True Smelts

General

The true smelts of the family Osmeridae are small fishes found in cold coastal, estuarine, and freshwater habitats in the Northern Hemisphere. The term "true smelt" identifies these fishes from similar-looking species of the silverside family (Atherinopsidae, recently changed from Atherinidae) whose common names often include the word "smelt" (such as jacksmelt, or topsmelt). Smelt life history strategies range from completing all life stages in freshwater, migrating from marine or estuarine habitats to freshwater to spawn (anadromous), or living entirely in the marine environment and spawning in the surf or subtidal zone. Like salmonids, the true smelts have an adipose fin and some have a curious cucumber odor.

Most of the 12 species in the family support either sport or commercial fisheries due to their highly prized delicate flavor. They are also a major forage fish for marine mammals, birds, and predatory fishes such as salmon and cod. Seven of the 12 species occur in California: delta smelt, found only in the upper portions of the Sacramento-San Joaquin estuary; surf smelt, commonly known as day smelt, found along most of California's coast but spawning only from Santa Cruz northward; wakasagi, a Japanese freshwater species introduced into California reservoirs which has also taken up residence in the Sacramento-San Joaquin estuary; night smelt, found from Pt. Arguello, northward; longfin smelt, an estuarine species found mainly in the Sacramento-San Joaquin estuary; eulachon, an anadromous species found mainly in the Klamath River; and whitebait smelt, a rather uncommon marine species ranging from San Francisco Bay northward, about which little is known.

The six native smelts have all supported commercial fisheries in the past, but only surf and night smelts contribute significantly to the fisheries today. The combined fisheries vary from year to year, with catch ranging from 0.5 to 2.1 million pounds per year (1970 to 1999). In 1995, for example, over 2.0 million pounds of smelt were landed, with a wholesale value of over $600,000. The average wholesale price per pound ranges from $0.20 to $0.30. Smelts are sought commercially not only for human consumption but also as feed for marine mammals, birds and fishes in aquariums, and as bait for fishing.

Unfortunately, most of the historical commercial landing records for smelt, gathered by the California Department of Fish and Game (DFG), were lumped together, so the relative importance of each species in the past fisheries cannot be determined. The catch records for 1916 through 1969 are for "smelt" and "whitebait smelt." The term, "smelt" included not only surf smelt but jacksmelt, topsmelt, and grunion. After 1969, the silverside catch was removed from the "smelt" statistics and all smelts except whitebait and night smelt were lumped into the category "true smelt." However, it is unlikely that whitebait smelt were ever harvested in very large numbers. Furthermore, "whitebait smelt" was the only smelt category available to fish processors who filled out the required DFG pink slips on which catch is recorded. Therefore, it is quite likely that "whitebait smelt" in the historical fisheries statistics includes all species of smelt harvested (but mainly surf and night smelt).

Since 1977, landings of smelts have been recorded in their own species categories; however up to one third of the landings were still reported as "true smelt" and not identified to species. After 1989, the percentage of landings reported in the "true smelt" category has averaged less than 0.5 percent of the total landings. Therefore, while the total smelt catch can be estimated for the past several decades, landings by species can only be determined since 1990.

In addition to commercial landings, there is a large, but largely unreported, sport fishery for surf smelt and night smelt. The Marine Recreational Fishery Statistical Survey (MRFSS), established by the National Marine Fisheries Service (NMFS) in 1979, estimates the impact of recreational fishing on marine resources. Estimates of annual recreational smelt catches (1980 to 1998), based on phone and intercept surveys, range from nearly 200,000 pounds in 1998 to less than 5,000 pounds in 1983. Nearly all of these recreational catches are reported as surf smelt.

Delta Smelt

History of the Fishery

In the 19th century, delta smelt *(Hypomesus transpacificus)* and longfin smelt were the object of a commercial fishery that supplied markets in San Francisco. Much of the market seems to have been for dried fish for the Chinese community. In the 20th century, delta smelt have not been the target of a fishery, however other bait fisheries in the Sacramento-San Joaquin estuary (*e.g.*, shrimp, threadfin shad) often collect delta smelt as bycatch.

