

2.450 Plate II-48 schematically summarizes the current pattern in the vicinity of the bar during each tidal cycle. One can readily see the dominating effect the flood-ebb flow has on the current regime.

2.451 The interaction of coastal and tidal currents with sea state has given rise to four distinguishable sediment layers around the bar (203). There is a relatively clear upper water layer extending 25 to 35 feet below the sea surface and a deeper turbid layer extending from 3 to 15 feet off the sandy bottom. A third, fluid layer 3 to 6 inches deep exists on the bottom over the fourth, underlying compacted sand layer. The fluid and turbid sediment layers were found to be the transport strata for material on the bar which are composed of suspended sediments in horizontal motion along the water-bottom interface. Depth and sediment concentration of the turbid layer are a function of sea state and current velocities. The deeper, fluid sediment layer is composed of uncompacted sand moving as bed load but is absent during calm conditions. As sea state and currents become more turbulent, the turbid and fluid layers grow in depth and their sediment load increases. This dynamic movement of the layers at the bar does not allow long-term accumulation of surface build-up of any material deposited on the bar, whether it is material washed out from the Bay or disposed dredged material (48).

2. Marine Biological Characteristics off the Central California Coast

- 2.452 a. Plankton. Plankton in the Bay estuary was described earlier and since all the plankton species in the Bay, with some exceptions in Suisun Bay, are of marine origin, the complicated cyclic patterns of these minute creatures in the Bay are a reflection of what are occurring in the ocean. Tidal cycles play less of a factor in affecting plankton species composition outside the Bay, with the exception of the area shoreward of the sand bar, but seasonal changes are quite important.
- 2.453 Seasons of the weather are directly related to the three oceanographic seasons mentioned previously, and affect sunlight intensity over the water and availability of nutrients to phytoplankton. These in turn, affect plankton species composition and numbers. Of the three oceanographic seasons, the Upwelling Period between February and July has the most pronounced effect on phytoplankton. Abundant nutrients such as phosphates and silicates are brought to the surface from lower depths of the ocean by the upwelling process, and sufficient sunlight is available during this time of the year to allow optimum phytoplankton photosynthesis. These conditions result in a population explosion of the phytoplankton community known as a "plankton bloom."
- 2.454 Not all phytoplankton species bloom during the Upwelling Period, however, even though this period is more dramatic than the others. There are species and varieties that find the other two oceanographic seasons more favorable for growth and thus blooms can be detected during each oceanographic season.
- 2.455 As in the Bay, diatoms are the dominant phytoplankton types, Dinoflagellates are less numerous but are an integral part of the phytoplankton community. All phytoplankton form the nutritional basis from which all marine animal life are directly or indirectly dependent upon.
- 2.456 With respect to zooplankton, the animal portion of the plankton that typically feeds on the phytoplankton, the variety found in Central San Francisco Bay is also found in the Gulf of the Farallones. During the winter or Davidson Period, the zooplankton in the Gulf are dominated by salps (pelagic tunicates) and copepods. The variety of types is least during the winter as is also true in the Bay. In spring, when there is a super abundance of phytoplankton to feed on, the variety of zooplankton is at its greatest. In addition to salps and copepods (of which there are many species), fish eggs and larvae, cirripeds (young barnacles) and crab larvae are abounding (21).

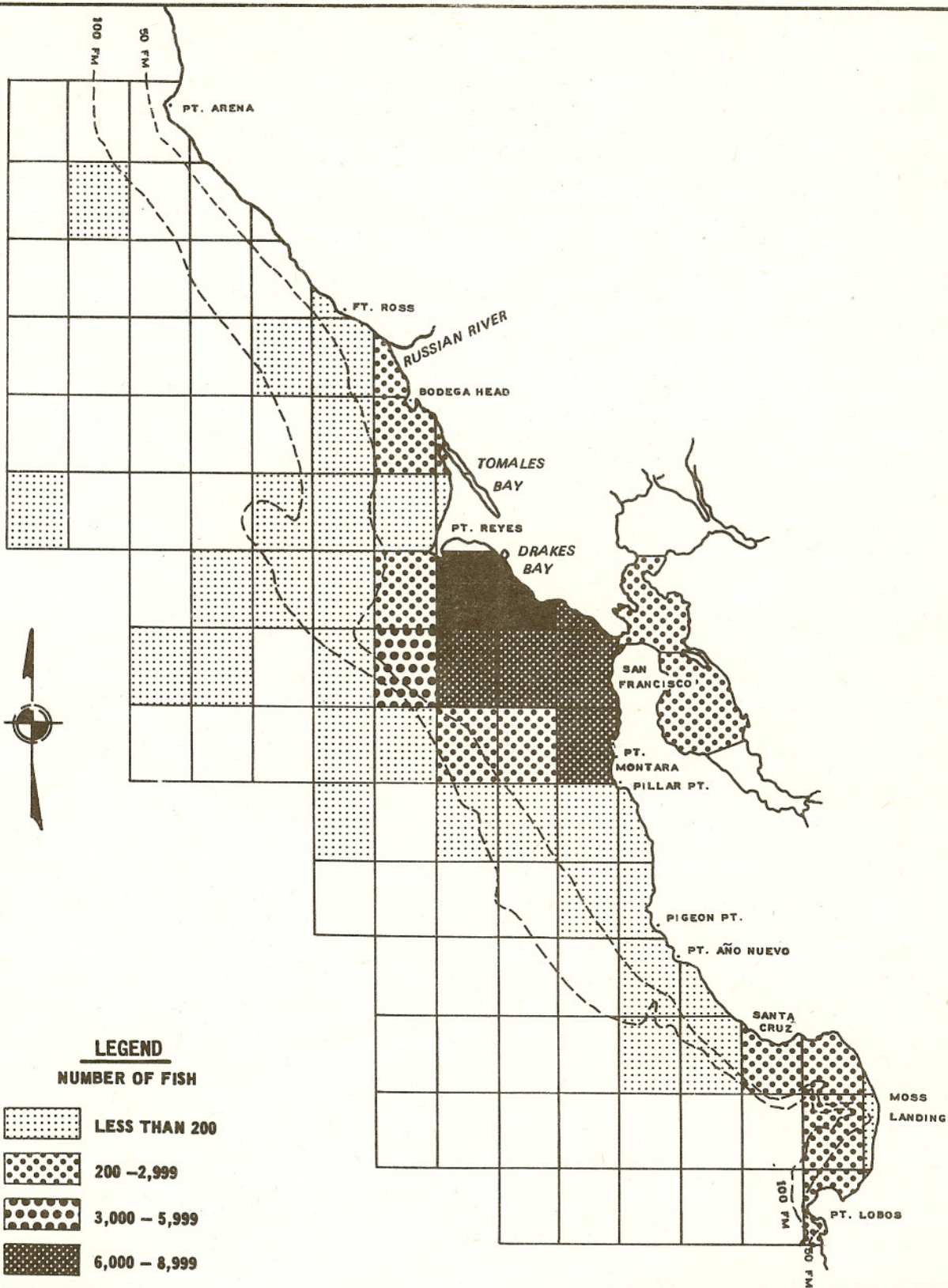
- 2.457 Except for ocean shrimp (Pandalus), no zooplanker per se is commercially or recreationally important. Ocean shrimp are commercially caught north of Point Reyes but none are harvested in the Gulf of the Farallones. There are members of the ocean zooplankton community that give rise to commercially and recreationally important species, however; the most obvious are fishes and crabs.
- 2.458 The life history of the Dungeness crab with respect to their dependence on the San Francisco Bay was briefly described earlier. Because of the dominating nature of ebb-flood currents through the Golden Gate, much of the zooplankton stages of the Dungeness crab are swept into the Bay during winter when they are most abundant. Those seaward of the sandbar are less influenced by the tides and thus remain a part of the ocean plankton community. Larvae crabs voraciously feed on the plenitude of copepods. A more detailed discussion of the Dungeness crab is given under Benthos of San Francisco Bar and Vicinity.
- 2.459 b. Fish. Bane and Bane list 172 fish species that are known to frequent the inshore waters of the central California coast (11), which include all the anadromous and marine species within the Bay. Many of these are commercially and recreationally valuable of which a few will be discussed in greater detail to depict the diversity and importance of coastal marine fishes, and their relationship to the overall ecology of the inshore waters of the central California coast. All of the species to be discussed can be found in the general vicinity of the sand bar and 100-Fathom Disposal Site.
- 2.460 (1) Chinook Salmon. Chinook salmon fishing (all species of salmon for that matter) in the Gulf of the Farallones produces the most consistent salmon yields in the State. This area is heavily, commercially fished for chinooks and every year over half of the State's sport salmon catch comes from the Gulf (179). This area is very productive because it is in the main migratory route between San Francisco Bay and the ocean. Salmon fishing in California is exclusively a troll fishery (hook and line only) regulated by the State. The commercial fishing season is from April 15 to September 30 for chinooks and May 15 to September 30 for Coho salmon. Chinooks are mostly caught between 5-30 fathom depths at a trolling speed of one to three knots (126). Peak salmon catches occur in early summer off San Francisco.
- 2.461 Recreational (party boat) fishing for salmon is extremely popular off the central California coast and landings always rank among the highest of sport fishes. Recreational salmon fishing is allowed year-round north of Tomales Point and in San Francisco Bay but can only be legally taken seaward of the Golden Gate and south of Tomales Point between mid-February and mid-November.

