Appendix B Impacts of Alternatives on Groundfish

4.2.1 Impacts of Alternative 1: *Status quo*

Summary of Alternative 1 The policy goal of alternative 1 is to continue current fishery management provided by the FMP in a manner consistent with Council objectives of maintaining a year-round groundfish fishery, preventing overfishing, and rebuilding overfished stocks at current levels of effort. In this alternative, bycatch and bycatch mortality is controlled in part through modifying effort and gear efficiency. Trip limits are used to discourage fishing in certain areas based on species encounter rates of overfished species. Gear restrictions are used where possible to reduce expected bycatch rates. Area closures are also used to reduce or prohibit fishing within Rockfish Conservation Areas (RCAs) on the continental shelf. Management relies on logbooks, port sampling, and partial observer coverage of the groundfish fleet.

Discussion of Tools Used The following mix of management measures are applied to create Alternative 1:

- **Harvest Levels** Ratios of overfished species to other groundfish are used to set total catch caps for the overfished species. Unlike some of the alternatives, these are 'soft' caps allocated to various fishery sectors. Other groundfish harvest is constrained to maintain expected catch ratios, thus lowering overall OY and reducing harvest opportunities on healthy stocks. The GMT's quota species monitoring(QSM) program is used to track soft caps and the Council recommends appropriate in-season adjustments to ensure overall catch remains at or below recommended OY. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.1).

- **Vessel trip limits** Trip limits are the most restrictive with this alternative due to the need to keep catch and bycatch of overfished species within OY at current levels of effort, and to maintain a year-round season. This tool is ranked 4th out of a range of 1-4 scored for the alternatives (Table 4.3.1).
- **Vessel catch limits** Vessel catch limits not explicitly used as a tool in this alternative. This tool ranks last or 4th out of a range of 1-4 scored for the alternatives (Table 4.3.1).
- **Gear regulations** Gear restrictions are used to minimize take of undersized fish and overfished species, reduce bycatch and bycatch mortality. Survival rates of bycatch escaping gear is unknown. Experimental Fishing Permits (EFPs) are used allowing fishers the opportunity to experiment with various gear modifications in an effort to reduce bycatch and bycatch mortality of overfished species in particular This tool is ranked 2nd out of a range of 1-3 scored for the alternatives (Table 4.3.1).
- **Time/area closures** Extensive use of Rockfish Conservation Areas (RCAs) are used under *status quo* to keep catch of overfished species from exceeding OYs, thus reducing bycatch and bycatch mortality. Large areas of the shelf are off limits to directed groundfish fishing. Some open access and recreational fishing still occurs within RCAs This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.1).

- **Capacity reduction** Capacity reduction is not explicitly considered under this alternative. ***(It should be noted that Congress has authorized a capacity reduction program and bids are being solicited in order to reduce groundfish fleet size. If the program is successful, Alternative 2 would be more closely aligned with a status quo management program.)***
- **Data reporting, record-keeping, and monitoring** Under *status quo* management, 100% of the at-sea catcher/processor whiting fleet and approximately 10% of the remaining commercial groundfish fleet are monitored with on-board observers. Data are used to estimate the total catch and catch ratios of overfished species co-occurring with other groundfish. Under status quo management, these data are updated annually and used to change forecast of OY and trip limit impacts by fishery sector for the annual specifications process This tool is ranked 5th out of a range of 1-5 scored for the alternatives (Table 4.3.1).

Impacts on Groundfish

The *status quo* alternative ranking of effects on reducing groundfish bycatch, bycatch mortality, and increasing accountability are summarized in Table 4.3.1. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest levels establish limits on the harvest of groundfish by through annual specification of ABCs and OYs. Overfished species constrain access to other healthier stocks of groundfish. When OY is effectively managed as a harvest cap, as it is for overfished species, it may limit or mitigate bycatch and bycatch mortality when used in combination with other tools, such as time/area closures. Under *status quo*, a soft 'scorecard' is used to track estimated mortality by fishery. Performance of the different fishery sectors is measured against this scorecard during the fishing season using the best estimates of in-season landed catch and anticipated bycatch. No portion of OY is held in reserve and fishery sectors are not held accountable of exceeding soft scorecard limits. In-season management action may be applied to fishery sectors in order to keep catches close to pre-season estimates of fishing mortality. *Status quo* ranks the same as or lower than other alternatives with respect to effective performance standards, use of OY reserve, and application of sector limits (Table 4.3.1). Observer data gathered in-season along with other fishery information such as logbook data are used to update estimated mortality on an annual basis. See Table 4.2.0 for 2002 and 2003 OYs and estimated total removals for 2002.

<u>Overfished Groundfish</u>

Most of the overfished species live on the continental shelf. Under the *status quo* alternative, rebuilding of groundfish within Northern and Southern Shelf Environments would take place in less than Tmax with a probability greater than 60%. Rebuilding most rockfish stocks is expected to take decades to achieve. In the Northern Shelf Environment, canary and yelloweye rockfish will constrain catches of other species for many years as they rebuild. Likewise, canary rockfish, cowcod, and boccacio will constrain harvest of other groundfish within the Southern Shelf Environment. Lingcod, also caught on the shelf, co-occurs with overfished and other rockfish species. OY for lingcod is high enough as not to be constraining and catches are currently well below OY.

Current management allocates OY among users to accommodate bycatch needs while allowing limited access to healthier species of groundfish exceeding OYs of species under rebuilding plans. Most overfished species allocations are 'soft' allocations, in the sense that management

measures for each fishery sector are adjusted to try and target the soft allocation. Flexibility between allocated amounts is allowed, however, if overall catches are projected to be below OY.

Analysis of different allocation options between recreational and commercial fisheries indicate a greater impact on some species if more are allocated to the recreational fishery because it takes a higher percentage of juvenile fish. For canary rockfish, a higher proportion of younger fish in the recreational catch results in a higher "per-ton" impact on rebuilding (PFMC 2003b).

Pacific whiting and widow rockfish are two species within the pelagic environment that have been determined to be overfished. In the years preceding this determination, OY levels were high enough to allow directed fishing towards widow rockfish by the whiting midwater trawl fleet, and trip limits were structured to allow a significant portion of the OY to be taken in such a manner. OY under rebuilding for widow rockfish is much lower than catches in the last decade.

Emphasis Species

Under the *status quo* alternative, some species of groundfish have annual landed catch levels that are well below OY specifications due to OYs for constraining overfished species or species under precautionary management. These constraints have a significant and direct impact on fishing opportunities. Yellowtail rockfish catches are constrained will below OY due to low OYs for co-occurring canary rockfish and boccacio. Chilipepper rockfish is largely constrained by market conditions. Regulations also constrain the harvest of the slope Dover sole, thornyhead, and sablefish (DTS) complex to prevent shortspine thornyhead from being overfished. DTS trip limits based on expected catch ratios of this complex allow access to healthier Dover sole and longspine thornyhead stocks (see discussion on trip limits below). Ratio management may lead to regulatory discard of sablefish and shortspine thornyhead in particular as fishers pursue attainment of Dover sole and longspine thornyhead OYS. Current catches of Dover sole and sablefish are close to but less than OY. Shortspine thornyhead OY is low and annual catches attain OY, while catches of longspine thornyhead are well below OY. Undersized and lower priced sablefish may be discarded in favor of larger more valuable fish - a practice known as 'high-grading'. The fishing strategy reduces the chance of early attainment of sablefish OY and increases the value of the catch.

In other cases, OY is underachieved due to existing market limits not linked to regulatory limits. For example, English sole OY is set at the ABC level of 3,100 mt, coastwide. Current catch levels are well below ABC (Table 4.2.0). Some level of bycatch and bycatch mortality is likely to occur in either of these cases. Forgone catch may indirectly reduce bycatch and bycatch mortality if limiting OYs for overfished species results in reduced catch of other groundfish.

Trip limits for the trawl and non-trawl fisheries are described in the Federal Register (NMFS, 2003). Under status quo, trip limits are designed to spread OY out to maintain a year-round season and to provide an incidental catch allowance for overfished species caught with co-occurring groundfish. Some trip limits for overfished species are very small to discourage any targeting on restricted species. Most contemporary trip limits are cumulative 2 month period limits. Cumulative limits have the effect of minimizing regulatory related discard of groundfish in excess of the limit until the last trip of the period.

Recent analysis of 2002 observer data suggests significant bycatch in the form of regulatory and non-regulatory discard associated with cumulative trip limits based on ratios of anticipated bycatch (PFMC 2003d). The *status quo* alternative application of trip limits ranks 4th out of a range of 1-4 as a tool to reduce bycatch and bycatch mortality for most species, compared to other alternatives that reduce the need to use landing limits (Table 4.3.1).

Overfished Groundfish

Over time, trip limits for individual species have been modified to reflect species associations Knowledge of species depth distributions and associations allowed application of trip limits to sub-groups of species. For example, groups of species were broken out of the Sebastes complex with separate trip limits to discourage targeting on overfished species. Separate sub-groups were developed for nearshore, shelf and slope environments, along with some sub-group and individual species trip limits. See Table 2.1-12 of the 2003 Groundfish Annual SEIS (PFMC 2003b). Lower limits for these subgroups to protect overfished species resulted in a high percentage of OY for the subgroup left unharvested. Yellowtail rockfish is an example of a shelf rockfish species with a harvest well below OY due to recent trip limit constraints applied to shelf rockfish in order to protect canary rockfish (currently, area closures have the same consequence).

In 2000, NMFS reduced trip limits for shelf rockfish were coupled with restrictions on the size of roller gear that could be used on the continental shelf. A study by Hannah (2003, In Press) showed that reductions in trip limits prior to 2000 already began reducing fishing effort in areas of 'prime trawlable rockfish habitat'. The same study also demonstrated that fishing continued adjacent to the harder bottomed high relief rockfish habitat areas. OY reductions and catch ratio management led to more restrictive measures in 2003.

In 2003, depth based management of RCAs affected all gear types to some degree. Canary rockfish trawl limits were only 100 lb per month for the year, with the exception of 300 lb per month during the May-August period when canary rockfish are seasonally more abundant shoreward of the Rockfish Conservation Area (RCA) inner depth limits. Likewise, trip limits for bocaccio are contained within the 300 lb per month limit for minor nearshore rockfish which may be taken shoreward of the RCA. Limits for other species of groundfish are therefore constrained to limit the take of overfished species and species under precautionary management.

Currently, logbook and observer data are used to project expected catch ratios of overfished species to other target species. Individual trip limits are adjusted to keep overfished species OY from being exceeded. Under *status quo*, if actual ratios of overfished species to target species differ from those projected, bycatch and bycatch mortality may occur. Discarding of overfished species may occur if the actual proportion of overfished species is higher than expected. Likewise, if the actual proportion of overfished species is lower than expected, discarding of the target species may occur.

In a study of West Coast groundfish, discard rates were found to vary inversely with the size of the trawl trip limits imposed (Pikitch *et al.* 1988). *Status quo* trip limits may therefore result in a higher catch and bycatch mortality of overfished species compared to alternatives that allow larger trip limits, or alternatives that utilize a different set of management tools. Vessel trip limits for overfished species are very restrictive under current effort levels and OYs, and are

designed to provide for non-target incidental catch, although some target fishing is allowed for lingcod. Generally, restrictive landing limits can lead to higher bycatch and bycatch mortality due to regulation induced discarding. Cumulative 1 or 2 month limits are used to help minimize discard. Under status quo, regulatory induced discard of overfished species may be higher in comparison with other alternatives which use other approaches to maintain catch within OY, encourage landing of more of the catch, or avoid take of overfished groundfish.

Emphasis Species

As noted earlier (See discussion above in Overfished Groundfish) regulatory induced discard may be high if managers place constraints on other groundfish to protect co-occurring overfished species. Much of the success using ratios to manage trip limits depends on the how well ratios reflect actual catch proportions. In addition, the target 'mixture' sought by fishers is sensitive to prices of various components of the catch. Currently, catch ratios are applied to species making up the DTS complex in order to prevent over harvest of shortspine thornyhead. While most of the Dover sole harvest is close to OY, a significant proportion of longspine thornyhead and sablefish OY is un-attained. Previous discard rates for Dover sole are thought to be related to undersized fish and are estimated to be 5% (Sampson and Wood 2002). Recent analysis of the 2002 observer data show that Dover sole discard may be a high as 17% (PFMC 2003d). However, discard of shortspine thornyhead is thought to as high as 30% and there is some evidence that sablefish discard rates may be as high as 40%, suggesting that catch ratios may not be accurate, high-grading may be occurring, or that their application does not take into account the degree of variability seen under actual fishing practices. Discard of small sablefish may be taking place as they typically are priced lower than medium to large fish, and the most recent assessment suggests a strong incoming year-class. Discard of shortspine thornyheads (due to regulatory limits) may be taking place in order to attain Dover or sablefish limits.

While regulatory discard of species such as English sole and other shelf and nearshore flatfish species may be low or absent , there may be economic reasons to discard. Trip limits for English sole are liberal under current effort levels and OY. Analysis of trip frequencies show that few trips attain the regulatory induced limit (Table 4-2). Market limits on the quantity landed may induce an unknown amount of economic discard. Undersized English sole are also a major component of discarded catch (See **Gear restrictions**, below).

A new cumulative limit approximating an IQ program and an extended season for fixed gear sablefish fishers reduces the need for a 'derby' style fishery. The new program implemented in 2002 (?) removes the need to race for fixed gear limited entry OY share. This program may reduce the need to discard fish compared to other sectors without IQs, as fishers have more time to move to areas with higher concentrations of marketable fish (see discussion of handling below under **Gear restrictions**).

Gear restrictions modify selectivity and placement of fishing gear. Some restrictions such as trawl mesh size may allow undersized fish an opportunity to escape. Trawl roller gear size coupled with a depth restriction may minimize the risk that trawl gear will be used on habitats with high concentrations of rockfish. Gear restrictions under *status quo* are similar to those found in three other alternatives, and rank 2nd in a range of effect scores from 1-3 (Table 4.3.1).

Overfished Groundfish

Gear restrictions, modifications, and deployment practices can reduce bycatch and bycatch mortality of overfished species. The minimum 4.5" mesh size aids in the escapement of juvenile rockfish. Rates of survival of escaping fish are not known, however. Due to the lack of a swim bladder, lingcod would have a greater chance of survival than rockfish, when caught with trawl gear. To protect overfished rockfish, the Council initially recommended very small trip limits for those using trawls with large roller gear when fishing on the continental shelf. Larger trip limits were allowed for those fishing primarily for flatfish with small diameter footrope trawl gear. A study by Hannah (2003) showed that trawlers avoided rocky reef areas on the shelf as a result of the regulation, and that encounter rates of these species were reduced. Enough fish were caught however to require further action by the Council. OYs for shelf rockfish such as canary rockfish, yelloweye rockfish, and boccacio were so low the Council more recently has prohibited fishing of nearly all gears within RCAs, including small and large footrope trawl gears and groundfish directed hook and line gears (?). Under *status quo,* these measures have a direct effect of eliminating bycatch and bycatch mortality of species within the RCA. Also, effort can increase outside of RCAs creating new challenges to maintaining harvest below OYs specified for overfished species, even at very low encounter rates seen outside of RCAs. Effort shifting can also have a direct impact, increasing bycatch and bycatch mortality of overfished species outside of the RCA boundaries.

State action has also been taken to require fish excluder devices to reduce rockfish catch in the shrimp trawl fishery, thus reducing bycatch. Survival rates of excluded fish are largely unknown (Davis and Ryer 2003). With use of fish excluders, the catch of rockfish and bycatch mortality in the shrimp trawl fishery should be lower in comparison with nets that do not use these devices. Fish caught in trawls without excluder devices can escape through meshes or may be discarded once brought to the surface. Only very small fish can escape through the meshes of a shrimp trawl.

