



## CALIFORNIA WETFISH PRODUCERS ASSOCIATION

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Representing California's Historic Fishery

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### BACKGROUND

#### CALIFORNIA'S WETFISH INDUSTRY

#### A TRADITIONAL INDUSTRY WITH A CONTEMPORARY OUTLOOK

California's fishing industry was built largely on 'wetfish', so called because historically the fish were canned 'wet from the sea', with minimal preprocessing. Sardines, mackerel, anchovy and market squid (now called coastal pelagic species) have contributed the lion's share of California's commercial seafood harvest since before the turn of the 20<sup>th</sup> century. California's wetfish industry was founded by immigrant fishermen, and the enterprise of these fishing families helped to build the ports of Monterey and San Pedro, as well as San Diego and San Francisco. Today's wetfish industry is a traditional industry with a contemporary outlook: streamlined and more efficient but still peopled by fourth and fifth-generation fishing families. Today the sons and daughters continue the enterprise begun by their fathers and grandfathers 100 years ago.

Until recent years, landings of **coastal pelagic species (CPS)** have represented an average **82 percent of the total statewide commercial seafood harvest by volume**, and approximately **37 percent of the dockside value** (based on landings 2010-2012). Market squid was California's most valuable fishery in two of the three years, contributing more than \$206 million in ex-vessel value over the time period. Since 2007, the last year of substantial sardine landings (89,238 tons valued at more than \$8 million ex vessel), market squid also has become the economic driver of the wetfish industry. Due to squid's ultra short shelf life fresh, processors produce mostly "fresher frozen" squid in retail and restaurant packs to serve local and domestic markets, and squid also represents a significant percentage, both by volume and value, of the Golden State's seafood exports.

Coastal pelagic species are among California's most important seafood exports. In a state that imports more than 90 percent of its seafood, California's wetfish complex contributes importantly to the Golden State's fishing economy, and in addition, helps substantially to offset the seafood trade imbalance.

<b>Major Wetfish Exports – 2011</b>	<b>150,202,828 kilos</b>	<b>\$195,418,835</b>
Total CA {2011 export values}	186,859,917 kilos	\$402,700,721
<b>% All Wetfish</b>	<b>80.4%</b>	<b>48.5%</b>
<b>% Squid</b>	<b>69.6% by weight</b>	<b>44.3% by export value</b>

Transformed from its storied beginnings, California's wetfish industry today remains an essential part of California's fishing heritage and culture, as well as a key contributor to California's economy.

#### ECONOMIC IMPORTANCE TO THE STATE OF CALIFORNIA

**Coastal pelagic species comprise the foundation of many harbor communities; the volume crossing the dock is critically important to maintain harbor infrastructure and dockside employment.**

Port	2011 Wetfish % of Total Port Landings	2011 Wetfish % of Total Port XV Value
Monterey Harbor	97.5%	76.3%
Moss Landing	96.2%	66.3%
Ventura	98.7%	82% (squid)
Port Hueneme	99.9%	99.9%
San Pedro	99.6%	93.4%
Terminal Island	97.7%	81.4%

## Background – continued 2

The CPS complex represents the lion's share of fishery revenue paid to the Department of Fish and Wildlife. Over the past decade the wetfish industry has contributed close to \$20 million in landing taxes and license fees to harvest coastal pelagic species.

Market squid fishing permit fees are among the highest of any fishery in California; transferable vessel and brail permits cost \$2,764.50 in 2016. In 2016 the market squid fleet numbered 152 vessels, including 68 transferable vessel permits and 45 transferable brail permits. In addition, there were 30 transferable light boat permits, which assist the fleet in locating and aggregating squid, but are not allowed to catch squid themselves. Not all vessels are active during the fishing season.

### THE WETFISH FLEET

CPS finfish species are typically harvested with round-haul nets (purse seine, drum seine, lampara). CPS finfish are managed under the federal CPS Fishery Management Plan. California's CPS fleet operates under a federal limited entry program with **65 transferable permits** issued (62 are currently active). Vessels range in size from approximately 30-90 feet in length and 20-140 gross registered tons in capacity. Purse seine vessels require **5-8 crewmen** to operate, including the skipper.

Market squid, a monitored species under the CPS FMP, is actively managed by the State of California under the Market Squid Fishery Management Plan. A state limited entry program was established in 2004, sharply reducing fleet size from more than 160 vessel permits to **77 transferable purse seine vessel permits** (68 purchased permits in 2016). Approximately **45-50 of the squid vessels also maintain CPS finfish permits** (on the same vessel) and fish for both squid and CPS species, depending on season and availability.

