# Appendix G. Master List of Species Likely to Benefit from MPAs

The Marine Life Protection Act requires that the Master Plan identify select species or groups of species likely to benefit from MPAs. Species likely to benefit from establishing an MPA are those whose home range, behavior, reproduction, exploitation rate or population status indicates that they may benefit from spatial management. This includes species that are directly targeted by fisheries, those which are caught incidental to fishing for the target species (bycatch) and which cannot be returned to the water with a high rate of survival, and those which may be indirectly impacted through ecological changes within MPAs. A reduction in removal of a species within MPAs has been shown worldwide to increase abundance, mean size, and reproductive potential of certain fished species[1]. These increases are seen primarily in fished species, though other species are also seen to increase.

An equally important consideration of whether a species may benefit is the tendency of individuals of a species, which are at or above harvestable size, to move, either ontogenetically (related to growth) or seasonally (related to spawning or migration cycles). Species with a strong tendency to move will not benefit significantly from the establishment of MPAs unless individual sites are large enough to encompass their entire range of movement. These include pelagic species such as northern anchovy, Pacific sardine, Pacific mackerel, jack mackerel, Pacific herring, and California market squid, highly migratory species such as albacore, tuna (bigeye, bluefin, yellowfin tuna, and skipjack), Pacific bonito, wahoo, opah, dolphin fish, swordfish, and striped marlin, most shark species (with the possible exception of smouthhounds, leopard, and angel sharks), and other migratory species, including chinook and cojo salmon, striped bass, yellowtail, barracuda, Pacific hake, and sablefish. However, establishing MPAs in areas which are known spawning grounds for such species would benefit stocks by allowing successful spawning by those sexually mature individuals which have not been harvested in open fishing areas.

Tables G-1 and G-2 include Californian marine species which are likely to benefit from the establishment of MPAs. The list includes both harvested species and other species that may benefit from MPAs due to reduced bycatch or habitat disturbance or enhanced ecological function due to increased abundance of harvested species. This list will be refined in each regional process to indicate which species are of particular concern and are most necessary to consider in the modification or design of MPAs. The resulting lists of “key species” most likely to benefit in each study region follow the more general list here.

[1] Halpern, B.S. 2003. The impact of marine reserves: do reserves work and does reserve size matter? Ecological Applications 13(1) Supplement: S117-S137.