Video observation of fish excluders has shown that many fish are able to actively seek and find exits or passively be excluded from shrimp trawls, while the net is at fishing depth. Escaping rockfish avoid barotrauma associated with being brought to the surface and discarded. Studies have shown that time on deck (Parker *et al.* 2003) and temperature gradient (Davis and Ryer 2003)are important factors in survivability of fishes without swim bladders, such as lingcod and sablefish. While they may have an increased chance of survival when released at the surface, trauma inducing factors could be avoided altogether through the use of fish excluders (Hannah 2003b). Additional delayed morality may occur however. Laboratory studies have shown that direct mortality can still occur and behavioral impairment can cause additional delayed mortality (Davis and Ryer 2003). Under *status quo*, state requirements for excluder gear would have a positive and direct impact, reducing bycatch over gears that did not use these devices. Excluders and the selectivity effects of mesh size in general are likely to have a direct impact, causing an unquantifiable amount of bycatch mortality.

Catch of overfished species is expected to be very low to non-existent in fixed gear groundfish fisheries. Although 20 mt of lingcod may be taken by fixed gear limited entry fishers, overall OY is not likely to be attained. Bycatch and bycatch mortality lingcod caught with fixed is

related to the minimum size limit of 24 inches and handling effects on fish described above. Little is known about survivability of fish escaping gear prior to it being hauled to the surface.

Emphasis Species

Other abundant and important groundfish found in the shelf environment include yellowtail rockfish, chilipepper, shelf flatfishes including arrowtooth flounder, petrale sole, and English sole. Important slope complex species include Dover sole, short and longspine thornyhead, and sablefish (the 'DTS' complex).

Gear restrictions, modifications, and deployment practices can reduce bycatch and bycatch mortality of groundfish. The minimum 4.5" mesh size aids in the escapement of juvenile or small sablefish and flatfish, although enough small fish are retained to contribute to significant size related discard. Sablefish also lack a swim bladder and likely have a higher rate of survival if caught and released.

Mesh size studies have shown that discard of undersized English sole may make up more than 50% of the catch in numbers (TenEyck and Demory 1975). Nearly all of the males and approximately 19% of the females were discarded. English sole have a prominent anal fin spine that has a tendency to catch on trawl meshes. The last stock assessment for female English sole used an assume rate of discard of 12.4% during the period 1985-1992 (Sampson and Stewart 1993). Rates of survival of escaping fish are not known.

Small footrope gear effective at fishing flatfish on non-rocky habitat, and large footrope gear was prohibited within RCAs in 2003 due to incidental catch of overfished rockfish species. Trip limits are structured to effectively limit practical use of large footrope gears for deeper water species, seaward of RCAs.

State action taken to require fish excluder devices and reduce canary rockfish catch in the shrimp trawl fishery affects overall catch of other groundfish species as well (Hannah *et al.* 1996). Survival rates of excluded fish are not known and there is no estimate of bycatch mortality (see discussion above under Overfished Groundfish). Direct impacts include reduced bycatch, reduced bycatch mortality for some of the fish, and some increased unobserved bycatch mortality of fish interacting with excluder gear.

Efforts to access other healthier groundfish stocks under a new management regime explored in this EIS, where depth-based restrictions reduce access, may depend on refining fishing gear configurations to make them more selective for these species. Efforts are planned and ongoing through EFPs sponsored by CDFG, ODFW, and WDFW. If successful, gear modifications may allow more access to yellowtail rockfish or flatfish, while minimizing impacts to overfished species. The impact of such gear may result in increased catches of species harvested below OY. To the degree catches increase, bycatch and bycatch mortality may increase. Gear modifications could have a net overall benefit by reducing bycatch and bycatch mortality of overfished species.
(add Wallace reference if appropriate - arrowtooth flounder)
(add Parker reference if appropriate - flatfish trawl efp and lingcod)

Gear restrictions or prohibitions are effective at reducing bycatch within RCAs. Little is known about the fate of fish caught by trawl and fixed gears that manage to escape through meshes or

become freed from hooks. Additional gear measures beyond those under *status quo* may be needed to reduce bycatch impacts outside of RCAs.

Sablefish caught by hook or pot gear are known to be susceptible to mortality due to sand flea infestation. Studies in Alaska have found this source of mortality to be small and that all sources of discard amounted to only 12% of the total allowable catch (TAC) in the directed fishery (Richardson and O'Connell 2002). Sablefish may be caught and escape from hooks or through meshes of traps. The survivability of these fish is not known. In addition, fixed gear fishers release undersized sablefish contributing to bycatch and bycatch mortality. In 2002, the Council recommended an decrease in size limit from 22 inches to 20 inches to minimize the amount of sablefish discard. Studies cited above indicate that temperature gradient may influence survivability of sablefish . Time of year fish are harvested therefore influence the potential impact of temperature gradients. The individual cumulative tier limits and extended season may contribute to a reduction in bycatch and bycatch mortality (see discussion above under **Trip limits**).

Time/Area Closures effectively reduce bycatch and bycatch mortality within the boundaries of the closed area, and for a particular fishery sector, if fishing is prohibited. Outside of the boundaries, bycatch and bycatch mortality may increase if effort is shifted to open areas. Some level of harvest may be allowed within restricted fishing areas using modified gears. To the degree these gears are selective against catch of the species being protected, bycatch and bycatch mortality should be reduced.

<u>Overfished Groundfish</u>
Other regulations such as gear, time, depth, or area restrictions in the form of RCAs are designed to minimize the likelihood of encountering canary and yelloweye rockfish in the Northern Shelf Environment, and cowcod and bocaccio in the Southern Shelf Environment. The RCA strategy under *status quo* is to reduce or eliminate effort where there is a high encounter rate of overfished species and redirect effort outside of the RCA where encounter rates are low. Because of the seasonal distributional behavior of rockfish, encounter rates and fishing patterns are monitored and adjustments are made to keep overall harvest within total catch OYs. Some rockfish have a wider distribution than others, or make seasonal movements requiring the use of large RCAs.

Canary rockfish are seasonally more abundant shoreward of the RCAs inner depth limits and landing limits are adjusted to reflect this seasonal distribution to minimize encounter rates. Seasonal mobility and aggregating behavior of canary rockfish within and outside of RCAs may affect ratios of incidental catch of this species to other groundfish. Under status quo, adverse changes to ratios may not be accounted for until the end of the fishing season. Bycatch and bycatch mortality may increase as a consequence. Recent changes in the depth limits of the northern RCA are intended to reduce the chances of fishers encountering large concentrations of canary rockfish, however.

Cowcod are at very low levels of abundance. Cowcod RCAs are small compared to other shelf RCAS and are located in the southern shelf environment. The cowcod RCA was designed to

protect mature fish with a high site affinity for habitats consisting of rocky reefs with overhangs and sheltering caves.

Emphasis Species
Rockfish Conservation Areas under status quo effectively eliminate fishing in areas where overfished rockfish are concentrated. See discussion in under Overfished Groundfish above. Other shelf rockfish species are underutilized under current area management. Yellowtail and chilipepper rockfishes annual catches are both well below OY (Table 4.2.0).

RCAs may also concentrate effort seaward of the RCA boundary. The DTS complex catch, bycatch, and bycatch mortality could increase during these closures due to effort shifting.

Several species of groundfish move onto the shelf during certain times of the year. RCAs may reduce the vulnerability of these other species to harvest, thereby reducing bycatch and bycatch mortality, depending on the timing and application of the RCA.

English sole and other shelf or nearshore flatfish may still be taken with small footrope trawls fished in the North Shelf Environment shoreward of 50 or 100 fm depending on time of year. RCAs would reduce access to flatfish to some degree, although a significant proportion of the biomass is shoreward of 50 fm.

If effort concentrates shoreward of RCAs, catch, bycatch, and bycatch mortality of shoreward species may also increase.

4.2.2 Impacts of Alternative 2: *Larger trip limits - fleet reduction*

Summary of Alternative 2 The policy goal of this alternative is to reduce bycatch by reducing harvest capacity and increasing trip limit size without reducing the length of the season. In this alternative, bycatch and bycatch mortality is controlled in part by modifying effort and gear efficiency. This goal supports Council objectives of maintaining a year-round groundfish fishery, preventing overfishing, and rebuilding overfished stocks while maintaining an economical monitoring program. It adds the new objective of reducing fleet capacity which is embodied in the Council adopted Strategic Plan for west coast groundfish.

Discussion of Tools Used The following mix of management measures are applied to create Alternative 2:

- **Harvest Levels** (harvest policy, rebuilding) ABCs and OYs are assumed to be the same as under *status quo* however, proportionately more catch would be available to individual vessels remaining in the fleet compared to *status quo.* The Council could make a decision to utilize any proportionate fleet increase in catch share to shorten the time to rebuild overfished species. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (See performance standards and OY reserves in Table 4.3.2).
- **Vessel trip limits** Vessel trip limits are used and should increase under this alternative due to a 50% reduction in effort through capacity reduction. Regulatory induced discard is

inversely proportional to trip limit size, the direct impacts of this alternative would be to reduce bycatch and associated mortality. This tool ranks between 2nd to 4th out of a range of 1-4 scored for the alternatives (Table 4.3.2).

- **Vessel catch limits** Vessel catch limits not explicitly used as a tool in this alternative. This tool ranks last or 4th out of a range of 1-4 scored for the alternatives (Table 4.3.2).
- **Gear regulations** Gear regulations under this alternative would be the same or similar to those in Alternative 1. It is not anticipated that a 50% reduction in fleet capacity would permit the use of large footrope gear within current RCA boundaries. This tool is ranked 2nd out of a range of 1-3 scored for the alternatives (Table 4.3.2).
- **Time/area closures** The application of RCAs would be the same as those in Alternative 1. A 50% reduction in fishing effort might allow redefinition of the timing and application of closed areas to provide more opportunities for the remaining fleet to access other groundfish resources within current RCA boundaries. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.2).
- **Capacity reduction** Capacity reduction could take place in the form of a vessel buy-back program resulting in a 50% reduction in effective effort. Effective effort is effort that produces an average catch of groundfish per trawl hour fished. Effort reduction should create larger shares of catch for the remaining fleet and increase the efficiency of other tools used to reduce bycatch and bycatch mortality of groundfish. Alternatively, a buyback program may not be successful in reducing effective effort if the lowest producing vessels retire from the fleet. If the latter scenario were to be true, positive impacts on reducing bycatch and bycatch mortality might be lessened, but would still have a net benefit compared to Alternative 1. This tool ranks 1st out of a range of 1-3scored for the alternatives (Table 4.3.2).
- **Data reporting, record-keeping, and monitoring.** Catch reporting, record-keeping, and monitoring through use of observers may improve over *status quo*. Assuming the number of observer days remains the same, a higher proportion of total trips should have observers due to the reduced fleet size, larger trip limits, and reduced total number of trips. If effort increases, trip limits may have to be reduced, and observer coverage would become more like *status quo.* This tool is ranked 4th out of a range of 1-5 scored for the alternatives (Table 4.3.2).

Impacts on Groundfish

The Alternative 2 ranking of effects on reducing groundfish bycatch, bycatch mortality, and increasing accountability are summarized in Table 4.3.2. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest Levels would be the same as under *status quo* for groundfish. Catch available based on recommended OYs would be shared among fewer vessels under this option. The Council could make a decision to utilize any proportionate fleet increase in OY share to shorten the time to rebuild overfished species.

Other than soft sector allocations similar to *status quo*, there would be no performance standards or OY reserves, and ranking of this tool the same as *status quo*, or 3rd out of the range of 1-3.

Trip Limits should increase, especially outside of RCAs as a consequence of a 50% reduction in effective capacity of the commercial fleet. Effects of increased trip limits described above under General Effects of Fishery Management Tools are likely to be significant compared to *status quo* and rank 2nd or 3rd out of a range of 1-4 scored for other alternatives, depending on the species. Some alternatives rank 1st due to elimination of trip limits as a tool.

Overfished Groundfish

Increased trip limit size may have a direct and positive impact, making possible an increase in per vessel retained catch of overfished groundfish and reducing bycatch associated with regulatory induced discards. In a study of west coast groundfish, discard rates were found to vary inversely with the size of the trawl trip limits imposed (Pikitch *et al.* 1988). All limits of overfished rockfish are low under *status quo* compared to historical levels. Reducing discard by increasing trip limit size would still depend on the appropriate application of RCAs and ratio management. A fine balance would be needed to allow more overfished species to be caught as incidental catch to other target strategies, without creating a trip limit large enough to encourage targeting of the overfished species.

The Council could elect to keep limits lower in an attempt to rebuild overfished species faster. Bycatch and bycatch mortality might be reduced in comparison to the above scenario, due to a reduction in overall harvest opportunity. The smaller limits might offset this reduction due to the effect of smaller trip limits on regulatory induced bycatch.

Effects of increased trip limits result from capacity reduction. The alternative ranks 2nd in terms of ability of the trip limit tool to reduce bycatch and bycatch mortality of overfished species (Table 4.3.2).

Emphasis Species

Vessel trip limits could increase outside of RCAs boundaries as a consequence of a 50% reduction in effective capacity of the commercial fleet. Ratio management would allow more access to other groundfish as long as catch of overfished species did not exceed OY. Under status quo, several species of groundfish are harvested well below OY due to constraints on overfished species such as shortspine thornyhead currently under precautionary management. Under *status quo,* for example, there appears to be a lack of attainment of OYs for sablefish and longspine thornyhead at the same time there may be high discard rates of sablefish and shortspine thornyhead. A larger trip limit may help fishers gain access to OY and may reduce discarding.

Increased trip limit size should have little impact on some species that are more limited by markets than regulatory trip limits under status quo. For example, landings of English sole are limited by size and market limits, not trip limit size.

Because increased trip limit size may not result in a change in harvest for many emphasis species due to existing non-regulatory constraints such as undersized fish and market limits, the trip limit tool used in Alternative 2 ranks 3rd among alternative scores ranging from 1-4 (Table 4.3.2).

Since it is assumed most of the capacity reduction would apply to the trawl fleet, this tool would have less impact on trip limits for cabezon and black rockfish compared to other species. Cabezon and black rockfish are caught primarily by commercial limited entry or open access hook and line fishers and the recreational fishery. Effects of increased trip limits therefore, on reducing bycatch and bycatch mortality for nearshore species like black rockfish and cabezon under ranks 4rd out of a possible range of 1-4 (Table 4.3.2).

Gear Restrictions under this alternative might be relaxed compared to *status quo.* Gear restrictions are likely to remain the same as under *status quo* in the near future due to rebuilding requirements of overfished species, however. Alternative 2 application of gear tools therefore rank the same as *status quo*, or 2nd among alternative scores ranging from 1-3 (Table 4.3.2).

Overfished Groundfish
It is not anticipated that a 50% reduction in fleet capacity would permit the use of large footrope gear within current RCA boundaries in the near future.

Emphasis Species
Current regulations prohibit fishing within RCAs by most gear types, including groundfish trawl gears with the exception of pelagic trawls. A 50% reduction in effort may allow use of small foot rope trawl gears within RCAs. An analysis of Oregon and Washington trawl logbook data showed that both trip limits and the 8 inch size restriction on trawl roller gear were effective in reducing or eliminating trawl effort over 'prime trawlable rockfish habitat' (Hannah 2003). Current shelf RCAs have a significant amount of ground still trawlable with small footrope trawl gears. If fishing with these trawls were allowed within RCAs, bycatch and bycatch mortality could increase for both overfished and healthy groundfish stocks.

Time/Area Closures The timing, bathymetric limits, and gear restrictions associated with RCAs could be modified from those under *status quo* at lower levels of effort. RCAs are likely to remain the same as under *status quo* in the near future due to rebuilding requirements of overfished species, however. Alternative 2 application of time/area closures therefore rank the same as *status quo*, or 2nd among alternative scores ranging from 1-3 (Table 4.3.2).

Overfished Groundfish
A 50% reduction in fishing effort might allow re-definition of the timing and application of closed areas to provide more opportunities for the remaining fleet to access other groundfish resources within current RCA boundaries. Increased access to resources within the RCA may increase bycatch, and bycatch mortality of overfished species. On the other hand, the Council could choose to reduce overall catch levels along with fleet reductions and use lower catch rates to rebuild overfished stocks faster. Reduced harvest and faster rebuilding would likely require continuance of *status quo* RCAs.