Plate II-49 depicts where most of the salmon are caught off central California. Greatest numbers are caught just outside the Golden Gate between Point Reyes (Marin County) and Point Montara (San Mateo County). In the ocean, chinooks feed heavily on anchovies, juvenile rockfishes, Pacific herrings, euphausiids (shrimps) and larval crabs.






2.462 (2) Rockfish. This group of fishes, belonging to the genus Sebastes, is extraordinarily diverse in color, habitat, depth preference, and in geographical range. The genus consists of the largest number of marine fishes off California, constituting 58 recognized species as of 1972 (111). Of the 58, 48 are known to occur off central California and most are considered commercial and sport fishes. Most are caught in rather deep water, between 70-350 fathoms, and as their name implies, are associated with rocky reefs. Most spawn during the winter and their eggs are planktonic. Larval rockfish can be found year-round down to 100 fathoms. As adults, they actively feed on anything that can be accommodated within their mouths which include, but are not limited to, anchovies, lantern fish, young hake, smaller rockfish, sablefish, squid, euphausiids and tunicates.

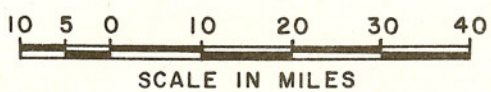
2.463 The most commonly caught rockfish species by commercial trawlers and party boats along central California include the Bocaccio (S. paucispinis) Chilipepper (S. goodei), Splitnose rockfish (S. diploproa), Widow rockfish (S. entomelas), Speckled rockfish (S. ovalis), Blue rockfish (S. mystinus), Yellowtail rockfish (S. flavidus), Black rockfish (S. melanops), and Canary rockfish (S. pinniger). High catch areas are centered south of San Francisco but waters around the Farallones also offer excellent fishing for rockfish. The most productive rockfish area is between Point Arena (Mendocino County) and Point Lobos (Monterey County) for commercial trawlers as shown on Plate II-50.

2.464 (3) Dover sole. Flatfish as a group (pleuronectiforms) constitutes a very important commercial fisheries in California waters averaging several million pounds annually. The single most important species, poundwise, is the Dover sole (Microstomus pacificus) of which 20 percent of the entire California catch of this species originates from the central California coast (126). Dover sole is primarily a deep water bottom fish, caught at depths between 290-360 fathoms. Peak landings occur during the summer, and for central California, between Point Montara to Ano Nuevo.



LEGEND
NUMBER OF FISH

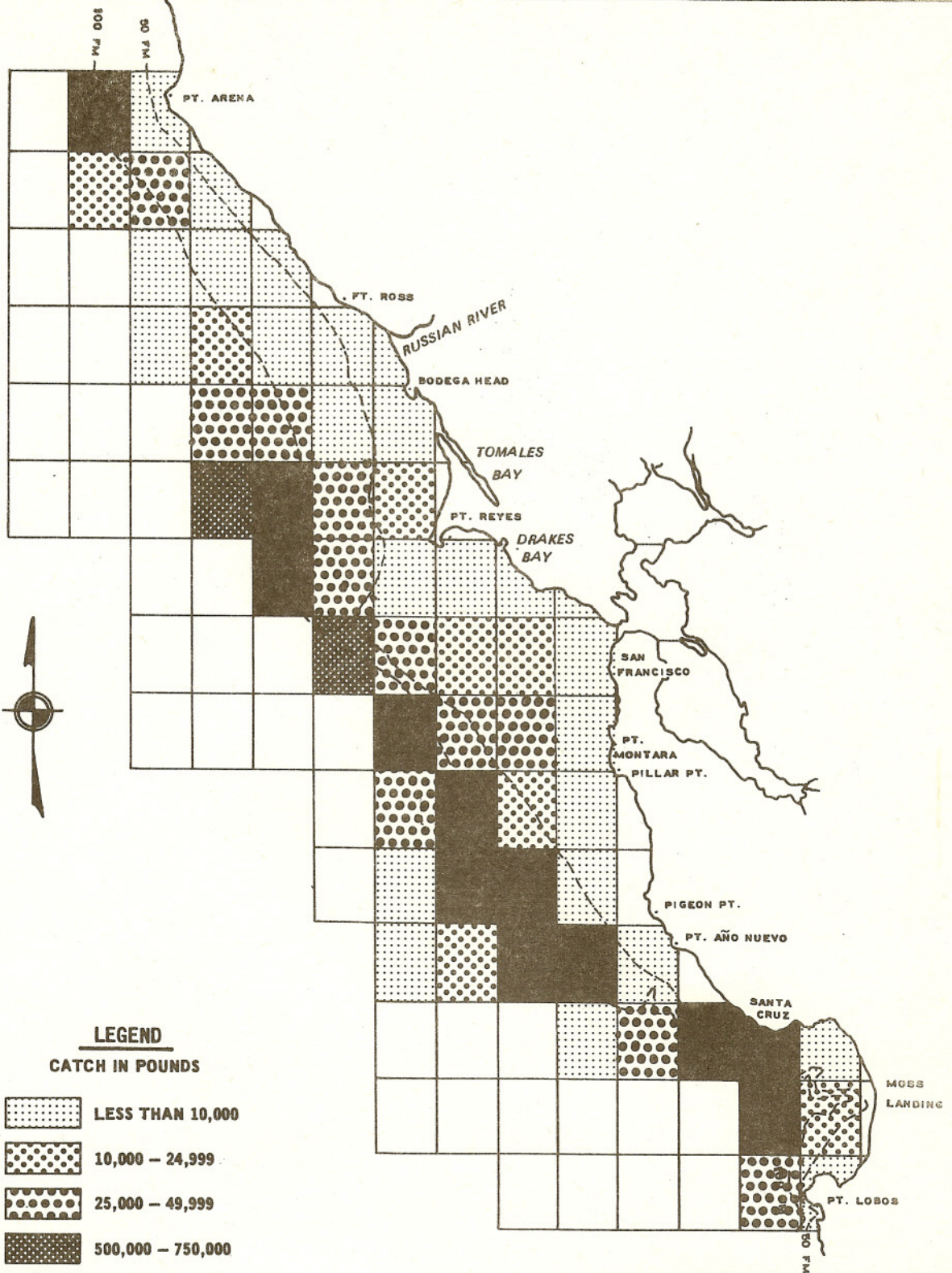
-  LESS THAN 200
-  200 - 2,999
-  3,000 - 5,999
-  6,000 - 8,999
-  9,000 - 11,999



