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THE Vivid Picture PROJECT

Marine Food Resources in the California Food System in 2030

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Introduction

This white paper aims to complement the numerous Vivid Picture projects that focus on the land-based agricultural food system. The sustainability of marine resources is a highly complicated and studied issue. This paper only seeks to analyze California's marine resources as a framework for understanding limits and opportunities for marine fisheries to provide food for California's people in the year 2030.

The first section of the paper, "Charting the Trends in California's Marine Resources," will present the overall trends in marine resources production over the last century, based on data from the National Marine Fisheries Service. It will focus on trends in landings, ex-vessel values, number of fishing vessels, gear types, and fishing regulations for all commercially important California fisheries. "Scenarios: Marine Food Resources in 2030," the second section, will focus on the demand-side conditions that may exist in California in 2030. Per capita fish consumption rates and population growth will be presented as a scenario for future demand and historic production trends will be summarized to predict 2030 per capita fish and shellfish supply. The third and final section, "Opportunities for Sustainable Production," will highlight opportunities to provide sustainable sources of fish, particularly high quality fresh fish, to California's people. Trends in landings and gear types for specific species will be detailed and discussed in the context a of growing need for sustainable value chains in California.

Background: California's Fisheries in the Vivid Picture

A comprehensive vision for a sustainable food system for California must incorporate the role of marine food resources. The Vivid Picture goals of achieving a more local, traceable, healthy, accessible, and affordable supply of food can and should rely on in-state fish and shellfish products in important ways because:

- As a coastal state, California hosts a wide diversity of marine resources that offer a huge opportunity to provide access to quality food for local and regional markets.
- Over 10 major ports and numerous smaller ports along California's coast support a range of commercial producers, processors and distributors, as well as
- California's fisheries resources are abundant close to shore providing food for many short-trip recreational sport fishers and commercial passenger fishing vessels.
- In addition to providing a quality source of protein, many marine fish which occur in California's waters are rich in health promoting vitamins, minerals, oils, and Omega-3 fatty acids.
- Unique anadromous fish, such as Chinook salmon in California, serve to educate residents about the interacting factors that shape the health of species, people, and ecosystems.
- In contrast to California's land-based agriculture, fishermen and fisheries resources can often be more flexible in relation to shifting environmental

conditions by fishing for different species, with different gear types or methods, or in different locations.

- California's marine resources are a diverse and wild resource that have the potential to many more types of food than are currently harvested for local and regional consumption.

Charting the Trends in California's Marine Resources

Data Sources

The factors that influence the quantity of fisheries products that producers supply include market prices and demand, quotas and regulations, the size of fish stocks, the gear type and gear methods used, fishing effort in terms of time and fleet size, and natural variability. The best overall indicator available that summarizes those factors over time is the trend in fish landings from all California ports.

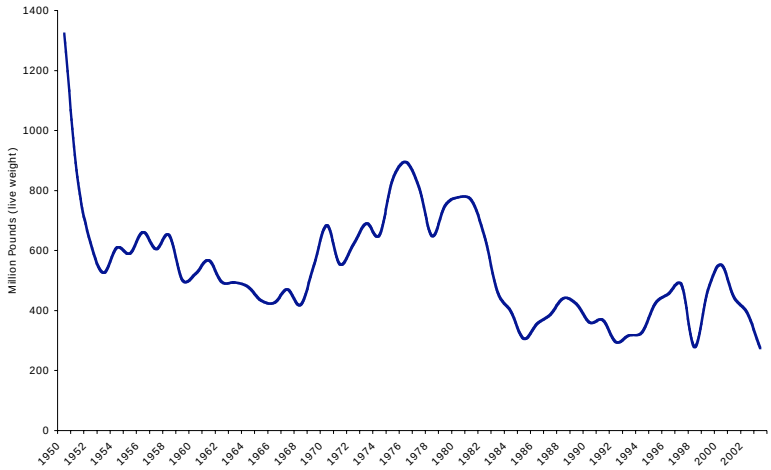
Landings data provides information on the poundage (in live weight) and prices (at time of purchase) and the gear type used for fish that are brought ashore. Data are recorded at the point of transaction between the fishermen and the dealers or processors. The data used in this analysis were obtained from the National Marine Fisheries Service (2004), and were originally extracted from the Pacific States Marine Fisheries Commission and the California Department of Fish and Game to create coordinated landings summaries for California ports spanning from 1950 to 2003. It must be noted that the National Marine Fisheries Service does not intend the data to be used for highly rigorous analysis because some landings records have been removed or mis-categorized for the purpose of confidentiality. There also exist a number of limits for this specific California-based analysis because the data: 1) do not exclude in-state landings by vessels which harvested fish outside of California's waters; 2) do not include landings of fish harvested in California's waters but landed outside the state, 3) do not include records of fish that are processed and sold at sea, and 4) do not include records of non-commercial species or species landed by recreational or subsistence fishermen. In addition, because of changing conventions for the categories of species and gear type, the time series is often reduced in which to compare trends. Nevertheless, the landings data provide the best picture available, and despite their limits can highlight important fisheries trends.

