LIMITED ENTRY FLEET CAPACITY MANAGEMENT AND A MARKET SQUID MAXIMUM SUSTAINABLE YIELD CONTROL RULE

AMENDMENT 10 TO THE COASTAL PELAGIC SPECIES FISHERY MANAGEMENT PLAN

INCLUDING
ENVIRONMENTAL ASSESSMENT/REGULATORY IMPACT REVIEW AND DETERMINATION OF THE IMPACT ON SMALL BUSINESSES

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TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
CDFG	California Department of Fish and Game
Commission	California Fish and Game Commission
Council	Pacific Fishery Management Council
CPS	Coastal Pelagic Species
CPSAS	Coastal Pelagic Species Advisory Subpanel
CPSMT	Coastal Pelagic Species Management Team
CZMA	Coastal Zone Management Act
DEA	data envelopment analysis
EA	environmental assessment
EE	egg escapement method
EEZ	exclusive economic zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
ENSO	El Niño Southern Oscillation
E.O.	Executive Order
ESA	Endangered Species Act
FMP	fishery management plan
FONSI	finding of no significant impact
GT	calculated gross tonnage per 46 CFR 69.209
LE	limited entry
Magnuson-Stevens Act or MSA	Magnuson-Stevens Fishery Conservation and Management Act
MOU	memorandum of understanding
MSY	maximum sustainable yield
mt	metric tons
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NS	National Standards (per by the Magnuson-Stevens Act)
ODFW	Oregon Department of Fish and Wildlife
OY	optimum yield

PDO	Pacific Decadal Oscillation
PRA	Paperwork Reduction Act
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SBA	Small Business Administration
Secretary	U.S. Secretary of Commerce
SSC	Scientific and Statistical Committee
STAR	Stock Assessment Review
SWFSC	Southwest Fisheries Science Center
WDFW	Washington Department of Fish and Wildlife

1.0 INTRODUCTION – PURPOSE AND NEED FOR ACTION

1.1 How This Document is Organized

This fishery management plan (FMP) amendment contains two distinct, unrelated elements that address deficiencies in the coastal pelagic species (CPS) FMP. The first pertains to establishing a capacity goal and permit transferability for the limited entry fleet. The second element addresses the need for a maximum sustainable yield (MSY; or proxy) for the market squid resource, as required by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). While unrelated, these two elements are embodied in a single plan amendment in order to minimize redundancy of elements common to all Environmental Assessments (EAs) and Regulatory Impact Reviews (RIRs).

This section discusses the purpose and need for these two actions. Section 2 describes the Proposed Action and other alternatives that the Council considered to address management objectives. Section 3 is a description of the affected environment. Section 4 contains an analysis of the environmental consequences of each alternative, including a rationale for the Proposed Action. Section 5 summarizes the Proposed Action's consistency with FMP objectives and the Magnuson-Stevens Act. Section 6 addresses other laws, besides the Magnuson-Stevens Act, that apply to the development of fishery management actions. Section 7 contains reference material including a list of preparers. Appendix A is the Finding of No Significant Impact.

Extensive background information is provided in the appendices of this document. Appendix B is a copy of the approval letter for Amendment 8, outlining reasons for disapproving the market squid MSY portion of the FMP. Appendix C (PFMC, 2001a) contains the Coastal Pelagic Species Management Team's (CPSMT's) detailed analysis of the fleet's harvesting capacity and serves as the basis for options considered for a capacity goal and conditions for the transfer of existing permits. Appendices D, E, F, and G comprise various analyses and recommendations pertinent to developing management alternatives for market squid MSY. Appendix H contains a complete listing of the State of California's Fish and Game Code and Title 14 Code of Regulations pertaining to market squid management. Appendix I contains the CPS FMP as would be revised by this amendment.

1.2 Purpose: Establishing a Capacity Goal and Related Limited Entry Measures

Proposed action: Establish a capacity goal for the limited entry (LE) fishery, provide for LE permit transferability to achieve and maintain the capacity goal, and establish a process for considering new limited entry permits.

Purpose: Ensure fishing capacity in the CPS limited entry fishery is in balance with resource availability.

1.2.1 Need: Problems for Resolution

The limited entry program established under Amendment 8 was implemented to prevent overcapitalization of the CPS fleet. Permits were transferable without restrictions during the first year of the program (2000). As of 2001, permits were made non-transferable except when the permitted vessel is totally lost, stolen, or scrapped, and the permit is placed on a replacement vessel of the same or less net tonnage. These restrictions were intended to place a cap on the harvesting capacity of the fleet pending the establishment of a capacity goal. The Coastal Pelagic Species Advisory Subpanel (CPSAS) and the public have expressed concern about the transferability restrictions and whether the number of permits initially issued reflects optimal capacity in the fishery. To address these concerns, the Council directed the CPSMT to analyze several issues related to capacity and permit transferability, (1) establish a goal for the CPS finfish fishery (i.e., what should the fishery "look like" in terms of the number of vessels and the amount of capacity); (2) develop mechanisms for achieving the goal; (3) establish mechanisms for adjusting permit transferability to maintain the capacity goal; and (4) establish a procedure for issuing new permits once the goal is attained.

1.2.2 Background

In November 2000, the CPSMT provided a range of scenarios under which a capacity goal could be established, (1) maintain a diverse CPS finfish fleet (similar to current number of vessels), which also relies on other fishing opportunities such as squid and tuna; (2) determine the size of a smaller fleet of vessels with certain characteristics (e.g., small number of larger, "efficient" vessels or smaller number composed of CPS finfish "specialists"); or (3) base the fleet size on expectations of long-term expected yields from the combined CPS finfish species and the number of vessels physically capable of harvesting that yield. The Council directed the CPSMT to continue work on establishing a capacity goal and addressing other capacity related issues such as permit transferability. Alternative capacity goals were to be constructed following the three options outlined by the CPSMT.

The CPSMT and CPSAS discussed these issues at their February 2001 and March 2001 meetings. At the April 2001 Council meeting, the CPSMT reported the results of their capacity analysis and recommended several alternatives for setting a capacity goal and addressing permit transferability (Appendix C). The CPSMT was subsequently directed to develop mechanisms for adjusting permit transferability, in the event the fleet should exceed the capacity goal, and establish criteria for issuing new permits. The CPSMT further developed options for these permit sub-issues, presenting them to the CPSAS and Council at the November 2001 meeting. Fleet capacity goal and permit transferability alternatives presented in this amendment represent the range of options developed by the CPSMT and CPSAS—with review and input from the Council, SSC, and the public—and agreed to by the Council.

1.3 Purpose: Establishing an MSY Proxy for Market Squid

Proposed action: Establish an MSY proxy and provide management measures to minimize the likelihood of overfishing.

Purpose: Bring the CPS FMP into compliance with the Magnuson-Stevens Act.

1.3.1 Need: Problems for Resolution

Two of the topics required by the Magnuson-Stevens Act to be included in all FMPs were not approved in Amendment 8 (the CPS FMP), which required action to correct these deficiencies. One topic, bycatch provisions for the CPS fishery, was addressed and approved in Amendment 9 (66*FR*44896). Another topic, determination of optimum yield (OY) for market squid, was not approved, primarily because MSY-related analyses documented in an early draft of Amendment 9 were, for the most part, based strictly on landings information from the fishery and thus, were considered potentially misleading for determining sustainable exploitation strategies (e.g., MSY, MSY proxy, or OY) for the stock (Appendix B). That is, concerns centered on evaluating additional information that may be available, particularly, biological or fishery-independent data applicable to the squid population, to ensure adopted harvest policies meet their intended objective and do not risk the long-term stability of the stock due to overfishing.