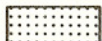




COMPOSITE ENVIRONMENTAL STATEMENT
SAN FRANCISCO BAY REGION CALIFORNIA

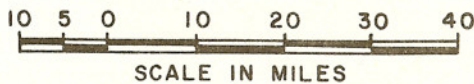
ORIGIN OF AVERAGE ANNUAL SALMON CATCHES BY PARTY BOATS FROM POINT ARENA TO POINT LOBOS 1962 - 1966

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: _____ FILE NO. _____
TRACED: _____
CHECKED: _____ TO ACCOMPANY REPORT DATED _____



LEGEND
CATCH IN POUNDS

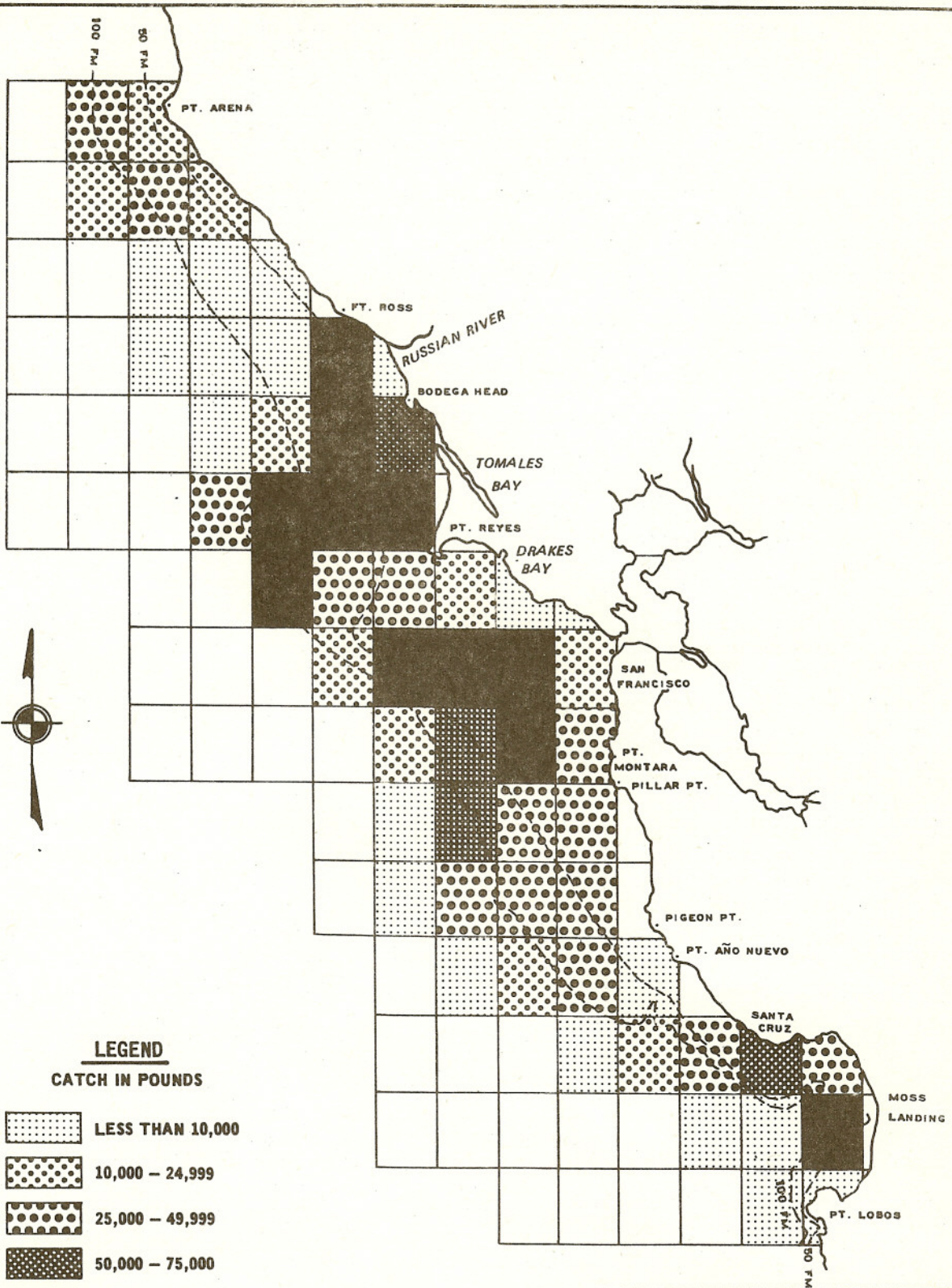
-  LESS THAN 10,000
-  10,000 - 24,999
-  25,000 - 49,999
-  500,000 - 750,000
-  OVER 75,000








COMPOSITE ENVIRONMENTAL STATEMENT
 SAN FRANCISCO BAY REGION CALIFORNIA
 ORIGIN OF AVERAGE ANNUAL ROCKFISH
 CATCHES FROM POINT ARENA TO
 POINT LOBOS-BY OTTER TRAWLERS
 1962 - 1966
 U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
 DRAWN: TO ACCOMPANY REPORT
 TRACED: DATED
 CHECKED: FILE NO.

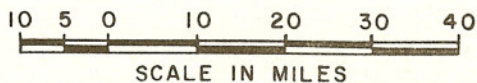
- 2.465 Spawning takes place in winter in deep water between 350-600 fathoms with greatest concentrations between points offshore of Bodega Bay and Point Montara (126). After spawning, the adults again move inshore to their summer feeding grounds. The eggs are pelagic. The adults, as would be expected from their bottom nature, feed mainly on the benthos such as snails, clams, annelid and peanut worms, nematodes, scaphopods (tooth shells), and ophiuroids (brittle stars).
- 2.466 (4) English sole. This is another flatfish abundantly taken offshore of San Francisco. In fact, the area between Fort Ross and Point Montara from 20 to 150 fathoms, contains California's most productive English sole (Parophrys vetulus) fishing grounds (126). Like the Dover sole, they spawn in the winter but in much shallower waters (20-60 fathoms). Eggs are pelagic and tend to drift into nearby bays and protected areas, which serve as nursery grounds. San Francisco Bay and the Gulf of the Farallones are important nursery areas for the English sole. Juveniles and adults primarily feed on the benthos.
- 2.467 Their distribution is reflected by where they are commercially caught and heaviest catches occur in the Gulf of the Farallones in less than 100 fathoms and north to Fort Ross (Plate II-51).
- 2.468 (5) Petrole sole. The third most important flatfish landing of central California is the Petrole sole (Eopsetta jordani) of which 60 percent are commercially caught from the Gulf of the Farallones between 180-210 fathoms (126). Many are also caught in shallower waters in 25-60 fathoms.
- 2.469 Spawning occurs in winter at which time the Petrole sole migrates into deeper water. One of the most important spawning areas is situated 30 to 40 miles southwest of the San Francisco Lightship in 180-230 fathoms (126). Adults move back inshore after spawning. Eggs are pelagic. A year-round fishery exists for the Petrole sole but peak landings occur during the summer and winter months.
- 2.470 (6) Other Flatfish. There are several other flatfish species of lesser importance but collectively constitute major annual landings. These species include the Rex sole (Glyptocephalus zachirus), two species of sanddabs (Citharichthys spp.) and the California halibut (Paralichthys californicus); all found in the Gulf of the Farallones.

