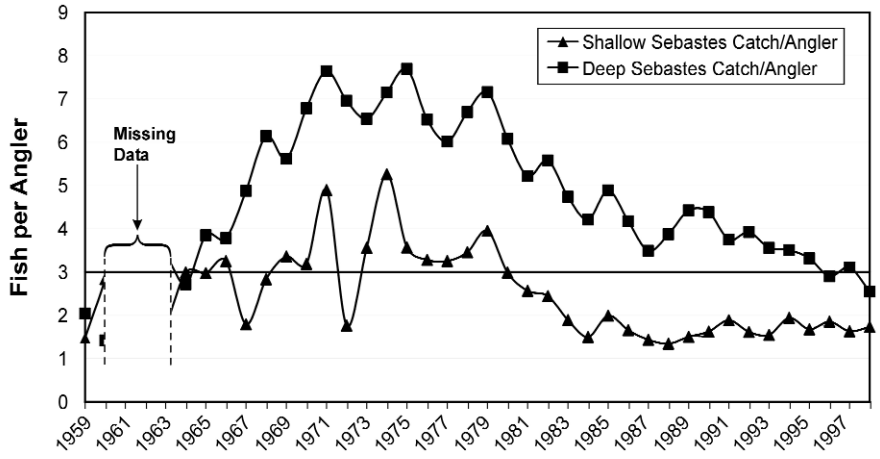

Figure 8. Annual catches of shallow and deep-water *Sebastes* species by CPFVs, 1959–98.

annual CPFV catch of rockfish peaked in 1975 at 3.3 million fish, decreasing by 80% since then to 648,000 fish in 1998. A plot of the number of fish per angler of the deep-water and shallow-water rockfish (fig. 8) shows that after peaking in the mid-1970s at 7.5 and 5 fish per angler, respectively, catches of both groups began to decline. The shallow-water catches leveled out at around 1.7 fish per angler in the late 1980s, but the deep-water catches continued to decline to the end of the series. This severe decline in CPFV rockfish catches has also been noted by Love et. al. 1998. Following the decline in the *Sebastes* catches that occurred in the early 1980s, CPFVs appear to have begun targeting other species to supplement their catches. Sculpin, cabezon, and ocean whitefish are three bottom species that are commonly caught together in the winter/spring months when alternatives such as yellowtail, bass, bonito, and barracuda may not be available. A plot of monthly *Sebastes* spp.

catches along with the combined catches of California scorpionfish (sculpin) (*Scorpaena guttata*), cabezon (*Scorpaenichthys marmoratus*), ocean whitefish (*Caulolatilus princeps*), and sanddabs (*Citharicthys* spp.) (fig. 9) shows that fishery effort may have switched from rockfish to these alternative species. However, as mentioned by Hill and Barnes (1998), the decline in catches of rockfish species may have resulted in increased reporting of these more marginal species to the *Los Angeles Times* as a means of drawing more customers.

Cowcod (*Sebastes levis*), a rockfish long prized by anglers because of its flavor and size, has experienced a severe decline in numbers. The Pacific Fishery Management Council has classed it as overfished, and it is currently being managed under a rebuilding plan (Butler 2003).

Catches reported in the *Los Angeles Times* peaked at over 25,000 fish per year in the early 1970s, declining 72% through the late 1970s to 7,000 fish by 1983, and declining further to a catch of 1,100 fish in 1998 (fig. 10a). These figures represent a decline of 96% in cowcod catches in the past two decades. Viewing the catches by zone (fig. 10b), one can see that zones B and C account for most of the CPFV catch of cowcod. Cowcod catches in zone B peaked in 1967 at 16,000 fish, then began declining in the late 1960s, with large annual fluctuations until the late 1970s. Zone C cowcod catches peaked at 18,000 fish in 1973, remaining at fairly high levels until beginning a rapid decline around 1982. These two zones also coincide with the majority of the larval catch on CalCOFI cruises off southern California (Moser et al. 1994). In 2001, a 4,300 mi^2 Cowcod Conservation Area that was closed to deep-water bottom fishing was established around offshore banks 43–120 miles offshore of zones B and C, coinciding with the region of highest historical cowcod catches and incidence of larval fish.