California's wetfish fleet is one of the "greenest" fleets in the world, with one of the lowest CO<sub>2</sub> footprints, according to studies by internationally acclaimed scientists Tyedmers, Hilborn and Parrish. This is due to the fleet's operational profile: the efficiency of harvesting a volume of high-quality seafood close to port. This fleet uses only 6.8 gallons of diesel to produce one ton (2,000 pounds) of protein, on average, based on harvest and fuel consumption data derived from a cross-section of wetfish vessels. Even adding greenhouse gas (GHG) emissions produced by processing / shipping, California's wetfish fleet still excels, as long-haul shipping has the lowest emissions of any mode of transport. Compare this ratio to groundfish trawl at 114 gallons per ton of seafood, or beef at 333.9 gallons per ton. This efficiency will become increasingly important in the future, as the world becomes more aware of the looming crisis caused by climate change and ocean acidification.

### THE MARKETS:

Wetfish processing is concentrated in about **10-12 family-owned companies**, most of whom have operated in Monterey, San Pedro or points in-between for decades, and generations. **Each company employs 30 to more than 450 permanent employees**, who process and pack wetfish in myriad forms for domestic consumption and export to more than 26 countries worldwide.

*Excerpt from SOUTHERN CALIFORNIA CPS PROCESSOR COST-EARNINGS REPORT  
– THE IMPORTANCE OF SARDINES IN THE SOUTHERN CA CPS FISHERY [2004]*

Overall, the S.CA. sardine/wetfish industry employs between 1,400 and 1,500 workers, including seasonal employees, and the maximum packing capacity is estimated between 1,900 and 2,000 tons per 24-hour day, in aggregate.

*Excerpt from MONTEREY REGION CPS PROCESSOR COST-EARNINGS REPORT  
– THE IMPORTANCE OF SARDINES IN THE MONTEREY BAY AREA CPS FISHERY [2005]*

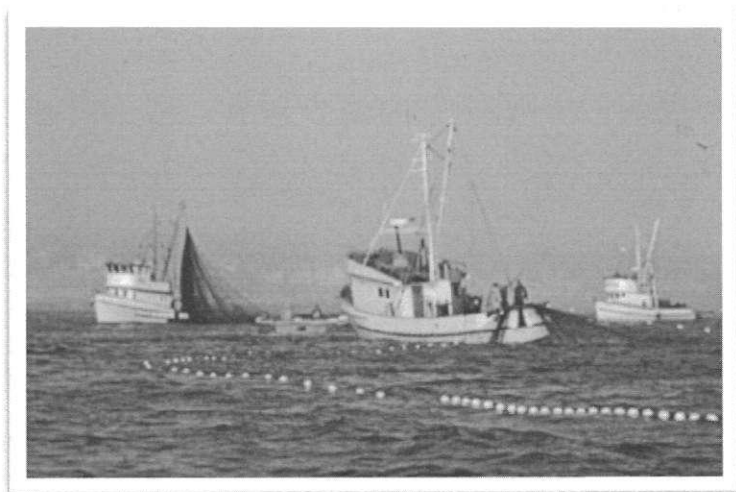
Overall, the Monterey Bay area sardine/wetfish industry employs at least 420 workers, including seasonal employees, and the maximum packing capacity is estimated at approximately 1,100 tons per 24-hour day, in aggregate.

In 2013 the City of Monterey commissioned a Fishing Community Sustainability Plan. An economic assessment of the wetfish industry in the Monterey Bay Area projected 720 jobs, including seasonal workers, and packing capacity of 1,400 tons per day.

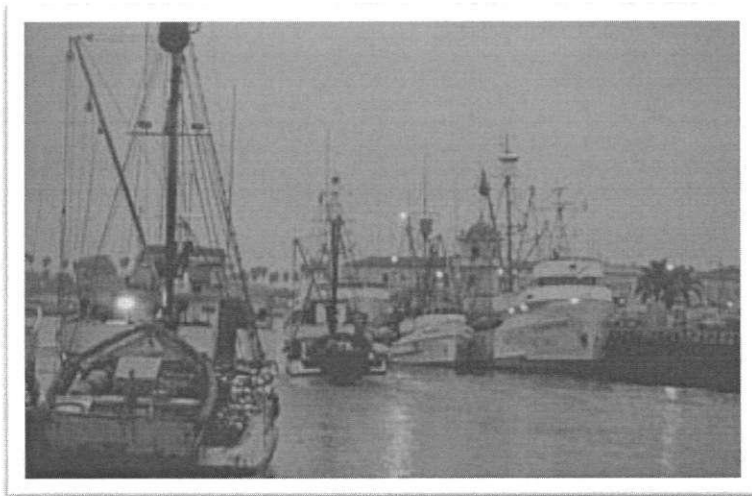
The wetfish industry is alive and well, in both Monterey and Southern California. Indeed, California's historic wetfish industry is the foundation of California's commercial fishing economy.