- 2.471 When all the flatfishes are considered, one can see that they are a major resource of the Gulf of the Farallones and support a large segment of the commercial fishing industry. Plate II-52 shows a composite picture of their concentrations off central California.
- 2.472 (7) Other Commercially and Recreationally Important Fishes. In addition to the above species, many other marine fish are caught by commercial trawlers and party boats off central California. When treated as a group, they constitute a sizeable portion of the annual landings. Many of these species occur in the Gulf of the Farallones near the sand bar and at the 100-Fathom Disposal Site vicinity, and include numerous sharks, skates and rays, Pacific hake, White croaker, Jack mackerel, Pacific mackerel, Pacific bonito, Albacore, surf perches, Cabezon, anchovies, herrings, Sablefish and Lingcod.
- 2.473 (8) General conclusions. Just from the fin fisheries data, the immense productivity of the inshore waters of central California, particularly of the Gulf of the Farallones can be seen. Most of the important fishes discussed have pelagic eggs which are an integral part of the plankton community. Fish virtually use all depths of the continental shelf for feeding, spawning and/or nursing. Extensive use of the bottom by flatfish is obvious from the above discussion of species. The subtle biological interrelationship between the Gulf and San Francisco Bay also becomes apparent from the above discussion. Not only are salmon dependent on both the ocean and estuarine (bay) environments but several species of flatfish, the Pacific herring and others are as well. Salmon live their adult lives in the ocean but spawn in freshwater; several flatfish species use the bays as nursery grounds for the young; and the Pacific herring lays its sticky eggs in shallow bays and the young feed in those protected waters.
- 2.474 Areas of greatest productivity for all commercially important fish (except the salmon) along central California waters are shown on Plate II-53. Note that the most productive areas are in the Gulf of the Farallones and south of the Farallon Islands at depths greater than 50 fathoms. The productive areas south of the Farallones are near the 100-Fathom Disposal Site.
- 2.475 c. Other Pelagic Species. There are open water inhabitants other than fish that are ecologically and commercially important. Ocean shrimp (Pandalus jordani), for example, are commercially netted north of Point Reyes (126). They are a part of the plankton community but somewhat larger and more active than typical plankters. They can be found near the surface preying on other plankters but are more commonly found in 40 to 65 fathom depths.



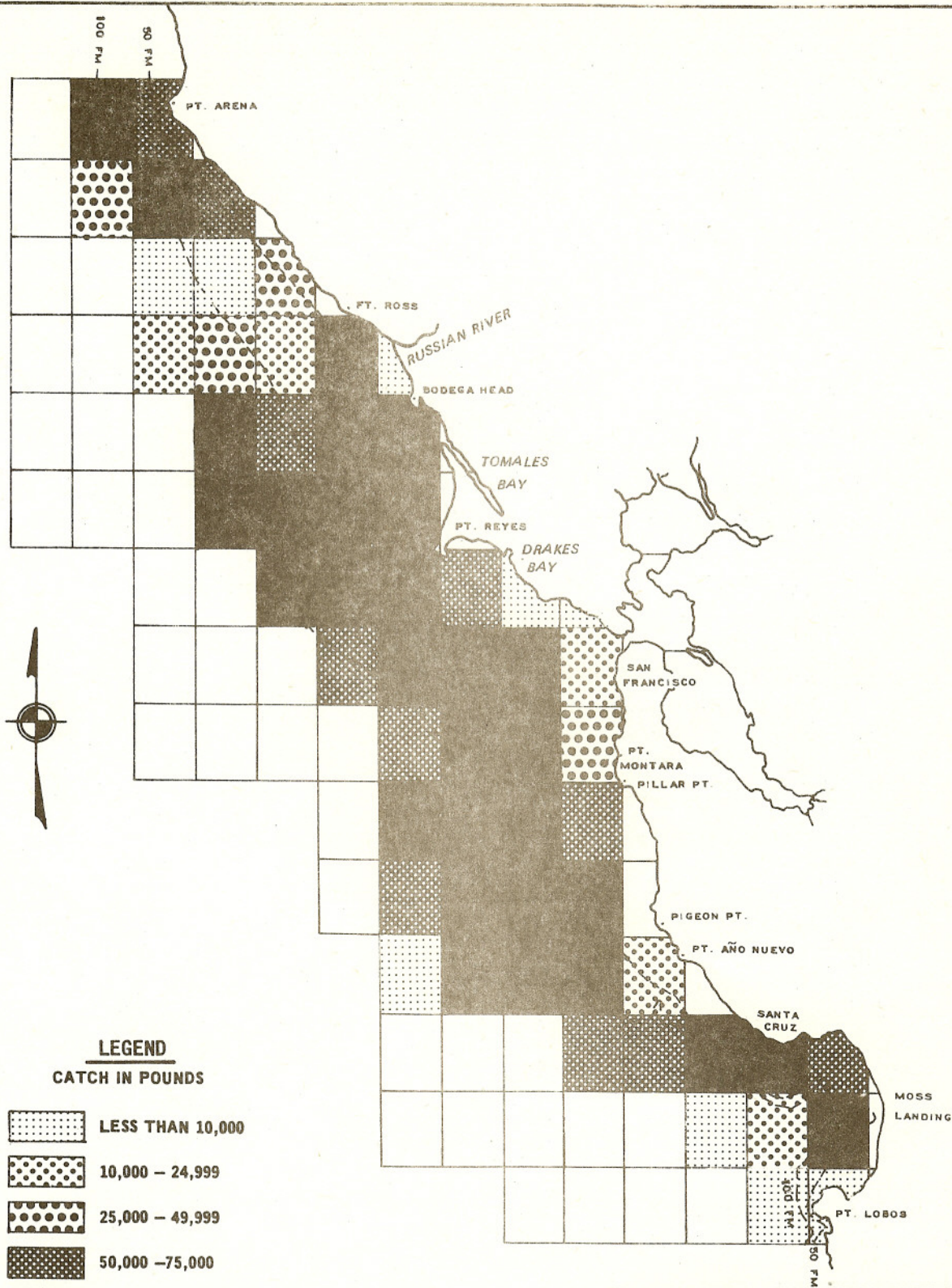
LEGEND
CATCH IN POUNDS

-  LESS THAN 10,000
-  10,000 - 24,999
-  25,000 - 49,999
-  50,000 - 75,000
-  OVER 75,000








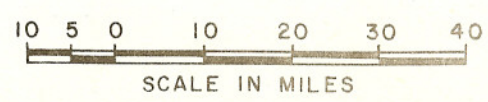
COMPOSITE ENVIRONMENTAL STATEMENT
SAN FRANCISCO BAY REGION CALIFORNIA
ORIGIN OF AVERAGE ANNUAL ENGLISH SOLE
CATCHES FROM POINT ARENA TO
POINT LOBOS BY OTTER TRAWLERS
1962 - 1966

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: FILE NO.
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED

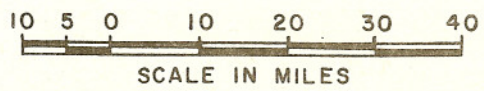
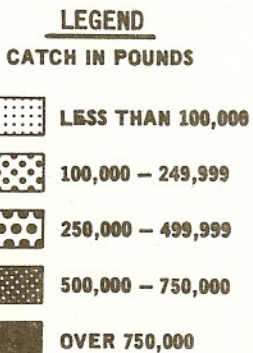
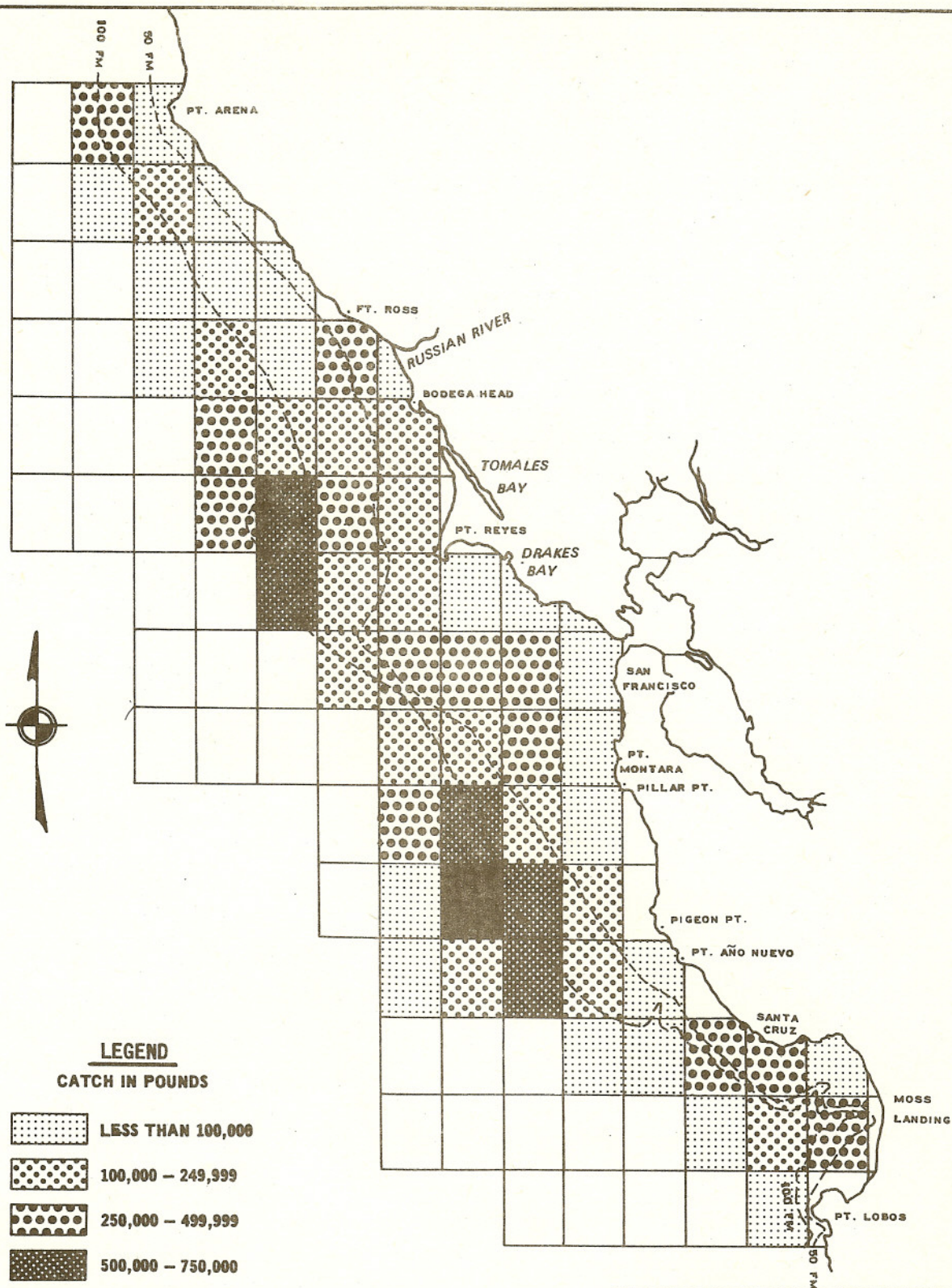


LEGEND
CATCH IN POUNDS

-  LESS THAN 10,000
-  10,000 - 24,999
-  25,000 - 49,999
-  50,000 - 75,000
-  OVER 75,000



COMPOSITE ENVIRONMENTAL STATEMENT
 SAN FRANCISCO BAY REGION CALIFORNIA
**ORIGIN OF AVERAGE ANNUAL FLATFISH
 CATCHES FROM POINT ARENA TO
 POINT LOBOS BY OTTER TRAWLERS
 1962 - 1966**
 U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
 DRAWN: FILE NO
 TRACED: TO ACCOMPANY REPORT
 CHECKED: DATED



COMPOSITE ENVIRONMENTAL STATEMENT
SAN FRANCISCO BAY REGION CALIFORNIA

ORIGIN OF AVERAGE ANNUAL CATCH OF ALL SPECIES FROM POINT ARENA TO POINT LOBOS LANDED BY OTTER TRAWLERS 1962 - 1966

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: TO ACCOMPANY REPORT FILE NO.
TRACED: DATED
CHECKED: DATED

- 2.476 Squid (Loligo opalescens) is another important fisheries product of California. In terms of annual landings, squid rivals the salmon and flatfish, averaging several million pounds per year. Largest landings are at Monterey and peak catches occur during the summer.
- 2.477 The distribution of the ocean shrimp and squid extends through the Gulf of the Farallones but they are not abundant (at least not commercially abundant) in these waters.
- 2.478 d. Benthos of San Francisco Bar and Vicinity. Although the sand bar, eight miles seaward of the Golden Gate, and San Francisco Bay are significantly affected by tidal flow (Plate II-48), the bottom life between these two areas are very different. Substrate of the bar is mostly sand derived from the coast whereas in the Bay the substrate is a sand-silt-clay mixture derived mostly from the Sacramento-San Joaquin system.
- 2.479 Because the bar environment is a moderately high energy area subject to strong tidal currents and wave action, bottom life must be well adapted to shifting sand and burial to successfully survive. Studies by the Army Corps of Engineers (203), and Yancey and Wilde (263) indicate this to be true. The most common benthic animal sampled from the bar by both the Corps, and Yancey and Wilde was the sand dollar (Dendraster excentricus). This flat, oval-disc animal is three to four inches in diameter and aggregates in very large beds. As its name implies, it is found in a sandy environment. According to Wakeman and Fong, densities on the bar were as high as 225 sand dollars per square meter with an average of 90 per square meter (252). Sand dollars stand vertically, about two-thirds buried in the sand and are uniformly perpendicular to the current. They are active feeders on minute edibles such as benthic diatoms inhabiting the sand particles. Diver observations reveal that the sand dollar inhabits both the bar and the Main Ship Channel which is dredged annually, (203).
- 2.480 The Dungeness crab is another species that is abundant around the bar and for that matter, the Gulf of the Farallones. They are commercially harvested from Alaska to Avila, California, and the principal fishing ground in California is the Gulf. They are quite mobile and enjoy scavenging for anything edible on the bottom. Their ability to bury in loose sand enables them to live in and around the bar. Also, the bar surrounds the entrance to the Bay from which young Dungeness that have nursed in the Bay, egress to the open ocean; thus, large numbers of Dungeness would at least be found in the bar vicinity at certain times of the year. The Dungeness crab is further addressed under the benthos description of the 100-Fathom Disposal Site.

- 2.481 Other fauna that have been collected from the bar environment are various clams, snails, tooth shells, shrimps, other crustaceans and annelid worms. Clams and snails were common which included a number of species. This is not surprising, since many clams and snails are mobile and can burrow. Spisula, Clinocardium (basket cockle), Siliqua (razor clam), Tellina (tellen clam), and Olivella (olive snails) are types of clams and snails typical of sandy substrates, active, able to burrow, and are found at the bar.
- 2.482 Although the bar exhibits a diverse bottom fauna, dominated by the sand dollar, Dungeness crab and various clams and snails, the overall bar benthos is considered pauperate when compared to the deeper, shelf community away from the strong influence of the tidal currents and the shallower, rocky shore community north of the bay. This would be as expected when the unique physical conditions of the bar (previously discussed) are considered.
- 2.483 e. Benthos at the 100-Fathom Region. No biological investigation of the EPA designated 100-Fathom Disposal Site has ever been undertaken but general knowledge of the shelf biota off central California can probably be applied to this site, assuming that the substrate of the shelf is more or less consistent throughout the whole area. In addition, the San Francisco District in cooperation with the U.S. Navy, recently conducted a five day survey of a 100-fathom site five miles west of the Farallones to determine the effects of ocean disposal (231). This data can probably be applied to the EPA designated site, which is approximately 15 miles southeast of the studied area.
- 2.484 The continental shelf of the central California coast is a highly productive area which is the reason why the area is so heavily fished. Commercially and recreationally important species off central California have already been described, and these and many other species utilize the shelf for spawning, feeding and/or nursing. A good fishing area is indicative that the location contains an abundant supply of food organisms, such as plankton, smaller fish, worms, clams, snails and a sundry other forms necessary to support life higher up the food chain.
- 2.485 Yancey and Wilde observed that the shelf area (greater than 40 feet deep) is mostly fine sand and contains copious amounts of arthropods, molluscs, annelids and some echinoderms (263). Bivalves were the dominant macro-invertebrates of the shelf biota.
- 2.486 The five day ocean disposal survey by the Corps and the Navy was conducted in September 1974. Sediment and infaunal grab samples were taken and underwater photographs by the Navy's cable-controlled research submersible, CURV III, documented the epibenthic macrofauna. Sediment composition was similar to what Yancey and Wilde reported in shallower waters; that of fine grain sediments (mostly fine sand and some silt).