1.3.2 Background

Options to estimate an MSY-proxy for market squid were initiated at a public meeting of the CPSMT in La Jolla, California on August 3 and 4, 1999. On August 24, 1999, a meeting was held between the CPSMT and the CPSAS. At its September meeting, the Council gave further direction to the CPSMT regarding MSY for squid. At its March 2000 meeting, the Council asked the CPSMT for a more thorough analysis of the alternatives proposed for establishing an MSY-proxy for squid and associated bycatch. At a public meeting in La Jolla, California on April 20 and 21, 2000, the CPSMT reviewed comments from the Council and the Scientific and Statistical Committee (SSC), and prepared additional material for establishing an MSY-proxy for squid based on historical landings and potential spawning area. These preliminary options and analyses were included in an early draft of Amendment 9 (Appendix D).

Based on presented testimony regarding draft Amendment 9, the Council decided to exclude squid MSY alternatives from Amendment 9 and wait until new stock assessment analyses for squid could be completed. At the November 2000 Council meeting, the SSC recommended the CPSMT work with the National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) to organize a stock assessment workshop to review ongoing squid research and integrate new approaches into the FMP. A squid stock assessment review (STAR) was held May 14-17, 2001. Findings from the STAR Panel were presented to the CPSMT on August 14-15, 2001 and the CPSAS and Council in November 2001 (see Appendix F; PFMC, 2001c). Based on the STAR Panel Report and further discussion, the CPSMT drafted recommendations for squid research and management and presented their report to the CPSAS and Council in November 2001 (Appendix G; PFMC, 2001). The market squid MSY alternatives presented in Amendment 10 represent the range of options developed by the CPSMT and CPSAS, based on review and input from the Council, SSC, and the general public. The CPSMT Report concerning the management of the squid resource was adopted by the Council in November 2001.

The CPS FMP includes two management categories for CPS fish stocks and fisheries: Active and Monitored management. Active management generally applies to stocks and associated fisheries that are characterized by biologically significant levels of catch or unique biological and/or socioeconomic considerations that require relatively intense harvest management procedures. The second category, Monitored management, is for stocks and fisheries that can be effectively managed by tracking landings and evaluating available relative indices of abundance and thus, do not typically require intensive harvest management regulations. Currently, Pacific sardine and Pacific mackerel are under Active management. Market squid, northern anchovy, and jack mackerel are under Monitored management.

The purpose of Active and Monitored management is to use available fishery agency resources in the most efficient manner, while satisfying goals and objectives of the FMP. The distinction enables scientists and managers to concentrate their efforts on stocks and sectors of the CPS fishery that need the greatest attention or where the most significant benefits are expected.

Active management may be characterized by periodic stock assessments and/or periodic adjustments of target harvest levels based on MSY control rules. Monitored management, in contrast, involves tracking trends in landings and when available, qualitative comparisons to relative abundance data, but does not typically involve formal stock assessments or periodic adjustments to target harvest levels. Species in both categories may be subject to management measures such as catch allocations, gear regulations, closed areas, closed seasons, or other forms of active management.

The CPS FMP provides explicit MSY control rules, as well as definitions for "overfishing" and "overfished stocks," for all species under Active management. Whereas, Monitored management may use generic or other general definitions of overfishing and overfished stocks that are not necessarily based on specific minimum thresholds for fishing mortality or biomass. Essential fish habitat (EFH) is described for all stocks, regardless of management category.

The CPSMT reviews all CPS stocks annually and makes recommendations to the Council and agencies regarding appropriate management categories for each stock (Active or Monitored). Changes to the appropriate management category for each species can be made annually by the Council, based on available data, including acceptable biological catch (ABC) levels and MSY control rules, and the goals and objectives of the CPS FMP.

The main objective of an MSY control rule for a Monitored stock is to help gauge the need for Active management. As stated previously, the MSY control rules and harvest policies for Monitored CPS stocks may be based on broader concepts and constraints than those used for stocks with significant fisheries that fall under Active management. Any fishery that supports catches approaching ABC or MSY levels should come under Active management, unless there is too little information available or other practical problems. Overfishing of a Monitored CPS stock is "approached" whenever current estimates or projections indicate that a minimum stock threshold will be realized within two years.

1.4 Scoping Summary

The Council process offers many opportunities to determine the scope of the action and the likely environmental consequences that merit analysis and disclosure. This work is carried out by advisory bodies and at Council meetings, which are open to the public. The preceding background discussion describes how the Proposed Actions analyzed in this document evolved with direction from the Council and development by various advisory bodies, in particular the CPSMT and CPSAS. Section 7.2 of this document lists public meetings where issues and analyses contained in Amendment 10 were developed, analyzed, and adopted.

Previous FMP amendments can be used to narrow the scope of the analysis if they have discussed impacts equivalent to the likely impacts of the Proposed Action, and the status of the affected resources has not changed substantially. An environmental impact statement (EIS) accompanied Amendment 8, which implemented the limited entry program that this amendment modifies. The analysis in that document can be used to narrow the scope of the analysis in this document. The EIS found that the limited entry program impacts "are primarily socioeconomic, although some environmental effects may arise if the tendency to overfish in open access fisheries is reduced by limited entry fisheries" (PFMC 1998, p. EIS-17). The capacity management measures described in this amendment would not affect harvest levels, which are determined by other FMP management measures. In addition, the status of the target resources have not changed substantially since the EIS was completed. For these reasons, the impact analysis for capacity management focuses on socioeconomic impacts.[1/] Any method chosen for setting market squid MSY would not have direct impacts on the resource. Further, at this time squid are not an actively managed species, so MSY estimates are only used to monitor their status. The analysis of management alternatives, therefore, focuses on the reliability of different approaches for estimating biomass and MSY. The Amendment 8 EIS notes, "There is not enough information available to evaluate impacts of the default MSY control rule for market squid because squid are not well understood" (PFMC 1998, p. EIS-18). These constraints also apply to the analysis in this document. In practical terms, the Proposed Action for squid management provides an approach to evaluate the effects of fishing mortality on the spawning potential of the stock and in particular, to examine the relation between the stock's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}).

1/ In addition to satisfying NEPA requirements, the analysis addresses requirements under the Regulatory Flexibility Act and Executive Order 12866, which focus on economic impacts.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Capacity Management in the CPS Limited Entry Fleet

Limited entry (LE) capacity-related alternatives are derived by combining elements from four sets of options, (A) establish a capacity goal, (B) specify conditions for transferring permits from one vessel to another, (C) set mechanisms to adjust transferability conditions in order to maintain the capacity goal, and (D) set procedures for issuing new limited entry permits. It is important to note that the choice of a particular option may be contingent on choosing another. For example, any mechanism for adjusting permit conditions depends on which option is chosen for permit transferability, which in turn depends to some extent on the capacity goal that is chosen.

A. Capacity goal	B. Permit transfer	C. Adjusting transferability[2/]	D. New permits
A.1. large, diverse fleet	B.1. no action	C.1. no action	D.1. no qualifying criteria; lottery or auction
A.2. small, specialized fleet	B.2. free transferability	C.2. 5% trigger	D.2. FMP qualifying criteria
A.3. based on long-term yield	B.3. restricted transferability	C.3. 10% trigger	D.3. new qualifying criteria
A.4. no action		C.4. 5% trigger, no 10% allowance	D.4. no action
		C.5. 10% trigger, no 10% allowance	

Proposed action options underlined.

Management alternatives are based on different combinations of these four option sets. No Action (Alternative 1)–composed of A.4, B.1, C.1, and D.4–is described in Section 2.1.1. The Proposed Action (Alternative 2)–composed of A.1, B.3, C.4, and D.2–is described in Section 2.1.2. Alternatives 3-7, which are composed of other possible combinations of options, are discussed in Section 2.1.3.

2.1.1 Alternative 1 (No Action)

The No Action Alternative, a required element of an EA, makes it possible to evaluate the effects of the Proposed Action with respect to conditions that would prevail if No Actions were taken and the current management regime continued without these changes.

Capacity Goal (Option A.4): Under the current management regime the fleet is fixed at 65 vessels, with no capacity goal or limits on fleet gross tonnage (GT).