Table G-1. Finfish Species Likely to Benefit from Marine Protected Areas

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Bass, barred sand | 0-120 | southern California mainland | soft bottom less than 30 ft, eel grass beds | sand bottom | aggregate over sand in summer – early fall for spawning | planktonic | 3-4 weeks | moderate |
| Bass, giant sea | 15-150 | southern California mainland and islands | rocky reefs, kelp beds, sand bottom | rocky reefs, kelp beds, sand flats | aggregate for several months during spawning | planktonic | one month; settle at ~ ¾ in. | moderate |
| Bass, kelp | 0-75 | southern California mainland and islands (uncommon central Calif.) | rocky reefs, kelp beds, eel grass beds | rocky reefs, kelp beds | aggregate in kelp beds and over rocky reefs for spawning in late May- September | planktonic | 28-30 days | moderate |
| Bass, spotted sand | 0-200 | Santa Monica Bay and south | sand, mud, jetties, eel grass beds | soft bottom, kelp forests, eel grass beds, jetties | aggregate near bays to spawn in summer | planktonic | 25-31 days | low |
| Blacksmith | 0-150 | southern California (to Monterey Bay) | rocky reefs | rocky reefs, kelp beds | demersal eggs in nests; defended by male | planktonic | short to moderate | moderate |
| Bocaccio | 0-1050 | All | over hard and soft bottom | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Cabezon | 0-250 | All regions, including islands | rocky reefs, breakwaters, kelp beds, tide pools, open ocean | rocky reefs, kelp beds | eggs adhesive, attach to substrate, often macroalgae | planktonic | 3-4 months | low |
| Chilipepper | 0-1080 | All | soft bottom | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Corbina, California | 0-45 | southern California mainland | soft bottom, nearshore including surf zone | soft bottom, surf zone and bays | growth rate faster in estuaries; spawn offshore | planktonic | short | low |
| Cowcod | 68-1200 | All | soft and hard bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Croaker, black | 0-150 | southern California mainland | soft bottom, nearshore including surf zone | soft bottom, surf zone; occasionally rocky reefs | one of few croakers to prefer rocky reefs and kelp beds | planktonic | short | low |
| Croaker, white | 0-420 | All; most common Point Reyes to Mexico border | near bottom in shallow soft habitat | soft bottom, primarily nearshore and estuaries | schooling; multiple spawning each year; adults in deeper water than juveniles | planktonic; larvae become epibenthic | short | low |
| Croaker, yellowfin | 0-150 | mainland, Pt. Conception south | soft bottom, nearshore and estuaries | soft bottom, beaches and piers, estuaries, kelp beds | spawning primarily in summer | planktonic | short | low |
| Eel, wolf | Intertidal to 600 | northern and central California | pelagic | rocky reefs, kelp beds | not a true eel; spawn Oct.-February | planktonic ? | 1-2 months | moderate |
| Flounder, starry | Shallow - 900 | northern and central California | estuaries and bays, nearshore soft bottom | soft bottom; estuaries and bays to upper slope | spawn near river mouths and in estuaries and bays | planktonic | 25-75 days | moderate |
| Garibaldi | 0-95 | southern California | rocky reefs, kelp beds | rocky reefs, kelp beds | males guard eggs, attached to red algae | planktonic | unknown | low |
| Goby, bluebanded | 0-210 incl. intertidal | southern California (uncommon to Monterey) | rocky reefs | rocky reefs, kelp beds | males guard eggs, attached on brood chambers | planktonic | unknown | low |
| Goby, zebra | Intertidal to 200 | southern California | rocky reefs | rocky reefs, usually in crevices and caves | demersal eggs, attached to roof of shelter | planktonic | unknown | low |
| Greenling, kelp | 0-150 | northern and central California | rocky reefs, kelp beds | rocky reefs, kelp beds | eggs adhere to rocky substrate | planktonic | unknown | moderate |
| Greenling, rock | shallow | northern and central California | rocky reefs, kelp beds | rocky reefs, kelp beds | eggs adhere to rocky substrate | planktonic | unknown | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Grunion, California | 0-60 | southern and central California | sandy nearshore areas | sandy nearshore areas | eggs deposited on sandy beaches; lack filaments | planktonic | low to moderate | moderate |
| Guitarfish, shovelnose | 0-50 | southern and central California | as adults | shallow sand or mud, open coast, bays, and estuaries | live-bearing | benthic | none | moderate |
| Hagfish, Pacific | 30-3096 | All | ? | soft bottom | deposit egg cases | ? | unknown | moderate |
| Halfmoon | 0-130 | southern California | rocky reefs, kelp beds | rocky reefs, kelp beds | regulates kelp growth by grazing | planktonic | unknown | moderate |
| Halibut, California | 0-300 | All | estuaries, shallow open coast soft bottom | estuaries and soft bottom open coast | distribution influenced by El Niño events | planktonic | < 30 days | moderate |
| Jacksmelt | shallow | All | kelp and eel grass beds; sandy beaches; harbors | kelp and eel grass beds; sandy beaches; harbors | eggs with filaments for attachment to eel grass and shallow algal beds | planktonic | low | moderate |
| Lingcod | 0-1400 | All | rocky reefs, kelp beds, hard bottom, soft bottom | rocky reefs, kelp beds, hard bottom, soft bottom | Spawns nearshore on rocky reefs; males guard eggs | planktonic | 3 months | high |
| Lizardfish, California | 5-750 | southern and central California | primarily soft bottom | primarily soft bottom | rest on bottom using pelvic fins | planktonic | unknown | moderate |
| Midshipman, plainfin | 0-1000 | All | soft bottom | soft bottom; spawn on hard substrate | Eggs deposited on rocks and hard substrate | planktonic | unknown | moderate |
| Opaleye | 0-95 | southern and central California | rocky intertidal | rocky reefs, kelp beds | regulates kelp growth by grazing | planktonic | unknown | moderate |
| Pacific ocean perch | 180-2100 | All | midwater over hard bottom | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Pacific pompano (Butterfish) | 30-300 | All | coastal pelagic | coastal pelagic | a schooling species; | planktonic | unknown | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Prickleback, monkeyface | 0-80 | northern and central California | rocky intertidal | rocky reefs, kelp beds | deposit eggs on rocky substrate | planktonic | low | low |
| Prickleback, rock | 0-60 | northern and central California | rocky intertidal | rocky reefs, shallow | deposit eggs on rocky substrate | planktonic | low | low |
| Queenfish | 0-180 | southern and central California | soft bottom | shallow water and sandy bottom; in bays and sloughs | spawn at night from March to September | planktonic | short | moderate |
| Ray, bat | 0-150 | All | shallow soft bottom; bays and estuaries | shallow sandy and rocky areas, including bays and estuaries; kelp beds | live-bearing | miniature adults | none | moderate |
| Rockfish, aurora | 600-1800 | All | soft bottom | hard and soft bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, bank | 102-810 | All | midwater | midwater over hard bottom, drop offs | live-bearing | planktonic | moderate | moderate |
| Rockfish, black | 0-1200 | northern and central California | soft bottom | rocky reefs, kelp forests | live-bearing | planktonic | moderate | moderate |
| Rockfish, black-and-yellow | 0-120 | southern and central California | shallow rocky reefs | shallow rocky reefs, kelp forests | live-bearing | planktonic | Low to moderate | low |
| Rockfish, blackgill | 720-1800 (juv.<660) | All | soft bottom | hard bottom, soft bottom, canyons, steep drop offs | live-bearing | planktonic | moderate | moderate |
| Rockfish, blue | 0-300 | All | rocky reefs, kelp forests, soft bottom | rocky reefs, kelp forests | live-bearing | planktonic | moderate | moderate |
| Rockfish, brown | 0-420 | All | low-relief hard and soft bottom | low-relief hard and soft bottom | live-bearing | planktonic | low to moderate | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Rockfish, calico | 60-840 | southern and central California | soft bottom | hard bottom, sand-rock and mud-rock interface | live-bearing | planktonic | moderate | low |
| Rockfish, canary | 0-900 | northern and central California | soft bottom; sand-rock interface | midwater and near bottom over hard bottom | live-bearing | planktonic | moderate | moderate to high |
| Rockfish, China | 36-420 | northern and central California | rocky reefs | rocky reefs, kelp forests | live-bearing | planktonic | low to moderate | low |
| Rockfish, copper | 0-600 | All | rocky reefs and soft bottom | rocky reefs, kelp forests | live-bearing | planktonic | moderate | low |
| Rockfish, darkblotched | 240-1800 | All | soft bottom | soft and hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, flag | 100-600 | southern and central California | rocky reefs | rocky reefs, canyons | live-bearing | planktonic | Moderate | low |
| Rockfish, freckled | 130-550 | southern California | soft bottom | hard bottom | live-bearing | planktonic | Moderate | low? |
| Rockfish, gopher | 0-180 | southern and central California | rocky reefs | rocky reefs, kelp forests | live-bearing | planktonic | low to moderate | low |
| Rockfish, grass | 0-150 | All | shallow rocky reefs | shallow rocky reefs, kelp forests | live-bearing | planktonic | moderate | low |
| Rockfish, greenblotched | 200-1300 | southern and central California | soft bottom | hard and soft bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, greenspotted | 160-660 | southern and central California | soft bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, greenstriped | 200-1320 | All | soft bottom | low relief hard bottom, soft bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, halfbanded | 192-1320 | southern and central California | soft bottom | low relief hard and soft bottom, cobble | live-bearing | planktonic | moderate | moderate |
| Rockfish, honeycomb | 90-250 | southern California | soft bottom | hard bottom | live-bearing | planktonic | moderate | |