Effects of Regulations

The *Los Angeles Times'* data set may also be useful for measuring the effects of fishing regulations on the recreational fishery. The California halibut and white sea bass (*Atractoscion nobilis*), species popular among California anglers, were caught in large numbers by anglers in the early 1960s and then declined rapidly, prompting size and catch regulations on the recreational catch (fig. 11). White sea bass sport catches peaked at around 19,000 fish in 1963, and catches declined to less than 2,000 fish in 1967 (fig 11a). Prior to 1972, the legal take per angler was ten fish with two fish under 28 inches allowed, but after 1972 no fish under 28 inches could be taken; this policy was modified in 1974 to allow the take of one fish under 28 inches. In 1981, the limit was changed to zero fish for part of the season and three fish thereafter, with none under 28 inches allowed; this was changed again in 1985 to one fish and then three fish during the season with the same size restrictions. These changes in regulations seemed to have had little effect on the white sea bass catches until the late 1980s and, notably, in 2000, when the sport catch again reached 18,000 fish.

Historically, high halibut catches over 100,000 fish annually were reported in the CPFV fishery in the mid- to late 1940s, declining to 11,000 fish in 1957 (Oliphant 1990). In our data time series, annual California halibut sport catches were over 100,000 fish from 1962 to 1966, peaking at 176,000 fish in 1963, then declining rapidly to 19,000 by 1971 (fig. 11b). Regulations for the recreational fishery changed from two fish and no size limit in the late 1950s, to five fish and no size limit in 1962, and then five fish and 22 in. minimum length in 1971. In the two decades from 1978 to 1998, annual CPFV catches of California halibut have averaged 7,660 fish, a drop of 96% from the high catches in 1963.

A legislative ban on coastal gillnetting in southern California waters was passed in 1990 (Proposition 132) and went into effect in January of 1994, creating a "Marine Resources Protection Zone" roughly 3 miles offshore in coastal waters and 1 mile offshore channel islands south of Point Arguello. Planting of hatchery-reared juvenile white sea bass began in 1986 and continues, with 502,885 released in southern California waters, of which 42,900 are expected to have reached adulthood of 2–3 years based on mortality estimates.[1] These factors may have contributed to the resurgence in the sport catch of white sea bass. A survey of 2–3-year-old white sea bass caught in 2000 indicates that 7% contained the coded wire tags implanted in the released juveniles. Much of the resurgence in the fishery may also be due to a strong recruitment in 1997.[2] As for the California halibut fishery, no effect of the gillnet closure nor other regulations has resulted in a return to 1960s levels in the recreational catch of halibut.

Management decisions may sometimes have unforeseen consequences. Reports began surfacing in 1998 of extremely large winter catches of sanddab, a small but delicately flavored flatfish with no bag limit. Poor rockfish catches in 1998, perhaps due to the El Niño event, may have resulted in increased fishing on sanddabs. In 2000, a 2-month rockfish closure in southern California waters was instituted with additional restrictions and areal closures in 2001. Regulations restricting winter fishing for rockfish were a strong incentive for the CPFV fleet to target other species. Looking at annual catches of sanddab (fig. 9), one can see that beginning in 1998, catches skyrocketed from incidental levels, generally below 2000 fish annually, to 80,000 fish in 1998, 128,000 in 2000, and 244,000 in 2001 (1999 data is not

[1]S. Crooke, CDFG, pers. comm.
[2]S. Crooke, CDFG, pers. comm.

