CALIFORNIA YELLOWTAIL

Seriola lalandi

Sometimes known as Yellowtail Jack, Forktail, Mossback, White Salmon, Horse-eye Bonito, Coronado

SUMMARY

California Yellowtail are found and caught commercially off California and Baja California, Mexico. They reach sexual maturity at an early age, but are relatively slow growing and known to form spawning aggregations, making them vulnerable to fishing pressure. Catches of California Yellowtail have fluctuated greatly over the years, tending to be greater during El Nino events when waters are warmer and much less during cool, La Nina events. Abundance levels of California Yellowtail populations are not known, but catches in recent years have been low. California Yellowtail are captured with both set and drift gillnets and hook-and-line. Drift gillnets and hook-and-line cause minimal habitat damage while set gillnets may cause moderate habitat damage. Bycatch in these fisheries is likely moderate. Some management regulations are in place for the California fisheries, such as a minimum size limit and restricted fishing areas, but regulations are not in place for Mexico fisheries.

Criterion	Points
Life History	1.50
Abundance	2.00
Habitat Quality and Fishing Gear Impacts	3.50
Management	0.75
Bycatch	2.00
Final Score	**1.95**
Color	

Final Score	Color
2.40 - 4.00	
1.60 - 2.39	
0.00 - 1.59	

LIFE HISTORY

Core Points (only one selection allowed)

If a value for intrinsic rate of increase ('r') is known, assign the score below based on this value. If no r-value is available, assign the score below for the correct age at 50% maturity for females if specified, or for the correct value of growth rate ('k'). If no estimates of r, age at 50% maturity, or k are available, assign the score below based on maximum age.

1.00 Intrinsic rate of increase <0.05; OR age at 50% maturity >10 years; OR growth rate <0.15; OR maximum age >30 years.

2.00 Intrinsic rate of increase = 0.05-0.15; OR age at 50% maturity = 5-10 years; OR a growth rate = 0.16–0.30; OR maximum age = 11-30 years.

The California Yellowtail is a member of the jack family, Carangidae, and may grow up to 5 ft in length (Sala et al. 2003). The largest recorded fish off California weighed 80 lbs (CDFG 2001), while the largest recorded fish off Mexico weighed 92.1 lbs (http://www.mexfish.com). Growth of the California Yellowtail is relatively slow, with an estimated 'k' of 0.136 (Baxter 1960), and may vary from year to year and between geographic areas (CDFG 2001). Younger fish tend to grow 3-4 lbs per year, while older fish may only grow 1-2 lbs per year. At age one, California Yellowtail are on average 20 inches and 3.8 lbs, at age five 33 in and 15.9 lbs, and at age ten 44 in and 35 lbs (Baxter 1960). The maximum observed and aged fish was 12 years old (Baxter 1960). Some California Yellowtail are able to spawn at 2 years of age and all are capable of spawning at age 3 (Baxter 1960, CDFG 2001). Although California Yellowtail reach sexual maturity at an early age, growth is slow and maximum age is moderate, so an overall score of 2 is awarded.

3.00 Intrinsic rate of increase >0.16; OR age at 50% maturity = 1-5 years; OR growth rate >0.30; OR maximum age <11 years.

Points of Adjustment (multiple selections allowed)

-0.25 Species has special behaviors that make it especially vulnerable to fishing pressure (e.g., spawning aggregations; site fidelity; segregation by sex; migratory bottlenecks; unusual attraction to gear; etc.).

California Yellowtail form spawning aggregations in offshore waters from the spring to summer/early autumn (Sala et al. 2003, CDFG 2001), which makes them vulnerable to capture. In the Gulf of California, spawning aggregations of up to 80 individuals have been observed, and fishermen are known to encircle these aggregations (Sala et al. 2003). In the California commercial fishery and in the commercial passenger fleet (i.e. charter boats), the highest California Yellowtail catches occur from May to September, coinciding with the spawning season (CDFG 2011a, Dotson and Charter 2003). They are

often captured and found schooling around islands, seamounts, rocky points, and offshore drifting rafts of brown alga (Sala et al. 2003).

-0.25 Species has a strategy for sexual development that makes it especially vulnerable to fishing pressure (e.g., age at 50% maturity >20 years; sequential hermaphrodites; extremely low fecundity).