Conditions for Transfer of Existing Permits (Option B.1): Under the current management regime permits cannot be transferred except, (1) if the permitted vessel is totally lost, stolen or scrapped, such that it cannot be used in a federally regulated commercial fishery, provided the application for the permit originates from the vessel owner who must place it on a replacement vessel of the same or less net tonnage within one year of disability of the permitted vessel, or (2) the permit is placed on a replacement vessel of the same or less net tonnage provided the previously permitted vessel is permanently retired from all federally managed commercial fisheries for which a permit is required.

2/ These options would be applicable only if Option B.3 is chosen. Option B.3 allows permit transfer with restrictions on the harvesting capacity of the vessel receiving the permit and is part of the Proposed Action. Trigger means a percentage change in overall fleet GT that triggers Council action. Allowance means, under option C.4 and C.5, the 10% transferability allowance (i.e., vessel GT + 10%) is removed after trigger percentage is reached.

Adjusting Permit Transferability to Maintain the Capacity Goal (Option C.1): Under status quo, there would be no provisions to adjust permit transferability to maintain the capacity goal.

Procedures for Issuing New Limited Entry Permits (Option D.4): Under status quo, there would be no provisions for issuing new permits.

2.1.2 Alternative 2 (Proposed Action)

Capacity Goal (Option A.1): Maintain a larger, diverse CPS finfish fleet, which also relies on other fishing opportunities such as squid and tuna, with normal harvesting capacity equal to the long-term expected aggregate finfish target harvest level, approximately 110,000 mt, and with physical capacity available to harvest peak period amounts of finfish, 275,000 mt. The current fleet of 65 vessels would satisfy this goal. Estimated normal harvesting capacity for the current fleet ranged from 60,000 mt to 111,000 mt per year; physical harvesting capacity ranged from 361,000 mt to 539,000 mt per year. Total calculated GT for the current fleet is 5,650.9 mt. Under this option, 5,650.9 mt of GT will, therefore, represent the fleet capacity goal. (See Appendix C for information on how these values were derived).

Conditions and effects of transferability should be reevaluated periodically in conjunction with achievement of the capacity goal and objectives of the FMP. The Council recommends setting a trigger for reevaluation based on an overall change in fleet GT of 5%. The CPSMT will evaluate capacity in the CPS finfish fishery relative to the capacity goal every two years starting in 2003, this would include a report to the Council with recommendations regarding the capacity goal and permit transferability.

Conditions for Transfer of Existing Permits (Option B.3): Allow CPS finfish limited entry permits to be transferred with restrictions on the harvesting capacity of the vessel to which it would be transferred to, (1) full transferability of permits to vessels of comparable capacity (vessel GT +10% allowance), and (2) allow permits to be combined up to a greater level of capacity in cases where the vessel to be transferred to is of greater harvesting capacity than the one from which the permit will be transferred.

Under the Proposed Action, each limited entry permit will have an endorsement based on the currently permitted vessel's calculated gross tonnage (GT) as defined in 46 CFR 69.209 for ship-shaped hulls, where:

$$GT = 0.67(Length*Breadth*Depth)/100.$$

The calculated GT endorsement and 10% allowance for each of the current 65 permits is provided in Table 2.2. The original permits and their respective endorsements will remain in effect for the lifetime of each permit, regardless of the GT of a vessel to which it may be transferred. In cases where a permit is transferred to a vessel with smaller GT, the original GT endorsement will remain, and excess GT may not be split out from the original permit configuration and sold. In cases where two or more permits are transferred to a larger vessel, the larger vessel will hold the original permits and may fish for CPS finfish as long as the aggregate GT endorsements, including the 10% allowances, add up to the new vessel's calculated GT. In the event a vessel with multiple permits wishes to leave the CPS limited entry program, those permits may be sold together or separately, but the original permit endorsement may not be altered. Specific examples of permit transfer scenarios are provided in Section 4.1.2.2.B. In order to ensure manageability of the permit program and stability of the fleet, only one transfer per permit will be allowed in each calender year. Permits may only be used on the vessel to which they are registered, and permit leasing will not be allowed. Catch history will be tied to the vessel, and not to the permits.

Adjusting Permit Transferability to Maintain the Capacity Goal (Option C.4): Restore fleet capacity to target fleet GT (5,650.9 mt) by restricting conditions for permit transfer when the upper threshold of fleet GT(fleet GT plus 5%, or 5,933.5 mt) is reached. Under this mechanism, once the trigger point is met or exceeded, permits could only be transferred to vessels with equal or smaller GT and the 10% vessel allowance would be removed. The 10% allowance could be reconsidered once total fleet GT is reduced to the 5,650.9 mt target.

Procedures for Issuing New Limited Entry Permits (Option D.2): Use qualifying criteria originally established in Amendment 8 for issuance of new CPS finfish limited entry permits. This would probably entail continuing down the list of vessels having landings during the 1993-1997 window period in order of decreasing window period landings. In this case, the next permit awarded would go to the 71st of the 640 vessels with window period finfish landings if this vessel were to apply. Each vessel on the list would need to have its harvest capacity evaluated so that in aggregate the new capacity target was not exceeded. New permits could be issued on either a temporary or permanent basis, depending on the circumstances surrounding the need for additional fleet capacity.

2.1.3 Other Possible Alternatives

Without a capacity goal (option set A) it is still reasonable to consider the full range of permit transferability options (option set B), although there would be no need for adjusting permit transferability to correct for overshooting the capacity goal (option set C).[3/] With a capacity goal (option set A), it seems unreasonable to allow full transferability which would greatly increase the likelihood of exceeding the capacity goal. However, it is reasonable to consider a capacity goal without permit transferability, which would negate the need for any transferability adjustment mechanism. Given these considerations, the following five alternatives, in addition to Alternative 1 (No Action) and Alternative 2 (Proposed Action) emerge.

Alternative 3: No capacity goal (Option A.4), and full permit transferability (Option B.2).
Option A.4: Under the current management regime the fleet is fixed at 65 vessels, with no capacity goal or limits on fleet GT.
Option B.2: Allow CPS finfish limited entry permits to be transferred without constraints.

Alternative 4: No capacity goal (Option A.4), with restricted permit transferability (Option B.3).
Option A.4: Under the current management regime the fleet is fixed at 65 vessels, with no capacity goal or limits on fleet GT.
Option B.3: Allow CPS finfish limited entry permits to be transferred with restrictions on the harvesting capacity of the vessel to which it would be transferred to, (1) full transferability of permits to vessels of comparable capacity (vessel GT +10% allowance), and (2) allow permits to be combined up to a greater level of capacity in cases where the vessel to be transferred to is of greater harvesting capacity than the one from which the permit will be transferred.

Alternative 5: Capacity goal (Option A.1) and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1).
Option A.1: Maintain a larger, diverse CPS finfish fleet, which also relies on other fishing opportunities such as squid and tuna, with normal harvesting capacity equal to the long-term expected aggregate finfish target harvest level, approximately 110,000 mt, and with physical capacity available to harvest peak period amounts of finfish, 275,000 mt. The current fleet of 65 vessels would satisfy this goal. Estimated normal harvesting capacity for the current fleet ranged from 60,000 mt to 111,000 mt per year; physical harvesting capacity ranged from 361,000 mt to 539,000 mt per year. Total calculated GT for the current fleet is 5,650.9 mt. Under this option, 5,650.9 mt of GT will, therefore, represent the fleet capacity goal.
Option B.1: Under status quo, permits cannot be transferred except, (1) if the permitted vessel is totally lost, stolen or scrapped, such that it cannot be used in a federally regulated commercial fishery, provided the application for the permit originates from the vessel owner who must place it on a replacement vessel of the same or less net tonnage within one year of disability of the permitted vessel, or (2) the permit is placed on a replacement vessel of the same or less net tonnage provided the previously permitted vessel is permanently retired from all federally managed commercial fisheries for which a permit is required.

3/ The no capacity goal option (A.4) and no permit transfer option (B.1) are contained in Alternative 1.

Alternative 6: Capacity goal (Option A.2) and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1).