Emphasis Species
A 50% reduction in fishing effort might allow redefinition of the timing and application of closed areas to provide more opportunities for the remaining fleet to access other groundfish resources within current RCA boundaries. For instance, current regulations prohibit bottom trawling on the continental shelf between 50 and 200 fm, affecting the harvest of yellowtail

rockfish, chilipepper rockfish, English sole and other flatfish species. Moving the inner boundary of the RCA out to 100 fm would allow access to more of the shelf flatfish such as English sole, sand sole, rex sole, and petrale sole that have moved into shallower water during the summer. Bycatch and bycatch mortality may be similar to *status quo* as current catch levels are low with respect to OY and most of the bycatch is associated with undersized fish and market limits.

Capacity Reduction Capacity reduction would take place in the form of a vessel buy-back program, that would reduce effective effort by 50%. Effects of capacity reduction described above under General Effects of Fishery Management Tools are likely to be significant compared to *status quo* and other alternatives. Alternative 2's use of the tool ranks 1st or 3rd out of a range of 1-4 scored for other alternatives, depending on the species.

Overfished Groundfish
Assuming a 50% reduction in effective effort occurred through a buy-back program, a proportionate increase in overfished species trip limit size would be anticipated. Thus, effort reduction would have an indirect impact on reducing bycatch and bycatch mortality.

Emphasis Species
Trip limits for several species of groundfish at or near MSY should increase as a consequence of a 50% reduction in effective effort under this alternative. Effort reduction would have an indirect effect on reducing bycatch and bycatch mortality of other groundfish.

Since it is assumed most of the capacity reduction would apply to the trawl fleet, this tool would have less impact on cabezon and black rockfish compared to other species. Cabezon and black rockfish are caught primarily by commercial limited entry or open access hook and line fishers and the recreational fishery. Effects of capacity reduction on reducing bycatch and bycatch mortality for nearshore species like black rockfish and cabezon under ranks 3rd out of a possible range of 1-3 (Table 4.3.2).

4.2.3 Impacts of Alternative 3: *Larger trip limits - shorten season*

Summary of Alternative 3 The policy goal of this alternative is to reduce bycatch by shortening the fishing season by 50%. In this alternative, bycatch and bycatch mortality is controlled in part by modifying effort and gear efficiency. It attempts to accomplish effort reduction sought in alternative 2 without reducing fleet size. This goal supports Council objectives of preventing overfishing, and rebuilding overfished stocks while maintaining an economical monitoring program. It may be contrary to the current goal of maintaining a year-round groundfish fishery, although platooning is used in an attempt to accomplish this objective.

Discussion of Tools Used The following mix of management measures are applied to create Alternative 3:

- Harvest Levels (harvest policy, rebuilding) Harvest Levels are assumed to be the same as under *status quo*.
- **Vessel trip limits** This alternative assumes the season would be shortened for fishing vessels and that some form of platooning would be used to maintain fishing throughout the year. Vessel trip limits under this alternative would be the same as under alternative 2. Season length for the platooned fleet would be modeled by the GMT to maintain trip limits. Trip limits equivalent to those in Alternative 2 would reduce bycatch and bycatch mortality in a fashion similar to alternative 2. This tool ranks 3rd out of a range of 1-4 scored for the alternatives.
- **Vessel catch limits** Vessel catch limits not explicitly used as a tool in this alternative. This tool ranks last or 4th out of a range of 1-4 scored for the alternatives (Table 4.3.3).
- **Gear Regulations** under this alternative would be similar to *status quo* and be structured to keep catches within the OY limits for overfished species. It is not anticipated that a 50% reduction in fishing season would permit the use of large footrope gear within current RCA boundaries, however small footrope gear may be re-introduced into RCAs. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.3).
- **Time/area closures** In addition to the RCAs used in *status quo*, this alternative compresses the fishery through seasonal closures for a platooned fleet. For instance, each half of the fleet would have a fishing season of only 6 months. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.3).
- **Capacity reduction** No capacity reduction is considered under this alternative. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.3).
- **Data reporting, record-keeping, and monitoring** Catch reporting, record-keeping, and monitoring with the same number of observer days as under *status quo* is assumed. A compressed season would mean that the percentage of total trips covered by observers would increase over *status quo*. This tool is ranked 3rd out of a range of 1-5 scored for the alternatives (Table 4.3.3).

Impacts on Groundfish

Effects of tools used in alternative 3 to reduce groundfish bycatch, bycatch mortality, and increasing accountability are ranked and summarized in Table 4.3.3. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest Levels Objectives for setting optimum yield would remain the same as in *status quo.* Under alternative 3, fishing periods would be compressed or the season shortened. Catch shares should increase on a per trip basis compared to *status quo* but fleet size would remain the same. Other than soft sector allocations similar to *status quo*, there would be no performance standards or OY reserves. Ranking of this tool as used in alternative 3 would be the same as *status quo*, or 3rd out of the range of 1-3 (Table 4.3.3).

Overfished Groundfish

On a per vessel basis, a shorter season may allow larger shares of OY per trip due to potentially larger trip limits compared to *status quo*, and would have an impact similar to Alternative 2, reducing bycatch and bycatch mortality of overfished species.

Emphasis Species
Objectives for optimum yield would remain the same as in *status quo.* On a per vessel basis, a shorter season may allow larger shares of OY per trip compared to *status quo*. Several species of groundfish at or above MSY are currently under-harvested due to constraints on overfished stocks or market limits. One possible consequence of this alternative is that more OY would go unharvested due to the reduced season.

Vessel trip limits Vessel trip limits would initially be the same as those in alternative 2. The season would be shortened to match the new trip limit. The shortened season would allow access to more of the overall OY for groundfish species. Much would depend on fleet response to a shortened season and larger cumulative limit. Platooning of the fleet would be done to maintain a supply of groundfish year-round. If fishers increase effort to compensate for the reduced season, season length would be reduced to maintain trip limit size. The compressed season anticipated larger trip limits should have a significant impact on reducing bycatch and bycatch mortality compared to *status quo.* Although trip limits should be similar to alternative 2, the capacity reduction alternative, this alternative ranks lower as it may be difficult to optimize trip limits and season length in such a fashion as to minimize bycatch and bycatch mortality compared to alternative 2 (Table 4.3.3).

Overfished Groundfish
Vessel trip limits would increase, especially outside of RCAs as a consequence of a 50% reduction in the fishing season. The fleet would be platooned into two or three groups with shortened fishing periods. This would create a more even flow of fish and supports the current Council goal of maintaining a year-season. In either case, the larger trip limit sizes would tend to decrease bycatch and bycatch mortality associated with regulatory induced discards. If fishers compensate for the shortened season and larger trip limit by increasing effort, the benefits of a shortened season might not be realized. Too much effort could result in the season being reduced. A shorter season may reduce harvest if some fishers elect not fish during the openings. Bycatch and bycatch mortality would be reduced but product flow may be interrupted.

Emphasis Species
Vessel trip limits would increase, especially outside of RCAs as a consequence of a 50% reduction in the fishing season.

As was described above under the *status quo,* bycatch of species within the DTS may be the result of several factors, including size, attainment of regulatory limit, and high grading related price structure of different sizes of sablefish. A 50% reduction in fishing season and increased trip limits for components of the complex would tend to reduce regulatory induced discard. Within the DTS complex, bycatch of shortspine thornyhead may be reduced if a larger trip limit for this species is allowed. High grading of sablefish may still occur, however.

The potential increase in trip limit size not likely a significant factor for some species of groundfish like those in the other flatfish category. Landing limits under *status quo* are quite liberal compared to current catches and attainment of the cumulative limit under alternative 3 is not likely. Bycatch and bycatch mortality is related to market limitations related to undersized fish, price, and constraints on quantity. If fleet response to the shortened season is to seek some

alternative fishery rather than increase effort during season openings, bycatch and bycatch mortality may be reduced due to a reduction in overall harvest levels.

Gear Regulations Gear regulations alternative would be similar to *status quo* and structured to keep catches within the OY limits for overfished species. Gear restrictions are likely to remain the same as under *status quo* in the near future due to rebuilding requirements of overfished species, however. Alternative 3 application of gear tools therefore ranks the same as *status quo*, or 2nd among alternative scores ranging from 1-3 (Table 4.3.3).

Overfished Groundfish
It is not anticipated that a 50% reduction in fishing season would permit the use of large footrope gear within current RCA boundaries. However, small footrope trawls could be re-introduced into RCAs if overall OYs for overfished species could be maintained. Currently, lingcod and yelloweye catches remain below OY. Lingcod in particular may be harvested at a higher rate if small footrope trawls are reintroduced. Even with more liberal trip limits and new gear options, canary rockfish catch is very close to OY, thus would constrain access to fishing within the RCAs. Thus, bycatch and bycatch mortality within RCAs could increase over *status quo,* if management measures similar to those used in 2000-2002 were employed within the RCAs. Current canary rockfish, therefore may preclude use of small roller gear within the RCAs. A similar circumstance exists for the southern shelf area - boccacio catch under *status quo* is very close to OY.

Emphasis Species
Larger trip limits stemming from a shorter season may allow access to species of groundfish within the RCA that are precluded from harvest under *status quo.* Harvest levels for several species of shelf groundfish are below current OY levels. Use of small footrope gear could allow more access to Dover, English and petrale soles found on the shelf. Unfortunately, canary rockfish and bocaccio catches under *status quo* are very close to OY, so the use of such gear is unlikely.

Time/Area Closures Fishing Season would be significantly different than the other alternatives. The primary effect of seasonal closures is modeled under the trip limit tool for this alternative (see above).

RCAs similar to *status quo* would be used.. RCAs are likely to remain the same as under *status quo* in the near future due to rebuilding requirements of overfished species, however. Alternative 3 application of time/area closures therefore rank the same as *status quo*, or 2nd among alternative scores ranging from 1-3 (Table 4.3.3).

Overfished Groundfish
The principal tool for this alternative is to reduce time on the water using seasonal closures. Reducing time on the water would allow larger trip limits during open periods. As was pointed out above, this would have a positive benefit as larger trip limits tend to reduce bycatch in the form of regulatory induced discard of overfished species. Platooning of the fleet would be done to maintain a year-round flow of groundfish to markets, thus impacts would be comparable to alternative 2. Compared to *status quo*, this alternative would still have a positive benefit in

reducing bycatch and bycatch mortality of overfished species due to the general effect of increased trip limits size. The season may have to be shortened in order to maintain trip limit size. If the season is too short, some fishers may be elect not to fish. Overall catch of overfished species my decline or trip limits could be increased. The impact of effort reduction due to fishers opting out, would be a reduction in bycatch and bycatch mortality of overfished species.

Emphasis Species

In addition to the RCAs described under Alternative 1, the principal tool for this alternative is to reduce time on the water using seasonal closures. Depending on the timing of a seasonal closure, bycatch and bycatch mortality may be reduced. If platooning is considered as an option, fisheries outside of the RCAs might be feasible as increased trip limits would provide some flexibility in application of ratio management. For example, the DTS fishery could provide year round opportunities for a platooned fleet with larger trip limit sizes. In addition, a significant proportion of flatfish are distributed shoreward of RCAs, there may be an opportunity to have exceptions to closures for the shallow water flatfish fishery.

4.2.4 Impacts of Alternative 4: *Fleet sector catch limits*

Summary of Alternative 4 The policy goal of this alternative is to reduce bycatch by setting catch limits for the various fleet sectors and establishing an in-season catch monitoring or verification program to ensure catch caps are not exceeded. In this alternative control of bycatch and bycatch mortality is effected by controlling overall catch and gear effeciency. This goal supports Council objectives of preventing overfishing, and rebuilding overfished stocks, and maintaining a year-round fishing season. Fishery monitoring is increased over *status quo* at an increased cost.

Discussion of Tools Used The following mix of management measures are applied to create Alternative 4:

- Harvest Levels (harvest policy, rebuilding) Objectives for optimum yield and rebuilding would remain the same as in s*tatus quo.* Harvest policy would be modified from *status quo* in that OY would be broken down into caps for each fishing sector with in-season monitoring of caps. Fishery sectors for groundfish would be broad consisting of separate fleet caps for limited entry midwater trawl, limited entry bottom trawl, limited entry fixed gear, open access, and recreational fleets. Overfished species constrain harvest of other groundfish and are distributed unevenly along the coast. Thus, this alternative assumes a partitioning of the caps north and south of Cape Mendicino at 40° 10' N. Lat. for most species. When OY is reached, further fishing would be prohibited or severely curtailed. A portion of other groundfish OY would be set aside in reserve for the fishery sector with the lowest bycatch to provide an incentive to lower catch rates of overfished species. The primary direct effect of this Alternative would be reductions in bycatch due to strict caps and monitoring of overfished species harvest. This tool is ranked 2nd out of a range of 1-3 scored for the alternatives (See performance standards and OY reserves in Table 4.3.4)**.**

- **Vessel trip limits** Vessel trip limits would initially be the same as *status quo* and based on previously observed joint catch ratios of overfished and co-occurring groundfish species. Vessel trip limits may be altered compared to the *status quo.* More careful monitoring of catch coupled with fleet sector incentives would reduce catch and bycatch of overfished species. To the degree that limits were liberalized, bycatch and bycatch mortality of overfished species may be reduced. This tool ranks between 2nd and 3rd out of a range of 1-4 scored for the alternatives (Table 4.3.4)**.**
- **Catch Limits** Sector allocation would be used to partition available OY into sector caps by fishery. Increased monitoring and sector management measures would provide fishers with incentives to keep within sector caps reducing bycatch and bycatch mortality compared to the first 3 alternatives. This tool ranks 3rd out of a range of 1-4 scored for the alternatives (Table 4.3.4)

- **Gear Regulations** Gear regulations under this alternative would be the same or similar to *status quo*, and would be structured to keep catches within the OY limits for overfished species. Incentives would be stronger to modify gear in order to reduce bycatch and bycatch mortality, due to strict caps and robust monitoring system of this alternative. Gear

modifications that reduced the take of overfished rockfish outside of RCAs would have a direct positive impact on bycatch and bycatch mortality, compared to the first three alternatives. The fate of excluded fish is unknown. Fish interacting with and escaping fishing gear may succumb to delayed mortality even though bycatch in the form of discards is reduced. This tool is ranked 2nd out of a range of 1-3 scored for the alternatives (Table 4.3.4).

- **Time/Area Closures** Initially time and area closures (RCAs) would be similar to those under *status quo*, and would be based on the previously observed catch ratios of various groundfish species. Some additional flexibility might be possible due to increased monitoring and updating of catch ratios and performance of the fishing sectors. This alternative may allow changes in time or depth of RCAs based on OY cap tracking of overfished species. Closures, when and where they occur, may directly reduce bycatch and bycatch mortality of overfished within the closed area. Due to the general lack of incentives to discard overfished species under this alternative, most of the effect of bycatch reduction would likely be accomplished through higher rates of retention. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.4).

- **Capacity Reduction** Capacity reduction is not considered under this alternative. This tool is ranked 3rd out of a range of 1-3 scored for the alternatives (Table 4.3.4)

- **Data Reporting, Record-keeping, and Monitoring** Catch reporting, record keeping, and monitoring uses a more robust program than *status quo*. 100% logbook coverage would be required to aid in improving accuracy of estimated catch by commercial and charter boats. Observer coverage of commercial fleets would be increased and with coverage placed on a subsets of each sector. Observed catch rates would be extrapolated (expanded) to the entire sector. Recreational sampling would be also be increased. The net effect would be to estimate total catch to within $\pm$ 25%. In-season monitoring of commercial and recreational fisheries would ensure caps would not be exceeded by any given sector. These controls would have a direct effect of reducing bycatch of overfished species compared to the first three alternatives. Bycatch mortality may also be reduced in the commercial fishery compared to the first three alternatives as fishers are more likely to retain catches of overfished species . Bycatch mortality of overfished species caught and released in the recreational fishery is unknown. This tool is ranked 2nd out of a range of 1-5 scored for the alternatives (Table 4.3.4).