-0.25 Species has a small or restricted range (e.g., endemism; numerous evolutionarily significant units; restricted to one coastline; e.g., American lobster; striped bass; endemic reef fishes).

-0.25 Species exhibits high natural population variability driven by broad-scale environmental change (e.g. El Nino; decadal oscillations).

California Yellowtail catches and juvenile survival appears to be strongly correlated to water temperature, being greater when water temperatures are warm during El Nino Southern Oscillation (ENSO) events (Radovich 1961). More fish are known to migrate from Mexico waters into California waters when water temperatures are warmer, making them more available to California fishermen. Sport catches from California Commercial Passenger Fishing Vessel fleet have been excellent during warm, El Nino years, landing over 450,000 fish, whereas during cool, La Nina years catches have been less than 10,000 fish (CDFG 2001). Points are thus subtracted.

+0.25 Species does not have special behaviors that increase ease or population consequences of capture OR has special behaviors that make it less vulnerable to fishing pressure (e.g., species is widely dispersed during spawning).

+0.25 **Species has a strategy for sexual development that makes it especially resilient to fishing pressure (e.g., age at 50% maturity <1 year; extremely high fecundity).**

California Yellowtail broadcast spawn during the spring and summer (CDFG 2001). The younger fish will only spawn once during the spawning season, whereas the older fish (>7 years) will spawn multiple times (Baxter 1960, CDFG 2001). Total annual fecundity increases with size ranging from 458,000 eggs in smaller fish up to 3,914,000 eggs for a 32 lbs fish (Baxter 1960); therefore high reproductive output is largely dependent on the older, larger fish. Overall California Yellowtail has a moderate to high fecundity, so no points are added.

+0.25 **Species is distributed over a very wide range (e.g., throughout an entire hemisphere or ocean basin; e.g., swordfish; tuna; Patagonian toothfish).**

In recent years, California Yellowtail has been considered to be a circumglobal species found in temperate and tropical waters (Fishbase 2011). However, there are several disjucnt (i.e. wide geographical separation) populations, and recent genetic analysis provides evidence for four separate species corresponding to the four major regions: the Northeastern Pacific (U.S. and Mexico), the Northwest Pacific (Japan), the South Pacific

(New Zealand, Australia, and Chile), and the South Atlantic (South Africa and Brazil) (Martinez-Takeshita N and Allen LG, unpublished data).

Off the Pacific coast of North America, Yellowtail occur from southern Washington through Baja California, Mexico, including the Gulf of California and are thought to comprise two populations, with the Cedros Islands off central Baja California being the dividing line (Baxter 1960). This species is found in a variety of habitats, including coastal and oceanic areas, from the surface to depths of 228 ft (CDFG 2011b).

Although there is currently considered one worldwide California Yellowtail species, since recent evidence suggests this may not be the case, no points are added.

+0.25 Species does not exhibit high natural population variability driven by broad-scale environmental change (e.g., El Nino; decadal oscillations).

1.50 Points for Life History

ABUNDANCE

Core Points (only one selection allowed)

Compared to natural or un-fished level, the species population is:

1.00 Low: Abundance or biomass is <75% of BMSY or similar proxy (e.g., spawning potential ratio).

2.00 Medium: Abundance or biomass is 75-125% of BMSY or similar proxy; OR population is approaching or recovering from an overfished condition; OR adequate information on abundance or biomass is not available.

The California Yellowtail is a highly prized recreational fish, with recreational catches greatly exceeding commercial catches (Collins 1973, CDFG 2001) The majority of California Yellowtail landed in the U.S. Pacific are caught off the California coast from Point Conception to the Coronado Islands, with the exception of the Californian Commercial Passenger Fishing Vessel Fleet which primarily fishes for Yellowtail off central Baja California (CDFG 2001). Landings in the California commercial fishery have varied greatly over the years, due to changes in market demand, as well as environmental variability. The highest catches have occurred during warm, El Nino years, while smaller catches have occurred in cold, La Nina years (CDFG 2001, Dotson and Charter 2003). In the early 1900s, there was high demand for canned Yellowtail and catches ranged from 2 to 12 million lbs (Collins 1973, CDFG 2001). However, since

1954 there has been little interest in canned Yellowtail and the commercial fishery has declined significantly (Collins 1973, CDFG 2001). Catches are largely incidental to the white seabass fishery (Baxter 1960, Collins 1973), and since 2000 have ranged from 8,000 to 110,000 lbs (CDFG 2011a). In the recreational fishery (Commercial Passenger Fishing Vessel Fleet), catches have ranged from less than 10,000 to over 400,000 fish since the 1950s, with recent catches around 70,000 fish (CDFG 2011a).