2.487 However, unlike Yancey and Wilde's observation of bivalves being the dominant macroinvertebrates of shallower depths, CURVE III pictures revealed that arthropods made up over 70 percent of the epibenthic macrofauna at the disposal site vicinity. The area was well populated (1.4 animals per square meter) but the species diversity was relatively low. Thirteen species were counted from the photographs but three constituted 85 percent of all bottom animals. The dominant bottom types were: shrimps (Cragon sp.) which comprised 69 percent of the total numbers counted, octopus (11 percent), and Allocentrotus (five percent), which is a very common subtidal sea urchin off the central California coast. The infaunal grab samples have not been quantified yet and thus the gross observations made by CURV III may be misleading. Camera resolution was not fine enough to pick up tube worms, small sea cucumbers, small molluscs or any burrowing forms. High catch statistics of flatfish and rockfish from this area (Plates II-52 and II-50) are suggestive that the bottom does harbor a rich supply of these smaller animals, and the fact there is a large population of shrimps is suggestive of copious amounts of scavengable food.

2.488 f. Marine Mammals. Daugherty lists 34 species of marine mammals in California ocean waters (43) and most occur far offshore, away from any local dredging or disposal activity. A few do frequent inshore of the 100-fathom depth along central California, however, and like pelagic fishes, are active migrants that can range over a wide geographical area.

2.489 The best known of the large whales off California is the California gray whale (Eschrichtius gibbosus) which migrates from the Bering Sea southward to Baja California during the winter. While migrating south, they are fairly close to shore and can be seen near the Farallones. There is debate as to whether they feed while in transit southward but while in the Bering Sea, they largely feed on zooplankton and to a lesser extent on fish.

2.490 Two porpoises, which are related to the whales, are occasionally seen close to shore. These are the Harbor porpoise (Phocoena phocoena) and the Dall porpoise (Phocoenoides dalli) and both have been recorded in San Francisco Bay. They are normally found offshore and actively feed on fish and squid.

2.491 Seals and sea lions are more common inshore than whales and porpoises because of their dependence on land-- seals and sea lions are born on land. There are several species that inhabit the waters off the central coast as exemplified by the name Seal Rocks off of San Francisco. Two species are particularly common: the Steller sea lion (Eumetopias jubata) and the darker and smaller California sea lion (Zalophus californianus). Both occur together

except during the summer and can be found at Ano Nuevo Island (San Mateo County), Seal Rocks, the Farallones and Point Reyes. California sea lions are only found from the Channel Islands south during the summer breeding season. Stellers breed throughout their range from southern California to Alaska. Both feed on squid and fish.

2.492 The largest seal is the Northern elephant seal (Mirounga angustirostris), with the bulls attaining a length of 15-16 feet and weighing over two tons. Although more common farther south, there is a breeding population at Ano Nuevo Island during the winter and there are indications that they have started breeding on the Farallones. Before these creatures were hunted to near extinction in the late 1800's, they were abundant as far north as Point Reyes. They are now protected and their comeback has been slow but dramatic over the last century. Elephant seals feed mostly on small sharks, rays, ratfish, rockfish and squid which are indicative that they feed in fairly deep water (43).

2.493 The Harbor seal (Phoca vitulina) was mentioned earlier with respect to the breeding colony in San Francisco Bay but is more common outside the Golden Gate. They are frequently seen close to shore and often haul out of the surf zone to bask in the sun and sleep. They may be seen together with the Elephant seals and sea lions at the Farallones and other offshore rocks. The Harbor seal feeds on fish, squid, shellfish and octopus.

2.494 Although rare in the Gulf of the Farallones, the Sea otter (Enhydra lutris) is a familiar marine mammal of Monterey Bay and south. They were hunted to near extinction in the 1800's but have been protected since 1911. Like the Elephant seals, they have made a successful comeback. In fact, there is now controversy as to whether to control its population, particularly in Monterey Bay, because of the alleged competition between sea otters and the abalone fishermen. Besides having a taste for abalone, sea otters have a large appetite for other shellfish, octopus, sea urchins, crabs, and some fish.

2.495 g. Farallon National Wildlife Refuge. About 28 miles west of San Francisco are the Farallon Islands. They extend for about seven miles in a northwesterly direction, and are roadless, essentially inaccessible, and, with one exception, undeveloped. A Coast Guard lighthouse installation exists on Southeast Farallon.

- 2.496 The islands comprise an important sea bird rookery, hosting upwards of 150,000 to 200,000 birds each summer. Their value as sea bird production areas led to the establishment of a Federal wildlife sanctuary embracing the northern three island groups in 1909. The Southeast Farallons were added in 1969, and the refuge now totals 211 acres.
- 2.497 An added measure of protection was recently afforded the refuge by an Act of Congress which designates all but the Southeast Island, into the National Wilderness Preservation System.
- 2.498 Eleven species of pelagic birds are known to nest on the Farallons; the most conspicuous being the Brandt's Cormorant and the Common Murre.
- 2.499 Stellar and California Sea Lions are abundant, and the Elephant Seal has recently returned to the Islands after an absence of over 100 years. Public use of the refuge is presently limited. Bay Area Chapters of the National Audubon Society sponsor bird-watching, charter boat tours around the islands.
- 2.500 h. Endangered Species. The California gray whale, described earlier, is still considered endangered although its eastern Pacific population is increasing and apparently stable. Its population was severely depleted in the 19th century but has been protected since 1938. During their annual migration south to Baja California during the winter, gray whales venture inshore of the 100-fathom depth, and are often seen shoreward of the Farallones (Plate II-45). Other large whales seen off central California that are listed as endangered because of over-exploitation, but occur further offshore than the gray whales, are: the Sperm whale, Blue whale, Finback whale, Sei whale, Humpback whale and the Right whale.
- 2.501 With respect to pinnipeds (seals and sea lions), none are considered endangered off the California coast although one fur seal is listed as rare by the State. The Guadalupe fur seal (Archtocephalus townsendi) has a status of rare, and historically occurred from the Farallon Islands to Baja California. It was last sighted in California in 1949, when one individual was observed on San Nicolas Island. A breeding colony on Guadalupe Island, Mexico, is increasing in numbers, and under continued protection, the Guadalupe Fur Seal will probably begin to reclaim its northern distribution as the population grows.