Status of Biological Knowledge

Our understanding of delta smelt life history has increased dramatically just prior to and since the delta smelt was listed as a threatened species in 1993 by both the federal government and the state of California. Since then, it has been the target of focused research to determine the factors affecting its abundance and to develop water management strategies to protect it. It is endemic only to the Sacramento-San Joaquin estuary, which also serves as the major water conduit for two-thirds of the state's human population. Hence, under protections set forth

in both the federal and state endangered species acts, the condition of the delta smelt population can play a major role in how water is managed throughout the state. The delta smelt is considered environmentally sensitive because it resides mainly in the brackish water portion of the estuary, is primarily an annual fish (*i.e.,* completes its life cycle, for the most part, in one year), is exclusively planktivorous and dependent on a zooplankton community that has been greatly altered by exotic species, has a very low fecundity for a fish with planktonic larvae, is fragile and easily stressed, and is a very poor swimmer.

The delta smelt is one of the smaller smelts. It reaches adult sizes at two to three inches and rarely lives more than one year. It is translucent with a silvery steel-blue streak along its sides and it exudes a strong odor of cucumbers. Most of the year, it resides in the open surface waters of the low salinity portions of the estuary where fresh and salt water mix. They are usually found at salinities between two and seven parts per thousand (ppt) although are not uncommon in salinities between zero and 18 ppt. Delta smelt migrate to freshwater areas of the estuary that are under tidal influence to spawn from late winter to early summer. Spawning usually takes place in shallow water where the eggs are demersal and attach to the substrate. Females produce between 1,200 and 2,600 eggs depending on size. Most adults die after spawning, however a few survive to a second year. In recent years, fewer smelt have survived to a second year and the average size of the first-year fish has significantly decreased. Larger fish may contribute significantly more to the egg supply and may be responsible for better success of the population when environmental conditions are favorable.

Delta smelt feed primarily on planktonic copepods, cladocerans, and amphipods. Recent dramatic shifts in the zooplankton community, both in terms of species invasions and total abundance, may affect delta smelt survival. Historically, the most common food item was the euryhaline copepod, *Eurytemora affinis;* however, this copepod has since been replaced by *Pseudodiaptomus forbesi,* as the primary prey item, although *E. affinis* is still strongly preferred. In recent years, the exotic Asian clam, *Potamocorbula amurensis*, has greatly reduced zooplankton densities in the estuary.

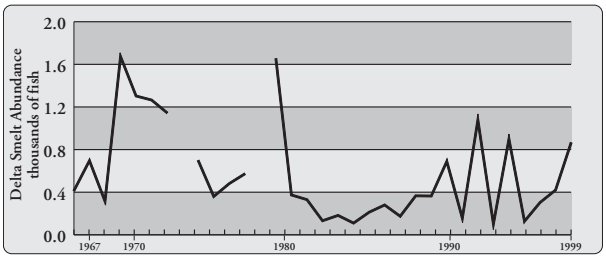
Genetic studies indicate that delta smelt are more closely related to surf smelt than to wakasagi even though they look more like the latter. Many of the traditional external characteristics used to identify different species (e.g., fin ray counts) overlap between delta smelt and wakasagi; however, the number of melanophores on the mandible (delta smelt has zero or one, wakasagi usually has five to many) is often used to separate the species. Hybrids between delta smelt and wakasagi, as well as delta and longfin smelt hybrids, have been observed in the estuary.

Since the wakasagi has become established in more brackish portions of the estuary, the potential for interbreeding as well as for increased competition for food, spawning areas, etc., has increased and may pose a significant threat to delta smelt recovery.

Unlike many fishes with similar life histories in the estuary, delta smelt abundance is not strongly affected by freshwater outflow or by the position of the low salinity zone; however, population levels are only high in years with moderate to high outflows. Distribution, however, is strongly related to freshwater outflow. In low outflow years, the population is concentrated above the confluence of the Sacramento and San Joaquin rivers in the narrow channels of the delta where it becomes more vulnerable to entrainment in water diversions, predation, pollutant exposure, and competition with wakasagi and other planktivorous fishes. Delta smelt do not exhibit a strong stock-recruitment relationship that would be expected for a near annual fish, therefore, environmental factors may strongly contribute to population success

Status of the Population

Delta smelt were once one of the most common fishes in the estuary. Historically, delta smelt abundance fluctuated from year to year, but from the early 1980s to the mid-1990s, the population was consistently low. In recent years, abundance has varied dramatically even though stringent measures are now in place to provide better habitat conditions for delta smelt. The causes of the delta smelt decline are multiple and synergistic and vary from year to year. These include: reductions in freshwater outflow caused by drought and by the diversion and upstream storage of large amounts of water by the state and federal water projects, entrainment losses to water diversions, high outflows in extremely wet years, exposure to toxicants, disease, competition, predation, and loss of genetic integrity.