| Rockfish, kelp | 0-150 | southern and central California | kelp forests and rocky reefs | kelp forests | live-bearing | planktonic | moderate | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Rockfish, Olive | 0-480 | southern and central California | kelp forests, soft bottom | rocky reefs, kelp forests | live-bearing | planktonic | moderate | low |
| Rockfish, pink | 250-1200 | southern and central California | soft bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, pinkrose | 325-960 | southern and central California | soft bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, quillback | 75-900 | northern and central California | rocky reefs | rocky reefs | live-bearing | planktonic | moderate | low |
| Rockfish, redbanded | 300-1560 | All | soft bottom | soft and hard bottom | live-bearing | planktonic | moderate | low |
| Rockfish, redstripe | 300-1200 | northern and central California | hard bottom | hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, rosethorn | 390-1800 | northern and central California | soft and hard bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, rosy | 50-420 | All | soft and hard bottom | hard bottom | live-bearing | planktonic | moderate | low |
| Rockfish, sharpchin | 300-1050 | All | hard bottom | hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, shortbelly | 0-930 | All | midwater over hard bottom | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, speckled | 100-1200 | All | hard bottom | hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, splitnose | 700-1560 | All | soft bottom | hard bottom, canyons | live-bearing | planktonic | moderate | moderate |
| Rockfish, squarespot | 60-600 | All | hard bottom | hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, starry | 80-900 | southern and central California | hard bottom | hard bottom | live-bearing | planktonic | moderate | low |
| Rockfish, stripetail | 192-1320 | All | soft bottom | soft and hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, swordspine | 250-1420 | southern and central California | soft bottom | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, tiger | 200-900 | northern and central California | hard bottom | hard bottom | live-bearing | planktonic | moderate | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Rockfish, treefish | 0-150 | southern and central California | rocky reefs | rocky reefs, kelp forests | live-bearing | planktonic | moderate | low |
| Rockfish, vermilion | 0-900 | All | soft and hard bottom | wide depth range, rocky reefs, kelp forests, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, widow | 0-1200 | All | midwater over hard bottom | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Rockfish, yelloweye | 150-1200 | northern and central California | rocky reefs | hard bottom, canyons | live-bearing | planktonic | moderate | low |
| Rockfish, yellowtail | 0-1800 | All | midwater | midwater over hard bottom | live-bearing | planktonic | moderate | moderate |
| Sanddab, Pacific | 30-1800 | All | soft bottom | soft bottom | may spawn twice a year | planktonic | unknown | moderate |
| Sargo | 0-130 | southern California | rocky reefs, kelp beds, sand | rocky reefs, kelp beds, sand bottom | broadcast spawners | planktonic | unknown | moderate |
| Scorpionfish, California | 0-600 | southern California | reef systems | hard and soft bottom | adults aggregate in 12 to 360 feet to spawn; eggs released in gelatinous masses that float to surface | planktonic | unknown | low |
| Sculpin, staghorn | 0-300 | All | soft bottom, estuaries | soft bottom, estuaries | abundant in San Francisco estuary | planktonic | unknown | moderate |
| Seabass, white | 0-400 | southern and central California occurs farther north during El Niño events | sandy area, estuaries, piers, jetties, kelp beds | kelp beds. rocky reefs, offshore banks, open ocean | adults aggregate in spring-summer during spawning | planktonic | | high |
| Shark, brown smoothhound | 0-360 | All | bays and estuaries | soft bottom, bays and estuaries, nearshore | live-bearing | miniature adults | zero | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Shark, gray smoothhound | 0-150 | All | bays and estuaries | soft bottom, bays and estuaries, nearshore | live-bearing | miniature adults | zero | moderate |
| Shark, horn | 0-492 | southern California | rocky reefs, kelp beds | rocky reefs, kelp beds | lay egg cases | miniature adults | zero | moderate |
| Shark, leopard | 0-300 | All | enclosed bays and sloughs; kelp beds; shallow sandy areas | enclosed bays and sloughs; kelp beds; shallow sandy areas near reefs | aggregate in very shallow water to release young; live-bearing | miniature adults | zero | moderate |
| Shark, Pacific angel | 3-600 | southern and central California | flat, sandy bottoms; | flat, sandy bottoms; sand channels between reefs | live-bearing | miniature adults | zero | moderate |
| Sheephead, California | 0-180 | southern and central California | rocky reefs, kelp beds | rocky reefs, kelp beds | changes sex from female to male with size | planktonic | unknown | low |
| Skate, big | 10-360 | northern and central California | soft bottom | soft bottom, occasionally rocky reefs | young hatch from eggs in cases | miniature adults | zero | moderate |
| Skate, California | 60-2200 | All | soft bottom | soft bottom | young hatch from eggs in cases | miniature adults | zero | moderate |
| Skate, longnose | 180-2040 | All | soft bottom | soft bottom | young hatch from eggs in cases | miniature adults | zero | moderate |
| Smelt, night | 0-420 | northern and central California | soft bottom | shallow sandy coastal areas | spawn in surf zone at night | planktonic | low to moderate | moderate |
| Smelt, surf | shallow | northern and central California | soft bottom | shallow sandy coastal areas | spawn in surf zone in daytime | planktonic | low to moderate | moderate |
| Smelt, whitebait | 0-180 | northern and central California | soft bottom | shallow sandy coastal areas, bays, and estuaries | spawn in sandy subtidal areas | planktonic | low to moderate | moderate |
| Sole, Dover | 60-3000 | All | soft bottom, deep water | soft bottom, deep water | a portion of the stock migrates | planktonic | at least 1 year | moderate |
| Sole, English | 60-1000 | All | soft bottom, shelf | soft bottom | migrates, spawns at 200-360 ft | planktonic | 6-10 weeks | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Sole, petrale | 60-1500 | All | soft and hard bottom, shelf | soft and hard bottom, shelf | migrates, spawns at 900-1200 ft | planktonic | unknown | moderate |
| Sole, rex | 60-2100 | All | Soft bottom, shelf and slope | soft bottom, shelf and slope | spawns at 300-900 ft | planktonic | at least 1 year | moderate |
| Sole, rock | 50-1200 | northern and central California | soft and hard bottom, shelf | soft and hard bottom, shelf | one of few flatfishes found on rocky bottom | planktonic | unknown | moderate |
| Sole, sand | 5-312 | northern and central California | Soft bottom, nearshore, estuaries | soft bottom, nearshore | one of few medium-large flatfish found inshore | planktonic | unknown | moderate |
| Sole, slender | 250-1700 | All | soft bottom, shelf and slope | soft bottom, shelf and slope | relatively abundant offshore species | planktonic | moderate | moderate |
| Surfperch, barred | 0-240 | southern and central California | beaches | beaches | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, black | 0-130 | All | rocky reef, kelp beds | rocky reef, kelp beds | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, calico | 0-30 | All | beaches | beaches | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, pile | 0-150 | All | rocky reefs, kelp beds, soft bottom | rocky reefs, kelp beds, soft bottom | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, rainbow | 0-130 | All | rocky reef, kelp beds | rocky reef, kelp beds | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, redtail | 0-60 | northern and central California | beaches | beaches | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, rubberlip | 0-150 | All | rocky reefs, kelp beds, soft bottom | rocky reefs, kelp beds, soft bottom | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, shiner | 0-480 | All | estuaries, soft bottom, kelp beds, rocky reef | estuaries, soft bottom, kelp beds, rocky reef | bear live, free-swimming young | not applicable | not applicable | moderate to high(?) |
| Surfperch, striped | 0-55 | All | rocky reef, kelp beds | rocky reef, kelp beds | bear live, free-swimming young | not applicable | not applicable | moderate |
| Surfperch, walleye | 0-60 | All | beaches | beaches | bear live, free-swimming young | not applicable | not applicable | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Surfperch, white | 0-140 | All | rocky reefs, kelp beds, soft bottom | rocky reefs, kelp beds, soft bottom | bear live, free-swimming young | not applicable | not applicable | moderate |
| Thornyhead, longspine | 1090-5000 | All | deep hard and soft bottom | deep hard and soft bottom; slope | lack swim bladder; may survive after being brought to surface and released; spawn gelatinous floating egg masses | planktonic | unknown | moderate to high |
| Thornyhead, shortspine | 84-5000+ | All | deep hard and soft bottom | deep hard and soft bottom; slope | lack swim bladder; may survive after being brought to surface and released; spawn gelatinous floating egg masses | planktonic | unknown | moderate to high |
| Tomcod, Pacific | 0-720 | northern and central California | unknown | soft bottom | broadcast spawners; high fecundity | planktonic | unknown | moderate |
| Topsmelt | shallow | All | kelp and eel grass beds; sandy beaches, harbors | kelp and eel grass beds; sandy beaches, harbors | spawns in eel grass and algal beds, possibly kelp beds; eggs attach to spawning substrate by adhesive filaments | planktonic | low | moderate |
| Turbot, C-O | shallow-966 | All | rocky reef, sand; shelf | rocky reef, sand; shelf | one of few flatfishes to occur in kelp beds | planktonic | unknown | moderate |
| Turbot, curlfin | 25-1146 | All | soft bottom | soft bottom; shelf | small mouth; difficult to catch with hook-and-line | planktonic | unknown | moderate |
| Whitefish, ocean | 0-300 | southern and central California | unknown | midwater over hard and soft bottom | responds favorably to El Niño conditions | planktonic | unknown | moderate |