Most California Yellowtail are resident to Mexico waters, only migrating to California waters during warm periods (Baxter 1960). Therefore the California fishery will be affected by the fishery off Mexico, and much of the Yellowtail catch is thought to be taken in Mexico (Collin 1973). However, estimates of California Yellowtail catches are not available for the Mexico fisheries. Commercial catches of Yellowtail are included in the catch of all jack species combined, which have increased dramatically since the 1990s in the southern Baja California region, remained relatively stable in the northern Baja California region, and fluctuated in the Gulf of California (SAGARPA 2010).

Information on the status of the California Yellowtail is very limited, but the last population update for Yellowtail in 2001 considered the population to be healthy (CDFG 2001a). The population is evaluated using landings data and catch per unit effort data (CPUE) from the Commercial Passenger Fishing Vessel Fleet, which takes most of its catch in Mexico waters (CDFG 2001). CPUE may provide a rough index of abundance, however, effort for this fleet is measured as number of total anglers, and these anglers are likely directing their effort toward various species; this is thus not the most robust measure of CPUE. From the 1950 to 2003, CPUE for California Yellowtail from the commercial passenger fishing fleet fluctuated at a relatively stable level, peaking during El Nino events (Los Angeles Times Recreational Fisheries Database 2011). The most recent 2009-2010 El Nino though did not result in exceptionally high catches (only 70,000 fish) as would be expected (CDFG 2011a). However, there has been a decline in the number of anglers over the last decade (CDFG 2011a), which could be the reason for the decline in catches. An estimate of CPUE is not available from the commercial fishery.

For the Mexico fisheries, an index of California Yellowtail abundance is not available, but the fisheries for jack species, which includes the Yellowtail, are considered to be fully exploited (SAGARPA 2010).

Overall there is a lack of adequate information to assess the state of the California Yellowtail population and therefore a score of 2 is awarded.

3.00 High: Abundance or biomass is >125% of BMSY or similar proxy.

Points of Adjustment (multiple selections allowed)

-0.25 **The population is declining over a generational time scale (as indicated by biomass estimates or standardized CPUE).**

Information on abundance trends of California Yellowtail populations is limited. Catch per unit effort data, measured as number of Yellowtail caught per angler, from the California Commercial Passenger Fleet indicates relatively stable catch trends over time, with peaks during El Nino years (Los Angeles Times Database). However, this information alone is insufficient to adequately assess abundance trends, and therefore points are not subtracted.

-0.25 **Age, size or sex distribution is skewed relative to the natural condition (e.g., truncated size/age structure or anomalous sex distribution).**

There was evidence of shift in the age/size distribution of the northern California Yellowtail catch between the 1970s and 1980s. Historically, 6 to 9 year olds dominated the catch, whereas from the 1980s to 2000s, the catch was dominated by 2 to 3 year olds (CDFG 2001a). In recent years, the average weight/age of the recreational catch has increased, but remains lower than that observed in the 1970s (RecFIN 2011, CDFG 2001). Therefore points will not be subtracted.

-0.25 Species is listed as "overfished" OR species is listed as "depleted", "endangered", or "threatened" by recognized national or international bodies.

-0.25 Current levels of abundance are likely to jeopardize the availability of food for other species or cause substantial change in the structure of the associated food web.

+0.25 The population is increasing over a generational time scale (as indicated by biomass estimates or standardized CPUE).

+0.25 Age, size or sex distribution is functionally normal.

+0.25 Species is close to virgin biomass.

+0.25 **Current levels of abundance provide adequate food for other predators or are not known to affect the structure of the associated food web.**

California Yellowtail are opportunistic daytime feeders. Fishes, such as sardines, anchovies, and mackerels, are the dominate prey items, but they will also feed on squids and pelagic red crabs (Baxter 1960, CDFG 2001a). Information on predators of California Yellowtail is not available. Various species are likely to feed on young California Yellowtail, but adults likely have few predators, given that the reach large sizes. Due to a lack of information, points are not added.