Fall Midwater Trawl Abundance Indicies
1967-1999, Delta Smelt
Data Source: DFG Central Valley Bay-Delta Branch. Indices for 1974 and 1979 were not available.

Surf Smelt

History of the Fishery

The fact that surf smelt *(Hypomesus pretiosus)* spawn on selected beaches at predictable times of the day and year has made them a favorite sport fish. The standard A-frame dip net used to catch this smelt is based on one used by American Indians in the aboriginal fishery. It consists of a three- to four-foot long triangle of netting with poles on two sides and bag at the apex, into which, fish can be flipped by tilting the net upwards. About 95 percent of all commercial landings are taken with this gear. The other five percent are captured using purse seines, trawls, or beach seines. This species was thought to be the dominant species in the commercial smelt catch; however, since all species categories have been reported, surf smelt average only one third (33.0 percent) of the smelt catch (1990 through 1999). Landings averaged 478,000 pounds between 1990 and 1999 with 70 percent being reported from Eureka and Arcata. Another 25 percent of the landings were reported in the Crescent City area. Surf smelt (and night smelt) are sold fresh in the coastal markets or sold to aquariums as feed for fish and marine mammals.

The sport fishery primarily uses techniques and A-frame nets similar to the commercial fishery. Beach seines ("jump nets") up to 20 feet long (with mesh sizes of at least 7/8 inch) are also legal in the sport fishery, as are cast nets (Hawaiian throw nets). The sport catch limit for smelt is 25 pounds per day, a regulation that has been in place for many years.

Unfortunately, we have no historical records of the recreational catch, although it was estimated to be 400,000 pounds, roughly four million smelt, in 1958. Since 1980, the MRFSS estimate of recreational surf smelt landings in California averages 86,000 pounds and ranges from 4,500 pounds in 1982 to 197,000 pounds in 1998. These recent estimates are less than half the 1958 estimate, perhaps suggesting that either changes in recreational effort or changes in surf smelt abundance has occurred. It should be noted that surf smelt was the only smelt to be reported in any numbers and very few night smelt landings were reported. This is unusual since night smelt currently make up over 50 percent of the commercial fishery.

Surf Smelt, *Hypomesus pretiosus*
Credit: DFG

Status of Biological Knowledge

Surf smelt are the most widely distributed smelt in California but are only common north of San Francisco Bay. They are schooling, plankton feeding fish that can reach 10 inches in length. Females typically grow the largest and live the longest (up to five years), while males rarely live longer than three years. Females are mature, however, in one to two years, producing 1,300 to 37,000 eggs. In California, most spawning occurs in June through September, in the surf zone of beaches, especially during high tides. The spawning smelt congregate in the surf during the day, usually while the tide is falling. The biggest congregations occur when high tide is in the late afternoon. The fertilized eggs adhere to sand and pebbles. The most favored spawning beaches are those made up largely of coarse sand and pea-sized gravel, with some freshwater seepage. During periods of heavy spawning, some beaches are literally coated with eggs. The eggs hatch in two to three weeks. Little is known about their larval life or of the habits of juvenile and adults in the ocean environment. They presumably spend their lives in waters close to shore, however, as smelt are a common bycatch in the shrimp fishery.