Option A.2: Work the fleet down to a smaller number of vessels with certain characteristics (e.g., smaller number of larger, "efficient" vessels; or smaller number composed of CPS finfish "specialists"), with normal harvesting capacity equal to average total finfish landings over the 1981-2000 period, approximately 57,676 mt.

Option B.1: Under status quo, permits cannot be transferred except, (1) if the permitted vessel is totally lost, stolen or scrapped, such that it cannot be used in a federally regulated commercial fishery, provided the application for the permit originates from the vessel owner who must place it on a replacement vessel of the same or less net tonnage within one year of disability of the permitted vessel, or (2) the permit is placed on a replacement vessel of the same or less net tonnage provided the previously permitted vessel is permanently retired from all federally managed commercial fisheries for which a permit is required.

Alternative 7: Capacity goal option A.3 and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1).

Option A.3: Base the fleet size on our expectations of long-term expected yields from the combined CPS finfish species and the number of vessels physically capable of harvesting that yield, 110,000 mt annually, without an excess capacity reserve.

Option B.1: Under status quo, permits cannot be transferred except, (1) if the permitted vessel is totally lost, stolen or scrapped, such that it cannot be used in a federally regulated commercial fishery, provided the application for the permit originates from the vessel owner who must place it on a replacement vessel of the same or less net tonnage within one year of disability of the permitted vessel, or (2) the permit is placed on a replacement vessel of the same or less net tonnage provided the previously permitted vessel is permanently retired from all federally managed commercial fisheries for which a permit is required.

2.1.4 Other Options Considered in Developing Alternatives

Several other options for adjusting permit transferability and issuing new permits were discussed in developing Amendment 10. Because the seven alternatives described above represent a reasonable range of practicable alternatives for managing capacity in the limited entry fleet, the remaining options were not included in the analysis of the No Action, Proposed Action, and other alternatives. However, for completeness, these options are described below and Section 4.1.4 briefly analyses operational aspects of these remaining options.

Option C.1: There would be no provisions for adjusting transferability. This option includes only the conditions for permit transfer described under Option B.3, which is part of the Proposed Action. A CPS limited entry permit would be transferable on a 1-for-1 basis to a vessel with a harvesting capacity not in excess of 110% of that of the transferring vessel; if in excess of 110%, additional permits would have to be combined with the original permit to match the harvesting capacity of the vessel to which the permits will be transferred.

Option C.2: Restore fleet capacity to target fleet GT (5,650.9 mt) by restricting conditions for permit transfer when the upper threshold of fleet GT(fleet GT plus 5%, or 5,933.5 mt) is reached. Under Alternative 2, once the trigger point is met or exceeded, permits could only be transferred by combining-up on a 2-for-1 basis. Transfer restrictions could be repealed once fleet GT is reduced back down to the 5,650.9 mt target.

Option C.3: Restore fleet capacity to target fleet GT (5,650.9 mt) by restricting conditions for permit transfer when the upper threshold of fleet GT(fleet GT plus 10%, or 6,216.0 mt) is reached. Under Alternative 3, once the trigger point is met or exceeded, permits could only be transferred by combining-up on a 2-for-1 basis. Transfer restrictions could be repealed once fleet GT is reduced back down to the 5,650.9 mt target.

Option C.5: Restore fleet capacity to target fleet GT (5,650.9 mt) by restricting conditions for permit transfer when the upper threshold of fleet GT(fleet GT plus 10%, or 6,216.0 mt) is reached. Under Alternative 5,

once the trigger point is met or exceeded, permits could only be transferred to vessels with equal or smaller GT and the 10% vessel allowance would be removed. The 10% allowance could be reconsidered once total fleet GT is reduced to 5,650.9 mt target.

Option D.1: The FMP does not specify qualifying criteria for additional or new limited entry permits. Under this option permits could be issued on a first come first served basis (e.g., through lottery or auction). Each vessel applying for a permit would have to have its harvest capacity evaluated so that in aggregate the new CPS finfish harvesting capacity target was not exceeded. This option is probably not feasible unless none of the vessels applying have a history in the fishery.

Option D.3: Establish new qualifying criteria. This would involve establishing a new window period, minimum landings, etc. This would probably be desirable if there were reasons to extend the window period further back in time to qualify vessels whose history in the fishery pre-dated the original window period. Each vessel applying for a permit would have to have its harvest capacity evaluated so that in aggregate the new CPS finfish harvesting capacity target was not exceeded. This option would require an amendment to the FMP.

2.2 Market Squid MSY Control Rule

As discussed in Section 1, the second, separate management measure considered in this EA is implementation of an MSY control rule for market squid. The Council considered four alternatives for this measure.

To satisfy the mandates of the Magnuson-Stevens Act, the Council has endeavored to apply the concept of MSY to market squid. However, given the life history of market squid, its sensitivity to environmental parameters, and the strong influence of markets on landings, market squid may not be suited to management under an MSY-based approach. The Council's SSC provided the following comments on this matter (SSC report to the Council, September 1999):

> Market squid is very short-lived; recruitment and availability to the fishery are probably highly susceptible to environmental influences, and its spawning distribution and life history are poorly understood. One option being considered by the Coastal Pelagic Species Management Team (CPSMT) is to specify MSY on the basis of historical landings, an approach suggested by Restrepo et al. for situations in which biological data are lacking. The Restrepo recommendations, however, are best suited for finfish stocks with multiple year classes and may not be appropriate for squid. Another option considered by the CPSMT is to postpone MSY estimation until the results from ongoing aging, genetic, early life history, and other studies become available. These studies have been initiated to provide a scientific basis for a state-mandated squid fishery management plan, which must be completed by April 1, 2001. Given the biology of squid, there is no guarantee that MSY can be meaningfully estimated even after the results of these studies are known. However, the SSC expects these studies to provide a more substantive basis for estimating MSY than a simplistic approach based on landings alone. Landings may be less reflective of biomass than of market conditions and technological changes in the fishery.
>
> The SSC recommends the CPSMT consider allowing MSY to vary with environmental conditions rather than using a point estimate.

In developing these alternatives, the Council followed the guidance provided by the National Standard Guidelines (50CFR600 *et seq.*) and notes the following as particularly germane (emphasis added):

- Conservation and management shall prevent overfishing while achieving OY on a continuing basis.
- Determination of OY is a decisional mechanism and is based on MSY. The OY and conservation and management must prevent overfishing.

- Each FMP should include an estimate of MSY (long-term average yield); control rule (harvest strategy); and stock size (average size of the stock).

- In choosing an MSY control rule, Councils should be guided by the characteristics of the fishery, FMP objectives, and best scientific information available. For example, allow a constant level of escapement in each year, to maximize long-term average yield.

- MSY values are estimates based on the best scientific information available. "Councils have a reasonable degree of latitude in determining which estimates to use and how these estimates are to be expressed."

- When data are insufficient to estimate MSY directly, Councils should adopt other measures of productive capacity that can serve as reasonable proxies for MSY, to the extent possible. Examples include various reference points defined in terms of relative spawning per recruit. For instance, the fishing mortality rate that reduces the long-term average level of spawning per recruit to 30 to 40 percent of the long-term average that would be expected in the absence of fishing may be a reasonable proxy for the MSY fishing mortality rate.

- Each FMP must specify, to the extent possible, objective and measurable status determination criteria for each stock or stock complex covered by that FMP and provide an analysis of how the status determination criteria were chosen and how they relate to reproductive potential. Status determination criteria must be expressed in a way that enables the Council and the Secretary to monitor the stock or stock complex and determine annually whether overfishing is occurring and whether the stock or stock complex is overfished. In all cases, status determination criteria must specify both of the following:
  (i) A maximum fishing mortality threshold or reasonable proxy thereof... expressed either as a single number or as a function of spawning biomass or other measure of productive capacity.
  (ii) A minimum stock size threshold or reasonable proxy thereof... expressed in terms of spawning biomass or other measure of productive capacity.