2.00 Points for Abundance

HABITAT QUALITY AND FISHING GEAR IMPACTS

Core Points (only one selection allowed)

Select the option that most accurately describes the effect of the fishing method upon the habitat that it affects

1.00 The fishing method causes great damage to physical and biogenic habitats (e.g., cyanide; blasting; bottom trawling; dredging).

2.00 The fishing method does moderate damage to physical and biogenic habitats (e.g., bottom gillnets; traps and pots; bottom longlines).

3.00 The fishing method does little damage to physical or biogenic habitats (e.g., hand picking; hand raking; hook and line; pelagic long lines; mid-water trawl or gillnet; purse seines).

Since 2000, commercial catch of California Yellowtail in California has ranged from 8,000 to 110,000 lbs (CDFG 2011). They are captured with gillnets (52-75% of the catch) and with hook-and line (25-48%) (NMFS 2011b). The gillnet fishery is a mixed fishery with white seabass and barracuda, and both set and drift gillnets are used (NMFS 2010, Larese 2009). In Mexico, California Yellowtail catch is lumped into the catch of all jack species. In these fisheries, gillnets are also used. Other gears may include beach seines, traps, and trolling (SAGARPA 2010).

Gillnets consist of a mesh-netting wall that is held vertically in the water column by floats on the top and weighs on the bottom (FAO 2011a,b). The difference between a set gillnet and drift gillnet is that set gillnets are anchored to the bottom of the seafloor and are not free to move, whereas drift gillnets are set in surface or mid-waters and may float freely with the water currents (FAO 2011a,b, CDFG 2011c). In California and Mexico waters, gillnets used to capture California Yellowtail must have a minimum mesh size of 6 inches and 3.5 inches, respectively (CDFG 2011c, SAGARPA 2010). The set gillnet fleet in California consists of 50 vessels that use nets of 1200 ft in length ((NMFS 2010, Larese 2009), and the drift gillnet fleet consist of 30 vessels with nets up to 6000 ft in length (NFMS 2007, NFMS 2010). The nets may soak in the water for a few hours or up to 1-2 days (CDFG 2002, Larese 2009). Drift gillnets result in minimal habitat damage, but since set gillnets contact the seafloor they may cause some habitat damage. All gillnets in California waters though have been banned from being used within 3 nautical miles of shore in southern California, providing protection to sensitive inshore habitat (CFDG 2011c). Hook-and-line gear rarely contacts the seafloor, resulting in minimal habitat damage.

The proportion of set gillnets verses drift gillnets used to captured to California Yellowtail is not available, but since drift gillnets and hook-and-line gears both cause minimal habitat damage and since gillnets are not allowed in inshore areas in California waters an overall score of 3 is awarded.

Points of Adjustment (multiple selections allowed)

-0.25 Habitat for this species is so compromised from non-fishery impacts that the ability of the habitat to support this species is substantially reduced (e.g., dams; pollution; coastal development).

-0.25 Critical habitat areas (e.g., spawning areas) for this species are not protected by management using time/area closures, marine reserves, etc.

California Yellowtail form spawning aggregations in offshore waters during the spring and summer, making them vulnerable to capture (CDFG 2001a, Sala et al. 2003). There are several marine protected areas that have been created in southern California waters, but they are primarily in inshore areas, and thus unlikely to provide protection to spawning fish (CDFG 2001a). Several marine protected areas have also been established in waters off of Baja California, MX and in the Gulf of California (SAGARPA 2010). None of these protected areas though are known to protect California Yellowtail habitats, and since spawning fish are known to be targeted by fishermen (Sala et al. 2003), points are subtracted.

-0.25 No efforts are being made to minimize damage from existing gear types OR new or modified gear is increasing habitat damage (e.g., fitting trawls with roller rigs or rockhopping gear; more robust gear for deep-sea fisheries).

-0.25 If gear impacts are substantial, resilience of affected habitats is very slow (e.g., deep water corals; rocky bottoms).

+0.25 Habitat for this species remains robust and viable and is capable of supporting this species.

California Yellowtail in the eastern Pacific are found off the coast of California, Baja Mexico, and in the Gulf of California from the surface to depths of 228 ft (CDFG 2011b). In California waters they may be found in inshore waters in the spring and fall and in offshore waters in the summer during spawning (CDFG 2001a). They are often captured around rocky reefs, seamounts, and drifting offshore rafts of brown alga (Sala et al. 2003). In near shore areas of California, high level of pollutants have been reported, which could potentially affect some Yellowtail habitats (CDFG 2002). However, there is currently no indication that the habitat is not viable and capable of supporting the species, so points are added.