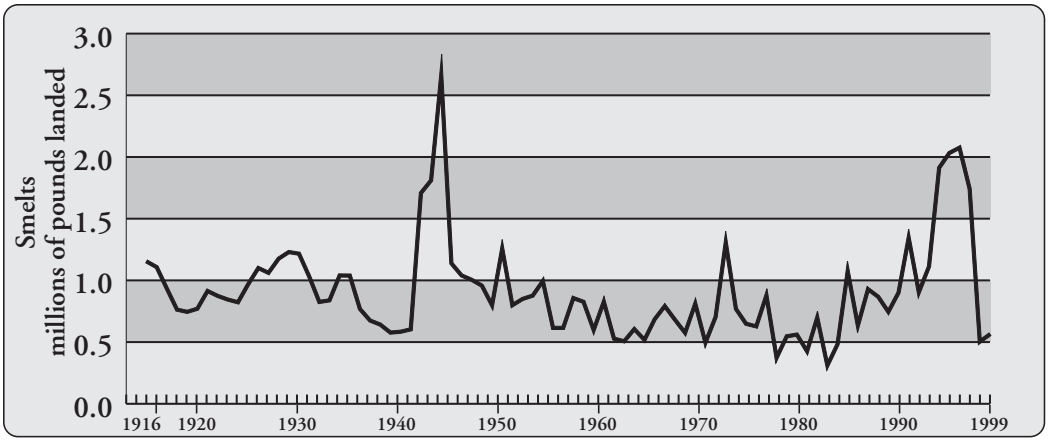
Status of the Population

The fishery for surf smelt may be decreasing while landings for night smelt have increased. Landings have dropped from over 800,000 pounds (1995 to 1997), to 100,000 pounds in 1998, to just over 12,000 pounds in 1999. Environmental factors such as seawater temperature changes (*e.g.*, El Niño) may dramatically affect population levels. However, given their short life-cycle, excessive fishing could cause smelt populations to plummet in just two or three years. Heavy recreational use of the beaches may also compact gravels and crush recently spawned eggs. It is also possible that the developing eggs may depend on water percolating through the gravels from above, so alterations of inflowing streams or lagoons may affect the suitability of the spawning habitat for egg survival.

Wakasagi

History of the Fishery

In Japan, wakasagi *(Hypomesus nipponensis)*, are a favored food fish, supporting a highly specialized fishery. Intensive commercial fishing and reduced catches stimulated the development of artificial propagation techniques that led to large-scale aquaculture facilities producing millions of wakasagi annually. This long history of artificial propagation of wakasagi is what made it so easy to transport them to California.



Commercial Landings 1916-1999, Smelts
Commercial landings include the combined landings of smelts and white bait smelts for 1916 through 1969 and the combined landings of true smelts, surf smelts, white bait smelts, and night smelts for 1970-1999. Data Source: DFG Catch Bulletins and commercial landing receipts.

Status of Biological Knowledge

The wakasagi was imported from Japan to California in 1959 by the Department of Fish and Game as a forage fish for salmonids in lakes and reservoirs. At the time, it was believed to be the same species as delta smelt. It was apparently easier to ship wakasagi eggs from Japan than it was to collect and transport live delta smelt from the Sacramento-San Joaquin estuary. Its current range in California is from Shastina Reservoir, Siskiyou County, in the northern part of the state to San Luis Reservoir and parts of the California Aqueduct in the central part of the state. An initial introduction in southern California at Big Bear Lake, San Bernardino County, apparently did not survive. It is common in Lake Oroville on the Feather River and Folsom Lake on the American River, two large water storage facilities in which water is released in large amounts for transport down the Sacramento River to the water diversions in the southern delta. Since 1995, wakasagi, in small numbers, have been widely distributed throughout the Sacramento-San Joaquin estuary.

The wakasagi has been well studied in Japan due to its demand as a favored food item, but little was known about it in California until recently. Once the wakasagi became established in the estuary and its potential as a threat to delta smelt realized, research on the species increased dramatically. In Japan, it can be either anadromous or resident in fresh water. In California, it has been well established in cold-water reservoirs and now appears to survive in estuarine conditions as well as in the warm-water reservoirs of the California Aqueduct. Wakasagi are able to tolerate a wider range of salinities and temperatures than delta smelt. They are also faster swimmers and are much more tolerant of stressful conditions.