Impacts on Groundfish
Effects of tools used in alternative 4 to reduce groundfish bycatch, bycatch mortality, and increasing accountability are ranked and summarized in Table 4.3.4. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest Levels Objectives for optimum yield and rebuilding would remain the same as in s*tatus quo.* Harvest policy would be modified from *status quo* in that OY would be broken down into caps allocated to each fishing sector with in-season monitoring of caps. Peformance standards

and sector allocations with OY reserves should have a significant effect, reducing potential bycatch and bycatch mortality compared to alternatives 1-3. Ranking of this tool as used in alternative 4 would be 3rd out of the range of 1-4 (Table 4.3.4).

Overfished Groundfish

Under this alternative, overfished species OY would be broken down into caps for each fishing sector with in-season monitoring of caps. When OY is reached, further fishing would be prohibited or severely curtailed. A portion of other groundfish OY would be set aside in reserve for each fishery sector to provide an incentive to lower catch rates of overfished species. If successful, the primary direct effect of this alternative would be reductions in bycatch of overfished species due to strict caps and monitoring of these species. It is highly likely that the shelf dwelling canary rockfish and boccacio will present the biggest challenge to sectors. Current harvest levels under *status quo* conditions are very close to OY. Catch of other overfished species are below OY largely due to fishing constraints caused by these two species.

There is some question as to whether incentives work on a fishery sector basis. Huppert *et al.* (1992) suggested that sector based incentive systems tend to penalize those participants who adopted methods of reducing bycatch of prohibited species as fewer target species are likely to be caught. Sector based incentive programs work best for relatively small and discreet fishing units like fishing co-operatives. The Pacific whiting fishery sector utilizes a similar program to limit harvest of salmon incidental catch.

The limited entry fixed gear fleet would likely be successful limiting bycatch of non-target species of concern (halibut, lingcod, and overfished rockfish), as the fleet size and catch of overfished species is small. In contrast, the recreational sector may have a difficult time controlling catch of overfished species through an incentive program as there are many and diverse participants. Thus, other means of controlling this sectors OY cap would likely be more effective.

Emphasis Species

Close monitoring of sector caps for overfished species could further constrain harvest of co-occurring other groundfish, especially if sector participants ignored incentives and did not apply bycatch reducing fishing tactics. A reduction in effort could result from early attainment of overfished species sector caps. The direct impact of OY caps may result in less harvest of other groundfish, thus reducing bycatch and bycatch mortality at the expense of lost economic opportunity. On the other hand, incentives, in the form of additional OY for the fishing sector may change enough of the sectors fishing practices to reduce bycatch of overfished species and increase catch of other groundfish. If bycatch is proportional to catch, bycatch and bycatch mortality may increase for other groundfish.

Vessel trip limits would initially be the same as *status quo* and based on previously observed joint catch ratios of overfished species and various groundfish species. Trip limits might be relaxed (increased) depending on the performance of fleet sectors at maintaining catch caps. Within this alternative, trip limits rank 2nd among alternative scores ranging from 1-4 (Table 4.3.4).

Overfished Groundfish
Vessel trip limits could be altered compared to the status quo due to more careful monitoring of catch, and vessel incentives to minimize catch and bycatch of overfished species, as the season progresses. To the degree that limits were liberalized, bycatch and bycatch mortality of overfished species may be reduced. Alternative 4 applies caps on a sector basis. Individual vessels may not have as strong of an incentive to avoid overfished species as in Alternatives 5 and 6. Therefore, it is likely that the greatest source of bycatch reduction is likely to be due to increased retention rates for bottom trawlers.

Studies of Alaska fisheries have shown that sector caps work with small identifiable fishing units, like cooperatives. The west coast whiting fleet is organized along similar lines and appear successful at implementing voluntary caps on bycatch of prohibited species. Under this alternative, a pelagic fishery catch cap for overfished shelf rockfish and widow rockfish may effectively managed by Pacific whiting cooperatives.

Emphasis Species
Limit changes under this alternative are not likely to affect those species with catch levels below existing cumulative catch limits, especially if they are market limited. Effects of potential limit changes on these species were ranked lower than overfished species (see shaded scores under Trip limits in Table 4.3.4). Catches of more desirable species, like yellowtail rockfish, currently harvested below cumulative catch limits due to constraints associated with overfished species may be more accessible if the vessel sector incentive program is successful.

Gear restrictions Management under alternative 4 would include incentives to modify gear as an aid in reducing bycatch and bycatch mortality and keeping under strict sector caps. Gear restrictions applied within this alternative rank 2nd out of a range of 1-3 among alternatives.

Overfished Groundfish
Gear modifications that reduced the take of rockfish outside of RCAs may have a direct positive impact on bycatch and bycatch mortality of overfished species, compared to the first three alternatives. Depending on the type of gear modification, some un-observed impacts may occur leading to bycatch mortality. Little is known about the survivability of fish escaping through meshes or escape panels. Fish excluder devices that eliminate overfished rockfish species provide a better opportunity for survival than sorting and discarding fish at the surface, which is generally lethal for rockfishes (see discussion under Alternative 1 *status quo* and Davis and Ryer (2003)). Cut-back trawls are being experimented with under EFPs. These nets are thought to be highly selective for flatfish and may allow rockfish to avoid capture without contact (Parker 2003).

With caps applied on a sector basis however, individual vessels may not have as strong of an incentive to modify gear to eliminate take of overfished species as in Alternatives 5 and 6 (see discussion above under **Harvest Levels**).

Emphasis Species
It is hoped that incentives to modify gear to reduce bycatch and bycatch mortality of overfished species would be strong, due to strict caps and robust monitoring system. If sector based caps are

successful at minimizing bycatch of overfished species, more of the OY for other groundfish should be accessible. The midwater trawl fishery may be successful in taking yellowtail rockfish without excessive bycatch of widow rockfish for example. The DTS fishery might enjoy a large portion of overall OY if, through incentives, undersized sablefish and shortspine thornyhead bycatch could be reduced. Impacts to nearshore flatfish bycatch and bycatch mortality are unknown as changes in gear are likely to be done to reduce impacts to overfished species. As pointed out above, the strength of the incentives depends on changes in gear and behavior on the part of the entire sector in order. There may not be as strong as incentive as possible if caps were applied on an individual vessel basis (See alternatives 5 and 6).

Time/area closures Initially time and area closures (RCAs) would be similar to those under *status quo*, and would be based on the previously observed catch ratios of various groundfish species. Some additional flexibility in defining RCAs might be possible if fleet sector response to sector caps reduces bycatch. Time/area closures applied within alternative 4 rank 2nd over a range of 1-3 among alternatives (Table 4.3.4).

Overfished Groundfish

This alternative may allow changes in time or depth of seasonal RCAs if fleet sectors are successful at maintaining harvest levels of overfished species at or below OY sector caps. Impacts to bycatch and bycatch mortality of overfished species would likely be the same as under *status quo*. Gains made due to successful fleet response to sector caps may be offset somewhat if managers change RCA boundaries to allow new opportunities to harvest other groundfish. Encounter rates with overfished shelf rockfish could increase as a result. If fishers retain overfished species, overall bycatch should be less than *status quo.*

Emphasis Species

Initially time and area closures (RCAs) would be similar to those under *status quo*, and would be based on the previously observed catch ratios of various groundfish species. Impacts to bycatch and bycatch mortality would likely be the same as under *status quo.* If RCA boundaries are changed to allow more access to other groundfish, catch, bycatch and bycatch mortality of other shelf groundfish could increase somewhat.

4.2.5 Impacts of Alternative 5: *Vessel catch limits*

Summary of Alternative 5 The policy goal of this alternative is to significantly reduce bycatch by limiting catch of each vessel through the use of transferable restricted species quotas (RSQs) for overfished species and transferable individual fishing quotas (IFQs). Direct control of catch and individual vessel accountability sets this alternative apart from the previous alternatives. A robust monitoring or catch verification program would be implemented to ensure catch caps are not exceeded. Discarding of overfished species would be prohibited. Gear regulations would be flexible, allowing fishers the ability to modify gear and operations to avoid catch of overfished species and reduce unwanted bycatch of all species. A system of rewards in the form of reserved OY would be used to create vessel incentives to reduce bycatch of overfished species.

This goal supports Council objectives of preventing overfishing, and rebuilding overfished stocks, and maintaining a year-round fishing season. Fishery monitoring is increased over *status quo* at an increased cost.

Discussion of Tools Used The following mix of management measures are applied to create Alternative 5:

- **Harvest Levels** Optimum yield would remain the same as in *status quo,* however distributions of available OY would be broken down into caps for each fishing vessel with in-season monitoring of caps. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused OY would be made available to those vessels that had not taken their overfished species allotment. The primary direct effect of this alternative would be reductions in bycatch due to strict caps and monitoring of overfished species harvest. Thus, bycatch (discarded catch) of overfished species should be reduced with this alternative as there would be little incentive to discard. This tool ranks 1st out of a range of 1-2 scored for alternatives (See Performance standard and OY reserves in Table 4.3.5).

- **Vessel trip limits** Vessel trip limits would be relaxed or absent, as each vessel would have an individual caps on overfished and other groundfish species. Direct effects expected under this alternative compared to *status quo* would be a reduction in regulatory induced discard of overfished species due to the absence of trip limits. This tool ranks 1st out of a range of 1-4 scored for the alternatives (Table 4.3.5).

- **Vessel Catch Limits** Individual vessel caps in the form of transferable restricted species catch quotas (RSQ) for overfished stocks and individual transferable fishing quotas (IFQ) for other groundfish species would be established with this alternative. Bycatch could be avoided due to relaxed trip limits. Catch limits should work positively to minimize discard of overfished species as there would exist no incentive to discard fish. In addition, RSQ or IFQ shares could be purchased if a fisher needed more share of groundfish to continue fishing. When vessels attain limits and cease fishing, bycatch and bycatch mortality would also be reduced to the degree overall effort is reduced when a vessel reaches a cap. Direct effects expected under this alternative compared to status quo would be a reduction in regulatory

induced discard of all species with RSQs. This tool ranks 1st or 2nd out of a range of 1-4 for the alternatives, depending on the species (Table 4.3.5).

- **Gear Regulations** Gear regulation would be more flexible than under *status quo.* Gear modification would be facilitated allowing fishers to experiment with different methods to reduce bycatch of overfished species. Strict caps and a robust catch monitoring system would allow fishers to chose modified gear in order to keep within a cap or seek other alternatives such as purchasing more quota shares or fish using a different strategy. This tool ranks 3rd out of a range of 1-3 for the alternatives (Table 4.3.5).

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- **Time/Area Closures** would be applied in a manner similar to the first four alternatives. However, under an RSQ/IFQ program, RCAs as they are currently used may be unnecessary. Once an individual vessel's RSQ/IFQ is attained, the vessel must cease to fish anywhere, until the fisher can obtain more quota. There may some limited circumstances where continued fishing might be allowed where the likelihood of encountering the particular species would be highly unlikely. Under an individual vessel catch limit/quota program, fishers would have greater incentive to improve the selectivity of their fishing gear and techniques, avoiding "troublesome" areas in the process and fishing more in areas where they can maximize their profit.

  Other types of time/area closures, such as habitat areas of particular concern, research reserves, etc., would apply to all types of fishing activities specified for those areas. This tool ranks 1st for most species, out of a range of 1-3 for the alternatives (Table 4.3.5).

- **Capacity Reduction** No direct reduction in capacity is considered under this alternative. See discussion under status *quo.* Some capacity reduction may occur if vessel owners sell RSQ or IFQ shares and elect to fish in a non-groundfish fishery. Capacity reduction accomplished through RSQ/ IFQ sales could have a positive direct effect on the overfished species, if a species cap for a vessel is not used by the vessel. Excess cap could be re-distributed to active fishers or left in reserve. This tool ranks 2nd out of a range of 1-3 for the alternatives (Table 4.3.5).

- **Data Reporting, Record-keeping, and Monitoring** Increased observer coverage would be required. VMS would be used to ensure vessels did not fish within RCAs or other closed areas (PFMC 2003e). Recreational sampling would also be increased under this alternative. In-season monitoring of commercial and recreational fisheries would ensure caps would not be exceeded by any given sector. These controls would have a direct effect of reducing bycatch of overfished species compared to the first three alternatives. Bycatch mortality may also be reduced in the commercial fishery compared to the first three alternatives as fishers are likely to retain catches. Bycatch mortality of groundfish caught and released in the recreational fishery is unknown. This tool ranks 1st or 2nd out of a range of 1-5 scored for the alternatives depending on the species (Table 4.3.5).

Impacts on Groundfish
Effects of tools used in alternative 5 on reducing groundfish bycatch, bycatch mortality, and increasing accountability are ranked and summarized in Table 4.3.5. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest Levels would differ from *status quo* in that OYs would be allocated to individual vessels in the form of RSQ and IFQ shares with a portion held in reserve. Performance standards and OY reserves are required by this alternative. Harvest caps cannot be exceeded by individual vessels and overfished species must be retained. Shares may be purchased in order to continue fishing. This alternative ranks 1st out of a range of 1-3 in terms of performance standards and OY reserves (Table 4.3.5).

Overfished Groundfish
OY for overfished species would be broken down into RSQs for each fishing vessel with in-season monitoring of caps. When OY is reached, further fishing would be prohibited or severely curtailed. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused or reserve OY for other groundfish would be made available to those vessels that had not taken their overfished species OY share.

Canary rockfish and boccacio catches are currently very close to OY, and constrain catches of other co-occurring groundfish. Under this alternative, incentives would be strong to develop specific gear modifications and adopt new fishing strategies to avoid taking these species. Without transferability, it might be impossible to conduct a fishery where encounter rates of these two species is high. OY shares under this alternative will be very small on a per vessel basis. One indirect effect will be a partitioning of the fleet into different fishing strategies, as vessel owners buy and sell RSQ and IFQ shares to make fishing practical and profitable for a particular strategy.

The primary direct effect of this alternative would be reductions in bycatch due to strict caps and monitoring of overfished species harvest. Thus, overfished species bycatch (discarded catch) should be reduced or eliminated with this alternative as there would be less incentive to do so. Discarded fish counts against the IFQ and observer coverage under this alternative is 100% of the commercial fleet. Some discarding could continue in minor nearshore and recreational fisheries.

Emphasis Species
OY for other groundfish would be broken down into IFQs for each fishing vessel with in-season monitoring of caps. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused OY would be made available to those vessels that had not taken their overfished species allotment. When OY is reached, further fishing would be prohibited or severely curtailed, unless additional IFQ share was purchased.

As was pointed out above, there may be strong incentives to buy and sell RSQ and IFQ shares in order to more selectively fish using different strategies. Fishers are not currently able to access other groundfish at or near MSY levels. As an example, some fishers may successfully modify gear and/or purchase enough canary rockfish RSQ to take advantage of yellowtail rockfish IFQ.

If enough fishers are successful at acquiring RSQ shares and/or are able to make appropriate gear modifications to catch more OY of other groundfish then catches of more species may move toward OY levels. The result may be an increase in bycatch and bycatch mortality of other groundfish due to higher catch attainment.

Some bycatch and discard mortality could still occur if a vessel approaches attainment of the IFQ. There may be some incentive to finish out the season by spreading out the remaining IFQ in order to maintain the supply of groundfish to the market. In addition, some bycatch and bycatch mortality could occur on the last trip when the IFQ is reached.

Vessel trip limits would be relaxed or absent. Essentially the trip limit would amount to the RSQ or IFQ that could be taken on an annual basis. Markets may influence trip size, however, and some bycatch and bycatch mortality may occur as a consequence. See discussion above under Harvest Levels. Trip limits rank 1st out of a range of 1-4 for this alternative (Table 4.3.5).

Overfished Groundfish
There would be no need for a trip limit as each vessel would have an individual cap on overfished species and an ITQ for other groundfish species. Direct effects expected under this alternative compared to status quo would be a reduction in regulatory induced discard of overfished species due to relaxed trip limits.