Table G-2. Invertebrate, Alga, and Plant Species Likely to Benefit from Marine Protected Areas

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| **Invertebrates** | | | | | | | | |
| Abalone, black | Intertidal | southern and central California | crevices in rocky reefs, kelp beds | rocky reefs, kelp beds | susceptible to withering syndrome disease | planktonic | 4-7 days | low |
| Abalone, flat | 20-70 | All regions, including islands | crevices in rocky reefs, kelp beds | rocky reefs, kelp beds | generally a cryptic species | planktonic | 4-7 days | low |
| Abalone, green | subtidal To 20 | South, mainland and islands | crevices in rocky reefs, kelp beds | rocky reefs, kelp beds | feed on drift algae | planktonic | 4-7 days | low |
| Abalone, pink | 20-120 | South, mainland and islands | crevices in rocky reefs, kelp beds. rock outcrops | rocky reefs, kelp beds. rock outcrops | generally occurs where water temp is above 14 C | planktonic | 4-7 days | low |
| Abalone, pinto | subtidal to 70 | northern and central California | crevices in rocky reefs, kelp beds | rocky reefs, kelp beds | commonly found at approx. 4-inch length | planktonic | 4-7 days | low |
| Abalone, red | Intertidal to 80 | All regions, including islands | crevices in rocky reefs, kelp beds, boulder outcrops, under canopy of red urchins | rocky reefs, kelp beds, boulder outcrops | largest abalone species in the world | planktonic | 4-7 days | low |
| Abalone, threaded | 20-80 | South, mainland and islands | crevices in rocky reefs, kelp beds | rocky reefs, kelp beds | some consider it a subspecies of Pinto abalone | planktonic | 4-7 days | low |
| Abalone, white | 80-200 | South, mainland and islands | exposed rocky areas | exposed rocky areas | maximum age estimated at 40 years | planktonic | 4-7 days | low |
| Clam, California jackknife | Intertidal to | South, mainland and islands | sandy mud, estuaries | sandy mud, estuaries | occupies a permanent burrow | planktonic | unknown | low |
| Clam, chione (several species) | Intertidal to 165 | South, mainland and islands | mud, sand, estuaries | mud, sand, estuaries | smooth chione subject to habitat loss due to harbor development | planktonic | unknown | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Clam, gaper (several species) | Intertidal to 150 | All regions | sand, sand/mud, estuaries | sand, sand/mud, estuaries | may live to 17 years | planktonic | unknown | low |
| Clam, geoduck | 0-360 | All regions | sand/mud, estuaries | sand/mud, estuaries | individuals may exceed 10 pounds | planktonic | 2 weeks | low |
| Clam, littleneck (several species) | Intertidal | All regions, including islands | cobble beds | cobble beds | prized food item | planktonic | unknown | low |
| Clam, Manila | Intertidal | All regions | sand/mud, estuaries | sand/mud, estuaries | introduced from Japan; important recreational species | planktonic | 3 weeks | low |
| Clam, Pismo | Intertidal to 80 | southern and central California | exposed sand | exposed sand | primary prey item of California sea otters | planktonic | pelagic phase 2-3 days | low |
| Clam, razor | Intertidal and shallow subtidal | northern and central California | exposed sand | exposed sand | individuals can bury themselves in 7 seconds | planktonic | 8 weeks | low |
| Clam, softshell | Intertidal | northern and central California | mud | mud | may have been introduced with eastern oyster | planktonic | unknown | low |
| Clam, Washington (several species) | Intertidal to 100 | All regions | sand/mud, estuaries | sand/mud, estuaries | known to concentrate paralytic shellfish poisoning toxin | planktonic | 4 weeks | Low |
| Cockles | Intertidal to 660 | All regions, including islands | sand, sand/mud, mud, estuaries | sand, sand/mud, mud, estuaries | one species may live to 16 years | planktonic | unknown | Low |
| Crab, box | 0-1800 | All regions, including islands | rocky reef, submarine canyons | rocky reef, submarine canyons | unknown | planktonic | unknown | unknown |
| Crab, brown rock | 0-300 | All regions, including islands | rocky reefs, kelp beds, | rocky reefs, kelp beds, | rock crabs may live 5-6 years | planktonic | 3-4 months | moderate |
| Crab, Dungeness | 0-300 | northern and central California | sand, sand-mud, estuaries | sand, sand-mud | larvae may be trans-ported more than 50 miles offshore | planktonic | 105-125 days | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| **Crab, red rock** | 0-750 | All regions, including islands | rocky reefs, submarine canyons | rocky reefs, submarine canyons | may co-occur with spot prawns | planktonic | 3-4 months | moderate |
| Crab, sand | Intertidal | All regions, including islands | intertidal, shallow subtidal sand | intertidal, shallow subtidal sand | larvae may occur with Dungeness crab larvae | planktonic | unknown | low |
| Crab, spider (sheep crab) | 20-410 | southern California | rocky reefs, kelp beds | rocky reefs, kelp beds | cease molting after reaching maturity | planktonic | unknown | moderate-high |
| Crab, yellow rock | 0-300 | southern California | sand, soft bottom | sand, soft bottom | egg-bearing females may congregate in rock-sand interface habitat | planktonic | 3-4 months | moderate |
| Cucumber, sea (several species) | 0-300 | All regions, including islands | rocky reefs, sand/mud | rocky reefs, sand/mud | do not form spawning aggregations | planktonic | 51-91 days | low |
| Limpets | Intertidal to 100 | All regions, including islands | rocky reefs | rocky reefs | some species may live 15 years | planktonic | less than 1 week | Low |
| Lobster, California | 0- 240 | South, mainland and islands | surf grass beds | rocky reef, kelp beds, eel grass beds | egg-bearing females generally found in shallow water | planktonic | 5-9 months | moderate-high |
| Mussels (several species) | Intertidal to 130 | All regions, including islands | rocky reefs, pilings | rocky reefs, pilings | bioaccumulator of toxins. | planktonic | 1 month | Low |
| Octopus (several species) | Intertidal to 660 | All regions, including islands | rocky reefs, kelp beds, soft bottom | rocky reefs, kelp beds, soft bottom | eggs are attached to substrate and brooded by females | planktonic | 1 month or less | Low |
| Prawn, ridgeback | 145-525 | South; mainland and islands | sand, shell, green mud | sand, shell, green mud | positive response to El Niño conditions | planktonic | unknown | low |
| Prawn, spot | 150-1,600 | All regions, including islands | shallower mud, mud-sand, sand/rock. rocky reef, submarine canyons | mud, mud-sand, sand/rock. rocky reef, submarine canyons | change sex from male to female during year 4 | planktonic | unknown | moderate |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Scallop, rock | Intertidal to 100 | All regions, including islands | rocky reefs, pier pilings, rock jetties | rocky reefs, pier pilings, rock jetties | intolerant of salinity less than 25 ppt | planktonic | 5 weeks | Low |
| Sea hare (two species) | 0-60 | southern and central California | hard and soft bottom, kelp beds | hard and soft bottom, kelp beds | large nerve ganglia make them useful for research | planktonic | 4-5 weeks | Low |
| Sea stars (many species) | Intertidal to deepest canyons | All regions, including islands | rocky reefs, hard bottom, sand | rocky reefs, hard bottom, sand | some species adapted to exposure at low tides | planktonic | unknown | Low |
| Shrimp, bay (several species) | 0-575 | All regions | soft bottom, estuaries | soft bottom, estuaries | major prey item for fishes | planktonic | 30-40 days | low-moderate |
| Shrimp, coonstripe | 60-600 | northern and central California | sand, gravel, rocky reef, submarine canyon | sand, gravel, rocky reef, submarine canyon | change sex from male to female during year 1 or 2 | planktonic | unknown | moderate |
| Shrimp, ghost and mud shrimp (several species) | Intertidal | All regions | sand, sand/mud, sand/ gravel | sand, sand/mud, sand/gravel | form permanent burrows or impermanent tunnels | planktonic | unknown | low |
| Shrimp, ocean | 150-1200 | northern and central California: Oregon border to Pt. Arguello | green mud, mud-sand | green mud, mud-sand | change sex from male to female during year 2 | planktonic | 2.5 to 3 months | moderate |
| Snail, moon | Intertidal to 500 | All regions, including islands | soft bottom | soft bottom | has aquiferous system of spongy sinuses in foot | planktonic | 2 weeks | low |
| Snail, top (several species) | 0-100 | southern California | rocky reefs, kelp beds, including canopy | rocky reefs, kelp beds, including canopy | common in upper kelp canopy | planktonic | unknown | low |
| Snail, turban (several species) | Intertidal to 250 | All regions, including islands | shallower rocky reefs, kelp beds, including canopy | rocky reefs, kelp beds, including canopy | feeds primarily on kelp and coralline algae | planktonic | unknown | low |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Squid, market | 0 to at least 600 | southern and central California | over soft bottom | over soft bottom | short-lived; average squid in commercial fishery is ½ year old. | planktonic | unknown | high |
| Urchin, purple | 0-300 | All regions, including islands | rocky reefs, kelp beds, under canopy of adults | rocky reefs, kelp beds | require high densities for successful spawning | planktonic | 6-8 weeks | low |
| Urchin, red | Intertidal to 400 | All regions, including islands | rocky reefs, kelp beds, under canopy of adults | rocky reefs, kelp beds | require high densities for successful spawning | planktonic | 6-8 weeks | low |
| Urchin, white | 0-990 | South, including islands | sand, eel grass beds | sand, eel grass beds | extremely efficient grazers on smaller algaes | planktonic | 30-60 days | low |
| Whelk, Kellet's | 0-230 | South, including islands | rocky reefs, kelp beds, gravel, sand | rocky reefs, kelp beds, gravel, sand | spawning aggregations of up to 20 individuals occur in spring | planktonic | unknown | low |
| Worms (polychaetes) | Intertidal to deepest canyons | All | rocky reefs in mussel beds, cobble beds, soft bottom | rocky reefs in mussel beds, cobble beds, soft bottom | several species have toothed proboscis | planktonic | variable | low |
| **Algae and Plants** | | | | | | | | |
| *Gelidium* sp. (many species) | Intertidal, to 100 | All regions, including islands | rocky reefs | rocky reefs | may forms mats of algal turf | not applicable | not applicable | none |
| *Gracilaria* sp. (many species) | Intertidal to 50 | All regions, including islands | soft bottoms | soft bottoms | used as spawning substrate by herring in SF Bay | not applicable | not applicable | none |
| Kelp, bull | 10-70 | northern and central California | on rock or cobble substrate | on rock or cobble substrate | found where water temp is < than 60 F | not applicable | not applicable | none |
| Kelp, giant | 20-120 | southern and central California | on sand and rock substrate | on sand and rock substrate | fronds may grow up to 24 inches per day | not applicable | not applicable | none |
| *Porphyra* sp. (many species) | Intertidal to 100 | All regions, including islands | rocky reefs | rocky reefs | may be common in high-energy surf zones | not applicable | not applicable | none |