**THE PORTS:**

**Monterey and Moss Landing** in central California, and **Ventura, Port Hueneme and San Pedro** in southern California, are the primary ports of landing for the wetfish industry. Smaller volumes may also be landed in **San Diego** and **San Francisco**. Since 1982, approximately 10-20 percent of landings on average have been offloaded in Monterey ports, and 80-90 percent of landings are offloaded in southern California ports, with the major share of those landings offloaded in San Pedro and Terminal Island. **Those numbers shift dramatically during El Niño events, when warm, unproductive waters push market squid into cooler northern waters.**



*Vessels seine for market squid in Monterey Bay*



*San Pedro wetfish fleet heads out from port*

Wetfish industry leadership established the nonprofit **California Wetfish Producers Association (CWPA)** in 2004. Members include fishermen and processors who produce most of the total statewide wetfish harvest. CWPA's mission includes sponsoring cooperative research to ensure sustainable fisheries and facilitating communications within and outside the wetfish industry.

This industry has heavily invested in research since early times, from the beginnings of the California Cooperative Fishery Investigations (CalCOFI). Today CWPA's cooperative research program continues the tradition, expanding knowledge of market squid and sardine, collaborating with the Department of Fish and Wildlife and Southwest Fishery Science Center.

# CALIFORNIA PORTS RELY ON SQUID & CPS FISHERIES

**HALF MOON BAY\***  
85% of port landings  
33.8% of dockside value

**MOSS LANDING\***  
94.4% of port landings  
63.9% of dockside value

**MONTEREY HARBOR\***  
88.8% of port landings  
44.4% of dockside value

**VENTURA\***  
97% of port landings  
71% of dockside value

**PORT HUENEME\***  
99.98% of port landings  
99.8% of dockside value

**SAN PEDRO\***  
99.6% of port landings  
94% of dockside value

**TERMINAL ISLAND\***  
97.9% of port landings  
87.2% of dockside value

## SQUID & CPS FISHERIES PROVIDE

**82%**  
of all CA port landings\*



**4,000 to 4,500**  
workers employed by CA CPS fisheries

**37%**  
of all CA dockside value\*



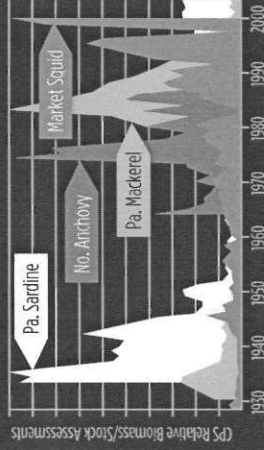
**\$325 MILLION**  
annual contribution to CA economy\*



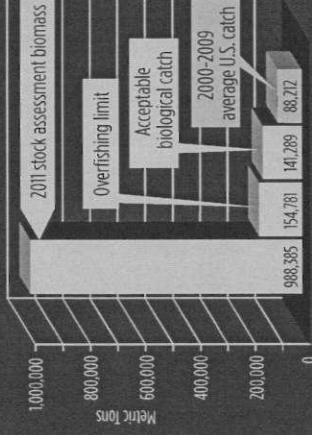
**Coastal Pelagic Species fisheries** (including market squid, sardines, mackerels, anchovy, coastal tunas) need flexibility in management to account for dynamic ocean cycles and facilitate productive harvest of this complex of species during their unique periods of abundance.

CA CPS fisheries are managed precautionarily with strict quotas/area closures and harvest only a small percentage of the biomass.

## DYNAMIC NATURAL FLUCTUATIONS OF CPS



## STRICT SARDINE QUOTAS



## LOW CARBON FOOTPRINT

To preserve quality, fishing areas for CA CPS are limited to day trips nearby the ports. This makes CA CPS among the most efficient, "greenest" fisheries in the world - with one of the lowest carbon footprints in the world. For example: CA CPS fisheries on average produce 2,000 pounds of protein for 6 gallons of diesel fuel.