Wakasagi are opportunistic planktivores, feeding mainly on planktonic copepods. In the Sacramento-San Joaquin estuary, they feed on the same food items as delta smelt and represent a competitive threat to the delta smelt's limited food supply. In Japan, most individuals from anadromous stocks apparently live one year, spawn, and die, while some freshwater populations may live up to four years. In California, wakasagi can live at least two years and may reach lengths of up to five inches. They usually spawn from February to May. The presence of hybrids in the estuary indicates that wakasagi can interbreed with delta smelt; however, no backcrossed individuals have been observed. The high degree of genetic divergence between the two species suggests that the hybrids may be infertile.

Status of the Population

The wakasagi is still expanding its range in central California and the consequences of this introduction may not yet be fully realized. It is a threat to delta smelt not only because it can interbreed; it may also compete for the same food items and spawning locations, and possibly prey on its larvae. The first known observation of a wakasagi in the estuary was in 1974. Since then, the number of observations of individuals has increased although large densities of wakasagi are still rare.

Now that wakasagi are firmly established in the estuary, protective measures for delta smelt have become much more difficult to manage due to the physical similarity of the two species, particularly at small sizes. Regular accounting of delta smelt catch is required of projects that export water out of the delta so they do not exceed a "take limit" (*i.e.,* allowable number of delta smelt that can be killed which is established to limit project impacts). At the state and federal water diversions, which may draw in and kill tens of thousands of young-of-the-year smelts (delta smelt, wakasagi, longfin smelt) daily in the spring, "real time" identification of small smelt becomes nearly impossible. Regulated water diversions are allowed until the established take limit is exceeded. Then diversions are further restricted reducing the amount of water that is exported. Thus, timely identi-

fication of delta smelt is a necessity since reductions in exports may be very costly.

Night Smelt

History of the Fishery

Night smelt *(Spirinchus starksi)* are also taken in large numbers, both in the commercial and sport fisheries, in much the same ways as surf smelt. Although night smelt are smaller in size and spawn only at night, they represent over 50 percent of the total commercial smelt landings valued at over two million dollars in the 1990s. Landings averaged over 1.2 million pounds annually from 1994 to 1996. Like surf smelt, night smelt are caught mainly with A-frame dip nets. Most are caught in the area around Eureka, which accounts for about 60 percent of all commercial smelt landings. Crescent City landings make up an additional 33 percent. Night smelt are either sold for consumption as fresh fish or shipped to aquariums for consumption by fish, birds, and mammals.

Catches of night smelt in the sport fishery, as reported in the MRFSS data, are surprisingly small since they now make up the bulk of the commercial smelt catch. This may be due to limited angler contact at night when the majority of landings takes place. The largest catch estimate was 131 pounds in 1986, less than one-tenth of one percent of the total sport smelt catch for that year.

Status of Biological Knowledge

Night smelt range in distribution from Point Arguello in central California to Alaska. Like surf smelt, night smelt are schooling, plankton-feeding fish that are important prey for other fishes as well as marine mammals and birds. They rarely exceed six inches in length or three years in age.

Spawning has been recorded from January through September on the same beaches as those used by surf smelt. Much of the spawning takes place earlier in the season than the spawning of surf smelt; so it is likely that most of the smelt catch before June is night smelt, with surf smelt the predominant species in the summer. However, both species have been observed using the same beaches on the same day, with night smelt spawning at night and surf smelt spawning during the day. Peaks of spawning occur between dusk and midnight on outgoing tides, although night smelt spawning seems much less tied to tidal height than is the spawning of surf smelt. A distinguishing feature of night smelt spawning aggregations is the prevalence of males close to shore (and in the shore fishery). The male to female ratio early in the season is eight-to-one, but by the end of the season it is nearly 100-to-one. The ratio is close to one to one in offshore catches of smelt. Females apparently spawn repeatedly during the season, dashing in to release their eggs among crowds of eager males. The fertilized eggs stick to the gravel and hatch in about two weeks.

Status of the Population

While night smelt has become the predominant smelt in the commercial landings in the 1990s, averaging over 800,000 pounds per year, we know very little about the status of the population. Given the short life-cycle, excessive fishing could cause smelt populations to plummet in just two or three years. Heavy recreational use of the beaches may also compact gravels and crush recently spawned eggs. It is also possible that the developing eggs may depend on water percolating through the gravels from above, so alterations of inflowing streams or lagoons may affect the suitability of the spawning habitat for egg survival.