Emphasis Species
Vessel trip limits would be relaxed or absent, as each vessel would have an individual RSQ cap on overfished species and an IFQ for other groundfish species. Under this alternative, regulatory induced discards of other groundfish are not anticipated. Market induced discard resulting from size, price, and quantity requirements would be expected.

Vessel catch limits Transferable individual vessel RSQs for overfished species would be established with this alternative. Transferable IFQs would be established for other groundfish species (See discussion under **Harvest Levels**). Overfished species would have to be retained and discarded catch of other species would count against a vessels quota. Bycatch and bycatch mortality would therefore be significantly reduced. compared to other alternatives not using individual quotas. Vessel catch limits in the form of RSQs and IFQs rank 2nd out of a range of 1-4 scored for the alternatives.

Overfished Groundfish
Individual catch limits should work positively to reduce discard of overfished species to near zero, due to a 100% retention requirement and relaxed trip limits. Regulatory induced discard associated with trip limits should be also be eliminated. OY reserves would provide incentives to minimize catch of overfished species.

RSQ shares would need to be purchased if a fisher needed more share of groundfish to continue fishing. Shares of canary rockfish and bocaccio in particular would be very small on a per vessel basis. Fishers are likely to purchase RSQ shares to participate in a fishing strategy that increases

the likelihood of encountering canary rockfish and bocaccio. Direct effects expected under this alternative compared to status quo would be a reduction in regulatory induced discard of overfished species.

Emphasis Species
Individual transferable quotas (IFQs) would be established for other groundfish species. Regulatory induced bycatch for some species of other groundfish like yellowtail rockfish and shortspine thornyhead could be avoided due to relaxed trip limits. IFQ shares will need to be purchased if a fisher needed more share of groundfish to continue fishing. Vessel catch limits are not expected to change bycatch and bycatch mortality of some groundfish species currently limited by market factors. Sablefish is not currently overfished and 100% retention would not be required. Some high-grading and discard is likely to occur with this species. English sole is another example of a species limited primarily by market factors. Bycatch of some species could increase if a vessel owner sold IFQ shares for some species and continued to fish in an area for other species.

Gear restrictions would be more flexible than *status quo.* Individual fishers would have the choice to modify gear to reduce effeciency, but would not be required to do so. Since regulatory gear requirements would be relaxed, fishers could also develop gear to more efficiently take a particular species. As a bycatch and bycatch mortality reduction tool, a rank of 3 out of a range of scores from 1-3 was assigned for this alternative, due to reduced regulatory constraints (Table 4.3.5. Note: from an economic standpoint, this tool may rank higher).

Overfished Groundfish
Gear modification would be facilitated allowing fishers to experiment with different methods to reduce bycatch of overfished shelf rockfish species. Strict caps and a robust catch monitoring system would allow relaxation of the EFP process normally required for modified gear. To the degree gear modifications were successful, this alternative may have a positive direct effect of reducing bycatch and bycatch mortality of overfished species. A more likely scenario is a reduction in bycatch due to higher retention rates, as fishers by and sell RSQ shares to develop selective fishing strategies that allow more access to other groundfish..

Emphasis Species
Gear regulation would be more flexible, allowing experimentation and modification to reduce bycatch and bycatch mortality of overfished species. The impact of such modifications on other groundfish is unknown.

Time/area closures would be based more on need to protect sensitive species, to protect essential fish habitat, and protect other benthic infauna such as corals and invertebrates. In order to accomplish this, the alternative proposes closures of areas to groundfish gears that make bottom contact. This tool is ranked 1st over a range of 1-3 in reducing bycatch and bycatch mortality of demersal bottom dwelling species.

Overfished Groundfish
Cowcod may still require an RCA to accomplish rebuilding. In addition other areas closed to bottom trawling, pot or longline gear in order to protect essential fish habitat would significantly reduce bycatch and bycatch mortality within those areas. Overfished species such as Pacific whiting and widow rockfish could still be taken up to OY dictated RSQ caps by vessels using pelagic gear (pelagic trawls and some hook and line gears). The effect of an area closed to bottom fishing would have less impact on the bycatch and bycatch mortality of Pacific whiting and widow rockfish (See shaded scores in Table 4.3.5).

Emphasis Species
Areas closed to bottom trawling, pot, and longline gears to protect essential fish habitat would significantly reduce other groundfish bycatch and bycatch mortality.

Capacity reduction No direct reduction in capacity is considered under this alternative. Some reduction could occur if fishers sold their RSQ and IFQ shares and retired from the fishery. Indirectly, capacity reduction could occur, and this tool is ranked 2nd over a range of alternative scores from 1-3 (Table 4.3.5).

Overfished Groundfish
Some capacity reduction may occur if vessel owners sell RSQ and IFQ shares and elect to fish in a non-groundfish fishery. Capacity reduction accomplished through RSQ and IFQ sales could have a positive direct reducing bycatch of overfished species. Some vessel owners may also chose to fish in other fisheries and hold onto RSQ and IFQ shares. To the degree shares were unused, catch, bycatch, and bycatch mortality would be reduced.

Emphasis Species
See discussion above.

4.2.6 Impacts of Alternative 6: *Full retention - MPAs*

Summary of Alternative 6: The policy goal of this alternative is to reduce bycatch to near zero by establishing large MPAs in areas where overfished groundfish are most likely to be encountered, prohibiting discard of groundfish, and accurately accounting for catch. This alternative controls bycatch and bycatch mortality by direct controls on both catch, effort, and gear efficiency.

This alternative supports Council objectives for protecting and rebuilding depleted groundfish stocks at a higher cost for monitoring than status quo.

Discussion of Tools Used: The following mix of management measures are applied to create Alternative 6:

- **Harvest Levels** Harvest OY would remain the same as in *status quo,* however distributions of available OY would be broken down into caps for each fishing vessel with in-season monitoring of caps. When OY is reached, further fishing would be prohibited or severely curtailed. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused OY would be made available to those vessels that had not taken their overfished species allotment. The primary direct effect of this Alternative would be a reductions in bycatch of groundfish to near 0 due to strict caps, 100% retention of all groundfish, and 100% observer coverage of the commercial fleet. Unobserved recreational trips would be the primary source bycatch. This tool ranks 1st out of a range of 1-2 scored for alternatives (See Performance standard and OY reserves in Table 4.2.6).

- **Vessel trip limits** Vessel trip limits would be relaxed or absent, as each vessel would have an individual cap on overfished species. Direct effects expected under this alternative compared to status quo would be a reduction in regulatory induced discard due to relaxed trip limits and 100% retention requirement. This tool ranks 1st out of a range of 1-4 scored for the alternatives (Table 4.3.5).

- **Vessel Catch Limits** Individual vessel caps in the form of RSQs for overfished stocks and IFQs for other groundfish would be established. 100% of all groundfish would be retained. Thus, bycatch would be near 0. This tool ranks 1st or 2nd out of a range of 1-4 for the alternatives, depending on the species (Table 4.3.6).

- **Gear Regulations** Gear regulation would be actively used to reduce bycatch and bycatch mortality. Through an incentive program, fishers would be encouraged to experiment with gear modifications, use different gear types, or adopt different fishing strategies to stay within bycatch caps. 100% observer coverage of the commercial fleet would allow relaxation of the EFP process normally required for modified gear. Gear modifications may result in exclusion of undersized and overfished groundfish. Bycatch could take the form fish caught but excluded by the gear. The bycatch mortality of escaping fish is unknown. This tool ranks 1st out of a range of 1-3 scored for the alternatives (Table 4.3.6).

- **Time/Area Closures** would take the form of large permanent or semi-permanent MPAs. The placement and size may differ significantly from all of the other alternatives. For purposes of this analysis, we assume MPAs would be patterned after option 3a of the Council's Phase I Technical Analysis of marine reserves (PFMC 2001). This type of reserve would be tailored to protect overfished species and would set aside 20% of the habitat or biomass with a similar reduction in harvest of the species. MPAs should directly reduce bycatch and bycatch mortality of fish within the closed area. The amount of reduction in bycatch and bycatch mortality due to an MPA would be in proportion to the amount of habitat set aside compared to the total amount of habitat vulnerable to fishing. This would vary depending on the species protected and design of the MPA. The 100% retention requirement would still be the primary means of reducing bycatch outside of MPAs. Some indirect benefits to the groundfish resource would likely occur due to reduce disturbance of habitat afforded by an MPA. This tool ranks 1st out of a range of 1-3 scored for the alternatives (Table 4.3.6).

- **Capacity Reduction** No direct reduction in capacity is considered under this alternative. Tradable IQs may result in consolidation of the fleet though sales of RSQ and IFQ shares (See alternative 5 discussion on capacity reduction). This tool ranks 2nd out of a range of 3 for the alternatives (Table 4.3.6).

- **Data Reporting,** Record-keeping, and Monitoring 100% observer coverage and 100% retention of all groundfish would be required for all commercial fishing sectors. Recreational sampling would also be increased under this alternative. In-season monitoring of commercial and recreational fisheries would ensure caps would not be exceeded by any given sector. These controls would have a direct effect of reducing bycatch compared to other alternatives. Bycatch mortality may also be reduced in the commercial fishery compared to the other alternatives, as fishers will be required to retain catches. Bycatch mortality of fish caught and released in the recreational fishery is unknown. This tool ranks 1st out of a range of 1-5 scored for the alternatives (Table 4.3.6).

Impacts on Groundfish

Effects of tools used in alternative 6 on reducing groundfish bycatch, bycatch mortality, and increasing accountability are ranked and summarized in Table 4.3.6. Effects are ranked by in comparison to the other alternatives. Lower numbers indicate a greater effect.

Harvest Levels OYs would remain the same as in *status quo,* however distributions of available OY would be broken down into caps for each fishing vessel with in-season monitoring of caps. Performance standards and OY reserves are required by this alternative. Harvest caps cannot be exceeded by individual vessels and overfished species must be retained. Shares may be purchased in order to continue fishing. This alternative ranks 1st out of a range of 1-3 in terms of performance standards and OY reserves (Table 4.3.6).

Overfished Groundfish
OY for overfished species would then be broken down into caps or RSQs for each fishing vessel with in-season monitoring of caps. When OY is reached, further fishing would be prohibited or severely curtailed. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused OY would be made available to those vessels that had not taken their overfished species allotment.

The impacts of application of this tool within alternative 6 is similar to the impacts described under alternative 5. Small individual shares of RSQ for some species like canary rockfish and boccacio would have to be purchased and sold to consolidate enough share to fish under certain strategies. The primary direct effect of this Alternative would be reductions in bycatch due to strict caps and 100% retention of all groundfish. Thus, overfished species bycatch (discarded catch) should be near 0 with this alternative due to 100% retention requirement. Unobserved recreational trips would be the primary source overfished species bycatch.

Emphasis Species
Objectives for optimum yield would remain the same as in *Status quo.* OY for overfished species only would then be broken down into caps for each fishing vessel with in-season monitoring of caps. When OY is reached, further fishing would be prohibited or severely curtailed. A reserve of various species would be set aside for vessels with the lowest catches or catch ratios of overfished species. Any unused OY would be made available to those vessels that had not taken their overfished species allotment. Tradable IFQ shares would have impacts similar to alternative 5 in that shares are likely to be bought and sold to consolidate fishing strategies. This alternative differs from alternative 5 in that all groundfish must be retained. The primary direct effect of this Alternative would be reductions in bycatch due to strict caps and 100% retention of all groundfish

Vessel trip limits would be relaxed or absent, as each vessel would have an individual RSQ and IFQ caps on groundfish. Essentially the trip limit would take the form of an individual vessel annual quota. Trip limits rank 1st out of a range of 1-4 for this alternative (Table 4.3.6).

Overfished Groundfish
Vessel trip limits would be relaxed or absent, as each vessel would have an individual cap on overfished species. Direct effects expected under this alternative compared to status quo would be a reduction in regulatory induced discard of overfished species due to relaxed trip limits and 100% retention requirement.

Emphasis Species
Vessel trip limits would be relaxed or absent, as each vessel would have an individual cap on other groundfish. Direct effects expected under this alternative compared to status quo would be a reduction in size related and market induced discard of other groundfish due to the 100% retention requirement.

Vessel catch limits Individual vessel caps for overfished stocks would be established with this Alternative. 100% of all groundfish would be retained. Bycatch and bycatch mortality would therefore be significantly reduced. compared to other alternatives not using individual quotas and

to alternative 5. Vessel catch limits in the form of RSQs and IFQs rank 1st out of a range of 1-4 scored for the alternatives.

Overfished Groundfish
The impacts to overfished groundfish would be similar to those under alternative 5. The 100% retention requirement would and 100% observer coverage would reduce bycatch of overfished species to near 0. Regulatory induced bycatch would be eliminated. See discussion above under alternative 5.

Emphasis Species
Individual transferable quotas (IFQs) would be established for other groundfish with this alternative. This application of catch limits in this alternative be similar to alternative 5. Impacts would be different due to the 100% retention requirement and 100% observer coverage. Bycatch of other groundfish would be near zero and regulatory and market related bycatch would be eliminated.

Gear restrictions would be applied more fully than *status quo.* Gear restrictions ranks 1st out alternative scores ranging from 1-3 (Table 4.3.6).

Overfished Groundfish
Fishers would be encouraged to experiment with gears in order to reduce bycatch and stay within RSQs. The best gears at reducing bycatch would be developed and applied. Some unseen mortality could take the form of overfished species caught but excluded by fishing gears. The bycatch mortality of escaping fish is unknown.

Emphasis Species
Fishers would be encouraged to experiment with gears in order to reduce bycatch and stay within IFQs. The best gears at reducing bycatch would be developed and applied. The 100% retention requirement may be very challenging for some fishers seeking ways of selecting against un-marketable fish. For example, fishers may increase mesh-size to in an attempt to eliminate most of the undersized fish. Reduction of catch of unwanted fish would contribute to the reduction in bycatch. However, unseen mortality could take the form of undersized fish caught but excluded by the gear. Impacts of direct and delayed mortality of escaping fish is poorly understood.

Time/area closures would take the form of permanent or semi-permanent MPAs. The placement and size may differ significantly from all of the other alternatives. We assume these areas to set aside at least 20% of the habitat or biomass of the overfished species, and that biomass available for harvest would be similarly reduced. MPAs would have more permanency than RCAs described in previous alternatives. Areas proposed by this alternative would be closed to all fishing. This tool ranks 1st out of alternative scores ranging from 1-3 (Table 4.3.6)

Overfished Groundfish
Habitat mapping would need to be accomplished in order to define new boundaries for overfished species. Because there are several overfished species, the proportion of area set aside to total fishable area may be larger or smaller than 20%. Impacts will be difficult to determine until the location and composite size of these areas are determined.

MPAs should directly reduce bycatch and bycatch mortality of overfished species within the closed area. The amount of reduction in bycatch and bycatch mortality due to an MPA would be in proportion to the amount of overfished species habitat set aside compared to the total amount of overfished species habitat vulnerable to fishing. Movement of fish into and out of reserves may confound efforts to protect fish using them. If harvest is not reduced, effort will likely shift away from MPAs to adjacent areas increasing impacts of fishing outside of the MPAs. Bycatch and bycatch mortality could increase unless catch is reduced in proportion the area set aside.
Studies of groundfish trawl fishery of the coast of British Columbia suggest fishing changes species composition and spatial structure of the fishery. Movement of trawlers through redistribution of effort and fish movement appears to reduce vulnerability (Walters and Bonfil 1999). The authors suggested use of individual effort quotas (rather than catch) and use of carefully placed MPAs to protect sensitive stocks.

Impacts of various MPA options for bocaccio, Pacific ocean perch, and lingcod are described in the Phase I Council report on marine reserves (PFMC 2001). Benefits of the reserves appear to be a reduction in rebuilding time similar to that which could be obtained through a reduction in exploitation rate, and reduced habitat impacts. Some loss of fishing opportunity will occur with MPAs using a reduced harvest rate (option 3a).