+0.25 Critical habitat areas (e.g., spawning areas) for this species are protected by management using time/area closures, marine reserves, etc.

+0.25 Gear innovations are being implemented over a majority of the fishing area to minimize damage from gear types OR no innovations necessary because gear effects are minimal.

Drift gillnets and hook-and-line gear cause minimal habitat damage, while set gillnets cause moderate habitat damage. All gillnets have been banned though in inshore waters of southern California (CDFG 2011c), providing protection to these habitats. Therefore points are added.

+0.25 If gear impacts are substantial, resilience of affected habitats is fast (e.g., mud or sandy bottoms) OR gear effects are minimal.

Drift gillnets and hook-and-line gear both result in minimal habitat damage. Although set gillnets can results in some habitat damage, these nets are not allowed to be used in sensitive near shore areas (CDFG 2011c). Therefore points are added.

3.50 Points for Habitat Quality and Fishing Gear Impacts

MANAGEMENT

Core Points (only one selection allowed)

Select the option that most accurately describes the current management of the fisheries of this species.

1.00 Regulations are ineffective (e.g., illegal fishing or overfishing is occurring) OR the fishery is unregulated (i.e., no control rules are in effect).

Regulations for California Yellowtail fisheries are established by the California government. The primary regulations for the commercial fishery are a minimum size limit of 28 inches and a trip catch limit of 500 lbs per person from May 1st through August 1st, which coincides with the spawning season (CDFG 2011c). Other regulations in place are incidental to regulations established for other species (i.e. white seabass). For example, a minimum mesh size of 6 inches is required for the gillnet fisheries, and gillnets have been banned within 3 nautical miles of mainland southern California (CDFG 2011c). Several marine protected areas have been established in inshore southern California waters and around the Channel Islands (CDFG 2011c), which may provide some benefits to California Yellowtail populations. For the California recreational fishery, there is a 10 fish bag limit, and 5 of these fish must be larger than 24 inches (CDFG 2011d).

Fisheries Management in Mexico is charged to the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), and assessment and evaluation of fisheries resources is conducted by the National Fisheries Institute (INAPESCA). California Yellowtail are assessed in a unit that includes all Jack species (SAGARPA 2010). There are no set regulations for Jack fisheries, with the exception a minimum 3.5 inch mesh size for gillnets. There are also a few established marine protected areas off Baja California and in the Gulf of California, although it is unclear whether these provide protection to Yellowtail. The fisheries for Jack species are considered to be fully exploited (SAGARPA 2010).

There is no evidence of drastic declines in the California Yellowtail population, but information is insufficient to adequately assess the state of the population. Although these are some regulations in place for the California Yellowtail fisheries in California, the fisheries in Mexico, where most California Yellowtail reside, are largely unregulated. Since the California fishery is dependent on the state of California Yellowtail in Mexico waters, a score of 1 is awarded.

2.00 Management measures are in place over a major portion over the species' range but implementation has not met conservation goals OR management measures are in place but have not been in place long enough to determine if they are likely to achieve conservation and sustainability goals.

3.00 Substantial management measures are in place over a large portion of the species range and have demonstrated success in achieving conservation and sustainability goals.

Points of Adjustment (multiple selections allowed)

-0.25 There is inadequate scientific monitoring of stock status, catch or fishing effort.

In California, commercial and recreational catch of California Yellowtail is monitored (CDFG 2011, RecFIN 2011), but fishing effort is not monitored, with the exception of an estimate of the number of anglers in the Commercial Passenger Fishing Vessel Fleet (CPFV). Catch trend data and some size data from the CPFV fleet have been used to assess the health of the population (CDFG 2001), but no index of abundance is available for the commercial fishery and no formal stock assessment has been conducted. The state of the population was last updated in 2001, and it is unclear when the population will be evaluated again.

In Mexico, scientific monitoring of California Yellowtail is extremely limited. Only the commercial catch of all Jack species combined is monitored (SAGARPA 2010), and no index of abundance is available.

Overall, scientific monitoring of California Yellowtail fisheries and populations is inadequate.

-0.25 Management does not explicitly address fishery effects on habitat, food webs, and ecosystems.