Several other datasets were used. Data presented in the trends section on vessel numbers and ex-vessel values were sourced from the California Department of Fish and Game publication, "California's Living Marine Resources: A Status Report" (CDFG, 2001) Data were obtained from the Recreational Fishing Information Network (RecFIN, 2005) on estimated recreational fishing landings in California for the year 2003. Explanations of trends data were also sourced from the California Department of Fish and Game 2001 publication, "California's Living Marine Resources: A Status Report" (CDFG, 2001).

Trends in Landings Since 1950

Overall trends indicate a decline the California's fisheries resources. Figure 1 displays the trend in total pounds of fish landed at California Ports between 1950 and 2003 summarized for all commercial species. A trend toward reduced fisheries production is clear, punctuated by a number peaks and troughs as large-scale fisheries were discovered and exploited.

Figure 1: Total Commercial Landings in California (1950-2003)



Eight main species (three tuna species, pacific sardine, northern anchovy, jack mackerel, chub mackerel, and California market squid) make up 72% of the total landings weight over time (Figure 2), and are the primary landings that shape the overall peaks and troughs in Figure 1. Figure 3 shows the trends for those species over time. Landings of California market squid, chub (pacific) mackerel, and pacific sardine show large recent increases. Chub mackerel and pacific sardine landings have increased and stocks have recovered after stocks collapsed and landings declined to zero during the 1960s and 1970s. California market squid is a rapidly expanding new fishery. The species landings that have declined continuously are the anchovy, jack mackerel, and tunas. Anchovy and jack mackerel fisheries were targeted to replace the collapsed sardine fishery, and subsequently experienced big peaks and rapid declines. The three tunas species—yellowfin, skipjack, and albacore—have all declined significantly compared to 1950s levels. The primary reason for these species declines is the shifting of commercial landings away from California and the relocation of canneries abroad. Because the California tuna fleets had developed into large scale purse seiners targeting tuna sets associated with schools of dolphins, increasing bycatch regulations in the 1980s forced the vessels offshore (CDFG, 2001). By 1990 regulations forced canneries to stop buying tuna caught amongst dolphins, and all but a few canneries relocated abroad to service the boats that had begun fishing primarily in the western pacific (CDFG, 2001).

Figure 2: Relative Total Landings in California (1950-2003)