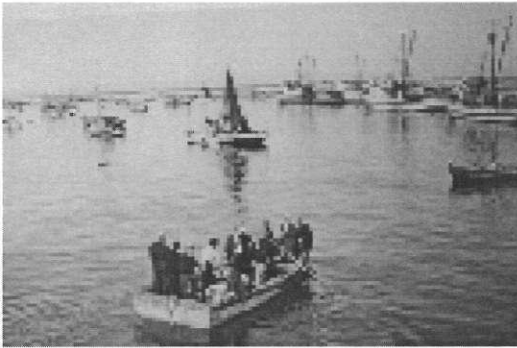
**FISHING AREA**  
**FEDERAL MPA**  
**STATE MPA**  
**NON-FISHING AREA**



\*2012 preliminary data by port

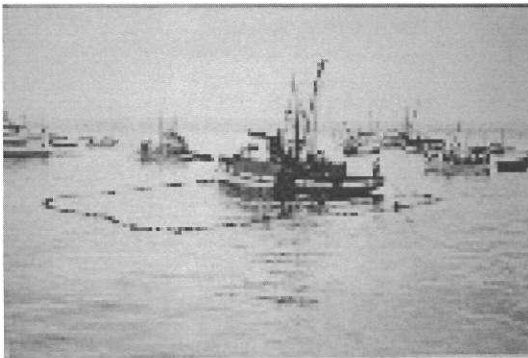
Artwork by eatfishandfood.com

## HISTORY OF CALIFORNIA'S WETFISH INDUSTRY

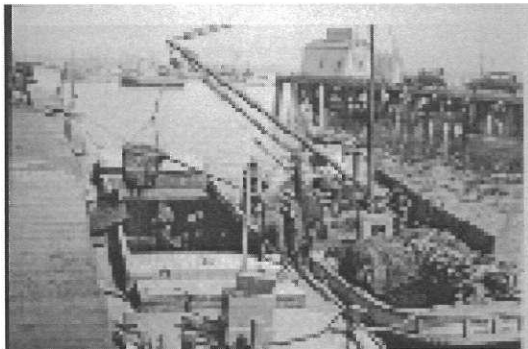


California's fishing industry was largely founded on "wetfish." The traditional catch -- sardines, mackerels, market squid and anchovy -- were called wetfish because they were canned "wet from the sea", with little pre-processing.

Then as now, wetfish were harvested with round-haul nets like the lampara and purse seine. The complex of fisheries that makes up California's wetfish industry helped to build the ports of San Pedro and Monterey, as well as San Diego and San Francisco.



Wetfish have contributed the lion's share of California's commercial fishery harvest since before the turn of the 20th century. When the first sardine cannery opened in 1889 in San Francisco, the bay saw its first "hulseines", used to take anchovies and sardines. Another industry milestone, Frank Booth moved to Monterey in 1900. Booth was impressed by the sheer number of sardines that abounded in Monterey Bay. He founded the F.E. Booth Company and built a plant in 1902 -- the real beginning of Monterey's famed sardine industry.



From its beginnings, supplying needed food during World War I, California's sardine industry grew to become the largest fishery in the western hemisphere, capitalizing on an abundance of sardines whose vast schools ranged from the Gulf of California to Southeast Alaska. From spawning centers off Baja and southern California, a silver tide of sardines migrated north in summer. In late fall and winter the fish reversed direction, moving south. Off San Francisco and Monterey, fishing peaked in fall, and off southern California it peaked in winter, when the largest fish returned from their northerly migrations.

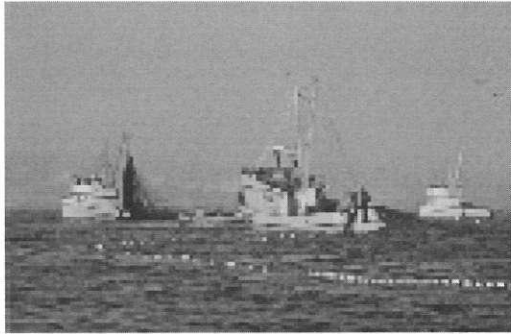
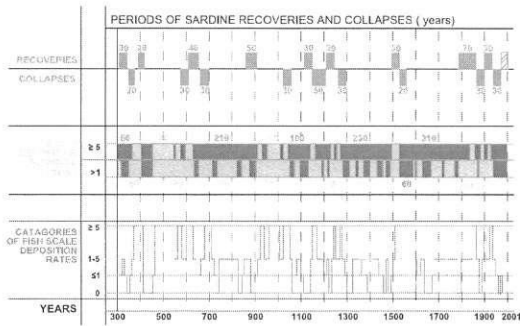


The abundance of sardines spurred a great debate over how much fish could be reduced to meal and oil and how much reserved for human consumption. In the 1940s, more than 100 canneries and reduction plants from San Francisco to San Diego employed thousands of workers to process sardines, and the fishing fleet numbered 376 vessels. The toil of immigrant fishermen built up a fishing commerce that became the lifeblood of San Pedro, Monterey, San Francisco and San Diego. All these cities boomed on the crest of the silver tide of sardines.

At its peak in the 1936-37 season, California's sardine fishery landed more than 726,000 tons of fish. Overall, about 70 percent of the catch went to reduction and 30 percent into cans for food.

Canneries put up nearly 3 million cases of canned sardines that season -- mostly headless, tailless fish swimming in tomato sauce or mustard. Annual landings averaged about 600,000 tons from the 1934-35 season until the mid-1940s.

# HISTORY OF CALIFORNIA'S WETFISH INDUSTRY



Then, suddenly, sardines vanished -- first from the Pacific Northwest, then from Monterey, and in the late 1950s from southern California. The cause of the fishery's collapse evoked great debate. Was it overfishing? Natural cycles? A combination of both?

Years later, marine biologists measuring fish scale deposits in deep ocean sediments off southern California found layers of sardine scales and layers of anchovy, with nine major sardine recoveries and subsequent collapses over a 1700-year period. Sardines and anchovies both vary in abundance over periods of about 60 years. Cold-water oceanic cycles favor anchovies and warm-water cycles favor sardines. The average time to recover a sardine population is about 30 years. Fish scale deposits show that sardines disappear periodically even without fishing pressure.

After sardines vanished, the wetfish industry turned to other fish, including anchovy and squid. In fact California's round-haul fleets have always fished on a diversity of species, depending on area, markets and seasons.