The 100% retention requirement would still be the primary means of reducing overfished species bycatch. Some indirect benefits to the overfished species would likely occur due to reduced disturbance of habitat afforded by an MPA.

Emphasis Species
Time/area closures would take the form of permanent or semi-permanent MPAs. The placement and size may differ significantly from all of the other alternatives. MPAs should directly reduce bycatch and bycatch mortality of other groundfish species within the closed area. The amount of reduction in bycatch due to an MPA would be in proportion to the amount of other species living within overfished species habitat set aside, compared to the total amount of habitat vulnerable to fishing.

The 100% retention requirement would be the primary means of reducing bycatch outside of MPAs.

Glossary and Acronyms

A

ABC Acceptable biological catch – see below

Abyss The deepest part of the ocean.

Acceptable biological catch (**ABC**) Refers to the allowable catch for a species or species group, based on its estimated abundance. The ABC is used to set the upper limit of the annual total allowable catch and is calculated by applying the estimated or proxy harvest rate that produces maximum sustainable yield to the estimated exploitable stock biomass.

Allocation Distribution of the opportunity to fish among user groups or individuals. The share a user group gets in sometimes based on historic harvest amounts.

Alternatives Different combinations of management objectives and measures to reduce bycatch to the extent practicable, reduce bycatch mortality, and to assess the amount and type of bycatch in the fishery. This EIS analyzes the environmental impacts of each alternative.

Angler A person catching fish or shellfish with no intent to sell. This includes people releasing the catch.

Annuli Annual variations in the pattern of growth rings on fish scales or otoliths.

Anthropogenic Refers to the effects of human activities.

B

B_0 Unfished biomass; the estimated size of a fish stock at equilibrium in the absence of fishing.

$B_{25\%}$ 25% of unfished biomass. This is the Council's threshold for declaring a stock overfished or the Minimum Stock Size Threshold.

$B_{40\%}$ 40% of unfished biomass. This is the Council's threshold for declaring a stock rebuilt or the size of the stock estimated to produce MSY. This is also referred to as B_{MSY}.

Bag limit The number and/or size of a species that a person can legally take in a day or trip. This may or may not be the same as a possession limit.

Baleen A specialized plate of horny material used by some species of whales (Mysticetes) to filter-feed.

Barotrauma Physical trauma or injury to a fish due to pressure change. When a fish is rapidly brought from deep water to the surface, the drop in pressure can cause a variety of physical problems, such as severe expansion of the swim bladder and gas bubbles in the blood.

Bathymetry The measurement of ocean depth.

Bathypelagic Zone The zone of the ocean that extends from 1,000m to 4,000m below the surface of the ocean.

Benthic Refers to organisms that live on or in the ocean floor.

Benthic Invertebrate	An animal, such as a mollusk, with no spinal column that lives on the ocean floor.
Best available science	The term "best available science" comes from the second National Standard listed in the Magnuson-Stevens Act and is the informational standard mandated for decision-making.
Bight	A name for the water body found abutting a large indentation in the coast. A bight is less enclosed than a bay.
Bimodal distribution	Indicating two length groups within which individuals are most abundant, possibly with other less abundant length groups around them.
Bioaccumulation	The build-up over time of substances (like metals) that cannot be excreted by an organism.
Biodiversity	The variation in life on Earth reflected at all levels, from various ecosystems and species, to the genetic variation within a species. See also ecosystem diversity, species diversity, genetic diversity.
Biological Opinion	A scientific assessment issued by the National Marine Fisheries Service, as required by the Endangered Species Act for listed species.
Biomass	The total weight of a group (or stock) of fish in a given area. The term biomass means total biomass (age one and above) unless stated otherwise.
BiOp	Biological opinion (see above)
Biota	Refers to any and all living organisms and the ecosystems in which they exist.
Biotic Factor	A living component of the environment which arises from and affects living organisms (distinct from physical factors). For example, the interaction between predators and prey is a biotic interaction.
Bioturbation	Disturbance of soft sediments by the movements and feeding activities of infauna (animals that live just beneath the surface of the sea bed).
B_{MSY}	The biomass that produces the maximum sustainable yield.
BO	Biological opinion (see above)
BRD	Bycatch reduction device (finfish excluders, etc.). These are devices incorporated in fishing gears designed to reduce the take of non-target species.
Bycatch	In this EIS, the term bycatch is used to mean discarded catch of any living marine resource, plus any unobserved mortality that results from a direct encounter with fishing gear. This is slightly broader than the Magnuson-Stevens Act definition, which is limited to fish and therefore does not include marine mammals and seabirds. These species are included in this EIS definition because they are protected by other laws and must also be avoided by fishers. Bycatch includes economic discards, regulatory discards, and fish donated to a charitable organization.
Bycatch model	A model used to calculate amounts of overfished species and other groundfish expected to be caught under various trip limits or certain combinations of measures. Strictly speaking, it calculates expected catch rather than bycatch.

C

CA	California

CalCOFI	California Cooperative Fishery Investigation
California Rockfish Conservation Area	The **CRCA** is defined as, (1) Ocean waters 20 fm to 250 fm between Cape Mendocino and Point Reyes and 20fm to 150 fm between Point Reyes and the U.S.-Mexico Border, and (2) the Cowcod Conservation Areas. The purpose of the CRCA is to regulate all gear types that have a potentially significant affect on rebuilding of overfished rockfish species south of Cape Mendocino.
California Bight	The region of concave coastline off Southern California between the headland at Point Conception and the U.S./Mexican border, and encompassing various islands, shallow banks, basins and troughs extending from the coast roughly 200 km offshore.
Catch	The total number or poundage of fish captured from an area over some period of time. This includes fish that are caught but released or discarded instead of being landed. The catch may take place in an area different from where the fish are landed. Note that catch, harvest, and landings are different terms with different definitions.
Catcher/processor	A factory-trawl vessel that participates in the Pacific whiting fishery. This type of vessel catches fish and processes fish. Also, a sector of the whiting fishery.
Catch per unit of effort	(CPUE) The quantity of fish caught (in number or in weight) with one standard Unit of fishing effort; (e.g., number of fish taken per 1,000 hooks per day or weight of fish, in tons, taken per hour of trawling). CPUE is often considered an index of fish biomass (or abundance). Sometimes referred to as catch rate. CPUE may be used as a measure of economic efficiency of fishing as well as an index of fish abundance.
CCA	Cowcod Conservation Area(s) - see below
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
Cetaceans	Marine mammals of the order *Cetacea*. Includes whales, dolphins and porpoises.
CFR	Code of Federal Regulations – see below
cm	centimeter
Coastal pelagic species	(**CPS**) Coastal pelagic species are schooling fish, not associated with the ocean bottom, that migrate in coastal waters. They are usually planktivorous (plankton-eating) and the main forage of higher level predators such as tuna, salmon, most groundfish, and man. Examples are herring, squid, anchovy, sardine, and mackerel.
Coastal Zone Management Act	(**CZMA**) An act of federal law with the main objective to encourage and assist states in developing coastal zone management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone.
Code of Federal Regulations	(**CFR**) A codification of the regulations published in the *Federal Register* by the executive departments and agencies of the federal government. The CFR is divided into 50 titles that represent broad areas subject to federal regulation. Title 50 contains wildlife and fisheries regulations.
Codend	The end of a trawl net. Fish are eventually swept into the codend as the net is dragged along.

Cohort	In a stock, a group of fish generated during the same spawning season and born during the same time period. Also, in cold and temperate areas, where fish are long-lived, a cohort corresponds usually to fish born during the same year (a year class).
Commercial fishing	Fishing in which the fish harvested, either whole or in part, are intended to enter commerce through sale, barter, or trade.
Commercial Fishery	A term related to the whole process of catching and marketing fish and shellfish for sale. It refers to and includes fisheries resources, fishermen, and related businesses directly or indirectly involved in harvesting, processing, or sales.
Community	An ecological unit composed of the various populations of micro-organisms, plants, and animals that inhabit a particular area.
Continental Shelf	The submerged continental land mass, not usually deeper than about 100 fathoms (200 m). The shelf may extend from a few miles off the coastline to several hundred miles.
Continental Slope	The steeply sloping seabed that connects the continental shelf and continental rise.
Convergence	The contact at the sea surface between two water masses converging, one plunging below the other.
Co-occurring stocks	Stocks of different fish that swim or school near one another, and may be caught together.
Coriolis effect	The deflection of air or water bodies, relative to the solid earth beneath, as a result of the earth's eastward rotation.
Council	Pacific Fishery Management Council
Cowcod Conservation Area(s)	(**CCA**) Two areas located in the Southern California Bight southwest of Santa Monica to the California-Mexico border that encompass roughly 4,300 nm^2 of habitat where the highest densities of cowcod occur. These areas are closed to bottom fishing in order to rebuild the cowcod stock to B_{MSY}.
CPFV	Commercial passenger fishing vessel or charterboat operating in waters off California
CPS	Coastal pelagic species - see above
CPUE	Catch per unit of effort - see above
CRCA	California Rockfish Conservation Area - see above
Cumulative limit	The total allowable amount of a species or species group, by weight, that a vessel may take and retain, possess, or land during a period of time. Fishers may take as many landings of a species or species complex as they like as long as they do not exceed the cumulative limit that applies to the vessel or permit during the designated period.
CZMA	Coastal Zone Management Act - see above

D

Decomposer An organism which gains energy by breaking down the final remains of living things. Predominantly bacteria and fungi, decomposers are important in freeing the last of minerals and nutrients from organic matter and recycling them back into the food web. See also decomposition; compare detrivore.

Decomposition The biochemical process where biological materials are broken down into smaller particles and eventually into basic chemical compounds and elements. See also decomposer.

DEIS Draft environmental impact statement

Demersal Fish and animals living in close relation with the sea floor.

Density dependence The degree to which recruitment changes as spawning biomass changes. Typically we assume that a Beverton-Holt form is appropriate and that the level of density-dependence is such that the recruitment only declines by 10% when the spawning biomass declines by 50%.

Derby fishery A fishery of a few days' or weeks' duration during which fishers compete to take as much catch as they can before the fishery closes.

Detritus Dead organic matter of plant or animal. See also detrivore.

Detrivore An organism that feeds on large bits of dead and decaying organic matter (detritus). What detrivores leave behind is used by decomposers. Crabs and seabirds are examples of detrivores. Compare decomposer; see also detritus.

Diatom One-celled phytoplankton with an external skeleton of silica.

Dispersal The spreading of individuals throughout suitable habitat within or outside the population range. In a more restricted sense, the movement of young animals away from their point of origin to locations where they will live at maturity

Distribution (1) A species distribution is the spatial pattern of its population or populations over its geographic range. (2) A population age distribution is the proportions of individuals in various age classes. (3) Within a population, individuals may be distributed evenly, randomly, or in groups throughout suitable habitat.

Diversity Genetic variations that allow a population to use a wider array of environments, protect against short-term spatial or temporal changes in the environment and survive long-term environmental changes.

Downwelling The process whereby prevailing seasonal winds create surface currents that cause surface water to sink, bringing nutrient-poor ocean surface water into the area.

DTS complex Dover sole/thornyhead/trawl-caught sablefish complex

E

EA Environmental assessment – see below

EC Enforcement Consultants – see below

Ecological Niche The role a plant or animal plays in its community. The niche of an organism is defined by what it eats, its predators, salt tolerances, light requirements etc. Two species are not stabile if they both live in the same habitat if they occupy identical niches.

Ecology The study of the physical and biological interactions between an organism and its natural environment.

Economic discard	The portion of bycatch that is not caused by regulations but is related to other factors. Fish discarded because they are too small to be sold, or the wrong species, are considered to be economic discards. Broadly defined it can mean all discard that is not related to regulations.
Ecosystem	A community of plants, animals and other organisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment.
Ecosystem Diversity	The diversity of biological communities and their physical environment. Diversity is determined by the species composition, physical structure and processes within an ecosystem. This is the highest level of biodiversity. See also biodiversity; compare species diversity, genetic diversity.
EEZ	Exclusive Economic Zone – see below
Effects	Impacts; anticipated results of an action. Effects include ecological, aesthetic, historic, cultural, economic, social, or health. They may be beneficial or detrimental. An EIS describes and analyzes anticipated effects of the alternatives. (Also, see impacts below)
Effort	The amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower.
EFH	Essential fish habitat – see below
EFP	Exempted fishing permit – see below
EIS	Environmental impact statement – see below
Ekman circulation	Movement of surface water at an angle from the wind, as a result of the Coriolis effect.
El Niño Southern Oscillation	(**ENSO** or **El Niño**) Abnormally warm ocean climate conditions, which in some years affect the Eastern coast of Latin America (centered on Peru) often around Christmas time. The anomaly is accompanied by dramatic changes in species abundance and distribution, higher local rainfall and flooding, massive deaths of fish and their predators. Many other climatic anomalies around the world are attributed to consequences of El Niño. See also La Niña, below.
Endangered Species Act	(**ESA**) An act of federal law that provides for the conservation of endangered and threatened species of fish, wildlife, and plants. When preparing fishery management plans, councils are required to consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service to determine whether the fishing under a fishery management plan is likely to jeopardize the continued existence of an ESA-listed species, or to result in harm to its critical habitat.
Endemic	An animal or plant species that naturally occurs in an area.
Energetics	The study of the flow and transformation of energy, as between trophic levels.
Enforcement Consultants	A Council committee that provides advice on enforcement of fishery regulations.
ENSO	El Niño Southern Oscillation – see above
Environment	All of the physical, chemical, and biological factors in the area where a plant or animal lives.

Environmental assessment (**EA**) As part of the National Environmental Policy Act (NEPA) process, an EA is a concise public document that provides evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact.

Environmental impact statement (**EIS**) As part of the National Environmental Policy Act (NEPA) process, an EIS is an analysis of the expected impacts resulting from the implementation of a fisheries management or development plan (or some other proposed action) on the environment. EISs are required for all fishery management plans as well as significant amendments to existing plans. The purpose of an EIS is to ensure that the fishery management plan gives appropriate consideration to environmental values in order to prevent harm to the environment.

EO Executive Order

EO 12866 A Federal executive order that, among other things, requires agencies to assess the economic costs and benefits of all regulatory proposals and complete a Regulatory Impact Analysis (RIA) that describes the costs and benefits of the proposed rule and alternative approaches, and justifies the chosen approach. See RIR.

Epibenthic A term for organisms that live attached to the bottom.

Epipelagic zone The upper region of the sea from the surface to about 200-300 meters depth. see Photic Zone

Epiphyte A plant that grows on another plant.

ESA Endangered Species Act

Essential fish habitat (**EFH**) Those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.

Estuary A semi-enclosed body of water with an open connection to the sea. Typically there is a mixing of sea and fresh water, and the influx of nutrients from both sources results in high productivity.

Evolutionarily Significant Unit **(ESU)** a population segment equivalent to the "Distinct Population" referred to in the Endangered Species Act

Exclusive Economic Zone (**EEZ**) All waters from the seaward boundary of coastal states out to 200 nautical miles. This was formally called the Fishery Conservation Zone (FCZ).

Exempted fishing permit (**EFP**) A permit issued by National Marine Fisheries Service that allows exemptions from some federal fishing regulations in order to study the effectiveness, bycatch rate, or other aspects of an experimental fishing gear or technique.

Exploitable biomass The biomass that is available to a unit of fishing effort. Defined as the sum of the population biomass at age (calculated as the mean within the fishing year) multiplied by the age-specific availability to the fishery. Exploitable biomass is equivalent to the catch biomass divided by the instantaneous fishing mortality rate.

Extirpation Situation when something is no longer present.

Exvessel Refers to activities that occur when a commercial fishing boat lands or unloads a catch. For example, the price received by a captain for the catch is an exvessel price.

F

F The rate of fishing mortality. – see below

F_{MSY} is the fishing mortality rate that maximizes catch biomass in the long term.

F_{OF} is the rate of fishing mortality defined as overfishing.