- Secretarial approval or disapproval of proposed status determination criteria will be based on consideration of whether the proposal:
  (i) Has sufficient scientific merit.
  (ii) Contains the elements described in paragraph (d)(2) of this section.
  (iii) Provides a basis for objective measurement of the status of the stock or stock complex against the criteria.
  (iv) Is operationally feasible.

2.2.1 Alternative 1 (No Action)

Do not set an MSY or MSY proxy.

2.2.2 Alternatives 2 and 3 (Historical Landings Methods)

Alternative 2: Set an MSY proxy based on evaluation of historical landings. Determine a proxy for MSY based on recent average catches from time periods when there is no qualitative or quantitative evidence of declining abundance. This Alternative is generally based on methods discussed in Restrepo *et al.* (1998) for determining MSY proxies in data-poor situations, i.e., when insufficient sample data are available for classical MSY calculations. Additionally, see section 5.2.1 in PFMC (2000) for squid-related analysis conducted by the CPSMT in support of this Alternative (Appendix D).

Alternative 3: Set an MSY proxy based on evaluation of historical catch by spatial block, along with measures of coastwide (potential) spawning area determined from research trawl survey data. This Alternative is generally based on ad hoc "area expansion" techniques, whereby documented catch statistics

are expanded using total, "potential" fishing areas and/or squid spawning habitat as the expansion factor(s) and subsequently, assuming MSY is roughly equivalent to average, expanded catch statistics over an extended time period. See sections 5.2.2 and 5.2.3 in PFMC (2000) for squid-related analysis conducted by the CPSMT in support of this Alternative (Appendix D).

Alternatives 2 and 3 represent initial work conducted by the CPSMT from late 1999 to early 2000 following directions from the Council to evaluate MSY-based analysis and management for the squid fishery operating off southern California within the Exclusive Economic Zone (EEZ) along the U.S. Pacific Coast. The analyses applicable to these Alternatives are documented in Appendix D. Both Alternatives 2 and 3 are efforts to utilize primarily landings information from the fishery for determining sustainable exploitation strategies for this population. The major advantage of using such Alternatives is that the approaches are fairly straightforward and relatively easy to carry out (e.g., in a monitoring context). That is, when assessing the status of fisheries in "data-poor" situations, it may be reasonable to use historical average catch as a proxy for MSY. In the initial stages of the overall squid research, time constraints precluded thorough investigations of relevant sample data and analysis applicable to the squid fishery. Thus, researchers examined the most accessible, accurate time series available, i.e., catch statistics archived in a centralized database. The Alternatives represent first attempts at developing MSY guidelines for the fishery. However, because these Alternatives rely only on basic fishery data (i.e., landings), they necessarily produce results that are subject to a great deal of uncertainty that is often only assessed qualitatively. Given that dynamics of the squid population itself, as well as more detailed fishery data, are not objectively considered in Alternatives 2 and 3, the approaches should be considered strictly baseline monitoring strategies.

Alternative 2 is simply an examination of historical landings from the squid fishery over an extended time period, whereby, (1) year-to-year fluctuations are examined, with particular attention to increasing or decreasing trends across time–the current fishery is controlled primarily by market conditions and not management regulations that would severely constrain fishing pressure; (2) "rebound" potential of the population is qualitatively assessed by examining the magnitude of the catches during, or immediately following, unfavorable oceanographic periods (e.g., El Niño/Southern Oscillation [ENSO] events); and finally, (3) if the catch time series indicates no continued downward trend in the catches (i.e., keeping in mind relatively stable market demands) and given that catches following unfavorable environmental conditions do rebound to levels observed during favorable conditions, then it is reasonable to use (i.e., assume) an average catch over the time period as a proxy for MSY.

Alternative 3 is an extension of Alternative 2, whereby, (1) estimates of catch include all areas that have been fished historically, in efforts to determine the total, "potential" fishing area for the California squid fishery in any given season; (2) estimates of catch, and presumably habitat, are expanded to even broader areas based on coastwide spawning habitat determined through research trawl survey studies; (3) assuming annual values of MSY are a function of the expanded catch (using the ratio of exploited to unexploited fishing areas and/or potential spawning habitat); and finally, (4) determining an average MSY from the extended time series that is based on expanded catch statistics. As stated previously, both Alternatives 2 and 3 are inherently based on rather simple assumptions concerning the relationship between squid population abundance and observed catches and "potential" catches as derived through simple, but possibly unrealistic, expansion methods. Although both Alternatives 2 and 3 are products of rigorous examination of catch sample data, investigations that also consider the biology of the population, as well as more detailed fishery information are likely to generate more realistic results and ultimately, more accurate information for developing management strategies for this, or any other fishery.

2.2.3 Alternative 4 (Proposed Action)

Set fishing mortality at (or below) a level estimated to produce long-term sustainable yields (i.e., establish a baseline MSY proxy, F_{MSY}) based on evaluation of female squid spawning success determined through port sampling programs, coupled with per-recruit analysis theory. The foundation of this Alternative is a reproductive escapement model generally referred to as the Egg Escapement Method (EE). This Alternative generates necessary statistics for determining the relationships between important equilibrium-based fishery

descriptors and biological attributes of the population. See Squid STAR Working Paper 9, Appendix E for technical details regarding analysis involved in the EE and the CPSMT Report, Appendix G for management-related issues associated with implementation of the EE.

Of the four alternatives, Alternative 4 takes advantage of the most sample data, both biological- and fishery-related information. The EE method is generally based on a modeling approach that addresses the squid's life history, with a focus on the mortality and spawning rates of sexually mature females. Specifically, per-recruit analysis theory is used to generate stock parameter estimates, such as mean standing stock of eggs per harvested female, eggs per recruit, and egg escapement; all of the estimates are evaluated across a range of fishing mortality (F). To gauge the fishery's impact on the squid population, the estimated reproductive output of the harvested population is compared to the population's output in the absence of fishing. In practical terms, the EE approach can be used to evaluate the effects of F on the spawning potential of the stock and in particular, to examine the relation between the stock's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}). However, it is important to note this approach does not provide estimates of historical or current total biomass. Thus, a definitive yield (i.e., quota or ABC) cannot be determined at this time for market squid, which is a Monitored species (see Section 1.3.2 for discussion of Active versus Monitored management categories). This point is further discussed in a management context below (see discussion in this Section regarding "threshold" level of egg escapement).

The EE approach can be used to assess whether the fleet is fishing above or below an *a priori*-determined sustainable level of exploitation and in this context, can be used as an effective management tool. The EE method offers advantages for squid fishery management. First, it allows for "real-time" management of the fishery, without an unnecessarily large investment in personnel or regulations. Secondly, the method clarifies the role and importance of sample data on age, reproductive anatomy, and fishing effort, which collectively, allow researchers to conduct the most thorough assessment at this time. In summary, the current port sampling program implemented by the CDFG, along with newly developed laboratory and analysis procedures conducted by the NMFS (Southwest Fisheries Science Center, [SWFSC]), can provide an objective method for establishing MSY-based management goals for the squid resource.

Finally, the following discussion addresses pertinent decisions made by the CPSMT to develop a workable monitoring/management plan for the squid fishery based on the EE method. The STAR Panel (see Squid STAR Panel Report, Appendix F) provided general recommendations regarding analytical methods and left determination of specific model configurations and other management-related parameters to the CPSMT. Four areas of the EE method needed further review and are presented in the following four paragraphs, for 1-4, respectively, (1) selection of a "preferred" model scenario; (2) selection of a "threshold" level of egg escapement (EE value) that can be considered a warning flag when tracking the status of the population; (3) fishery operations in (and after) ENSO events; and finally, (4) necessary management-related constraints (see CPSMT Report, Appendix G).