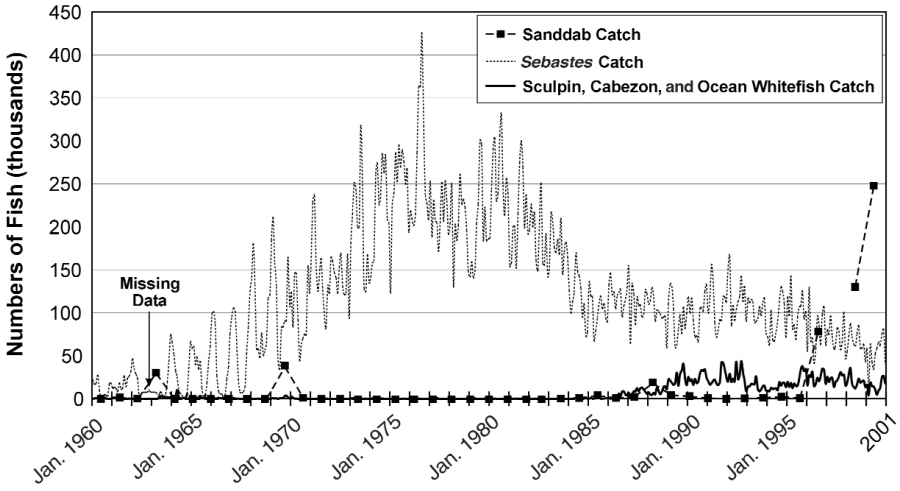

Figure 9. Monthly CPFV catches of *Sebastes* spp., sanddabs, and the combined grouping of sculpin, cabezon, and ocean whitefish, 1959–98.

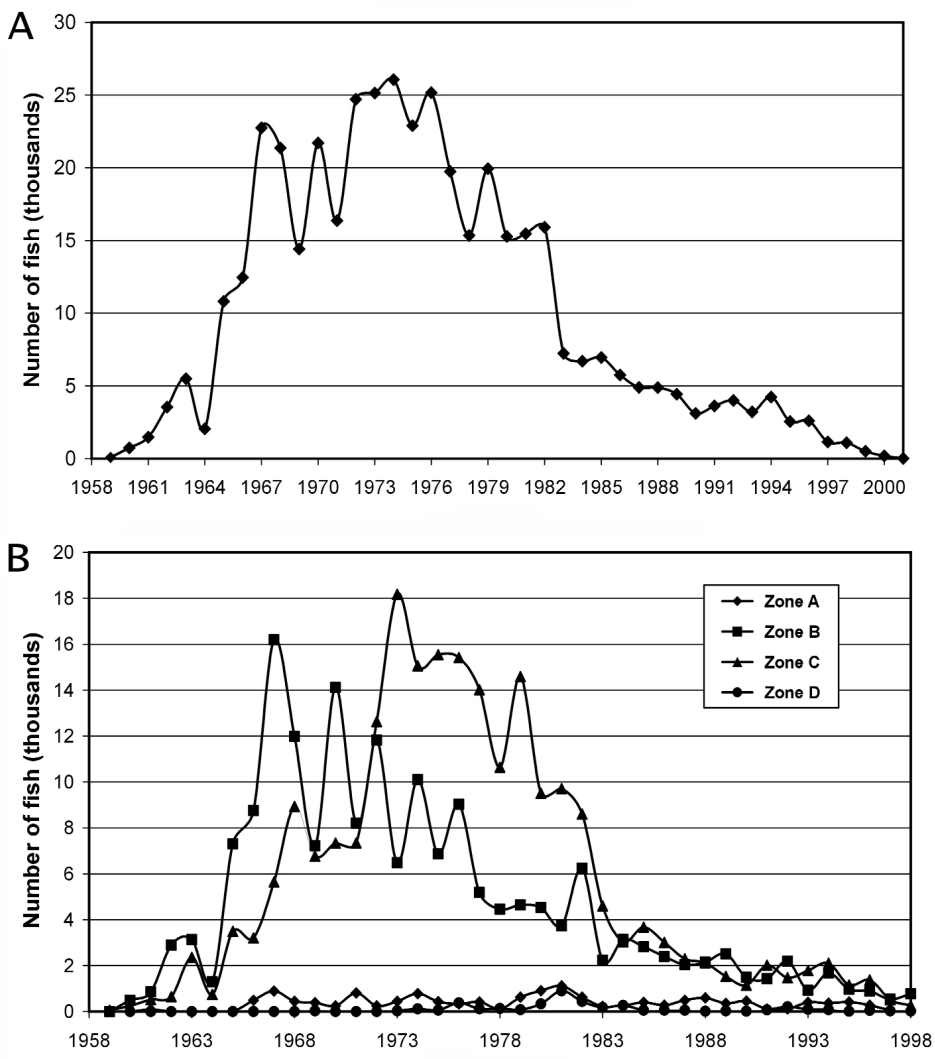

Figure 10. Annual CPFV catches of cowcod (*Sebastes levis*), 1959–98. *A*, overall catch; *B*, catch by zone.