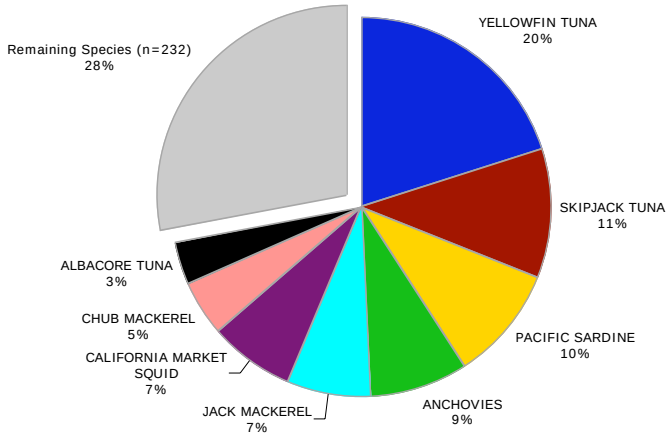
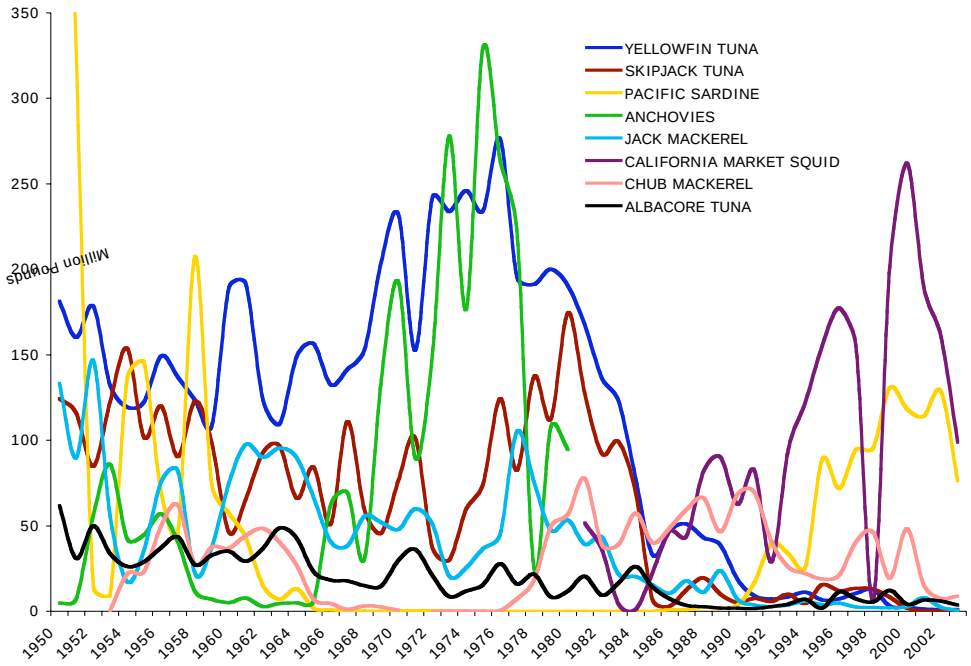


Figure 3: Eight Top Species by Total Landing Weight (1950-2003)



Trends in Vessel Numbers and Revenues Since 1981

The number of vessels that land species at California ports has been in steady decline since 1981. Since 1981 vessel numbers have dropped by over half, to just under 2,700. The decline of tuna fisheries and fleets began before this data series but has contributed to overall declines. For example, in the 1950s 3,000 boats fished in the central pacific for tuna and by the 1990s that number had dropped to fewer than 500 boats (CDFG, 2001).

The revenues from those vessels, known as ex-vessel values, have also fallen since 1981.

Figure 3: Number of Vessels Landing Catch in California, or California and Neighbooring States (1981-1999)

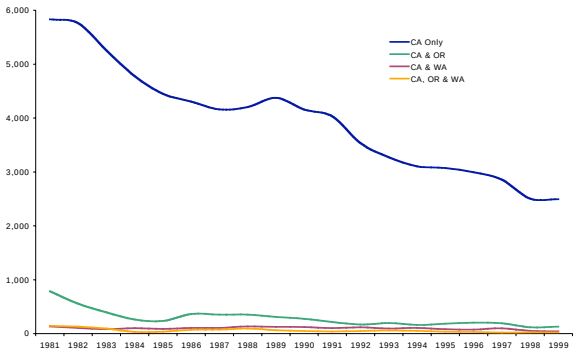
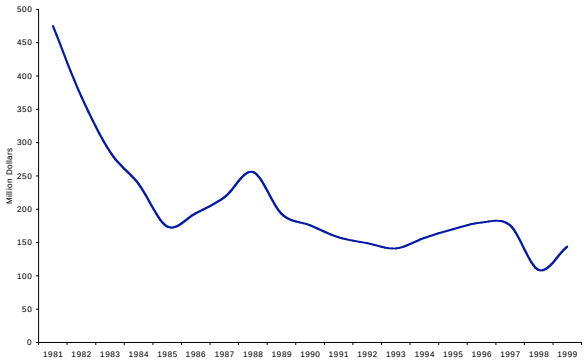


Figure 4: Ex-vessel Values of Commercial Landings in California (1981-1999)



Trends in Gear Type Since 1981

The type of gear used for a certain fishery makes a critical difference in controlling the number of fish that can be caught, the ability to target specific species, and the size of boat needed, among other factors. Figure 6 shows the relative contribution of gear types to total landings for all species from 1980 – 2003. The use of nets, particularly large drifting or entangling nets and trawls nets, are able to catch the most fish and are the primary methods used to capture the sardine, anchovy, tuna, mackerel, and squid that comprise the majority of total landings. Nets, including trawls, account for 92% of all landings by weight, totaling over 8.6 billion pounds.