| Species | Primary depth range (ft.) | Primary geographic range within state | Habitat preference juveniles | Habitat preference adults | Unique or significant life-history characteristics | Larval type | Larval duration [potential dispersal] | Potential for adult dispersal |
|---|---|---|---|---|---|---|---|---|
| Sea palm | Intertidal | northern and central California | exposed rocky reefs | exposed rocky reefs | individuals can regenerate blades but not stipe. | not applicable | not applicable | none |
| *Zostera marina* (eel grass) | 5-20 | All regions including islands | shallow sheltered mud and sand | shallow sheltered mud and sand | flowering plant | not applicable | not applicable | none |

## Some Key Species Likely to Benefit from MPAs in the Central Coast Study Region

Introduction:

The Marine Life Protection Act [Section 2856(a)(2)(B)] calls for "An identification of select species or groups of species likely to benefit from MPAs". Well-designed MPAs could result in population-level effects, deemed to be beneficial to certain species or groups of species. These might include: 1) increases in abundance, 2) changes in population size structure resulting from increases in the number of individuals living to achieve larger body sizes and older ages, 3) increases in reproductive output due to the increased abundance of larger, older individuals. At the multi-species community level, well-designed MPAs could result in changes in community-level parameters over time, such as diversity and structure (defined as the result of species present in the community and their abundances), which can be distinguished from those occurring in non-MPAs. These changes might result in differences in community functions among MPAs and other areas.

It is important to note that not all MPAs in all areas will necessarily have all of these results. The overall benefit to any individual species will necessarily depend upon the final MPA design. Additionally, not all individual MPAs or groups of MPAs will necessarily lead to benefits for all species. A variety of design considerations must be taken into account when developing MPAs in order to maximize the potential benefits to the broadest range of species.

In this section, the criteria, discussion, and resultant list focus on some individual species that may benefit from MPAs. While this discussion and criteria consider the current status of species, they are not intended to explain how MPAs might be used as a fisheries management tool. Although MPAs may assist with rebuilding of depleted populations, current fisheries management strategies and rebuilding plans may achieve the same results with regards to single stock management. The goals and objectives of the Marine Life Protection Act primarily address protection of habitats, natural heritage, diversity, and abundance, and do not specifically consider fisheries management.