-0.25 This species is overfished and no recovery plan or an ineffective recovery plan is in place.

-0.25 Management has failed to reduce excess capacity in this fishery or implements subsidies that result in excess capacity in this fishery.

+0.25 There is adequate scientific monitoring, analysis and interpretation of stock status, catch and fishing effort.

+0.25 **Management explicitly and effectively addresses fishery effects on habitat, food webs, and ecosystems.**

Some marine protected areas have been established in inshore southern California waters, off Baja California, Mexico, and in the Gulf of California, providing to protection to habitats and ecosystems (CDFG 2011bc, SAGARPA 2010). Additionally, in California, gillnets have been banned within 3 nautical miles of mainland California due to seabird and marine mammal bycatch concerns (CDFG 2011c, Larese 2009), and this ban also appear to have helped some near shore fish species recover (Pondella and Allen 2008). However, bycatch in California Yellowtail fisheries is poorly monitored, and ecosystem impacts are not adequately addressed in Mexico fisheries. Points are thus not added.

+0.25 This species is overfished and there is a recovery plan (including benchmarks, timetables and methods to evaluate success) in place that is showing signs of success OR recovery plan is not needed.

+0.25 **Management has taken action to control excess capacity or reduce subsidies that result in excess capacity OR no measures are necessary because fishery is not overcapitalized.**

The California Department of Fish and Game has take action to control excess capacity in the mixed species gillnet fishery, which includes California Yellowtail. No new licenses for this fishery are being granted to limit participation (CDFG 2011c). Participation in the California hook-and-line fishery and in Mexico fisheries however has not been limited. Since actions to control excess capacity have not been taken in all fisheries no points are added.

0.75 Points for Management

BYCATCH

Core Points (only one selection allowed)

Select the option that most accurately describes the current level of bycatch and the consequences that result from fishing this species. The term, "bycatch" used in this document excludes incidental catch of a species for which an adequate management framework exists. The terms, "endangered, threatened, or protected," used in this document refer to species status that is determined by national legislation such as the U.S. Endangered Species Act, the U.S. Marine Mammal Protection Act (or another nation's equivalent), the IUCN Red List, or a credible scientific body such as the American Fisheries Society.

1.00 Bycatch in this fishery is high (>100% of targeted landings), OR regularly includes a "threatened, endangered or protected species."

2.00 Bycatch in this fishery is moderate (10-99% of targeted landings) AND does not regularly include "threatened, endangered or protected species" OR level of bycatch is unknown.

California Yellowtail are captured with both set and drift gillnets and also with hook-and-line. Yellowtail captured with gillnets are captured in conjunction with other species, including white seabass and barracuda. Bycatch information for the set gillnet fishery is available from an intermittent observer program between 1990 and 2006 (Larese 2009). A wide variety of fish and invertebrate species (164+) were recorded as being discarded in this fishery, with the most frequent species being spider crabs (estimated 132,000 discards), bat rays (110,000), and Pacific mackerel (102,000) (Larese 2009). These bycatch estimates are considered to be a minimal estimate because observer coverage was low (8.7% of fishing sets) (Larese 2009). Bycatch for the drift gillnet fishery and the hook and line fishery has not been examined. The drift gillnet fishery may capture a variety of species similar to the set gillnet fishery. Hook-and-line fisheries generally have a low potential for bycatch (Chuenpagdee et al. 2003), and the majority of the bycatch should be able to be released alive.

Various interactions with protected or endangered species, including seabirds, marine mammals, and sharks, have also been recorded in gillnet fisheries, (NMFS 2010). Due to concerns over these interactions gillnets were banned in near shore waters of California in 1994 (Larese 2009, CDFG 2011c). This ban appears to have improved the populations of several near shore species that were on the verge on the collapse, including the white seabass, giant seabass, leopard shark, and soupfin shark (Pondella and Allen 2008). Additionally, both the drift and set gillnet fisheries were upgraded under the Marine Mammal Protection Act in 2009 from a category I listing (fisheries that frequently result in the incidental mortality and/or serious injury of marine mammal species) to a category II listing (fisheries that only occasionally result in the incidental mortality/injury of marine mammal species) (NMFS 2009, 2010). Bycatch of seabirds also appears to be relatively low. In 2007, there was an estimated 22 interactions with Brandt’s cormorants and 1 unidentified cormorant in the set gillnet fishery (Carretta and Enriquez 2009).