Figure 6: California Landings by Gear Type from 1980-2003

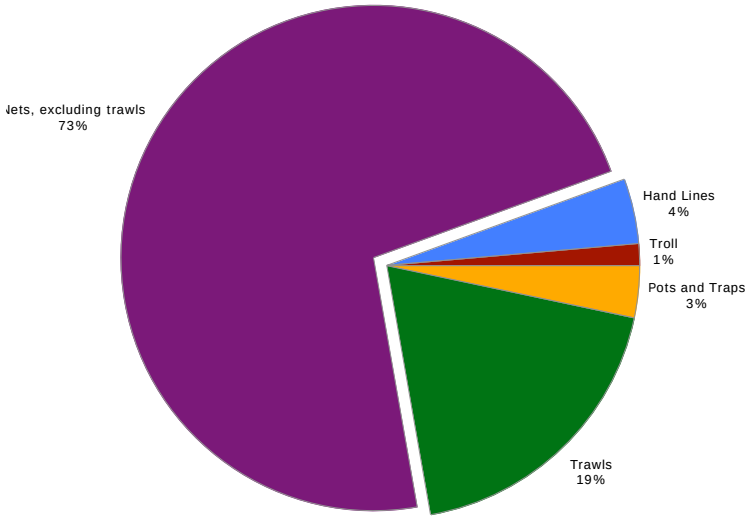


Figure 7 shows the trends of gear types over time, with nets, excluding trawls and trawls. Figure 8 shows the trend of trawls along with the trends for hand lines, trolls, and pots and traps (Note: some fisheries gears are not included within these categories).

Figure 7: Landings by Nets, Excluding Trawls (1981-2003)

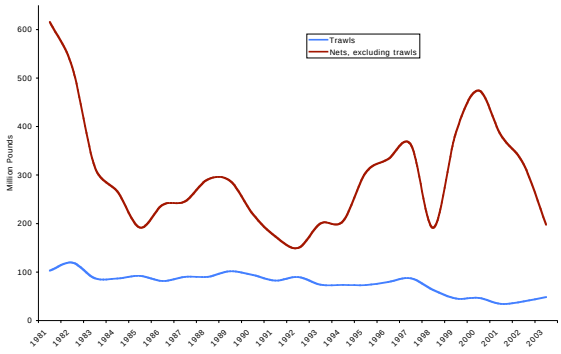
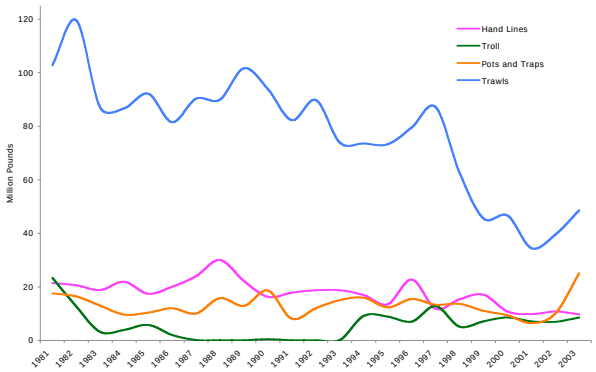


Figure 8: Landings by Hand Lines, Trolls, Pots and Traps, and Trawls (1981-2003)



Since 1981, we see significant declines only for trawls. The nets, excluding trawls declined in direct relation to the tuna fisheries but then rose again primarily due to the rise in California market squid landings. The landings for hand lines, trolls, and pots and traps, though small in relative landings, show steady to increasing landings.