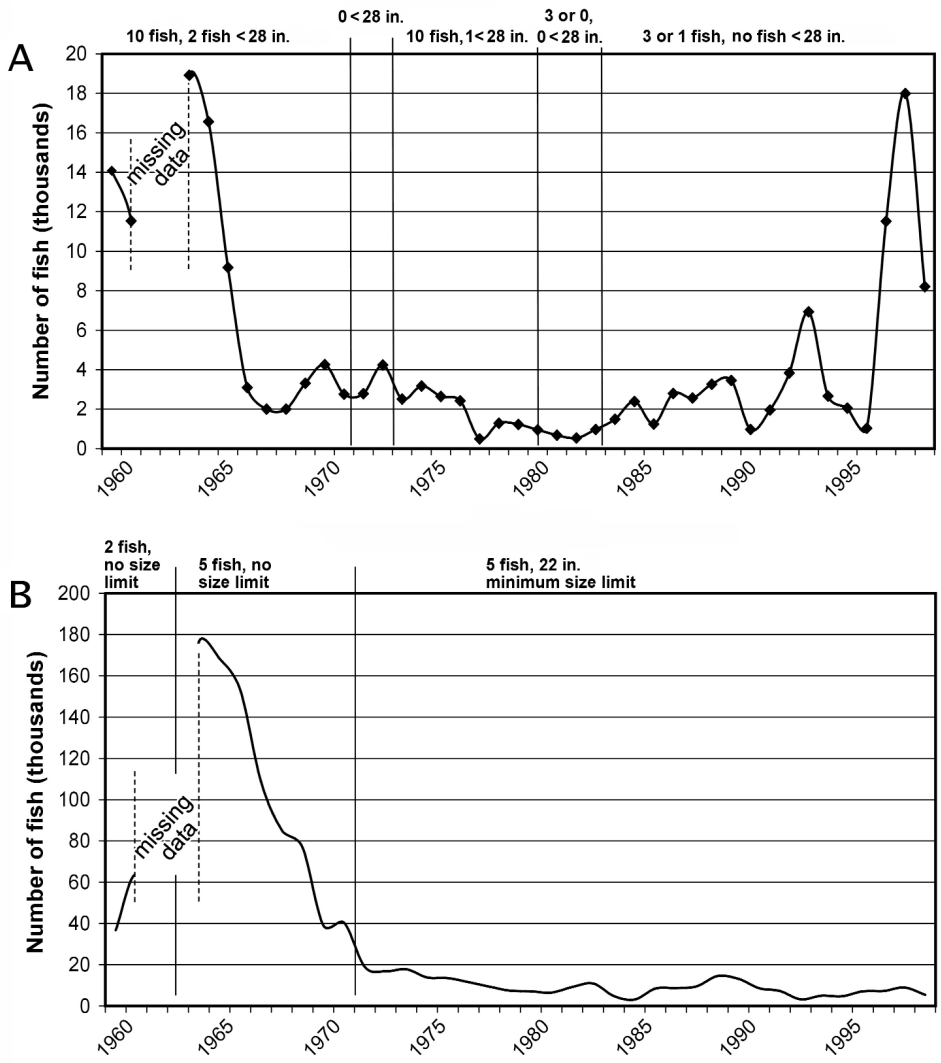

Figure 11. Annual CPFV catches and sport fishery regulations, 1959–2001. *A*, white sea bass (*Atractoscion nobilis*); and *B*, California halibut (*Paralichthys californicus*).

yet complete and is not included). However, when we look at sanddab catches by zone, zone B accounts for virtually all of the additional catch. Zone C historically has landed 2.5 times as many rockfish as zone B yet has not accounted for the large increase in sanddab catches. This raises the question of whether the increase in sanddab landings is actually a response to restrictions in the rockfish fishery restrictions or is caused by a large increase in sanddab numbers or discovery of this fishery by local anglers in zone B.