Discussion:

This list of some key species likely to benefit may be useful for designing MPAs and in the evaluation of MPAs. It is expected that the development of such a list be a dynamic process and subject to change as new information on the effects of MPAs and on species status becomes available. By definition, the primary change due to the establishment of an MPA (whether a reserve, park, or conservation area) is a reduction in take. Those species likely to benefit **directly** by a decrease in the level of harvest are those that are targeted by fisheries, as well as those that are caught incidentally to fishing for the target species (i.e., bycatch) and cannot be successfully returned to the water following capture. It is expected that species likely to benefit will be afforded some degree of reduced mortality within the MPAs and that the local population within an MPA will experience increased survivorship, increased growth, and/or larval production within the MPAs. These benefits may or may not transfer to this species in other areas, depending on the amount of spill over (transport of new recruits or adults beyond the range of the MPA) and on existence of nearby sinks (that is, loss of individuals due to increased mortality in certain areas).

**Direct** benefits of MPAs may also accrue for seabirds, turtles, and marine mammals (pinnipeds and whales). For instance, aside from fish species, bycatch in some fisheries also includes species of turtles, marine mammals, and seabirds. Other human impacts include vessel activities (e.g., noise, motion, lights) in areas surrounding seabird breeding colonies and marine mammal rookeries, and inadvertent entanglement in associated gear. Decreasing or eliminating such disturbance, harassment, and other negative interactions within an MPA will reduce mortality of these species.

Besides impacting particular species, fishing **indirectly** can cause changes to the function of communities and ecosystems. For example, because large predators (e.g., yelloweye rockfish, bocaccio) often are the targets of fisheries, restricting harvest within an MPA likely will change the trophic dynamics (both predator and competitive interactions) of the system. Similarly, the abundance of macroalgae and sea grasses can be strongly affected by **indirect** species interactions that differ between MPAs and non-MPAs. In addition, species that already are fully protected (e.g., Marine Mammal Protection Act, Endangered Species Act, etc.) could be afforded additional **indirect** benefit from MPAs. For example, sea otters, pinnipeds, and some seabirds prey on some of those species (e.g., abalone, urchins, rock crabs, squid, and young rockfish) that could be expected to increase in size and abundance with increased protection of an MPA. It should be noted, however, that some of these top predators (i.e., sea otters) may locally reduce or prevent any realized gain in their prey species within an MPA.

Foraging seabirds and marine mammals can congregate at prey aggregations that are associated with hydrographic (e.g., fronts and eddies) and topographic features (e.g., seamounts, submarine canyons, promontories). These areas have been suggested to serve as “refugia” for top predators during periods of reduced food due to climate variability (e.g., El Niño). Parts of the Monterey Canyon, for example, are persistent foraging sites for many seabird and marine mammal assemblages. Some seabirds and mammals persistently forage near and downstream from upwelling centers, many located near coastal promontories along the California coastline. Affording MPA status to such areas could benefit all such predators.

Reduction in fishing effort by some specific gears within an MPA can also reduce or eliminate disturbance or destruction of the biological and physical structural components of benthic habitats, thereby **indirectly** benefiting those organisms associated with such habitats. Because change to ecosystem function can be complex, usually is not well documented, and therefore is not entirely understood, it is difficult to surmise all species that may **indirectly** benefit (or alternately suffer loss) from increased protection within MPAs. In addition, the species likely to benefit (and the magnitude of those benefits) will vary from place to place and will be dependent on local conditions.

Proposed List:

Table G1 includes a draft list of some key central coast species most likely to benefit from MPAs. Species that occur in the central coast study region were included on this list primarily based on the extent of their adult mobility or dispersal, on their persistent use of specific sites to forage, grow, or breed, on certain life history characteristics that contribute to a species vulnerability to depletion, and on the status and trend of their population size.

The extent of movement of individual species generally changes among larval, juvenile, and adult life stages, and can influence how much protection that species receives from an MPA network. Many species in the central coast area have pelagic larval stages that disperse during several weeks to months, potentially over broad geographic areas, before settling to benthic habitats. Some of these species move from shallow water as juveniles to deeper depths as adults. Some species, such as squid, leopard sharks, and lingcod, exhibit seasonal patterns in movement that often are related to reproduction and/or feeding. MPAs are likely to have their greatest direct benefits on residential species. In general, MPAs offer direct protection to less mobile or sedentary species that locally aggregate in specific habitats (e.g., many of the rockfish species); these species can be especially vulnerable to local depletion by fisheries that target their specific habitats.

Mobile seabird and marine mammal species that breed and/or forage persistently in specific areas along the central coast also are included on this list. Mobile pelagic species (e.g., northern anchovy, Pacific sardine, salmon, herring etc.) represent a critical forage component in the central California coastal ecosystem, and protection afforded such species in an MPA could affect local ecosystem function. However, these pelagic species are less likely to benefit directly from the establishment of MPAs unless the size of the MPA encompasses their range of movement or the MPA is located to protect critical life stages (i.e., spawning or feeding aggregations, nursery grounds). For example, some salmon stocks can benefit from protection as they aggregate to spawn in areas near river mouths, and the herring fishery is highly regulated in their spawning areas in California bays.

Direct benefits of MPAs are expected to be much reduced for highly migratory species (e.g., swordfish, tunas, some sharks) that likely spend relatively little time inside local coastal MPAs. Protection of these mobile species and their contributions to local marine ecosystems may best be addressed by larger-scale regulatory measures.

Summary:

One or more of the following criteria were used in identifying some key species most likely to benefit in the central coast region. Note that this list is not exhaustive and other criteria may be appropriate. The individual criteria in the attached table are not additive within each species; that is, all criteria are not equally weighted in importance when considering potential MPA benefits for these species:

- Species occurs on the central coast
- Species is either directly or indirectly affected by take
- Species has small-to-moderate adult neighborhood size (e.g., small = 0-5 km; moderate = 10-20 km) and moderate-to-large take (either current or historic take).

- Species population trend, stock size, or status is known to have declined or been reduced.
- Species has unknown population size or status, but shares life history traits and/or co-occurs with species of low or declining status.
- Species has particular life stage (e.g., uses persistent breeding, foraging, or nursery areas) amenable to spatial management
- Species size structure has shifted towards smaller individuals.
- Species habitat is vulnerable to disturbance
- Species of particular ecological significance (e.g. kelp, sea otter, etc.)

For each of the above, a “1” in the following table means that species meets the criterion, a “0” means it does not meet the criterion, and “ND” means there is no data available. Comments about particular criteria or data sources are included where appropriate.