Trends in Fishing Regulations and Marine Conservation

Regulations are specific to various fisheries, but those fisheries which have experienced the largest landings are often the closest regulated, and post peak declines in landings can often be partially attributed to fisheries closures, the setting of strict catch quotas, or the limiting of harvest level by gear types that incur large bycatch (CDFG, 2001). While restrictions to fisheries reduce short-term production, they are aimed at stabilizing or reducing harvest rates to maintain long-term sustainability in the fishery. In California, there has been considerable historical quotas set and by catch restrictions. Most recently there has been an increase in area-based regulations, which focus on restricting harvest levels in certain areas. California waters under restricted management for certain fisheries total nearly 40 square miles (2002), not including sanctuary waters. In particular it shows the area of shelf closure for groundfish fisheries, and the current distribution of federally managed marine sanctuaries. We consider it reasonable to predict that more areas will in the future be reserved explicitly for ocean conservation and more management closures will occur to protect overfished stocks.

Scenarios: Marine Food Resources in 2030

Fish Consumption and Population

Per capita consumption of fish and shellfish in the United States has been increasing steadily. In 2003, 16.3 pounds of fish and shellfish were consumed per person (NMFS, 2004). This represents an 8% share of all meat consumption (USDA, 1995). Of total consumption, fresh and frozen consumption has nearly doubled in the last 50 years to

11.4 pounds per year of edible meat in 2003. The per capita consumption of canned products peaked in the late 1980s at 5.4 and fell back to 4.6 pounds in 2003. Cured products dropped from 3.9 pounds in 1910 to 0.3 pounds in 2003. Of the fresh and frozen consumption, fish and shellfish both accounted for 5.7 pounds, but shellfish consumption has been increasing more quickly. Therefore, if the trends over the last 100 years are extrapolated to 2030 levels, fish consumption of fresh and frozen products will likely rise to 6.5 pounds and shellfish will rise to 7.2 pounds, totaling 13.3 pounds edible weight consumed per capita.

California per capita consumption was not available for this paper, but we can assume that as a coastal state, rates for California would be relatively higher. The population of California is currently 34 million and predicted to rise to 46 million by 2030. This means that to maintain per capita consumption at or above US average levels (16.3 pounds), California would need to domestically supply 750 million edible weight pounds of seafood. A standard conversion between edible weight and live weight (the unit of measure for landings data) is 2.22 (USDA, 1992). Therefore, landings in live weight would need to total 1.6 billion pounds, and all of those fish and shellfish would need to be processed, distributed, and sold as food items within California.

Limits to Overall Production

Because commercial landings off all fish currently supply 274 million pounds and recreational landings are estimated at only 324 thousand pounds (RecFin, 2005), per capita supply from California's Marine waters totals 8 pounds live weight or 3.6 pounds edible weight. As context, the world per capital supply (with inland and marine aquaculture accounting for over half of total supply) currently matches the US per capita consumption, at 16 pounds edible weight (FAO, 2004). In California, assuming that current overall trends continue (by extrapolating the average decline in total landings since 1950 of just under 1% per year) then per capita supply by 2030 would drop to as low as 2 pounds edible weight.

Supplying 2 pounds per capita depends on many assumptions however. Those assumptions include 1) that the majority of the supply that is currently exported would be kept in-state to feed the people of California in 2030, 2) that the average diets of fish and shellfish would expand to include the range of species available, and particularly those newly developed, lower food chain fisheries such as sea urchins, sea cucumbers, and squid, 3) that those species currently used for fertilizers, pet food, baitfish, or other industrial uses uses would be made available for human consumption, and 4) that people's income will be sufficient enough to afford to buy fish and shellfish products at prices often higher than other proteins.

Therefore, there will be great limits of California's marine resources to provide for all people at current per capita levels of consumption into the future, given landings trends and increases in population and consumption. The declines in fishing vessels, fishing revenues, allowable fishing areas may also indicate further constraints in the short term. Less fishermen on fewer vessels will be required to sustain or expand landings while gaining sufficient profits from reduced opportunities. The capacity of the existing and future fleets will be stretched and the factors of vessel size and fishing effort will grow in importance. On one hand it might seem that bigger boats with greater capacity to land more fish (net-based gear types) and stay at sea longer, will be required. But, those