$F_{x\%}$ is the rate of fishing mortality that will reduce female spawning biomass per recruit to x% of its unfished level. $F_{100\%}$ is zero, and $F_{40\%}$ is believed to be a reasonable proxy for F_{MSY} for some species.

Factory-trawl A type of vessel that catches fish with trawl gear and processes the fish onboard. Sometimes called catcher/processor. In the West Coast groundfish fishery, the only target species for this type of vessel is Pacific whiting.

Fathom Six feet.

FEAM Fishery economic assessment model – see below

Fecundity The potential of an organism to produce offspring, measured in the number of gametes produced.

Federal Register The *Federal Register* is the official daily publication for Rules, Proposed Rules, and Notices of Federal agencies and organizations, as well as Executive Orders and other Presidential documents. Fisheries regulations are not considered final until they are published in the *Federal Register*.

Finfish A common term to define fish as separate from shellfish.

Fish Fish means finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds.

Fish stock A population of a species of fish from which catches are taken in a fishery. Use of the term "fish stock" usually implies that the particular population is more or less isolated from other stocks of the same species, and hence self-sustaining.

Fisheries observers Trained professionals who monitor and record catch data from commercial fishing vessels and processing facilities. Observers collect data on species composition of the catch, weights, and disposition of fish caught, seabird sightings and marine mammal interactions. Observers also collect biological data such as sexed fish lengths, weights and aging structures.

Fishery All the activities involved in catching a species of fish or group of species.

Fishery-dependent Describes data about fish resources collected by sampling commercial and recreational catches.

Fishery-independent Describes data about fish resources collected by methods other than sampling commercial and recreational catches. An example of such a method is a NMFS trawl survey.

Fishery economic assessment model (**FEAM**) uses historical landings data, information on industry cost and margin structure (vessels and processors), and income multipliers generated by IMPLAN to produce estimates of "regionalized" local income impact after deducting for leakage of payments to non-residents and to non-local suppliers, wholesalers, and manufacturers.

Fishery management plan (**FMP**) A plan, and its amendments, that contains measures for conserving and managing specific fisheries and fish stocks.

Fishing The catching, taking, or harvesting of fish; the attempted catching, taking, or harvesting of fish; any other activity that can reasonably be expected to result in the catching, taking, or harvesting of fish; any operations at sea in support of, or in preparation for, any of these activities. This term does not include any activity by a vessel conducting authorized scientific research.

Fishing community A community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs. Includes fishing vessel owners, fishing families, operators, crew, recreational fishers, fish processors, gear suppliers, and others in the community who depend on fishing.

Fishing mortality (**F**) - A measurement of the rate of removal of fish from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year; instantaneous is that percentage of fish dying at any one time. The acceptable rates of fishing mortality may vary from species to species.

Fishing year January 1 through December 31.

Fixed gear Fishing gear that is stationary after it is deployed (unlike trawl or troll gear which is moving when it is actively fishing). Within the context of the limited entry fleet, "fixed gear" means longline and fishpot (trap) gear. Within the context of the entire groundfish fishery, fixed gear includes longline, fishpot, and any other gear that is anchored at least at one end.

fm fathom (6 feet)

FMP fishery management plan – see above

Food Chain A linear sequence of organisms that exist on successive trophic levels within a natural community, through which energy is transferred by feeding. Primary producers capture energy from the environment (through photo- or chemo-synthesis) and form the base of the food chain. Energy is then passed to primary consumers (herbivores) and on to secondary and tertiary consumers (carnivores and top carnivores) (e.g. phytoplankton -> zooplankton -> herring -> salmon -> killer whales). Once they die, these organisms are in turn consumed and their energy transferred to detrivores and decomposers.

Food Web A non-linear network of feeding between organisms that includes many food chains, and hence multiple organisms on each trophic level. A network describing the feeding interactions of the species in an area.

Forage Fish such as herring, smelt and krill that are eaten by seabirds, mammals, and larger fish.

FWS U.S. Fish and Wildlife Service

G

Gamete A reproductive cell.

GAP Groundfish Advisory Subpanel – see below

GF Groundfish

Ghost fishing Situation when abandoned fishing gear continues to catch organisms

Gillnet A curtain-like net suspended in the water with mesh openings large enough to permit only the heads of the fish to pass through, ensnaring them around the gills when they attempt to escape

GMT Groundfish Management Team – see below

Green mud Greenish sand deposits in which glauconite is abundant.

Groundfish A species or group of fish that lives most of its life on or near the sea bottom.

Groundfish Advisory Subpanel (**GAP**) The Council established the GAP to obtain the input of the people most affected by, or interested in, the management of the groundfish fishery. This advisory body is made up of representatives with recreational, trawl, fixed gear, open access, tribal, environmental, and processor interests. Their advice is solicited when preparing fishery management plans, reviewing plans before sending them to the Secretary, and reviewing the effectiveness of plans once they are in operation.

Groundfish Management Team (**GMT**) Groundfish management plans are prepared by the Council's GMT, which consists of scientists and managers with specific technical knowledge of the groundfish fishery.

H

Habitat The immediate space where an animal or plant lives and has food, water and protection. Habitat loss, which includes the destruction, degradation, or fragmentation of habitats, is the primary cause of decreasing biodiversity.

Harvest The total number or poundage of fish caught and kept from an area over a period of time. Note that landings, catch and harvest are different.

Harvest specifications The detailed regulations that make up management measures – for example, trawl footrope size, depth limits, net mesh size, etc.

Harvest guideline(s) A numerical harvest level that is a general objective, but not a quota. Attainment of a harvest guideline does not require a management response, but it does prompt review of the fishery.

HG Harvest guideline(s) – see above

High seas All waters beyond the EEZ of the United States and beyond any foreign nation's EEZ, to the extent that such sea is recognized by the United States.

Highly migratory species (**HMS**) In the Council context, highly migratory species in the Pacific Ocean include species managed under the HMS Fishery Management Plan: tunas, sharks, billfish/swordfish, and dorado or dolphinfish.

HMS Highly migratory species – see above

Hydrography The arrangement and movement of bodies of water, such as currents and water masses.

I

IFQ Individual fishing quota. See below.

Impact Effect; a change from current conditions, or a change that would result from an action. Impacts may be direct, indirect and cumulative, and may be significant or not significant. An EIS provides an analysis of expected impacts that would result from the alternatives being considered and identifies those considered to be significant.

IMPLAN (IMpact Analysis for PLANning) a regional economic impact model

Incidental catch or incidental species Groundfish species caught when fishing for the primary purpose of catching a different species or species group. Incidental catch that is released, returned to the sea, discarded at sea, or retained and donated to a charitable food organization is considered a type of bycatch.

Individual fishing quota (IFQ) A Federal permit under a limited access system to harvest a quantity of fish, expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person (individual fisherman or vessel owner).

Individual transferable (or tradeable) quota (ITQ) A type of IFQ allocated to individual fishermen or vessel owners and which can be sold, leased, exchanged, etc, to others.

Initial Regulatory Flexibility Analysis (IRFA) An analysis required by the Regulatory Flexibility Act (see RFA).

INPFC International North Pacific Fishery Commission – see below

International Pacific Halibut Commission (IPHC) A Commission responsible for studying halibut stocks and the halibut fishery. The IPHC makes proposals to the U.S. and Canada concerning the regulation of the halibut fishery.

International North Pacific Fishery Commission (INPFC) was a tri-lateral commission of Canada, Japan and the U.S. established in 1952, to coordinate marine fisheries research and address scientific and management issues of mutual concern. Although the Commission was dissolved in 1993, the statistical areas defined by the are still commonly used in marine fisheries management.

Intertidal Between the high and low tide marks and periodically exposed to air.

IPHC International Pacific Halibut Commission – see above

IRFA Initial regulatory flexibility analysis – see above

Isotherm An imaginary line passing through points on the earth's surface having the same mean temperature.

ITQ Individual transferable (or tradeable) quota – see above

JKL

Jetty A rocky structure constructed from land into the sea to protect shore-based property.

Jig An artificial lure made to simulate live bait. It is usually made with a lead head cast on a single hook and is heavier than most other lures.

Juvenile A young fish or animal that has not reached sexual maturity.

Keystone species A species that maintains community structure through its feeding activities, and without which large changes would occur in the community.

Keystone predator The dominant predator or the top predator that has a major influence on community structure. For example, sea otters are a keystone predator in kelp beds. Sea otters eat urchins that feed on kelp which house a huge diversity of other organisms. If sea otter populations are lowered in an area the kelp beds are generally reduced and urchin barrens appear.

Knot A unit of speed equal to one nautical mile per hour (approximately 51 centimeters per second).

La Niña	An episode of strong trade winds and unusually low sea surface temperature in the central and eastern tropical Pacific. The opposite of El Niño (see above).
Landing	The number or poundage of fish unloaded at a dock by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the points at which fish are brought to shore. Note that landings, catch, and harvest define different things.
LE	Limited entry – see below
Limited entry fishery	A fishery for which a fixed number of permits have been issued in order to limit participation.
Limiting factor	A factor primarily responsible for determining the growth and/or reproduction of an organism or a population. The limiting factor may be a physical factor (such as temperature or light), a chemical factor (such as a particular nutrient), or a biological factor (such as a competing species). The limiting factor may differ at different times and places.
Littoral zone	The intertidal zone.
Local depletion	Local depletion occurs when localized catches take more fish than can be replaced either locally or through fish migrating into the catch area. Natural causes can also result in local depletion. Local depletion can occur apart from the status of the overall stock, and can be greater than decreases in the entire stock.
Logbook	A document or form for recording specified information about commercial fishing activities. Logbooks must be maintained by groundfish trawl vessels in accordance with state fishing regulations. Some logbook information is used in stock assessments, inseason monitoring, and predicting landings.
Long-term potential yield	The maximum long-term average yield that can be achieved through conscientious stewardship, by controlling the proportion of the population removed by harvesting by regulating fishing effort or total catch levels.

M

m	meters
M	Instantaneous natural mortality rate (as opposed to F, fishing mortality rate) or the rate of mortality not related to fishing.
Magnuson-Stevens Fishery Conservation and Management Act	The **MFCMA**, sometimes called the "**Magnuson-Stevens Act**," established the 200 nm fishery conservation zone (EEZ), the regional fishery management council system, and the process and mandates for regulating marine fisheries in the EEZ.
Marine Mammal Protection Act	The **MMPA** prohibits the harvest or harassment of marine mammals, although permits for incidental take of marine mammals while commercial fishing may be issued subject to regulation.
Marine Recreational Fisheries Statistical Survey	(**MRFSS**) A national survey conducted by National Marine Fisheries Service to estimate the impact of recreational fishing on marine resources.
Maturity	The age at which an animal is physically capable of reproduction

Maximum sustainable yield	(**MSY**) An estimate of the largest average annual catch or yield that can be continuously taken over a long period from a stock under prevailing ecological and environmental conditions . Since MSY is a long-term average, it need not be specified annually, but may be reassessed periodically based on the best scientific information available.
Maximum fishing mortality threshold	(**MFMT**) A threshold fishing mortality rate identified in the National Standard Guidelines above which constitutes overfishing.
MBTA	Migratory Bird Treaty Act
Mean	The sum of the data divided by the number of pieces of data; the average.
Median	Within a data set, the median is the number that divides the bottom 50% of the data from the top 50%.
Mesopelagic Zone	A somewhat arbitrary depth zone in offshore or oceanic waters, usually below 600 feet and above 3,000 (200-1,000 meters or 100-500 fathoms). It is bordered by the photic zone above and darkness below.
MFMT	Maximum fishing mortality threshold – see above
MHHW	Mean higher high water level or the average of the highest of two daily high tides in the Pacific Ocean (i.e., high tide line)
Minimum stock size threshold	(**MSST**) A threshold biomass used to determine if a stock is overfished. The proxy for groundfish MSST is $B_{25\%}$.
Mitigation	includes avoiding the impact altogether, minimizing impacts, rectifying the impact by repairing the environment, reducing or eliminating the impact over time, or compensating for the impact in other ways.
MLMA	California Marine Life Management Act.
MLPA	California Marine Life Protection Act.
mm	Millimeter
MMPA	Marine Mammal Protection Act – see above
Morphology	The physical characteristics of an individual.
Mothership	A vessel that does not catch groundfish but processes fish (whiting) delivered by other vessels. A sector of the whiting fishery.
MOU	Memorandum of Understanding
MPA	Marine protected area; an area in which some human activities are restricted.
MRFSS	Marine Recreational Fisheries Statistics Survey – see above
MRPZ	Marine resources protection zone
MSA	Magnuson-Stevens Fishery Conservation and Management Act (also known as Magnuson-Stevens Act) – see above
MSST	Minimum stock size threshold; sometimes called the overfishing threshold – see above
MSY	Maximum sustainable yield (see above).
mt	Metric ton = 2,204.62 pounds.

N

NAO NOAA Administrative Order

National Standards Guidelines (**NSG**) Guidelines issued by National Marine Fisheries Service to provide comprehensive guidance for the development of fishery management plans and amendments that comply with the national standards of the Magnuson-Stevens Act. These guidelines are found in Title 50, Code of Federal Regulations, part 600.

National Environmental Policy Act (**NEPA**) Passed by Congress in 1969, NEPA requires Federal agencies to consider the environment when making decisions regarding their programs. Section 102(2)(C) requires Federal agencies to prepare an Environmental Impact Statement (EIS) before taking major Federal actions that may significantly affect the quality of the human environment. The EIS includes: the environmental impact of the proposed action, any adverse environmental effects which cannot be avoided should the proposed action be implemented, alternatives to the proposed action, the relationship between local short-term uses of the environment and long-term productivity, and any irreversible commitments of resources which would be involved in the proposed action should it be implemented.

National Marine Fisheries Service (**NMFS** or **NOAA Fisheries**) A division of the U.S. Department of Commerce, National Ocean and Atmospheric Administration (NOAA). NMFS is responsible for conservation and management of offshore fisheries (and inland salmon). The NMFS Regional Director is a voting member of the Council.

NE Northeast

Nearshore "Nearshore" is defined (by the California Nearshore Fishery Management Plan) as the area from the high-tide line offshore to a depth of 120 ft (20 fm).

Nekton Pelagic organisms that are free-swimming and so whose movements are independent of the tides, currents and waves. Such animals include fish, whales, squid, crabs and shrimps.

NEPA National Environmental Policy Act – see above

Neritic Inhabiting coastal waters primarily over the continental shelf, generally over bottom depths equal to or less than 183 meters (100 fm) deep.

Neuston The distribution of nekton is limited by temperature and nutrient supply and decreases with decreasing depth. Compare benthic, plankton surface water.

NMFS National Marine Fisheries Service – see above

NOAA National Oceanic and Atmospheric Administration

NOI Notice of Intent

North Pacific Fishery Management Council (**NPFMC**) The regional fishery management council established by the Magnuson-Stevens Act to develop management plans and recommendations for managing marine fish stocks in the EEZ off Alaska.

NPDES National Pollutant Discharge Elimination System

NS Nearshore – see above

NSG National Standards Guidelines – see above

O

OA Open access. See below.

Oceanic Inhabiting the open sea, ranging beyond the continental and insular shelves, beyond the neritic zone.

ODFW Oregon Department of Fish and Wildlife

OMB Office of Management and Budget

Open-access fishery The segment of the groundfish fishery or any other fishery for which entry is not controlled by a limited entry permitting program.

Optimum yield (**OY**) The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems. The groundfish FMP specifies a default harvest control rule (the **"40-10" rule**) that reduces the OY of any stock found to be less than its estimated MSY stock size. If a stock is overfished, the OY provides for rebuilding to its MSY stock size, consistent with the analysis prepared for its rebuilding plan.

OSP Oregon State Police

OSP Optimum sustainable population (in reference to marine mammals)

Otolith "Ear bone" of a fish; calcareous concretions in the inner ear of a fish, functioning as organs of hearing and balance. They often show seasonal or annual "rings" that can be counted to determine age.