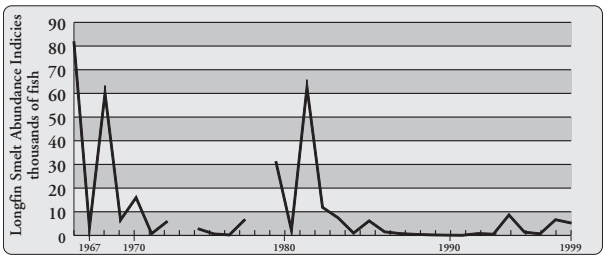
Longfin Smelt

History of the Fishery

Longfin smelt *(Spirinchus thaleichthys)* were once harvested along with delta smelt in the Sacramento-San Joaquin estuary for Chinese markets in San Francisco. There is currently no longfin smelt fishery in California, however it is often bycatch in the bay shrimp fishery.

Status of Biological Knowledge

The longfin smelt is a pelagic, estuarine fish, which ranges from Monterey Bay to Alaska. In California, it has historically been collected in the Sacramento-San Joaquin estuary, Russian River estuary, Humboldt Bay, and the Eel, Klamath, and Smith rivers. It is also often collected in the coastal waters of the Gulf of the Farallones particularly during late summer and fall.



Fall Midwater Trawl Abundance Indicies
1967-1999, Longfin Smelt
Data Source: DFG Central Valley Bay-Delta Branch. Indices for 1974 and 1979 were not available.

In the Sacramento-San Joaquin estuary, longfin smelt are widely distributed in the brackish parts of the estuary ranging in salinities from 14 to 28 ppt. Adults feed mainly on the opossum shrimp, while juveniles prefer copepods. Longfin smelt live up to three years and reach lengths of six inches, but most spawning adults are two years old and about four inches in length. Longfin smelt are anadromous and spawning takes place in the freshwater or slightly brackish portions of the estuary from December through April. Females produce between 5,000 and 24,000 eggs, which are adhesive and attach to the substrate. Hatching takes place in up to 40 days depending on the water temperature. This winter to early spring spawning period results in larvae hatching at times when freshwater outflows out of the estuary are highest. Early-stage larvae are surface oriented and are transported long distances by surface currents generated as these high freshwater flows mix with more saline water. As larvae mature, they move to lower portions of the water column at salinities of about 15 ppt where they can maintain their position in the estuary. Potential predators of longfin smelt include striped bass and inland silversides (eggs and larvae).

The annual abundance of longfin smelt in the Sacramento-San Joaquin estuary is significantly and positively correlated with the amount of freshwater outflow during spawning and larval periods. Potential mechanisms for this strong relationship include a reduction in predation during periods of high flows, increased habitat availability which may increase survival by reducing interspecific competition, and increases in nutrient levels which are transferred up the food chain.

Hybrids between longfin and delta smelt have been collected in the Sacramento-San Joaquin estuary. However, it is unlikely that offspring are fertile since these species are not closely related and no genetic introgression has been observed. Under certain hydrologic conditions longfin and delta smelt apparently overlap in their spawn times and locations. However, it appears that these circumstances are rare since only a few of these hybrids have been observed.

Status of the Population

Longfin smelt was once one of the most common fishes in the Sacramento-San Joaquin estuary; however, abundance reached an all time low in 1992, following seven years of drought. In the late 1990s, population levels have increased as hydrologic conditions have become wetter and freshwater outflows have increased, however population levels have not fully recovered to expected levels based on the abundance-outflow relationship. Additional factors potentially affecting abundance include reductions in outflows through water exports, entrainment losses to water diversions, climatic variations, toxic substances, increases in predation, reductions in food availability subsequent to invasions by exotic species.

Resident populations in coastal estuaries along the northern coast of California have declined dramatically or all but disappeared since the 1970s. Once common in Humboldt Bay, longfin smelt have only been observed in very small numbers in the mid-1990s. In addition, sporadic collections of longfin smelt from the Eel River estuary and the Klamath River occurred in the mid-1990s. There have been no recent observations in the Smith River. Although the causes of these declines in these northern estuaries are not known, they may be similar to the causes of the decline in the Sacramento-San Joaquin estuary.