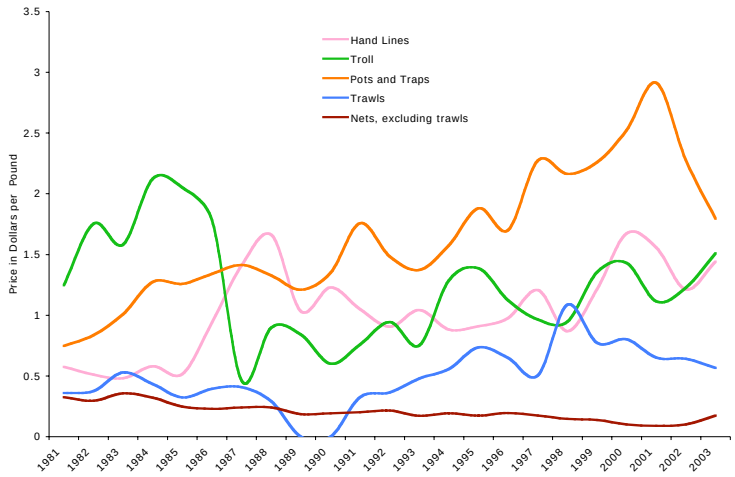
fisheries are the production types that have experienced the largest peaks and declines and have been the targets of the strictest regulations due to overfishing and bycatch. Therefore, a fundamental constraint upon future production is that the fisheries gears that have accounted for the majority of historical landings may prove to be increasingly less sustainable.

Opportunities for Production

Gear Types

On the backside of limits, there exist opportunities. It is clear that certain gear types will play a more critical role in future fisheries sustainability, particular those that are highly selective. For example, a notable exception to the problems of sustainability of the largest scale net fisheries is the California market squid fishery. The gear type used is a lampara seine that is used at night and results in negligible bycatch (SSC, 2005). The squid populations, despite high harvests, have also been determined to be healthy (CDFG, 2001). Particularly those more selective gear types that are linked to smaller, more flexible vessels, such as trolls, pots and traps, and hand lines, exhibit an opportunity to maintain or grow harvest levels. Figure 8 indicated that those gear types have not declined significantly in landings and therefore may have potential to expand. Figure 9 below indicates that those gear types that land fewer fish are able to receive higher average prices per pound, and those prices (which are not adjusted for inflation in this graph) have been increasing since the late 1980s. A key component to fisheries sustainability (and the ability of new fishermen to enter the fishery) is the financial sustainability of the vessels and this increase in price is a hopeful trend. Higher prices can allow fish to be brought more directly to market, and for less overall fish to be caught to cover a fisherman's operating costs.

Figure 9: All Landings by Price and Gear Type (1981-2003)



Demand

It is important to emphasize again that trends summarized by all fisheries are primarily shaped by declines in fisheries of the highly migratory species or pelagic species. These fisheries have been historically net caught in huge numbers and primarily processed into canned products or reduced to oil and fishmeal (CDFG, 2001). Canned fish is one type of fisheries product that has not been growing significantly in demand. Shifts in demand have been towards fish fillets, fresh or frozen, and fresh shell fish. The Food and Agriculture Association report, "The State of World Fisheries and Aquaculture 2004," notes that consumers in developed countries seem to be "changing their attitudes to fish." The report (FAO, 2004) states that "new perceptions of the value of fish include: (i) fish is not only something to eat but something that can improve your health—a health food; (ii) eating the "correct" fish can help preserve the aquatic environment—it is an "environmentally safe" food; and (iii) fish is a luxury worth eating occasionally, in small quantities and at high prices."

Fresh Fish Fisheries and Viable Value Chains

In light of growing demand for high quality fish that have health benefits and can preserve the environmental, California's fisheries do have high potential. A number of fisheries in California both have high value as fresh and frozen products, are harvested with selective gear types, and exhibit landings trends that are relatively steady or increasing. Therefore, these species should be the most important from which to develop sustainable value chains.

The most notable of these high quality species are dungeness crab, chinook salmon, California halibut, pacific sanddab, and albacore tuna. Figure 10 shows the landings trends of dungeness crab, which are primarily related to variability in ocean conditions (CDFG, 2001). Since 1950, dungeness crab landings have averaged nearly 10 million pounds, which indicate a significant amount of potential fresh seafood that can be brought to local and regional markets, often with little processing. Crab are primarily a pot fishery which is very selective (SSC, 2005). Crab can be processed easily or sold fresh to market, and value chains which link producers directly with consumers through farmers markets or mail order are highly feasible for crab. One example of this type of value chain player is Linda Brand Crab (www.lindabrandcrab.com) which is a family run company out of Illwaco, Washington. They both direct market to customers and work with local purchasing managers at New Seasons Market, a regional grocery in the Portland, Oregon metro area.