The CPSMT largely relied on researchers familiar with squid biology to identify a "preferred" (i.e., most plausible) model scenario from the suite proposed in the overall analysis (Appendix E). First, given that model version 1 was the more general of the two proposed versions and adequately captured what is currently known regarding the maturation schedule of this species, the CPSMT recommended that this version be focused on when deriving final estimates. Further, two important areas of squid biology that were treated in sensitivity analysis during modeling exercises included hypothesized rates of natural mortality (M) and egg laying (v). The CPSMT recommended the preferred model scenario be based on $M = 0.15$ and $v = 0.45$ (both are daily rates), given, (1) data on the energetics of egg production and longevity of sexually mature adults indicate higher values of M are more likely than lower values; and (2) anatomical examinations of reproductive organs of young spawning females support egg-laying rates that are roughly equivalent to $v = 0.45$.

A "threshold" level of egg escapement can be practically interpreted as a level of reproductive (egg) escapement that is believed to be at or near a minimum level that is considered necessary to allow the population to maintain its level of abundance into the future (i.e., allow for sustainable reproduction year after year). It is important to note that a threshold level of egg escapement applicable to this species is not known

in strict terms at this time (and likely not a fixed value on an annual basis), but rather, determined from evaluating general patterns of harvest observed in the squid fishery off California, as well as examining similar reference points relied upon in other squid fisheries as approximate guidelines. The CPSMT recommended a threshold value of 0.3 (30%) be used initially, given, (1) a reproductive escapement threshold of roughly 0.4 (40%) has been used effectively in other squid fisheries (e.g., Falkland Islands fishery)–keeping in mind that the Falkland Island fishery harvests primarily juveniles, whereas California's fishery targets primarily spawning aggregations (i.e., mature adults); (2) not all of the squid spawning grounds off the California coast are subject to fishing pressure; (3) an existing weekend closure allows two days per week (i.e., roughly, 28% escapement) for spawning in the absence of fishing; and (4) the daily mortality of females during spawning is likely quite high. Given the reasons above, it is certainly possible that a more appropriate threshold level is even lower than 0.3. That is, the West Coast market squid resource might withstand fishing at a rate that would result in a higher fishing mortality. However, the CPSMT does not recommend a lower level of egg escapement (i.e., higher fishing mortality), given, (1) this is a new approach that should be monitored for some time before adopting a lower threshold; (2) there are some uncertainties about the retention of eggs in the females after capture; (3) there may be unevaluated fishery-dependent sources of mortality after spawning, such as fishing gear destruction of egg beds; (4) squid are members of a lower animal trophic level of the marine ecosystem and thus, play an important role as a forage species utilized by animals at higher trophic levels; and (5) sample data indicate that it is not likely that the recommended threshold will hamper the operations of the fishery as observed since the mid 1990s. In practical terms, the fishing mortality that results in 30% escapement (the threshold level) is a proxy for F_{MSY} and equivalent to the fishing mortality rate that reduces the average egg production per female to 30% of its unfished level. The use of an MSY proxy in this context is generally similar to management approaches used for other domestic fisheries off the U.S. Pacific Coast, such as $F_{40\%}$ used in groundfish fishery management, with the exception that no quota can be determined at this time, given an estimate of current biomass is unavailable (i.e., quota = F_{MSY} * biomass estimate). A threshold level of egg escapement of 30% will be used initially (for the first two years following implementation, 2003-2005). However, given the discussion above, the level of egg escapement considered to be sustainable will be reviewed on an intermittent basis and revised recommendations may be proposed in the future. Ultimately, the market squid fishery can operate freely, within the constraints of the current management regime (most notably the annual harvest cap, see Section 3.2.3), as long as egg escapement is equal to, or greater than, the threshold value. To monitor resource status and MSY proxy effectiveness, assessments will be conducted on a yearly basis for the first two years (2003-05), possibly going to multi-year basis in the future.

The impacts of ENSO events on the reproductive success of squid are poorly understood at this time. That is, the CPSMT deferred consideration of the effects of ENSO conditions on the squid population and ultimately, the fishery itself, until studies that focus on the influence of such oceanographic phenomena on squid abundance and distribution generate useful management advice. A consistent observation during such events is a temporary cessation of availability to the fishery. Although researchers generally believe this disappearance is due to both reduced reproduction by the population and movement out of the established spawning grounds and into favorable habitat, the extent and magnitude of each response are not clearly defined at this time. Most importantly, there is no indication from the post-ENSO landings of long-term detrimental damage to the population's ability to sustain itself, i.e., the population has recovered relatively quickly following El Niño events. Although catches by the fleet dramatically decline during such periods and in effect, self-regulate the fishery, the CPSMT cautioned that further restrictions on catch may be warranted in the future, given the broad impact that these oceanographic conditions have on many marine animal populations distributed along the U.S. Pacific Coast.

The CPSMT concurred with the STAR Panel that the present squid fishery needs to be closely monitored using the state-coordinated port sampling programs. Fishery monitoring should be especially attentive to the possible future development of a juvenile fishery. Further, it is recommended that regulatory-related issues applicable to the current squid fishery off California remain under the jurisdiction of CDFG through consultation with the CPSMT itself – keeping in mind the federal-based policies inherently in place for all U.S.-based fisheries. In this context, the CPSMT supports the 113,398 mt annual landings cap on the total harvest of squid that has been implemented by the State of California. The EE method (the Proposed Action) should be considered a joint effort between CDFG and NMFS. Were squid fisheries to expand into Oregon or Washington, the assumptions underlying the EE approach would have to be reviewed to ensure

they were applicable. That is, to make certain the assumptions are valid in the northerly reaches of the habitat regarding population productivity, growth, and maturation in colder waters with stronger seasonality. Future involvement by Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW) would be critical to this evaluation, as well as development and implementation of the necessary monitoring programs of the northern fisheries.

Currently, the default control rule in the FMP, for monitored species, establishes an ABC at 25% of MSY. OY for a CPS stock is currently defined to be the level of harvest which is less than or equal to ABC estimated using an MSY control rule, consistent with the goals and objectives of the FMP, and used by the Council to manage the stock.

For squid, the approach proposed in Amendment 10 departs from the default harvest policy; in that it relies on California's landings cap as an overall limit on harvest and continuous sampling of market squid landings to monitor egg escapement as an MSY-proxy. The proposed control rule establishes a fishing mortality rate ($F_{30\%}$) that approximates F_{MSY}. If the monitoring program reveals escapement is being exceeded or drops below the level, management action will be triggered. Under the CPS FMP, Monitored species are eligible for active management if the default ABC is exceeded two years in a row. In the case of anchovy and jack mackerel, there are default ABCs. Since the egg escapement approach does not set a target ABC for squid, the control rule would be the $F_{30\%}$ fishing mortality rate. If escapement falls below that level two years in a row it would result in consideration for active management.

TABLE 2.1. **Summary of Impacts for Amendment 10 Issues and Alternatives**. Alternatives are evaluated relative to the status quo/No Action, and solely in terms of CPS finfish fishing operations; No Action suggests what will happen without an alternative action being taken. Socioeconomic effects include, (1) changes in net economic benefits (producer and consumer surplus), and; (2) economic impacts, i.e., changes in economic activity (business transactions, income and employment) in fishing communities. A complete evaluation of the impacts of each action is given in section 4.0.