DISCUSSION

The CPFV fleet is a valuable recreational and economic unit within California, with 200 licensed vessels in southern California in 2001 (Young 1969; Gruen, Gruen, and Associates 1979). The NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) concluded from an economic add-on survey in 1998 that southern California anglers on CPFVs or charter boats spent on average $35 per day on boat fees, bait, and fishing licenses (NMFS 2001). Expenditures for charter boat trips in southern California were estimated by Gautam (1996) as $68–97 and by Hanemann et al. (1989) as $80. Ticket prices of CPFV trips in southern California range from $25 to $30 for half-day boats, $36 to $66 for three-quarter day trips, $40 to $99 for a full day, and $85 to $175 for overnight trips to the islands or for offshore tuna fishing. According to the *Los Angeles Times'* database, 539,478 anglers took CPFV trips in 1998. Assuming a mean cost of $89 a ticket, ticket expenditures would total over $43 million. Huppert and Thomson (1984) estimate that the ticket price accounts for 75% of the trip cost. Travel, gear, and other costs add an additional 126% over the ticket price. Thus, the CPFV fleet may

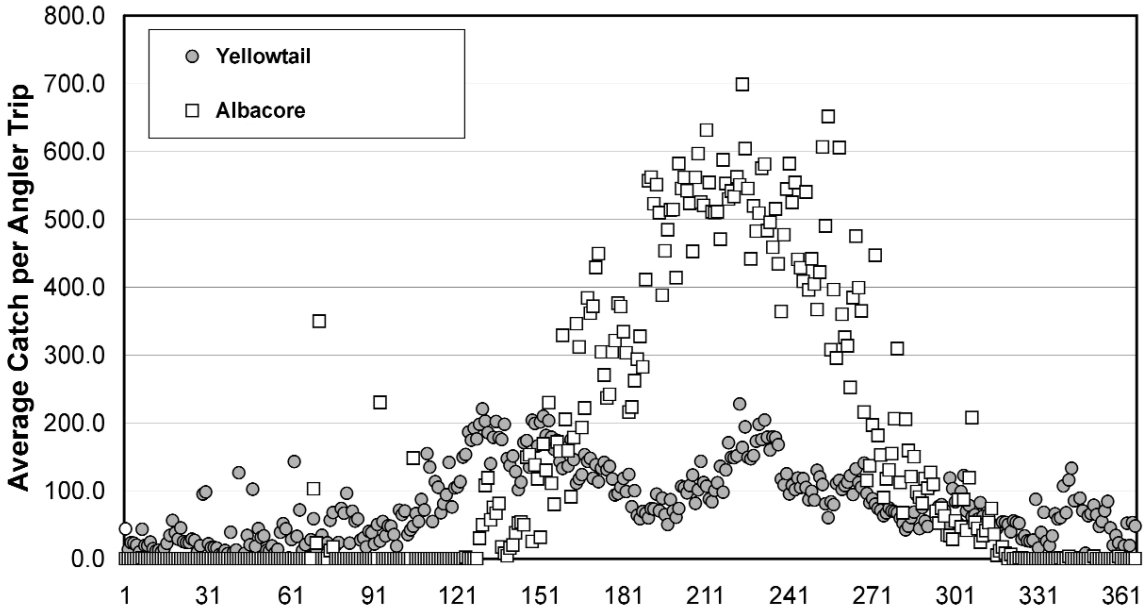

Figure 12. Average daily CPFV catches of yellowtail (*Seriola lalandi*) and albacore (*Thunnus alalunga*) in zone A, 1959–98.

contribute over $97 million to the economy. Thomson and Crook (1991), using MRFSS survey data, calculated the average CPFV cost to be $131 per trip, including ticket, tackle, equipment rental, mileage, food, and lodging. One recent estimate of the total value of southern California recreational fishing, including private boats, was $173 million annually (Gautam 1996).