Scientists declared the sardine resource fully recovered in 1999. Today California's wetfish industry is a traditional industry with a contemporary outlook. Today's industry is streamlined -- only 65 boats are licensed to fish sardines, mackerel and anchovy under a limited entry program enacted in 1999 with federal management of wetfish fisheries -- now called Coastal Pelagic Species.

Today sardines are heralded as the poster fish for ecosystem-based management -- the only fishery that accounts for the environment and sardines' importance as forage for other marine life. California's limited entry fleet fishes under strict harvest guidelines that react quickly to changes in oceanic cycles.

The sardine, mackerel and tuna canneries are all gone. But tradition continues nonetheless.

Today California sardines fill markets all over the world-- in myriad product forms. California's wetfish industry fills another important economic role, helping to offset the US trade deficit -- for seafood is the second largest commodity deficit, after oil, in the United States.

To be sure much has changed in California's wetfish industry -- but much remains the same -- the traditions, the culture, the importance.

Today the sons and daughters continue the enterprise begun by their fathers and grandfathers 50 or 100 years ago. California's wetfish industry still abides by its traditional reason for being -- summed up in an old Italian saying: "Eredita -- pass it on."

# California Seiners

**D**own along the Fishermen's Co-op Pier in San Pedro, California, the remnants of a once-mighty fleet of seiners slip their lines and head out into the misty dusk, their outlines silhouetted by the evening glow of the great Los Angeles Harbor. Most of the 20 or so vessels going fishing this night are wooden relics, veterans of up to 50 fishing seasons, although a few are modern, steel-hulled seiners. Tonight they will be employed in a much anticipated, though certainly short, sardine season.

Among those going to work on this ebb tide is Frank Vuoso, whose father immigrated to the United States from Italy before the Depression. Frank began fishing with his father on the *St. George II* in the mid-1950s at age 15. Now he captains the antiquated seiner that turns 52 years old this fall.

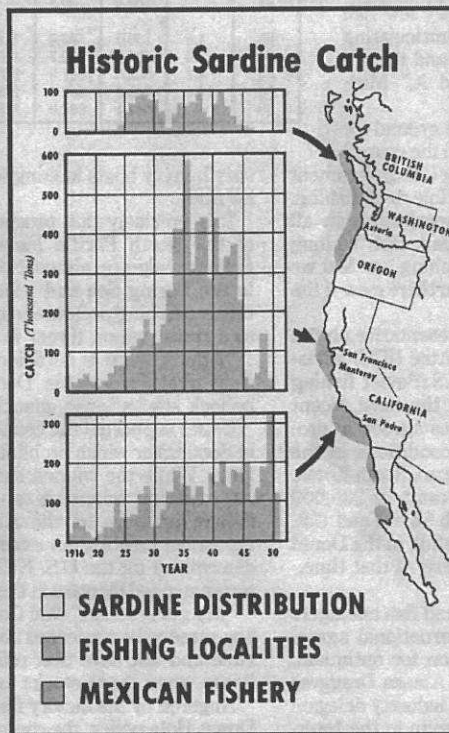
Ahead of the *St. George* on the calm windless sea is the *Vittoria*, another old-style seiner. Her skipper, Pete Fiore, began fishing at age 9 in Trapani, Sicily, like his father and grandfathers. Fiore immigrated to San Pedro in 1964 at age 26, acquired a boat, and worked hard to make a place for himself, his wife and two sons. Son Matthew had fished with him for the past seven years and Pete's dream was to pass the *Vittoria* on to his sons. But Matt was forced to find more lucrative work; he got off the boat a week before this sardine season.

Times are tough: the cost of living is going up, but the price of "wetfish"—the squid, mackerel, bonito and anchovy that the fleet must rely on to make ends meet—is going down to meet the competition from imports. Sardines once were the mainstay of the wetfish seine fleet—and they could be its salvation.

For Fiore, as for the entire fleet, the fear of losing the fruits of a life's labor—of losing the traditional way of life—is compounded by the knowledge that sardines have returned. The ocean is full of sardines that aren't being caught. The quota is small now; too small, fishermen say. But it wasn't always that way.

From its beginning as a supply of food during World War I, the sardine industry grew to become the largest fishery in the western hemisphere, capitalizing on the herring-like fishes whose schools ranged from Southeast Alaska to the Gulf of California. From major spawning centers off southern California and Baja, a silver tide of sardines migrated north in summer, the oldest, largest fish traveling as far as the Pacific Northwest. In late fall and winter the fish reversed direction, moving south.

Off San Francisco and Monterey fishing peaked in fall, and off southern California it peaked in winter when the largest fish returned from their northerly migrations. Cannery soon realized that reduction of the fish to fishmeal and oil was more profitable than canning. State resource managers argued that sardines should be reserved for human consumption, however, and the two opposing forces shadowboxed over the issue for three decades. In fact, a great conservation-versus-exploitation conflict developed, founded on how much fish could be reduced to meal and



# Bet on Sardines



Maneuvering the stocking brail against the open hatch, the crew transfers tons of silver sardines from the net to the hold of the *St. George II*.

oil. Meanwhile, between 1915 and 1935, the volume of sardines landed in the California fishery increased twentyfold. By the 1940s, over 100 canneries and reduction plants from San Francisco to San Diego employed thousands of workers to process sardines, and a fleet that numbered 376 vessels.