Figure 10: Landings of Dungeness Crab in California (1950-2003)

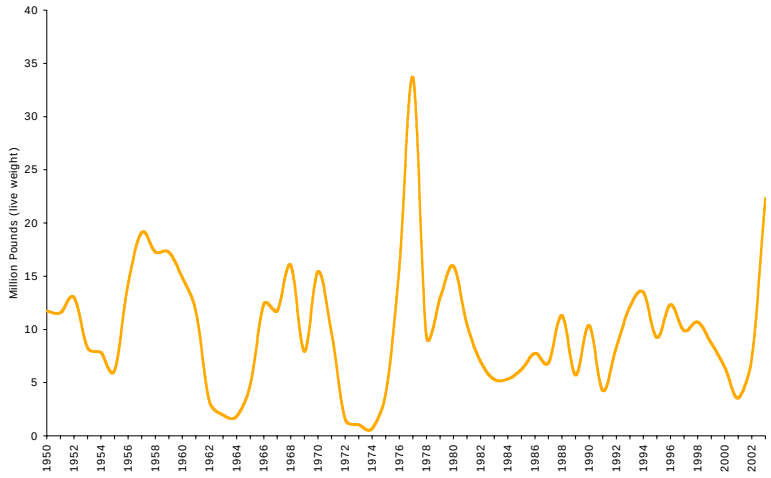


Figure 11 shows the trends for chinook salmon, halibut, and pacific sanddab. Chinook salmon fisheries are based on the abundant fall-run Sacramento river fish, and are taken in the ocean troll fishery with barbless hooks (SCC, 2005). The fishery has averaged over 6 million pounds per year in landings, and is the largest producer of troll caught chinook salmon on the pacific coast (CSC, 2005). One key to salmon fisheries value chains is fetching a descent market price. This has become increasingly challenging as imported farmed salmon has saturated the salmon market. One California group addressing this issue is the California Salmon Council who are seek Marine Stewardship Council certification of California-caught wild chinook. This eco-labeling scheme would boost the access of California salmon to new markets.

The trends reveal very steadily increasing and successful fisheries for California halibut and pacific sandabs. They are good examples of smaller scale fisheries that depend on gear types that can result in bycatch but if regulated and applied carefully they can expand with acceptable levels of bycatch. Pacific sanddab, is considered to have high quality flesh and the stock is healthy (CDFG, 2001). Many sanddab are caught in a targeted way with Danish Seine netting (SCC, 2005). California halibut are caught with trammel nets and hand lines in California for the top quality fresh fish market (SCC, 2005). These gear types have been rising in landings relative to other gear types which result in more bycatch and have been slowly being phased out by regulations. Figure 12 shows these trends, and how the different gear types for halibut are very independent of each other over time.

Figure 11: Landings for Four Selected Fresh Fish Fisheries in California (1950-2003)