Otter trawl A cone-shaped net that is dragged along the sea bottom. Its mouth is kept open by floats, weights and by two otter boards which shear outward as the net is towed.

Over-capitalization In a fishing fleet, this means more money has been invested in boats than the fishery can support. It can also refer to the ability of fishermen to increase effort without increasing the number of boats. If no new boats are added to a fishery, but each boat doubles its fishing power by carrying twice as much gear or using new technology (sonar, GPS, etc.), the new effort can have the same effect as doubling the number of boats. Other commercial fishery sectors can also become overcapitalized.

Overfished Any stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding. The term generally describes any stock or stock complex determined to be below its overfished/rebuilding threshold. The default proxy is generally 25% of its estimated unfished biomass; however, other scientifically valid values are also authorized.

Overfishing Fishing at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. More specifically, overfishing is defined as exceeding a maximum allowable fishing mortality rate (or the MFMT). For any groundfish stock or stock complex, the maximum allowable mortality rate will be set at a level not to exceed the corresponding MSY rate (F_{MSY}) or its proxy (e.g., $F_{35\%}$).

Oviparous Producing eggs that hatch outside the female's body.

Ovoviviparous Pertaining to an animal that incubates eggs inside the mother until they hatch.

OY Optimum yield – see above

P

PacFIN Pacific Coast Fisheries Information Network. A database managed by the Pacific States Marine Fisheries Commission that provides commercial fishery information for Washington, Oregon, and California.

Pacific decadal oscillation (PDO) A long-term, El Niño-like pattern of Pacific climate variability. Two main characteristics distinguish PDO from El Niño/Southern Oscillation (ENSO): first, 20th century PDO "events" persisted for 20-to-30 years, while typical ENSO events persisted for 6 to 18 months; second, the climatic "fingerprints" of the PDO are most visible in the North Pacific/North American sector, while secondary signatures exist in the tropics - the opposite is true for ENSO.

Pacific Fishery Management Council (PFMC) The regional fishery management council established by the Magnuson-Stevens Act to develop management plans and recommendations for managing marine fish stocks (including salmon) in the EEZ off the coasts of Washington, Oregon and California.

Pacific States Marine Fisheries Commission (PSMFC) Authorized by Congress in 1947, the PSMFC is one of three interstate commissions dedicated to resolving fishery issues. Representing California, Oregon, Washington, Idaho, and Alaska, the PSMFC does not have regulatory or management authority; rather it serves as a forum for discussion, and works for coastwide consensus to state and federal authorities. PSMFC addresses issues that fall outside state or regional management council jurisdiction.

Parturition Birth

Patchy distribution A condition in which organisms occur in aggregations.

PBR Potential biological removal – see below

PDO Pacific decadal oscillation – see above

Pelagic Inhabiting the water column as opposed to being associated with the sea floor; generally occurring anywhere from the surface to 1000 meters (547 fm). See also epipelagic and mesopelagic.

Pelagic Refers to the plants and animals that live in the water column or in the open waters of the ocean rather than the ocean floor (see benthic). Life is found throughout the pelagic zone, however is more concentrated at shallower depths. Pelagic organisms can be further divided into the plankton and nekton. Compare benthic. (epipelagic: living in the upper or photic layer between 0 and 200 meters; mesopelagic: living between 200 and 1000 meters).

Permit stacking The registration of more than one limited entry permit for a single vessel, where a vessel is allowed additional catch for each additional permit registered for use with the vessel.

PFMC Pacific Fishery Management Council – see above

Photic zone The surface layer of the ocean that is penetrated by sunlight. The photic zone is the layer of the ocean that has been explored the most as it is relatively easy to access with conventional diving equipment. Light can penetrate down to approximately 200m which marks the end of the photic zone. Also referred to as the Sunlight Zone or the Epipelagic Zone.

Phytoplankton Microscopic planktonic plants. Examples include diatoms and dinoflagellates

Pinniped A member of the order of marine mammals that includes the seals, sea lions, and walruses, all having four swimming flippers.

Piscivorous An organism that eats fish.

Planktivorous An organism that feeds on planktonic organisms.

Plankton Pelagic organisms that float through the water column, not attached to any substrate and unable to move against the currents and tides. Plankton can be further divided into phytoplankton and zooplankton, meroplankton and holoplankton. Compare nekton.

POP Pacific ocean perch

Population All individuals of the same species living in a certain area during a given time. Environmental barriers may divide the population into local breeding units with restricted interbreeding between the localized units.

Potential biological removal (PBR) The maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

PRA Paperwork Reduction Act

Preferred alternative The alternative that is identified as preferred by the authors of an environmental impact statement or environmental assessment. It is identified to indicate which alternative is likely to be selected, thereby helping the public focus its comments.

Processing The preparation or packaging of fish to render it suitable for human consumption, retail sale, industrial uses, or long-term storage, including but not limited to cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but not heading and gutting unless additional preparation is done.

Production Gross primary production is the amount of light energy converted to chemical energy in the form of organic compounds by autotrophs like algae. The amount left after respiration is net primary production and is usually expressed as biomass or calories/unit area/unit time. Net production for carnivores and herbivores is based on the same concept, except that chemical energy from food, not light, is used and partially stored for life processes. Efficiency of energy transfers between trophic levels ranges from 10-65% (depending on the organism and trophic level). Organisms at high trophic levels have only a fraction of the energy available to them that was stored in plant biomass. After respiration loss, net production goes into growth and reproduction, and some is passed to the next trophic level.

Productivity The rate at which a given quantity of organic material is produced by organisms.

Prohibited species Species that may not be retained, and that should not be captured or harmed. Prohibited species identified in the groundfish FMP include Pacific halibut, salmonids, and Dungeness crab.

Prohibited species catch or cap (PSC) A PSC limit is a specified limit on the amount of the species that may be caught or killed.

PSMFC Pacific States Marine Fisheries Commission – see above.

Q-R

Q The selectivity of fishing gear or the ratio of fish caught by the gear to those actually present.

QSM	Quota species monitoring is a PacFIN database that monitors the cumulative landings of species managed either with individual OYs or OYs prescribed for a species complex (grouping of species in a single management unit). The GMT uses quota species monitoring to develop inseason groundfish fishery management recommendations to attempt to attain, but not exceed, prescribed OYs.
Quota	A specified numerical harvest objective, the attainment (or expected attainment) of which causes closure of the fishery for that species or species group.
R/S	Recruits per spawner
R	Recruits or recruitment**.** This is the estimated production of new members to a population as measured at a specific life stage.
R_0	Level of unfished recruitment
Rebuilding	Implementing management measures that increase a fish stock to its target size.
Rebuilding Plan	When abundance of a groundfish stock is found to have declined to 25% or less of the size it was before any fishing (or to some other early stock size), it must be rebuilt to its MSY stock size, which is typically about 40% of the unfished size. A rebuilding plan calculates how long it will take to rebuild the stock and the methods and management measures that will be used.
RecFin	Recreational Fishery Information Network. A database managed by the Pacific States Marine Fisheries Commission that provides recreational fishery information for Washington, Oregon, and California.
Recreational Fishing	Recreational fishing means fishing for sport or pleasure, but not for sale.
Recruit	An individual fish that has moved into a certain class, such as the spawning class or fishing-size class.
Recruitment	(1) Entry of new fish into a population, whether by reproduction or immigration; (2) Addition of new individuals to the fished component of a stock (because they have acquired the size, age, or location that makes them part of it.)
Regime shift	A long-term change in marine ecosystems and/or in biological production resulting from a change in the physical environment. – see also PDO above
Regulatory discard	The portion of bycatch that results from fishers complying with the regulations.
Regulatory Flexibility Analysis (or Act)	(**RFA**) Anytime an agency publishes a notice of proposed rule making, an RFA is required. It describes the action, why it is necessary, the objectives and legal basis for the action, a description of who will be impacted by the action, and a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule. The types of entities subject to the rule, and the professional skills required to prepare the report or record, must also be described.
Reproductive potential	The number of offspring possible for a female of a given species to produce if she lives to the average age.
Restricted species catch quota	(**RSQ**) A specified catch limit of an overfished stock that applies to an individual vessel or limited entry permit holder. A type of individual quota or cap.
RFA	Regulatory Flexibility Analysis, or Regulatory Flexibility Act – see below
RIR	Regulatory Impact Review – See Regulatory Flexibility Analysis.

Roller trawl A trawl net equipped with rollers that enable the net to go over rocky areas without snagging.

Rulemaking The process of developing Federal regulations which occurs in several steps, including publishing proposed rules in the *Federal Register*, accepting comments on the proposed rule, and publishing the final rule. An "advanced notice of proposed rulemaking" is published when dealing with especially important or controversial rules.

S

SAFE Stock assessment and fishery evaluation. See below.

Salmonid A member of the Salmonidae family of fishes.

Scientific and Statistical Committee (**SSC**) An advisory committee of the PFMC made up of scientists and economists. The Magnuson-Stevens Act requires that each council maintain an SSC to assist in gathering and analyzing statistical, biological, ecological, economic, social, and other scientific information that is relevant to the development of fishery management plans.

Scoping An early and open process for determining the scope (range) of issues to be addressed and for identifying the significant issues related to a proposed action.

***Sebastes* complex** Rockfish assemblage, including most species of the genus *Sebastes*.

Secondary Consumer A heterotrophic, carnivorous organism that feeds on a primary consumer. Herring feeding on zooplankton are an example of a secondary consumer. See also food chain, heterotroph, primary consumer.

Secretary The U.S. Secretary of Commerce.

Sessile Referring to animals that are permanently attached to a substrate.

Set gillnet A gillnet that is anchored on both ends.

Setline Fishing gear made up of a long main line attached to which are a large number of short branch lines. At the end of each branch line is a baited hook. When catching groundfish and Pacific halibut, setlines are typically laid on the sea-floor. When catching swordfish, shark or tuna they are buoyed near the surface. Setlines can be twenty or more miles long. They are also called longlines.

Shelf see continental shelf, above.

Shelf survey NMFS bottom trawl surveys of the continental shelf, designed to provide information on distribution and abundance of demersal species, and other biological resource information.

Shore-based Refers to catcher vessels that deliver Pacific whiting to processing facilities on land. This sector of the whiting fishery, as the other sectors, has a whiting allocation.

SFA Sustainable Fisheries Act of 1996 that amended the Magnuson-Stevens Act with stricter stock conservation standards including the prescribed rules for rebuilding overfished marine fish populations.

Simple random sampling A sampling procedure for which each possible sample is equally likely to be the one selected. A sample obtained by simple random sampling is called a simple random sample.

Slope see continental slope, above.

Slope survey	NMFS bottom trawl surveys of the continental slope, designed to provide information on distribution and abundance of demersal species, and other biological resource information.
Southern California bight	See California Bight
Spawning biomass	The biomass of mature female fish at the beginning of the year. If the production of eggs is not proportional to body weight, then this definition is construed to be proportional to expected egg production.
Species	(1) A fundamental taxonomic group ranking after a genus. (2) A group of organisms recognized as distinct from other groups, whose members can interbreed and produce fertile offspring
Species Richness	The number of different species that exist within a given area or community. Compare species abundance.
Species diversity	A measure of both species abundance and species richness. An area that has a large number of species and many representative individuals from each species is more diverse than an area that has only a single species. See also biodiversity; compare ecosystem diversity.
Spawning Potential Ratio	**(SPR)** the number of eggs that could be produced by an average recruit in a fished stock, divided by the number of eggs that could be produced by an average recruit in an unfished stock. SPR can also be expressed as the spawning stock biomass per recruit (SSBR)
Spawning Stock Biomass	(**SSB**) the total weight of the fish in a stock that are old enough to spawn
SSBR	Spawning Stock Biomass Per Recruit - the spawning stock biomass divided by the number of recruits to the stock, or how much spawning biomass an average recruit would be expected to produce.
SSC	Scientific and Statistical Committee – see above
STAR	Stock assessment review
STAR Panel	Stock Assessment Review Panel
STAT	Stock Assessment Team
Status quo	"No action," or the current conditions and expected conditions if no action is taken.
Stock	A grouping of fish usually based on genetic relationship, geographic distribution, and movement patterns. Stock is the practical unit of a population that is selected for management or harvesting purposes. In some casts a managed stock may include more than one species.
Stock Assessment and Fishery Evaluation (SAFE)	A SAFE document is a document prepared by the Council that provides a summary of the most recent biological condition of species in the fishery management unit, and the social and economic condition of the recreational and commercial fishing industries, including the fish processing sector. It summarizes, on a periodic basis, the best scientific information available concerning the past, present, and possible future condition of the stocks and fisheries managed in the FMP.

Stratified random sampling A sampling method in which one (1) divides the population into subpopulations (called strata), (2) obtains from each stratum a simple random sample of size proportional to the size of the stratum, and (3) uses all of the members obtained in step 2 as the sample.

Substrate A solid surface on which an organism lives or to which it is attached (also called substratum); or, a chemical that forms the basis of a biochemical reaction or acts as a nutrient for microorganisms.

Subtidal zone The benthic zone extending from the low tide mark to the outer edge of the continental shelf.

Sustainable A sustainable way of life is one in which human needs are met without diminishing the ability of other people, wild species, or future generations to survive.

SWFSC Southwest Fisheries Science Center (NMFS)

Swim bladder A sac inside the fish's body by which the fish can control buoyancy

Sympatry The common occurrence of two taxa (closely related forms) in the same geographic area.

T

TAC Total allowable catch (this term is used for Pacific halibut and for Alaska groundfish but typically not for West Coast groundfish)

Target fishing Fishing for the primary purpose of catching a particular species or species group (the target species).

Territorial sea A zone extending seaward from the shore or internal waters of a nation for a distance of twelve miles (19.3 km) as defined by the United Nations Conference on the Law of the Sea (UNCLOS). The coastal state has full authority over this zone but must allow rights of innocent passage.

Thermocline The often sharply defined boundary between surface water and deeper, cooler water. The water layer in which temperature changes most rapidly with increasing depth.

T_{MAX} The maximum time period to rebuild an overfished stock according to National Standard Guidelines

T_{MIN} The minimum time period to rebuild an overfished stock according to National Standard Guidelines

Total catch OY Total catch optimum yield. The landed catch plus discard mortality.

Trammel net An entangling net that hangs down in several curtains.

Transect A straight line placed on the ground along which ecological measurements are taken. If an ecologist wanted to sample the diversity of intertidal organisms in the intertidal, he/she would place a number of transects perpendicular to the shore and take samples at predetermined interval lengths.

Trawl A sturdy bag or net that can be dragged along the ocean bottom, or at various depths above the bottom, to catch fish.

Tribal Refers to vessels owned and operated by members of the four coastal Indian Tribes in Washington that harvest groundfish. Amounts of various groundfish, including sablefish and whiting, are set aside for harvest by Tribal fishers.

Troll To trail artificial or natural baits behind a moving boat. The bait can be made to skip along the surface or trailed below at any depth to just above the bottom.

Trophic Concerning feeding habits, food chains, or nutrition

Trophic level The nutritional position occupied by an organism in a food chain or food web; e.g. primary producers (plants); primary consumers (herbivores); secondary consumers (carnivores), etc.

U

U and A Usual and accustomed

Upwelling The process whereby prevailing seasonal winds create surface currents that allow nutrient rich cold water from the ocean depths to move into the euphotic or epipelagic zone.

USCG U.S. Coast Guard

USFWS U.S. Fish and Wildlife Service

Viviparous Bringing forth living young, rather than being an egg-layer. Rockfish are viviparous.

VMS Vessel monitoring system

VWXYZ

WA Washington

Water column The water from the surface to the bottom at a given point.

WDFW Washington Department of Fish and Wildlife

WOC Washington, Oregon and California

Year-class Refers to animals of a species population hatched or born in the same year at about the same time; also known as a cohort. Strong year classes result when there is high larval and juvenile survival; the reverse is true for weak year-classes. The effects of strong and weak year-classes on population size and structure persist for years in species with long lives. Variation in year-class strength often affects fisheries.

YOY Young-of-the-year.

Zooplankton Animal members of the plankton.