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | "ND" = No data | |
| **Invertebrates** | | | | | | | | | | | | | |
| black abalone | Rock | Intertidal | 20 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | Only benefit in areas absent of sea otters |
| brown rock crab | Both | 0 | >330 | 1 | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | Only benefit in areas absent of sea otters |
| corals | Rock | 40 | >500 | 1 | 0 | 0 | ND | ND | 1 | 0 | 1 | 1 | Possible impacts from trawling or other bottom contact |
| Dungeness crab | Sand | 0 | 755 | 0 | 1 | 1 | ND | 0 | 0 | 0 | 0 | 0 | Due to management regime, no size shift |
| ghost shrimp | Sand | Intertidal | 1 | 1 | 1 | 0 | ND | ND | 0 | 0 | 1 | 0 | fish bait |
| gorgonians | Rock | 40 | >500 | 1 | 0 | 0 | ND | ND | 1 | 0 | 1 | 1 | Possible impacts from trawling or other bottom contact |
| limpets | Rock | Intertidal | 98 | 1 | 0 | 0 | ND | 1 | 0 | 0 | 1 | 1 | removal impacts other species |
| littleneck clams | Coarse Sand | Intertidal | Inter-tidal | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 0 | |
| market squid | Pelagic/ Sand | | | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 1 | Both forage species and predators on small fishes |
| moon snail | Sand | Intertidal | 499 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 0 | |
| mud shrimp | Sand | Intertidal | 1 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 0 | |
| mussels | Rock | Intertidal | 131 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 1 | removal impacts other species |
| Pismo clam | Sand | 0 | 82 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | very slow growing adults, long lived, 50 years, Only benefit in areas absent of sea otters |
| purple urchin | Both | 0 | 302 | 1 | 0 | 0 | ND | ND | 0 | 0 | 0 | 1 | Only benefit in areas absent of sea otters, removal impacts other species |
| red abalone | Rock | Intertidal | 200 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | short-lived, non-feeding larval stage, Only benefit in areas absent of sea otters |
| red rock crab | Both | 0 | 750 | 1 | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | Only benefit in areas absent of sea otters |
| red urchin | Both | Intertidal | 295 | 1 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 1 | Only benefit in areas absent of sea otters, removal impacts other species |
| rock scallop | Rock | 0 | 98 | 1 | ND | ND | ND | ND | 1 | 0 | 0 | 0 | Evidence of positive impact in So. Cal reserves |
| sand crab | Sand | Intertidal | 1 | 1 | 0 | 0 | ND | ND | 0 | 0 | 0 | 0 | |
| sea hares | Both | 0 | 59 | 1 | 0 | 0 | ND | ND | 0 | 0 | 0 | 0 | |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sea pens | Sand | 25 | >300 | 1 | 0 | 0 | ND | ND | 1 | 0 | 1 | 1 | Possible impacts from trawling or other bottom contact |
| sea stars | Both | Intertidal | >600 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 1 | Keystone species in intertidal |
| sponges | Rock | Intertidal | >2000 | 1 | 0 | 0 | ND | ND | 1 | 0 | 1 | 1 | Possible impacts from trawling or other bottom contact |
| spot prawn | Sand/Interface | 150 | 1600 | 1 | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | |
| turban snail | Rock | Intertidal | 249 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 0 | |
| worms | Both | Intertidal | >600 | 1 | 0 | 0 | ND | ND | 0 | 0 | 1 | 0 | |
| **Plant and Algae** | | | | | | | | | | | | | |
| bull kelp | Rock | 1 | 59 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| eel grass | Sand | 1 | 10 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | |
| giant kelp | Rock | 20 | 121 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| other intertidal algal species | Rock | Intertidal | Intertidal | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | |
| rock weeds | Rock | Intertidal | Intertidal | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | |
| sea palm | Rock | Intertidal | Intertidal | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | |
| **Fishes** | | | | | | | | | | | | | |
| aurora rockfish | Sand/ Rock | 266 | 2930 | ND | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| bank rockfish | Rock | 102 | 1489 | ND | 1 | 1 | ND | 1 | 1 | 0 | 0 | 0 | declines in pop size and age/length in fishery |
| barred surfperch | Sand | 0 | 240 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | piers;jetties;sandy beaches |
| bat ray | Sand/ Rock | 0 | 354 | 0 | 1 | 0 | ND | ND | 1 | 1 | 1 | 1 | aggregate to spawn and breed inshore. Very often in the sandy areas in kelp beds, between the rocks. Top predator. Digging in sand has profound impact on invertebrate community. |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| big skate | Sand | 7 | 2624 | 0 | 0 | 0 | ND | ND | 1 | 0 | 0 | 0 | low fecundity |
| black rockfish | Rock | 0 | 1200 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | Per Steve Ralston, CA population likely below 40% |
| black surfperch | Rock | 0 | 150 | 1 | 1 | 1 | ND | ND | 1 | 0 | 1 | 0 | piers; jetties; estuaries; kelp; low fecundity |
| black-and-yellow rockfish | Rock | 0 | 120 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| blackgill rockfish | Rock | 289 | 2520 | ND | 1 | 1 | 0 | ND | 1 | 0 | 0 | 0 | |
| blue rockfish | Rock | 0 | 1800 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | filter barnacle larvae (Gaines and Roughgarden) |
| bocaccio | Rock | 0 | 1578 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | Top predator; adults with low movement. declining lengths in central CA CPFV (Mason 1998) |
| bronzespotted rockfish | rock | 246 | 1354 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| brown rockfish | Rock | 0 | 480 | 1 | 1 | 1 | ND | 0 | 1 | 0 | 0 | 0 | locally important species in places like SF Bay since 1850 |
| brown smoothhound | Sand | 0 | 922 | 0 | 1 | 0 | ND | ND | 1 | 1 | 1 | 0 | inshore nursery |
| cabezon | Rock | 0 | 360 | 1 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| calico rockfish | Rock | 0 | 1000 | 1 | 0 | 0 | ND | ND | 1 | 0 | 0 | 0 | |
| California halibut | Sand | 1 | 922 | 0 | 1 | 1 | 0 | ND | 0 | 1 | 0 | 0 | nursery and spawning aggregations |
| California skate | Sand | 43 | 5248 | 0 | 0 | 0 | ND | ND | 1 | 0 | 0 | 0 | |
| canary rockfish | Rock | 0 | 1440 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | declining lengths in central CA CPFV (Mason 1998) |
| chilipepper rockfish | rock | 0 | 1611 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | declining lengths in central CA CPFV (Mason 1998) |
| china rockfish | rock | 10 | 420 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| copper rockfish | Rock | 0 | 607 | 1 | 1 | 1 | ND | 1 | 1 | 0 | 0 | 0 | |
| cowcod | Rock | 132 | 1610 | 1 | 0 | 1 | 1 | ND | 1 | 0 | 0 | 1 | |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| darkblotched rockfish | Both | 95 | 2985 | 1 | 1 | 1 | 1 | ND | 1 | 0 | 0 | 0 | |
| Dover sole | Sand | 7 | 4500 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| English sole | Sand | 0 | 1800 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| flag rockfish | Rock | 100 | 1371 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| gopher rockfish | Rock | 0 | 282 | 1 | 1 | 1 | 0 | ND | 1 | 0 | 0 | 0 | |
| grass rockfish | Rock | 0 | 150 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| greenblotched rockfish | Rock | 180 | 1610 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| greenspotted rockfish | Both | 98 | 1243 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| greenstriped rockfish | Sand/ Interface | 39 | 3756 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| kelp greenling | Rock | 0 | 426 | 1 | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | |
| kelp rockfish | Rock | 0 | 190 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| leopard shark | Sand | 0 | 515 | 0 | 1 | 0 | ND | ND | 1 | 1 | 1 | 0 | estuarine pupping and nursery grounds. Very common in kelp beds, often up in the water column in kelp beds at night. |
| lingcod | Rock | 0 | 1558 | 1 | 1 | 1 | 1 | ND | 0 | 1 | 0 | 0 | reproductive aggregations |
| longnose skate | Sand | 30 | 3506 | 0 | 0 | 0 | ND | ND | 1 | 0 | 0 | 0 | low fecundity |
| longspine thornyhead | Sand | 660 | 5760 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| monkeyface prickleback | Rock | 0 | 80 | 1 | 1 | 1 | ND | ND | 1 | 0 | 1 | 0 | homing; tidepools; large TL; potential local depletion |
| olive rockfish | Rock | 0 | 564 | 1 | 1 | 1 | ND | 1 | 1 | 0 | 0 | 0 | |
| Pacific hagfish | Sand/ Rock | 53 | 3168 | 0 | 0 | 1 | ND | ND | 0 | 0 | 0 | 0 | |
| petrale sole | Sand | 0 | 1800 | 0 | 1 | 1 | 1 | ND | 0 | 0 | 0 | 0 | |
| pile surfperch | Rock | 0 | 295 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | piers; jetties; estuaries; kelp. Low fecundity |
| pink rockfish | Rock | 150 | 1200 | 1 | 0 | 0 | ND | ND | 1 | 0 | 0 | 0 | |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| quillback rockfish | rock | 16 | 899 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| rainbow surfperch | Rock | 0 | 165 | ND | 0 | 0 | ND | ND | 1 | 0 | 1 | 0 | harbors; eelgrass. some evidence they move inshore and offshore, movements are not known; low fecundity. |
| redbanded rockfish | Rock | 161 | 3756 | ND | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| rex sole | Sand | 0 | 3756 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| rosethorn rockfish | Both | 194 | 3756 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| rosy rockfish | Rock | 24 | 864 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| rubberlip surfperch | Rock | 0 | 165 | ND | 1 | 1 | ND | ND | 1 | 0 | 1 | 0 | piers; jetties; kelp. Low fecundity |
| sand sole | Sand | 0 | 1066 | ND | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | |
| sanddab, Pacific | Sand | 0 | 1800 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | |
| shiner surfperch | Both | 0 | 480 | ND | 1 | 1 | ND | ND | 0 | 0 | 1 | 0 | estuaries; kelpbeds |
| shortspine thornyhead | Sand/ Rock | 56 | 5000 | 0 | 1 | 1 | 0 | ND | 0 | 0 | 0 | 0 | Juveniles, in particular, are often found on rocks. |
| slender sole | Sand | 30 | 3756 | 0 | 0 | 0 | ND | ND | 0 | 0 | 0 | 0 | |
| speckled rockfish | Rock | 100 | 1200 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| splitnose rockfish | sand | 262 | 2932 | 0 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| squarespot rockfish | Rock | 60 | 1000 | 1 | 1 | 0 | 0 | ND | 1 | 0 | 0 | 0 | |
| starry flounder | Sand | 0 | 1968 | ND | 1 | 1 | 0 | ND | 0 | 0 | 1 | 0 | estuarine nurseries |
| starry rockfish | Rock | 50 | 900 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |
| striped surfperch | Rock | 0 | 165 | 0 | 1 | 1 | ND | ND | 0 | 0 | 1 | 0 | piers; jetties; estuaries; kelp |
| surf smelt | Sand | 0 | 30 | 0 | 1 | 1 | ND | ND | 0 | 1 | 1 | 0 | spawn in surfzone |
| topsmelt | Sand | 0 | 85 | ND | 1 | 1 | ND | ND | 0 | 1 | 1 | 0 | eggs laid on plants in backwater |
| treefish | Rock | 0 | 320 | 1 | 1 | 1 | ND | ND | 1 | 0 | 0 | 0 | |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| vermilion rockfish | Rock | 0 | 1440 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | southern CA declines in length (Love et al.) |
| walleye surfperch | Both | 0 | 597 | 1 | 1 | 1 | ND | ND | 0 | 0 | 0 | 0 | sandy beaches; piers |
| white croaker | Sand | 0 | 781 | 0 | 0 | 0 | ND | ND | 0 | 0 | 0 | 0 | |
| white surfperch | Both | 0 | 230 | 1 | 1 | 1 | ND | ND | 0 | 0 | 1 | 0 | estuaries |
| widow rockfish | Rock | 0 | 2625 | 0 | 0 | 1 | 1 | ND | 1 | 1 | 0 | 0 | known to aggregate around pinnacles/seamounts |
| wolf eel | Rock | 0 | 740 | 1 | 0 | 0 | ND | ND | 0 | 1 | 0 | 0 | sedentary;mate-for-life? Large size |
| yelloweye rockfish | Rock | 49 | 1800 | 1 | 0 | 1 | 1 | ND | 1 | 0 | 0 | 1 | Top predator. |
| yellowtail rockfish | rock | 0 | 1801 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | declining lengths in central CA CPFV (Mason 1998) |
| **Seabirds (breeding)** | | | | | | | | | | | | | |
| Brandt's Cormorant | | surface | 50 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| Brown Pelican | | surface | 10 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction, downlisting under consideration |
| Common Murre | | surface | 600 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| Double-crested Cormorant | | surface | 50 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| Least Tern | | surface | surface | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| Marbled Murrelet | | surface | 100 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | Significant decline in California population (Only found in northern part of central coast),potential for forage base increase, potential human disturbance reduction |
| Pelagic Cormorant | | surface | 50 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |