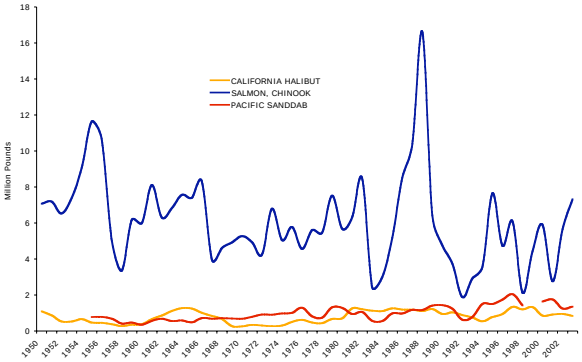
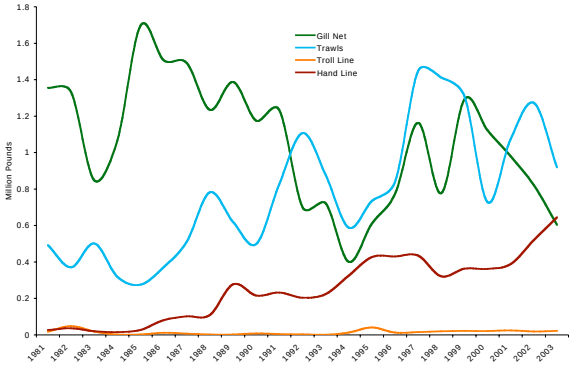
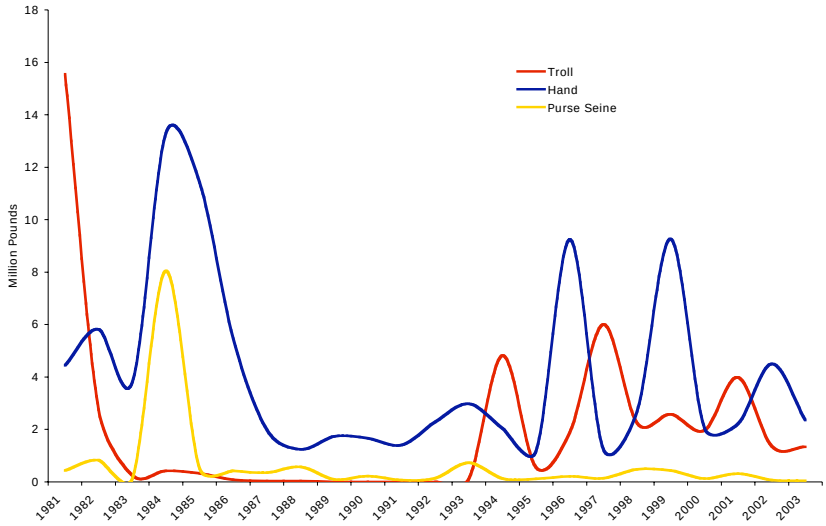


Figure 12: California Halibut Landings by Gear Type (1981-2003)



Local value chains for these flounder species have been promoted by the Monterey Fish Market. The Market wholesales sustainable fish products and works hard, in partnership with other key fisheries stake-holders, to educate consumers about their choices. For example they are currently promoting the lesser-known sanddabs as a high quality product by exhibiting pan-fried sanddab recipes on their website (www.webseafood.com). Also they publish a Sustainable Advisory List for California seafood which is remarkable in how it both distinguishes California halibut from Alaskan caught pacific halibut and the main gear types used to catch California halibut. With this level of detail it goes beyond other valuable, but simplified consumer guidelines for healthy or sustainable fish to eat like "The Fish List" (www.thefishlist.org).

Figure 13: Albacore Tuna Landings by Gear Type (1981-2003)



Albacore tuna is also a species that deserve more focused attention. It is the highest quality tuna, or the "White Meat" tuna, and is principally taken in a troll fishery that is generally regarded as healthy. Recent findings related to high mercury levels in predatory ocean fish (FDA, 2005) and their related health affects, have implicated all the California tuna species and swordfish. However west coast troll caught albacore is considered to have significantly lower levels (well below FDA and EPA limits) of mercury

because they are caught at a smaller size and have had less time to accumulate mercury (Local Ocean, 2005; Oregon's Choice Seafoods, 2005). In addition, the troll fishery harvests albacore selectively and is not associated with dolphin schools. Seen in Figure 13, since the early 1990s the landings, by hand line and trolling, point to the viability of the fishery in California. Because albacore is the highest quality of the tuna species is holds the highest potential for growth in demand from fresh markets and high quality microcanneries (Oregon's Choice Seafoods, 2005).

Two value chain players have contributed greatly to a revitalized albacore market that distinguishes itself from the huge offshore vessels and canneries. Oregon's Choice Seafoods is a Newport, Oregon microcannery producer of albacore tuna for natural foods markets and direct mail order. Local Ocean is a Newport, Oregon fish market and grill that specializes in the highest quality fish from local sources with the express purpose of traceability of their products and providing a market to support the local fleet.

As a whole these five fisheries and the value chains that connect them to consumers, can offer opportunities for a different outlook in 2030. They do not answer the issue of how to provide access for all people of California with healthy food. But while they are not opportunities in quantity, they are still opportunities in quality. Identifying fisheries that can support a more healthy balance between producers and consumers, and between humans and nature, is the first step towards identifying how to move forward. As the Vivid Picture project continues, a more focused and detailed look at California's marine resources will be needed to further develop these ideas, and translate them from opportunities to models, within the California food system.

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