Option / Alternatives	Environmental Effects	Socioeconomic Effects
No Action–Alternative 1		
Capacity Goal for the CPS Limited Entry Fleet (Option A.4)	None	Long-term: increase in consumer and producer surplus; increased economic activity in CPS fishing communities
Conditions for Transfer of Existing Permits (Option B.1)	None	Long-term: slight increase in producer and consumer surplus; no change in fishing community economic activity
Adjusting Permit Transferability to Maintain the Capacity Goal (Option C.1)	N/A	N/A
Procedures for Issuing New Limited Entry Permits (Option D.4)	N/A	N/A
Proposed Action–Alternative 2		
Capacity Goal for the CPS Limited Entry Fleet (Option A.1)	None	Long-term: increase in consumer and producer surplus; increased economic activity in CPS fishing communities
Conditions for Transfer of Existing Permits (Option B.3)	None	Long term: increase in producer and consumer surplus; no change in fishing community economic activity
Adjusting Permit Transferability to Maintain the Capacity Goal (Option C.4)	None	Intermediate to long-term: increase in producer surplus, no change in consumer surplus; no change in fishing community economic activity

Option / Alternatives	Environmental Effects	Socioeconomic Effects
Procedures for Issuing New Limited Entry Permits (Option D.2)	None	Short to long term: increase in producer and consumer surplus; no change in fishing community economic activity
Alternative 3		
Capacity Goal for the CPS Limited Entry Fleet (Option A.4)	None	Long-term: increase in consumer and producer surplus; increased economic activity in CPS fishing communities
Conditions for Transfer of Existing Permits (Option B.2)	None	Long-term: no change or slight decrease in producer surplus; decrease in consumer surplus; increased fishing community economic activity
Alternative 4		
Capacity Goal for the CPS Limited Entry Fleet (Option A.4)	None	Long-term: increase in consumer and producer surplus; increased economic activity in CPS fishing communities
Conditions for Transfer of Existing Permits (Option B.3)	None	Long term: increase in producer and consumer surplus; no change in fishing community economic activity
Alternative 5		
Capacity Goal for the CPS Limited Entry Fleet (Option A.1)	None	Long-term: increase in consumer and producer surplus; increased economic activity in CPS fishing communities
Conditions for Transfer of Existing Permits (Option B.1)	None	Long-term: slight increase in producer and consumer surplus; no change in fishing community economic activity
Alternative 6		
Capacity Goal for the CPS Limited Entry Fleet (Option A.2)	None	Long-term: decrease in consumer surplus; reduction in fishing community economic activity
Conditions for Transfer of Existing Permits (Option B.1)	None	Long-term: slight increase in producer and consumer surplus; no change in fishing community economic activity
Alternative 7		
Capacity Goal for the CPS Limited Entry Fleet (Option A.3)	None	Long-term: decrease in consumer surplus; reduction in fishing community economic activity
Conditions for Transfer of Existing Permits (Option B.1)	None	Long-term: slight increase in producer and consumer surplus; no change in fishing community economic activity

Market Squid MSY Control Rule		
No Action – Alternative 1	A "risk prone" approach that could jeopardize the population's ability to maintain long-term abundance levels, i.e., not considered precautionary management	Long-term: relatively high potential for decrease in producer and consumer surplus, as well as economic activity of the overall fishing community
Alternative 2	A "risk prone" approach that could jeopardize the population's ability to maintain long-term abundance levels, i.e., not considered precautionary management	Long-term: relatively high potential for decrease in producer and consumer surplus, as well as economic activity of the overall fishing community
Alternative 3	A "risk prone" approach that could jeopardize the population's ability to maintain long-term abundance levels, i.e., not considered precautionary management	Long-term: relatively high potential for decrease in producer and consumer surplus, as well as economic activity of the overall fishing community
Proposed Action – Alternative 4	A "risk averse" approach that includes measures that generally protect the population's ability to maintain long-term abundance levels, i.e., considered precautionary management	Long-term: relatively high potential for increase in producer and consumer surplus, as well as economic activity of the overall fishing community

TABLE 2.2. **CPS limited entry permit vessel listing,** with U.S. Coast Guard registered measurements and calculated gross tonnage (GT) endorsement and maximum transfer allowance values for each vessel. This table is an updated listing and is more current than Table 1 in Appendix C.

Vessel Name	CG Number	LE Permit	Registered Measurements (ft.)[a/] Length	Breadth	Depth	Calculated GT[b/] Endorsement	Maximum Allowance (GT+10%)
Misty Moon	D578511	1	49.6	19.0	10.1	63.8	70.1
Paloma	D280452	2	47.4	16.5	8.3	43.5	47.8
St. George II	D238969	3	71.4	21.2	9.7	98.4	108.2
Barbara H	D643518	4	64.9	24.0	11.6	121.1	133.2
San Antonio	D236947	5	72.1	19.5	8.7	82.0	90.1
Annie D	D246533	6	73.2	21.5	9.3	98.1	107.9
San Pedro Pride	D549506	7	79.6	24.5	12.3	160.7	176.8
Ferrigno Boy	D602455	8	69.6	23.7	12.6	139.3	153.2
King Philip	D1061827	9	79.0	26.0	11.4	156.9	172.6
Sea Wave	D951443	10	78.0	22.0	18.0	206.9	227.6
Mary Louise	D247128	11	58.3	18.0	8.0	56.2	61.9
Bainbridge	D236505	12	78.6	22.7	9.6	114.8	126.2
Pioneer	D246212	13	77.8	24.3	11.2	141.9	156.1
Maria	D236760	14	70.7	20.5	9.2	89.3	98.3
St. Joseph	D633570	15	62.9	22.0	9.1	84.4	92.8
Sea Scout	D248454	16	81.5	23.1	10.9	137.5	151.2
Retriever	D582022	17	54.2	19.6	8.7	61.9	68.1
Atlantis	D649333	18	49.6	19.0	10.1	63.8	70.1
G. Nazzareno	D246518	19	78.0	22.7	10.5	124.6	137.0
Sea Queen	D582167	20	68.4	22.0	11.1	111.9	123.1
Pacific Leader	D643138	21	59.5	21.0	9.2	77.0	84.7
Chovie Clipper	D524626	22	51.1	18.0	10.3	63.5	69.8
Pacific Journey[c/]	OR661ZK	23	64.3	22.0	10.3	97.7	107.4
Ocean Angel I	D584336	24	49.6	19.0	10.1	63.8	70.1
Maria T	D509632	25	57.3	18.1	9.8	68.1	74.9
Manana	D253321	26	40.1	13.2	6.7	23.8	26.1
Miss Julie	D548223	27	49.5	17.8	9.4	55.5	61.0
Mineo Bros.	D939449	28	58.0	21.0	9.0	73.4	80.8
Sea Queen	D583781	29	49.0	16.0	8.0	42.0	46.2
Little Joe II	D531019	30	50.1	16.0	7.6	40.8	44.9
Caitlin Ann	D960836	31	95.0	33.0	10.7	224.7	247.2
Eldorado	D690849	32	56.0	17.0	8.6	54.9	60.3

Vessel Name	CG Number	LE Permit	Registered Measurements (ft.)[a/] Length	Breadth	Depth	Calculated GT[b/] Endorsement	Maximum Allowance (GT+10%)
Kristen Gail	D618791	33	87.0	26.0	12.8	194.0	213.4
Fiore D'Mare	D550564	34	71.5	23.0	11.4	125.6	138.2
Endurance	D613302	35	49.0	16.0	8.0	42.0	46.2
New Sunbeam	D284470	36	50.3	20.0	4.0	27.0	29.7
Calogera A	D984694	37	57.8	21.0	10.5	85.3	93.8
Eileen	D252749	38	79.4	22.1	10.2	119.9	131.9
Pamela Rose	D693271	39	54.0	19.0	9.0	61.9	68.1
New Stella	D598813	40	58.0	22.0	8.4	71.8	79.0
Traveler	D661936	41	56.0	17.0	6.9	44.0	48.4
Lucky Star	D295673	42	49.9	17.0	7.3	41.5	45.6
Ocean Angel II	D622522	43	74.5	28.0	10.7	149.5	164.5
Mello Boy	D1061917	44	66.0	26.0	12.0	138.0	151.8
Trionfo	D625449	45	63.8	19.3	9.6	79.2	87.1
Jenny Lynn	D541444	46	66.0	21.6	8.9	85.0	93.5
Heavy Duty	D655523	47	52.7	21.2	10.1	75.6	83.2
Aliotti Bros	D685870	48	67.6	26.0	9.1	107.2	117.9
Lady J	D647528	49	50.3	17.0	7.1	40.7	44.7
Anna S	D253402	50	50.8	16.2	9.1	50.2	55.2
Endeavor	D971540	51	57.4	19.0	9.9	72.3	79.6
Antoinette W	D606156	52	45.4	16.0	7.6	37.0	40.7
Donna B	D648720	53	73.2	25.0	12.9	158.2	174.0
Papa George	D549243	54	72.0	22.8	11.5	126.5	139.1
Mercurio Bros	D650376	55	42.0	16.7	8.6	40.4	44.5
Kathy Jeanne	D507798	56	65.9	22.2	8.8	86.3	94.9
Merva W	D532023	57	56.7	17.9	8.0	54.4	59.8
Santa Maria	D236806	58	79.2	19.5	8.8	91.1	100.2
Buccaneer	D592177	59	62.1	19.9	9.0	74.5	82.0
Midnight Hour	D276920	60	61.1	18.0	8.6	63.4	69.7
Nancy B II	D542513	61	56.4	18.0	8.8	59.9	65.8
Miss Kristina	D580843	62	50.0	16.0	7.4	39.7	43.6
Emerald Sea	D626289	63	62.7	26.0	7.9	86.3	94.9
Connie Marie	D624240	64	49.9	17.9	9.1	54.5	59.9
Theresa Marie	D629721	65	40.6	14.7	6.6	26.4	29.0

a/ Vessel dimension data were obtained from the U.S. Coast Guard web site http://psix.uscg.mil.