The toil of immigrant Italian, Sicilian, and Slavic fishermen built up a fishing commerce that became the lifeblood of San Pedro, Monterey, San Francisco, and San Diego. All of these cities boomed on the crest of the silver tide of a seemingly inexhaustible supply of sardines. Biologists estimate the historic sardine spawning biomass of mature fish was 3 to 4 million tons. At its zenith in the 1936-37 season, California's sardine fishery landed over 726,000 tons of fish—overall, about 70% of California's sardine catch went to reduction and 30% into cans for food. Canneries put up nearly 3 million cases of canned sardines in the 1936-37 season—primarily headless, tailless fish swimming in tomato sauce or mustard. Annual landings averaged about 600,000 tons from the 1934-35 season until 1944-45.

**T**hen, suddenly, sardines vanished—first from the Pacific Northwest, then from Monterey, and in the late 1950s, from southern California. State Fish and Game managers, who had warned against excessive exploitation for two decades but who lacked the authority to regulate it, later estimated that the maximum sustainable yield for the fishery should have been about 250,000 tons per year. In addition,

**Story & Photos  
by  
D. B. Pleschner**



federal biologists associated with the Bureau of Commercial Fisheries theorized that the sardine biomass would have suffered a steep decline even with reduced fishing limits due to unfavorable environmental conditions.

The cause of this fishery's depletion evoked great debate. Was it overfished? Did cyclical changes in ocean temperature decimate the biomass? Perhaps a combination of both? The causes for the disappearance of the Pacific sardine still provoke intense argument, but the fact is that North America's largest fishery collapsed, the sardine industry went bankrupt, and the wetfish fleet, what remained of it, returned to other fish to eke out a living. And that's how things have stood for over 25 years.

**A**fter sardines disappeared, the California legislature enacted strict laws to rehabilitate the resource. The California Department of Fish and Game (CDFG) outlawed all directed fishing until the spawning biomass reached 20,000 tons, at which point a 1,000-ton quota could be authorized. In addition, the law restricted the amount of sardine caught incidental to mackerel fishing (which along with squid has kept the diminished seine fleet going over the years). Sardine by-catch is limited to 35% by weight. CDFG first opened a 1,000-ton directed sardine fishery in 1986; 1991 marks the first quota raise over that minimum. In 1990 biologists estimated the spawning biomass at about 100,000 tons and CDFG set the quota for the 1991 targeted fishery at 2,499 tons—reserving 833 tons for Monterey area fishermen (whose season began August 1, as it did traditionally) and 1,666 tons for southern California, whose season opened January 6, the evening this story takes place.

The San Pedro fishermen don't have to run far to find fish. Overhead the four spotter planes, each surveying for a handful of boats, are already reporting sightings of schools. The previous night the pilots reported fair-sized schools only a few miles outside Los Angeles Harbor, and a big sardine school, maybe 3,000 tons, off the coast above Santa Barbara, about a 10-hour run northwest. Last summer, pilots reported sardine schools so dense that they were visible a mile away. The black spots of fish looked like giant lily pads, one pilot said. Fishermen heard that sardines had been



**Crewmen on the *St. George II* wet-pump sardines from the hold.**

seen as far north as Oregon.

"This time of year, mackerel are on the bottom and sardines are in mid-water," Frank Vuoso remarks, standing watch on the bridge of the *St. George II*. "Sardines rise to the surface at night, and often the schools are crescent-shaped, dense," he explains. Schools of anchovies show up on the water surface as long, sinewy stringers. When tagged by a beam of light, the fish flare. "Sardines flare and go straight; they move slowly, not afraid of the boat," he adds. "On the surface, mackerel normally flare and scatter. Mackerel schools break up faster."

Vuoso cruises past two seiners hauling in their nets; a few more boats prospect nearby. Around 9:00 p.m. he finds a promising school, and the crew of the *St. George II* jumps into action. The skiffman hops into the skiff, cuts loose and pulls the lead of the net off the seine boat. Skipper Vuoso guns the *St. George II* to set the 340-fathom-long by 45-fathom-deep net in a circle to meet the skiff, wrapping the fish. Securing the end of the net to the *St. George's* rail, the crew begins to purse the bottom of the net closed and back-haul. Five slickered crewmen labor under a drenching shower, re-stacking snap rings, corkline, and webbing on the stern, as the water-soaked net runs up through the hydraulic power block and back down to the deck.