It is also clear that the catches of this fleet can have a substantial effect on the abundance of some local stocks. While only a few fish are taken per angler per trip, when multiplied by the number of trips, the catch is substantial. In a study of the CPFV rockfish catches from 1980 to 1996, Love et al. (1998) noted not only that some previously abundant species of the *Sebastes* complex were no longer represented in the catch in the 1990s but also that older, larger individuals were particularly absent and smaller species predominated in later catches. The CPFV fleet catch has averaged about 4 million fish a year over the past four decades. The effect of marine recreational angling is substantially greater than the CPFV fleet alone, however. According to the 1998 MRFSS survey, private boaters average about twice as many trips as CPFV anglers per year. Although the effect of recreational fishing on local stocks is significant, the catch of large stocks of migratory species such as albacore tuna seem negligible compared to commercial landings. For example, for 1959–98 the CPFV fleet accounted for only 3.6% of the U.S. catch of North Pacific albacore and 0.7% of the total North Pacific landings for all countries.

The specific diversity of the catch is a salient feature of the CPFV recreational fishery and one of the more vexing properties when the goal is to understand underlying biological characteristics of the stock such as abundance and migration. We show here that the species composition of the catch varies with latitude, season, and, importantly, the species preferences of anglers and vessel operators. Perhaps one of the best examples of changes in seasonal preferences is the bimodal summer peak in yellowtail landings in zone A (fig. 12). No reasonable biological explanation exists for this midseason bimodality, but it is adequately explained by a midseason switch from local yellowtail to the more valued offshore fishing for albacore.

Obviously, the business function of the *Los Angeles Times'* reports is to attract potential clients to a particular landing by reporting the catch. This may lead to inaccurate reporting of catch by some landing operators. A comparison of *Los Angeles Times'* data to CPFV logbook data compiled by CDFG shows that the data sets are strongly correlated, with r^2 ranging from 0.937 to 0.981 for halibut, yellowtail, barracuda, and bonito for the years 1959–98 exclusive of 1961–62, for which there is no *Los Angeles Times'* data. Hill and Barnes (1998) also noted good correlations between the two databases with both over- and underreporting of catches by different ports and different years and a particular tendency to underreport less-valued species. Overreporting of catch in the *Los Angeles Times'* reports is probably no more serious a problem than the underreporting of catch common in commercial fisheries or in logbook records. Clearly, the strength of these data from the biological standpoint is the measurement of trends over decades

rather than absolute abundances. In this study, we identify major declines in recreational landings of halibut, rockfish, cowcod, and bonito, stability in yellowtail, and perhaps the onset of a recovery in white sea bass.

The advertisement aspect of the *Los Angeles Times'* data set, far from being a detraction, is in fact one of the more useful and interesting properties of the data set. The data set could be used, for example, to gauge angler responses and species preferences under a variety of fishing and regulatory situations. Our simple and preliminary analysis shows that angler response to the reports (number of anglers purchasing tickets) is positively correlated with reported catch on the previous day, with this effect diminishing over succeeding days. Although a thorough analysis would require a complex modeling approach, it is clear that the *Los Angeles Times*' daily reports provide a daily assay of angler response that could be used to model the response of anglers to a variety of regulatory situations.

The CPFV fishery came under very stringent regulations on 1 July 2002 when fishing was prohibited for rockfish, lingcod, ocean whitefish, and California scorpionfish (sculpin) in waters 20 fathoms and greater in depth by the PFMC. The zone D CPFV fleet faces difficult times because rockfishes dominated its catch (tab. 1). Adjustments will have to be made throughout the fleet since the prohibited species were a mainstay for the winter CPFV fishery regardless of zone, ranking first in catch numbers for two zones and second and third for the other two zones. The resourcefulness of the CPFV vessel and landing operators should not be underestimated, however. The total number of angler trips has remained remarkably constant over the years, despite major shifts in the abundance or availability of target species and an overall decline in the catch of 41% in recent years. Another measure of this resourcefulness was a surprising development of a fishery for sanddabs in 1999, presumably in response to new rockfish regulations. Catches soared to 12,200% of the long-term mean in just 4 years.

As long as the *Los Angeles Times* continues to report the catches of the fleet and the number of anglers, a way exists to track and interpret the responses of the CPFV fleet and their anglers on a daily basis to new regulations and changes in abundance and availability of stocks. We plan to continue compiling our database from the daily reports, and the database shall be made available for all to use at the SWFSC Web site.

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