| Species | Primary Bottom type (Rock/ Sand) | Shallow Depth (ft.) | Deepest Depth (ft.) | sm-mod adult home range (sm 0-5 km mod 10-20 km) | Currently mod-large take | Historically mod-large take | Low Pop. Estimate (<40% un-fished) | Size structure shifted toward sm indiv | life history trait vulnerable | life stage to benefit (e.g., spawn-ing activity, nursery area) | habitat impact-ed (by human activity) | Ecologically Imp. (key-stone or habitat forming) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pigeon Guillemot | | surface | 100 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| Rhinoceros Auklet | | surface | 300 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | potential for forage base increase, potential human disturbance reduction |
| **Seabird (Migrant)** | | | | | | | | | | | | | |
| Grebe spp. (Western, Clark's) | | surface | 30 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| Loon spp. (Pacific and Red-necked) | | surface | 50 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| Northern Fulmar | | surface | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| Red-necked Phalarope | | surface | surfac e | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| Scoter spp. (Surf, White-winged) | | surface | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| Shearwater spp. (Sooty, Black-vented) | | surface | 30 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | potential for forage base increase |
| **Marine mammals** | | | | | | | | | | | | | |
| Gray whale | | surface | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | potential for forage base increase |
| Harbor porpoise | | surface | | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | potential for forage base increase |
| Harbor seal | | surface | | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | potential for forage base increase, potential human disturbance reduction |
| Short-beaked common dolphin | | surface | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | potential for forage base increase |
| Southern Sea Otter | | surface | | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | potential for forage base increase |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Steller's sea lion | | surface | | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Ano Nuevo population has declined, potential for forage base increase, potential human disturbance reduction |