Up in the wheelhouse the sonar marks the volume of fish in the net as a big black hole in the middle of the screen. Back on deck the crew continues hauling the gear. Finally, with slack webbing drawn over the rail of the *St. George II* and the corkline now tied to the side of the skiff holding the net open, crewmen push a hydraulic-powered brailer again and again into a frothing mass of fish. In this manner over 25 tons of shimmering, silver-green sardines slither into the fish hold. The deck is cleared for the reset shortly after 10:15 p.m. "These sardines are a nice grade—nine- or 10-inch fish, maybe three to four years old," says a smiling Frank Vuoso.

The capacity of the *St. George II* is about 100 tons, but a cannery-imposed 60-ton limit is in effect for the operators of the 13 boats in the San Pedro Fishermen's Cooperative. These skippers deliver to United Food Processors, an operation which they own through the co-op. UFP is now the only cannery packing sardines for human consumption in southern California, where close to 30 canneries once did business. Vuoso explains, "Co-op fishermen borrowed money to buy the cannery a few years ago when StarKist planned to shut it down, because they had no choice. They bought it to keep their jobs."

**T**oday only two sardine canneries remain in the entire state: UFP at Terminal Island, across the shipping channel from San Pedro, and Monterey Fish Company in Monterey. Both canneries also pack mackerel and squid. UFP would like to expand its production but investment capital is hard to come by, especially with the cannery squeezed by tight margins and competition from lower-priced, imported wetfish. Sardines could be the answer—if the quota were raised.

"We knew one thing would kill us—the lack of fish," Vuoso declares. "Every year we face a two- or three-month period with no fish that puts us in a hole. It takes the rest of the year to crawl out. Before El Nino, anchovy kept us going between other fish. Now anchovies are not as plentiful—they're going through a cycle. Mackerel are unpredictable. There aren't enough to sustain a cannery, and when we find them, we can't keep the mackerel if the mix of fish runs over 35% sardines. Now we're finding

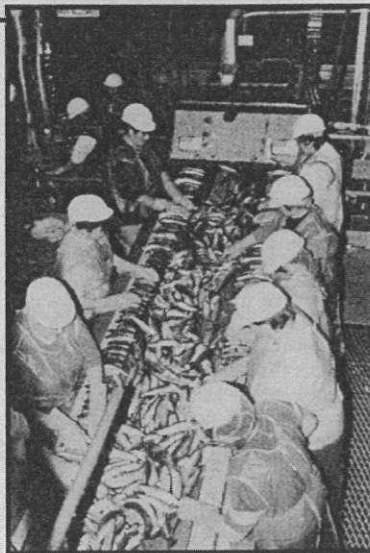
sardines everywhere we go. We need sardines for survival."

Vuoso returns his attention to the current hunt for these fish. The fishfinder and sonar show scattered schools. Some boats have already caught their limit and gone home. A few run to Catalina on the tip of a spotter plane. One steel seiner, the *Ferrigno Boy*, makes a 500-ton set 17 miles out and splits his net, but manages to save his limit. Vuoso picks up the thread of conversation quoting the current ex-vessel price of fish: about \$130 a ton for mackerel, \$120 a ton for squid, \$100 a ton for sardines—down about 33% in the last several years. "The problem selling fish now is foreign competition and politics," he says. "Everybody talks free trade, but the world doesn't trade free. Foreign governments subsidize their fleets and imports are taking over our markets with cheap prices.

"I got upset with the Department of Fish and Game," he says. "They want to rebuild the sardine stock to one million tons, and they say it may take 10 more years. Who are they saving it for? In 10 years we won't be here. Our government is letting our industry go out of business. And after we're gone, some foreign nation will come in and fish sardines. We just want to work. Sardines are available now; let us grow with the resource. Our skippers are too old to get shore jobs, and as things are, our sons have no future in fishing."

Vuoso prospects until midnight, then his pilot directs him to a 60-ton school, dropping a lightstick to mark it. The fish are too shallow to show up on the sonar or fathometer, so Vuoso sets around the lightstick on faith. When the crew dries up the net, the sonar marks a black blob. "Looks better than the last set," he chuckles. By 2:00 a.m. the *St. George II* is steaming to port with over 75 tons of large sardines aboard. Vuoso gives the extra 15 tons to Pete Fiore to top off the *Vittoria's* limit.

**S**an Pedro's wetfish fleet landed 1,029 tons of the southern sardine quota this evening. Straining plant capacity that normally runs about 300 tons a day, United Food Processors cans some 10,500 cases of sardines the day after the sardine season under the "Pacific Catch" label. The packing crew works two 12-hour shifts for two days; 120 workers at the processing tables. The



UFP cannery workers pack sardines in one-pound tall cans.

pack is committed before the cans are sealed, and orders are turned away. The remaining southern quota goes quickly the following Sunday.

With the southern sardine season over, most of the boats return to fishing mackerel. In the ensuing weeks, fishermen figure that for every 20 sets made, one catches mackerel and the rest come up with either pure sardines or mixed fish with the sardine ratio exceeding 50% of the catch in many cases. Frustration mounts. Bills go unpaid. Fishermen with newer, larger boats talk of leaving to go fishing in Costa Rica.