Because of the severe decline in abundance of longfin smelt in California in the early 1990s, the USFWS was petitioned to list the longfin smelt as a threatened species. The petition was denied in 1993, largely on the basis that the California populations were not genetically distinct from abundant and stable populations found in Washington.

Eulachon

History of the Fishery

The eulachon *(Thaleichthys pacificus)* is the largest of smelts found in California. It is also known as candlefish, because they are so oily that American Indians once dried them to burn like candles. They are highly prized as a food fish, being considered one of the tastiest of the smelts. Until the mid-1970s or so, eulachon supported a fairly consistent river sport dipnet fishery, as well as a dipnet fishery by American Indians. The commercial catch in California has apparently never been large (maximum reported landings are 3,000 pounds in 1987), but eulachon are important commercially in British Columbia.

Status of Biological Knowledge

Eulachon range from central California to Alaska. In California, they are found along the coast as far south as Monterey Bay and seem to prefer the outer continental shelf, where they school at depths of 150 to 750 feet. They reach a length of up to twelve inches and may live to be five years old. They feed mainly on euphausid shrimps, copepods, and other crustaceans and can reach maturity in two to three years. They are a very important food for predatory marine animals, including salmon, halibut, cod, and sturgeon.

Eulachon are anadromous, spending most of their life in the open ocean then migrating to lower reaches of coastal streams to spawn in fresh water. The principal spawning run in California is in the Klamath River, but runs have also

been recorded in the Mad and Smith Rivers and Redwood Creek. They spawn in gravelly riffles close to the stream mouths, rarely ascending more than six or seven miles. Most eulachon die after spawning, but a few apparently live to spawn a second time. Each female lays about 25,000 eggs which stick to the gravel and hatch in two to three weeks.

Status of Population

In recent years, eulachon numbers seem to have declined drastically; so they are now rare or absent from the Mad River and Redwood Creek and scarce in the Klamath River. However, the eulachon and its fishery have been largely ignored in the past, and so we do not known if the fish are at a low point in a natural population cycle or if they have been reduced by human related factors.

Whitebait Smelt

History of the Fishery

Although about half the commercial smelt catch was called "whitebait smelt," the species itself *(Allosmerus elongates)* is apparently uncommon throughout its range or only locally abundant and so it probably infrequently taken in the fishery.

Status of Biological Knowledge

One indication of the scarcity of whitebait smelt is that comparatively little is known about its biology. Like other smelt, they live in large schools and are voracious feeders on zooplankton. They tend to favor productive inshore areas and bays; however they are only rarely caught in estuaries or coastal waters. They are collected sporadically in San Francisco and San Pablo bays primarily during winter and spring. Spawning is thought to take place in sandy, subtidal areas. The Sacramento-San Joaquin estuary does not appear to be a spawning area since only post-larval to adult individuals have been collected there. Young-of-the-year remain translucent and are considered "post-larval" until they are almost three inches in length. They live one to three years and reach lengths of seven inches. The succession of even year classes in San Francisco Bay may suggest a two-year maturity schedule.

Status of Population

This species seems to be locally abundant and rarely enters the fishery. However, we have no idea if it was more abundant in the past or whether current populations are stable or not.

Discussion

California smelts provide examples at two ends of the spectrum of California fisheries. At one end are the surf smelt and night smelt, which together support a fairly large commercial and sport fishery. Although the fishery is one of the largest in California in terms of numbers and pounds of fish caught, its value is relatively low. It is also a fishery about which surprisingly little is known and could conceivably decline or collapse from a combination of overexploitation and alterations to the 19 or 20 principal spawning beaches, which are receiving increasingly heavy recreational use. At the other end of the fisheries spectrum are delta smelt, longfin smelt, eulachon, and whitebait smelt, all species, which once supported fisheries but that are now in relatively low numbers. One of these species has been listed as a threatened species, another was petitioned to be listed, and the other two we know so little about that we do not know if these populations are in trouble. Three of these species require fresh water for spawning and their declines are probably all related to alterations of the spawning and rearing habitats. It is clear that we need to know much more about all of California's smelt, so that they can be managed for fisheries of the future and to maintain their important roles in coastal and estuarine food webs.

Management Considerations

See the Management Considerations Appendix A for further information on all the true smelts.

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