D. ECONOMIC CHARACTERISTICS OF SAN FRANCISCO BAY-DELTA REGION

1. Region.

2.502 a. History. Beginning with the Gold Rush of 1849, San Francisco Bay with its protective waters offered not only safe harbor for ocean-going vessels, but also provided early-day means of local and regional transport between the scattered settlements along the bay's shoreline. San Francisco Bay was also the gateway to the Central Valley through San Pablo Bay, Carquinez Strait, Suisun Bay, and the Sacramento and San Joaquin Rivers to the cities of Sacramento and Stockton. When the Gold Rush began, Sacramento became the landing from which miners set off for the northern fields, while Stockton became the landing for the southern mines. The Sacramento and San Joaquin Rivers were heavily used for passenger and freight traffic until the completion of rail connections between the Central Valley and San Francisco Bay in the late 1860's. After the first years of the Gold Rush, the increasing size of ships and the rapid silting of the rivers due to hydraulic mining closed the inland ports to all but local craft.

2.503 During the latter part of the 19th century, the area was organized into counties, Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. The Central Valley also was organized into counties. Those counties in the Central Valley which are of interest to the study are Sacramento, Yolo, and San Joaquin. Ports are located in the counties of Sacramento and San Joaquin. The San Francisco Bay Area today is an important center for manufacturing, agricultural activity, and services.

2.504 The Central Valley counties of Sacramento, Yolo, and San Joaquin have developed into important agricultural, trade, manufacturing and service counties with important ports serving the area.

2.505 b. Population. During much of the 19th century, the San Francisco Bay Area accounted for nearly all of the population in Northern California. This trend has continued. Table II-27 shows the results of four recent censuses:

TABLE II-27

BAY AREA AND DELTA POPULATION

	4-1-50 U.S. Census	4-1-60 U.S. Census	4-1-70 U.S. Census	1-1-74 Calif. Dept. Finance
San Francisco Bay 9-County Area	2,681,322	3,638,939	4,628,199	4,820,800
Delta 3-County Area	518,530	818,494	1,017,051	1,085,800

A detailed breakdown of the population of the San Francisco Bay 9-County Area and the Delta 3-County Area is shown in Table II-28.

TABLE II-28

CHARACTERISTICS OF POPULATION AND FAMILY INCOME
1970

County	Total Population	Median Age	Total Number of Families	Earn less than \$3,000	Percent of Population *	FAMILIES		Earn \$10,000 or more	Percent of Population	INCOME	
						Earn \$3,000 to \$9,999	Percent of Population			Median \$	Mean \$
Alameda	1,073,180	28.5	266,135	20,947	7.9	91,653	34.4	153,535	57.7	11,133	12,340
Contra Costa	558,389	27.9	146,479	8,532	5.8	41,494	28.3	96,453	65.8	12,423	13,778
Marin	206,038	30.4	51,912	2,442	4.7	12,494	24.1	36,976	71.2	13,935	16,136
Napa	79,140	32.5	19,870	1,690	8.5	7,202	36.2	10,978	55.2	10,733	11,513
San Francisco	715,000	34.5	165,342	16,268	9.8	61,610	37.3	87,464	52.9	10,503	12,507
San Mateo	556,234	30.0	146,882	6,508	4.4	36,861	25.1	103,513	70.5	13,222	15,138
Santa Clara	1,064,714	25.7	262,584	13,708	5.2	76,095	29.0	172,781	65.8	12,456	13,644
Solano	169,941	24.8	42,669	3,627	8.5	18,066	42.3	20,976	49.2	9,880	10,653
Sonoma	<u>204,885</u>	<u>30.2</u>	<u>52,936</u>	<u>6,078</u>	<u>11.5</u>	<u>21,551</u>	<u>40.7</u>	<u>25,307</u>	<u>47.8</u>	<u>9,673</u>	<u>10,866</u>
9 Co. Total	4,628,194		1,154,809	79,800		367,026		707,983			
9 Co. Average		29.4			7.4		33.0		59.6	11,551	12,953
Sacramento	631,498	27.0	161,765	11,999	7.4	62,957	38.9	86,789	53.7	10,566	11,737
San Joaquin	290,207	28.9	73,264	7,682	10.5	31,013	42.3	34,569	47.2	9,602	10,689
Yolo	<u>91,788</u>	<u>24.3</u>	<u>21,889</u>	<u>2,221</u>	<u>10.2</u>	<u>9,484</u>	<u>43.3</u>	<u>10,184</u>	<u>46.5</u>	<u>9,482</u>	<u>10,641</u>
12 Co. Total	5,641,687		1,411,727	101,702		470,480		839,525			
12 Co. Average		27.0			7.9		35.2		56.9	11,134	12,470
State of California	19,957,304	28.4	5,001,255	404,326	8.1	1,863,486	37.3	2,733,443	54.6	10,732	12,227

Source: U.S. Department of Commerce, Bureau of the Census. 1970. General Social and Economic Characteristics of California.

2.506 c. Employment. Employment data for the San Francisco 9-County Area and the Delta 3-County Area are reported in the following table for selected years.

TABLE II-29
EMPLOYMENT WITH BAY-DELTA AREA

<u>Nine County Total</u>		
	<u>1960</u>	<u>1970</u>
Agr., Forestry, Fisheries and Mining	57,500	36,900
Contract Construction	94,200	100,000
Manufacturing	292,100	347,800
Trans., Communications and Utilities	121,600	163,200
Wholesale and Retail Trade	305,600	414,700
Finance, Insurance and Real Estate	87,100	127,100
Services	260,800	425,200
Government	<u>233,500</u>	<u>370,500</u>
Total All Industries	1,452,400	1,985,400

Source: Security Pacific National Bank, San Francisco Bay Area Report, April 1971, pp. 58-59.

<u>Three Delta County Total</u>			
	<u>1968</u>	<u>1970</u>	<u>1972*</u>
Agriculture	23,900	21,100	20,700
Mining	1,100	1,000	1,100
Construction	15,500	16,200	20,400
Manufacturing	40,800	37,500	37,500
Trans., Communications and Utilities	21,700	21,200	21,400
Trade	71,600	75,500	82,600
Finance, Insurance and Real Estate	13,400	13,800	15,000
Services	57,900	63,600	68,600
Government	123,700	128,600	131,800
Other Non-Agricultural Employment	<u>11,300</u>	<u>11,300</u>	<u>11,400</u>
Total All Industries	380,900	389,900	410,500

Source: Security Pacific National Bank, The Central Valley Report, April 1973, pp. 52-53, 59.

*Employment data for Yolo County is for year 1971. It was assumed differences between 1971 and 1972 would be minimal.

2.507 d. Personal Income. The total personal income for the 12-county area is shown in the table following. Also shown is the per capita income for the area.

TABLE II-30
PERSONAL INCOME

	<u>1971</u>	<u>1973</u>
Personal Income (000)	\$28,944,728	\$34,338,011
Per Capita Income	\$ 5,032	\$ 5,835

Source: Personal Income - Williams Research Associates.
Per Capita Income - California Department of Finance.
1971 per capita income is on an earning basis; 1973 on a residence basis.

2.508 e. Assessed Valuation. The gross total assessed valuation for the 12-county area is \$22,170,586,000 for the fiscal year 1974-1975. Land is assessed at \$7,049,319,000 and improvements on land \$11,964,739,000.

2.509 2. Counties. The economic and social characteristics of each of the 12 counties -- 9 in the San Francisco Bay Area and 3 in the Delta Area -- are presented below on an individual basis for purposes of providing data for easy reference.

a. San Francisco.

2.510 (1) History. An overland party was the first to discover San Francisco Bay in 1769. Sir Francis Drake explored this part of the California coast at an earlier period, but fog had obscured the entrance to the Bay. The first ship to anchor in San Francisco Bay was in 1775, but it was not until 1834 that the village settlement was established. In 1884 the number of people in San Francisco was only 50; two years later it was 150, and one year before the gold rush the population was 450 residents. However, during the Gold Rush days of 1848-1849 the population grew to 30,000. At the turn of the last century, San Francisco was the leading financial, wholesaling, shipping, foreign trade and manufacturing center on the Pacific Coast. In 1906 San Francisco was destroyed by a fire that followed an earthquake, but by 1910 the city had been rebuilt and had a population of 416,000. During World Wars I and II San Francisco had great increases in employment. During the Second World War the area became an important shipbuilding center and the principal port of embarkation for men and materials going to the Pacific theatre of war.