However, interactions with white sharks, which are listed as vulnerable by the IUCN (IUCN 2010), are still known to be captured in gillnets (Larese 2009, Lowe et al. 2012). The extent of these interactions remains unclear due to a lack of monitoring.

Overall, the level of bycatch in California Yellowtail fisheries is unknown. Interactions with marine mammals and seabirds appear to be occasional, but the extent and impact of interactions with white sharks in gillnets remains uncertain. A score of 2 is awarded due to a lack of information.

3.00 Bycatch in this fishery is low (<10% of targeted landings) and does not regularly include "threatened, endangered or protected species."

Points of Adjustment (multiple selections allowed)

-0.25 Bycatch in this fishery is a contributing factor to the decline of "threatened, endangered, or protected species" and no effective measures are being taken to reduce it.

-0.25 Bycatch of targeted or non-targeted species (e.g., undersize individuals) in this fishery is high and no measures are being taken to reduce it.

-0.25 Bycatch of this species (e.g., undersize individuals) in other fisheries is high OR bycatch of this species in other fisheries inhibits its recovery, and no measures are being taken to reduce it.

-0.25 The continued removal of the bycatch species contributes to its decline.

+0.25 **Measures taken over a major portion of the species range have been shown to reduce bycatch of "threatened, endangered, or protected species" or bycatch rates are no longer deemed to affect the abundance of the "protected" bycatch species OR no measures needed because fishery is highly selective (e.g., harpoon; spear).**

Gillnets were banned from inshore waters in southern California in 1994 due to marine mammal and seabird bycatch concerns (Larese 2009). Since then, bycatch of these species appears to have been reduced. Bycatch of mammals and seabirds in the California halibut/white seabass set gillnet fishery were reportedly relatively low in 2007 (Carretta and Enriquez 2009), and both the set gillnet and drift gillnet fisheries were recently upgraded under the marine mammal protection act from a category I (fisheries that cause frequent incidental mortalities of marine mammals) to a category II rating (fisheries that cause occasional incidental mortalities of marine mammals) (NMFS 2009, 2010).

Additionally, since 1994 there have been no observations of the critically endangered giant sea bass in the gillnet catch (Larese 2009), and abundance levels of this species now appear to be improving as a result of the inshore gillnet ban (Pondella and Allen 2008). However, some white sharks, which are considered to be vulnerable (IUCN 2010), are still being caught with gillnets (Lowe et al. 2012). Most of the white sharks are assumed

to be released alive, but mortality rates are not known (Lowe et al. 2012). Since the impact of gillnet fisheries interactions with white sharks remains uncertain, no points will be added.

+0.25 **There is bycatch of targeted (e.g., undersize individuals) or non-targeted species in this fishery and measures (e.g., gear modifications) have been implemented that have been shown to reduce bycatch over a large portion of the species range OR no measures are needed because fishery is highly selective (e.g., harpoon; spear).**

Bycatch is poorly monitored in California gillnet and hook-and-line fisheries which capture California Yellowtail, so the level of bycatch remains uncertain. In gillnets fisheries though, a variety of non-target fish and invertebrate species are often captured (Larese 2009). Gillnets were banned from inshore waters in southern California in 1994, and this may have had a positive effect on bycatch rates for some species (Larese 2009). Nearshore fish populations of the giant sea bass, white seabass, leopard shark, and soupfin shark, which were depleted prior to 1994, have been improving since the inshore gillnet ban (Pondella and Allen 2008). However, further monitoring is needed to determine if and how bycatch has changed.

Low numbers of California Yellowtail were recorded as being discarded in the set-gillnet fishery (Larese 2009). Generally larger California Yellowtails, above the legal size, are captured in gillnet fisheries, due to the selectivity of the gear (CDFG 2001).

Due to a lack of information on bycatch levels for non-target species, no points are added.

+0.25 **Bycatch of this species in other fisheries is low OR bycatch of this species in other fisheries inhibits its recovery, but effective measures are being taken to reduce it over a large portion of the range.**

Information on California Yellowtail bycatch in other fisheries is not available.

+0.25 The continued removal of the bycatch species in the targeted fishery has had or will likely have little or no impact on populations of the bycatch species OR there are no significant bycatch concerns because the fishery is highly selective (e.g., harpoon; spear).

2.00 Points for Bycatch

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