Fish managers say they sympathize with fishermen, but they have to look out for the resource. "Today's fishermen never saw a virgin sardine biomass," explains Rick Klingbeil, CDFG marine resources program manager for southern California. By nature, wetfish resources fluctuate widely, their abundance driven by the emergence of new year classes and environmental conditions favorable for survival. Historically there were 10 times more sardines than mackerel.

"Sometimes you can tell the difference between mackerel and sardines," says Pete Fiore, "but sometimes you cannot. To know for sure, you have to set, and if it's more than 35% sardines, you have to release it. Fish are dead on the bottom, and fishermen are starving. Nobody benefits. But that's the law now. We all lose."

"The sardine problem has basically shut down the wetfish fleet," declares Tom Crehan, manager of the San Pedro Co-op and United Food Processors cannery. "The livelihood of this industry is jeopardized. The boats are barely getting by. We've got a market and can't supply it. And the biologists don't have the resources to answer the question accurately: how much fish is out there? We're not talking about going back to the old days," he adds emphatically. "We have the same goal as CDFG—the question is how to get there. Why can't we rehabilitate the resource in 15 years instead of 10 and harvest some of it while it's here? We're asking for a comprehensive fishery management program."

This question of sardine resource rehabilitation is currently being examined by LMR Fisheries Research, a private firm under grant to investigate the sardine situation. Says LMR fisheries scientist Tom Barnes, "This fishery is at a crossroads. The sardine resource has come back to a point that it might recover fully on the strength of a few big year classes; or a few recruitment failures could drive it down again.

"Now that we have a few more decades of environmental data, we can say that the environment, particularly water temperature, played a major role in the sardine decline." During the cold-water cycle that extended from the late 1940s to the 1970s, sardines crashed (except during the warm-water El Nino event of 1957-58) and anchovies increased. "And heavy fishing pressure during that period made conditions worse," Barnes continued. Since the late 1970s, sea surface temperatures have entered a warm cycle: anchovies have declined, and sardines are coming back.

**B**eyond assessment of the resource, however, management is another question. "First it's a statistical and sampling problem, then a money problem," says Patty Wolf, CDFG's supervisor of pelagic fisheries. Biomass estimates are founded on yearly oceanic surveys between Point Conception and the Mexican border where sardine eggs are collected in the water column. Biologists estimate the spawning area based on these egg collections and then calculate the biomass of two-year-old and older fish needed to cover the area with eggs. (A 20,000-ton spawning biomass would cover 2,300 square miles.)

But catching the eggs is tricky because they turn into larvae in three days. Unfortunately, biologists must book annual cruises in advance with no guarantee that they coincide with peak spawning periods. Further, surveys to determine egg production have not been performed recently in the area above Point Conception because biologists feel that peak spawning centers are located in southern California and Baja California. Yet historically, in some seasons sardines spawned along much of the West Coast. State resource managers say they have seen no indication of strong sardine recruitment, like the colossal 1978 year class of Pacific mackerel that hoisted the mackerel fishery from moratorium to 30,000-ton harvest in five years; but in 1990 they had no opportunity to look because their fall mid-water trawl cruise to look for young sardines got axed in CDFG's budget crisis. Meanwhile, reports poured in of tiny sardines showing up in places they'd never been seen before.

"Ideally, we should survey at least twice a year and take more samples," Wolf says. But that could cost over

\$500,000, and the money's not available. "The biomass could be different; I'd like to have better information," she acknowledges. "But based on the best information we have, the spawning biomass is about 100,000 tons—about 3% of the historic total."

Adds CDFG's Rick Klingbeil, "This conflict is between what fishermen say is out there, based on what they see, versus what biologists say is out there, based on insufficient science. We feel that sardines would have come back sooner if the resource hadn't been fished so hard when the biomass was low. Fishermen have more to gain in the long run by being cautious."

**F**or decades the sardine controversy has turned on the issue of fish versus jobs; of conservation versus exploitation. But now there's a key difference: with the reduction plants gone, only two canneries remain which pack sardines for human consumption in California. Both carry on a nearly century-old tradition and they want to continue. Monterey Fish Company is even prepared to bet on the future by building a new can-

nery in Salinas.

That optimistic spirit may be warranted. Following meetings with Tom Crehan and co-op fishermen, CDFG director Pete Bontadelli announced on February 25 that the department had re-examined biological information on sardines, and the data indicate that a small additional harvest would not jeopardize sardine recovery. Thus CDFG raised the total sardine harvest level to 10% of the biomass for 1991, permitting 10,000 tons for all uses. After incidental catch and live and dead bait fishery allocations were deducted, Monterey area fishermen received a total harvest of 2,050 tons and southern California seiners got another 2,434 tons.

The move concerns some biologists, but fishermen appreciate CDFG's spirit of cooperation. The quota won't last long and problems will no doubt resurface; permanent solutions will require legislation. But this is a good beginning. Perhaps change will come soon, and with it, new hope for the future of southern California's once-thriving seine fleet.

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