- 2.511 (2) Population. According to U.S. Census figures for 1970, the population for the City and County of San Francisco was 715,673 persons.
- 2.512 (3) Employment. In 1970 total employment of San Franciscans in all industries was 318,311. In addition there were 11,094 in the armed services. The total labor force of 16 year old and older was 351,169. There were 21,764 unemployed. The rate of unemployment was 6.4 percent.
- 2.513 Using U.S. Census figures employment of San Francisco residents by industry for 1970 is presented in Table II-31.
- 2.514 (4) Industries. Agriculture was limited to 13 field acres in San Francisco County in 1972. In addition some 505,345 square feet of greenhouses produced a gross value of \$646,440 in cut flowers, indoor decoratives and farm products.
- 2.515 Manufacturing plants numbered 1,408 in San Francisco County in 1971. San Francisco is the center for food processing, shipping and receiving, and for apparel and textile industries. It also has printing and publishing houses, metal fabricating firms, and chemical manufactures. There were 51,787 employees in 1971, who received \$535,141,905 in wages.
- 2.516 Transportation facilities include the Bayshore Freeway (U.S. 101), which extends in a north-south direction and connects the southern counties of San Mateo and Santa Clara with the central business area of San Francisco. Interstate 80 carries traffic across the San Francisco-Oakland Bay Bridge to Sacramento and Reno, Nevada. U.S. 101 connects Marin County and Northern California, crossing the Golden Gate Bridge. Southern Pacific Railroad has a terminal within the city of San Francisco and a belt railroad provides interchange with Southern Pacific, Santa Fe, and Western Pacific Railroads. There is a large international airport about 15 miles south of the central city.
- 2.517 (5) Income. San Francisco County has a lower percentage of total family income than the State (68.0 percent to 84.7 percent). There is a correspondingly higher percentage of total income for unrelated individuals (32.0 percent to 15.3 percent).
- 2.518 For wage and salary earners San Francisco County has a lower percentage than the State average (72.9 percent to 78.4 percent). The percentage of non-farm self employed and farm self employed is lower than the State average (9.8 percent to 9.0 percent and .09 percent to .6 percent).

TABLE II-31

EMPLOYMENT OF RESIDENTS
BY INDUSTRY

<u>INDUSTRY</u>	<u>1970</u>
Agriculture, forestry and fisheries	1,855
Manufacturing	37,341
food	4,793
other	32,548
Transportation, communications and utilities	34,438
Wholesale and retail	64,822
Finance, insurance and real estate	37,140
Services	91,494
Government	38,405
TOTAL ALL INDUSTRY	318,311

SOURCE: U.S. Department of Commerce, Bureau of the Census. 1970.
General Social and Economic Characteristics of California.

2.519 Social Security income and welfare and public assistance income is higher than the State average (3.0 percent to 2.4 percent and 1.1 percent to .9 percent respectively).

2.520 Those deriving income from "other" sources is higher than the State average (13.4 percent to 8.7 percent).

2.521 The mean income for families and unrelated individuals living in the City and County of San Francisco (\$8,759) is lower than the State average of \$9,848 per annum.

2.522 By breaking the income down into three major groupings the figures can best be summarized as follows:

	% San Francisco	% California
\$9,999 or less	47.2	45.2
\$10,000 to \$14,999	25.7	28.0
\$15,000 or more	27.1	26.8

2.523 The number of families earning \$9,999 or less is higher for San Francisco County than for the State. San Francisco is also below the State average in income in the \$10,000 to \$14,999 class and only barely above the State average for income levels of \$15,000 or more.

2.524 All persons with income less than the poverty level in San Francisco is 14.0 percent as compared to 11.1 percent for the State. Tables II-32 and II-33 present the above data for San Francisco County and California.

TABLE II-32

TOTAL INCOME
SAN FRANCISCO COUNTY AND STATE OF CALIFORNIA

TYPE	TOTAL FOR COUNTY \$	% OF TOTAL	TOTAL FOR CALIFORNIA \$	% OF TOTAL
TOTAL FOR FAMILIES AND UNRELATED INDIVIDUALS	\$3,042,499,963	100.0	\$72,173,380,149	100.0
TOTAL FOR FAMILIES	\$2,067,932,394	68.0	\$61,150,344,885	84.7
TOTAL FOR UNRELATED INDIVIDUALS	\$ 974,508,310	32.0	\$11,023,035,264	15.3

FAMILY INCOME

SAN FRANCISCO COUNTY AND STATE OF CALIFORNIA

TYPE	TOTAL FOR COUNTY \$	% OF TOTAL	TOTAL FOR CALIFORNIA \$	% OF TOTAL
TOTAL FOR FAMILIES	\$2,067,932,394	100.0	\$61,150,344,885	100.0
WAGE OR SALARY	\$1,509,110,892	72.9	\$47,977,558,508	78.4
NON-FARM SELF EMPLOYED	\$ 203,216,132	9.8	\$ 5,482,083,524	9.0
FARM SELF EMPLOYED	2,050,020	.09	\$ 337,425,483	.6
SOCIAL SECURITY	\$ 63,707,976	3.0	\$ 1,444,373,738	2.4
PUBLIC ASSISTANCE OR PUBLIC WELFARE	22,902,258	1.1	\$ 581,594,745	.9
OTHER	\$ 277,728,528	13.4	\$ 5,338,090,580	8.7

SOURCE: U.S. Department of Commerce, Bureau of the Census. 1970.
General Social and Economic Characteristics of California.

TABLE II-33
SAN FRANCISCO COUNTY
DISTRIBUTION OF INCOME

1970

	County	% of Total	California	% of Total
All families and unrelated indi- viduals	347,357		7,328,754	
Median Income	\$6,765		\$8,279	
Mean Income	\$8,759		\$9,848	
<u>All families</u>	<u>165,342</u>	<u>100.0</u>	<u>5,001,255</u>	<u>100.0</u>
Less than \$1,000	4,933	3.0	111,268	2.2
\$1,000 to \$1,999	4,454	2.7	116,312	2.3
\$2,000 to \$2,999	6,881	4.2	176,746	3.5
\$3,000 to \$3,999	7,259	4.4	215,158	4.3
\$4,000 to \$4,999	7,414	4.5	222,202	4.3
\$5,000 to \$5,999	8,208	5.0	242,986	4.9
\$6,000 to \$6,999	9,466	5.7	264,960	5.3
\$7,000 to \$7,999	9,703	5.9	293,660	5.9
\$8,000 to \$8,999	9,757	5.9	312,881	6.3
\$9,000 to \$9,999	9,803	5.9	311,639	6.2
\$10,000 to \$11,999	19,068	11.5	635,825	12.7
\$12,000 to \$14,999	23,497	14.2	763,148	15.3
\$15,000 to \$24,999	33,072	20.0	1,029,394	20.6
\$25,000 to \$49,999	9,647	5.8	257,628	5.2
\$50,000 or more	2,180	1.3	47,448	1.0
Median Income	\$10,503		\$10,732	
Mean Income	\$12,507		\$12,227	
Families with female head	27,252		574,936	
Mean Income	\$ 7,481		\$ 6,527	
All unrelated individuals	182,015			
Mean Income	\$ 4,283		N/A	
Mean Income	\$ 5,354			
Female unrelated individuals	91,864			
Mean Income	\$ 4,289		N/A	
Per capita income of all persons	\$ 4,289		\$ 3,632	
All persons with income less than poverty level	97,617		2,152,716	
% of all persons	14.0		11.1	

Source: U.S. Department of Commerce, Bureau of the Census. 1970.
General Social and Economic Characteristics of California.