b/ Vessel calculated gross tonnage is GT=0.67(length*breadth*depth)/100. See 46 CFR 69.209.

c/ Pacific Journey was built in Canada and is not currently registered with the U.S. Coast Guard. Measurements are from marine surveyor Det Norske Veritas.

3.0 AFFECTED ENVIRONMENT

Comprehensive information on the affected environment may be found in Appendix A and Appendix D to the CPS FMP[4/]. The California Current is the eastern boundary of the North Pacific great subtropical anticyclonic gyre. At the northern extreme, subarctic water is entrained to flow equatorward. The great shifts in ocean climate at the decadal to century scale control the eastern boundary along the coasts of Washington, Oregon, California and Baja California. The California Current and the subarctic entrained waters are known as the "Transition" zone. The mixing of these waters with the seasonal coastal wind driven upwelling yield highly structured waters with patches of high nutrient and high productivity. High nutrient levels result from a winter buildup of regenerated nutrients and new nutrients from a shoaling thermocline, an influx of high-nutrient, subarctic water and small coastal intrusions of newly upwelled water. Pelagic fish species dominate the exploitable biomass of the system, with major concentrations of anchovy and squid close to the coastline ranging offshore to the habitats of sardine and jack mackerel. The California Current ecosystem is essentially a region of transport, coastal jets, divergence and upwelling. None of the stocks managed under the CPS FMP are considered overfished.

Seasonal and interannual environmental variability within the California Current ecosystem are associated with variations in the Pacific Basin atmospheric pressure systems, which control the local winds and Ekman transport, and affect flows of the equatorward California Current, the poleward undercurrent, and the inshore countercurrent. Variations on time scales of several years to decades are associated with alterations in the tropical and Aleutian pressure systems, (i.e., the ENSO phenomenon and the Pacific Decadal Oscillation [PDO]). ENSO and PDO events markedly alter flow and temperature of currents in the California Current.

Anchovy, sardine, hake, jack mackerel, and Pacific mackerel achieve the largest populations in the California current region as well as in other major eastern boundary currents. These populations are key to the trophic dynamics of the entire California Current ecosystem. Anchovy and sardines are the only fish in the ecosystem that consume large quantities of primary production (phytoplankton), all five of the species are significant consumers of zooplankton. All five species of fish, particularly mackerels and hake, and also squid are important predators of the early stages of fish. The juvenile stages of squid and all five species of finfish, and in many cases the adults, are important as forage for seabirds, pinnipeds, cetaceans, and other fish.

Trophic interactions between CPS and higher-trophic-level fish are poorly understood, and it is unknown if populations of individual predaceous fish are enhanced or hindered by large populations of CPS. It is not known if the value of CPS as forage to adult predators outweighs the negative effects of predation by CPS on larvae and juveniles of predator fish species plus competitive removal of phytoplankton, zooplankton, and other fish.

3.1 Essential Fish Habitat

A complete description of CPS EFH may be found in Appendix D of the CPS FMP. In determining EFH for CPS, the estuarine and marine habitat necessary to provide sufficient production to support MSY and a healthy ecosystem were considered. Using presence/absence data, EFH is based on a thermal range bordered within the geographic area where a managed species occurs at any life stage, where the species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the species. The specific description and identification of EFH for CPS finfish accommodates the fact the geographic range of all species varies widely over time in response to the temperature of the upper mixed layer of the ocean, particularly in the area north of 39° N latitude. This generalization is probably also true for market squid, but few data are available. Adult CPS finfish are generally not found at temperatures colder than 10° C or warmer than 26° C. Preferred temperatures (including minimum spawning temperatures) are generally above 13° C. Spawning is most common at 14° to 16° C.

4/ Unless stated, appendices cited in Section 3 refer specifically to appendices to the CPS FMP, not the current EA/RIR document.

3.2 Market Squid

3.2.1 Life History and Habitat

Market squid (*Loligo opalescens*) along the West Coast of North America were studied extensively during 1960 through 1980 (Recksiek and Frey 1978; Symposium of the 1978 CalCOFI Conference[5/]), but little research applicable to fisheries management has been carried out since then. Recent increases in squid landings have stimulated a variety of new research projects, but results have not yet been published.

Adult and juvenile market squid (Dickerson and Leos 1992) are distributed throughout the California and Alaska current systems from the southern tip of Baja California, Mexico (23° N latitude) to southeastern Alaska (55° N latitude). They are most abundant between Punta Eugenio, Baja California and Monterey Bay, central California. Market squid are harvested near the surface and generally considered pelagic, but are actually found over the continental shelf from the surface to depths of at least 800 meters. They prefer oceanic salinities and are rarely found in bays, estuaries, or near river mouths (Jefferts 1983). Adults and juveniles are most abundant between temperatures of 10° and 16° C (Roper *et al.* 1984).

Spawning squid concentrate in dense schools near spawning grounds, but habitat requirements for spawning are not well understood. Spawning occurs over a wide depth range, but the extent and significance of spawning in deep water is unknown. Known major spawning areas are shallow semi-protected, near shore areas with sandy or mud bottoms adjacent to submarine canyons where fishing occurs. In these locations, egg deposition is between 5 meters (Jefferts 1983) and 55 meters (Roper and Sweeney 1984), and most common between 20 meters and 35 meters. Off California, squid and squid eggs have been taken in bottom trawls at depths of about 800 meters near Monterey (Bob Leos, California Department of Fish and Game, pers. comm.) and have been observed at 180 meters near the Channel Islands (Roper and Sweeney 1984). Factors that determine spawning grounds have not been precisely identified. Hatchlings (called "paralarvae") are presumably dispersed by currents. Their distribution after leaving the spawning areas is largely unknown, but maps of market squid incidence from recent and historical surveys may be found in Appendix D of this document (Amendment 10 – EA/RIR). Attempts to differentiate squid stocks using anatomical and genetic characters have been inconclusive. Thus, the number of market squid stocks or subpopulations along the Pacific coast is unknown.

Spawning occurs year-round (Jefferts 1983). Peak spawning usually begins in southern California during the fall-spring season. Off central California, spawning normally begins in the spring-fall season. Squid spawning has been observed off Oregon during May through July. Off Washington and Canada, spawning normally begins in late summer. Year-round spawning likely reduces effects of poor temporary local conditions for survival of eggs or hatchlings. Year-round spawning suggests that stock abundance is not dependent on spawning success during a single short season or a single spawning area.

3.2.2 California's Market Squid Fishery

Market squid are important to both commercial and recreational fisheries. The commercial fishery has a long history in California, dating back to the mid-nineteenth century, but catches were usually less than 10,000 mt until the 1960's. During the 1980's, California's squid fishery grew rapidly in fleet size and landings when international demand for squid increased due to declining squid fisheries in other parts of the world. Today, this fishery lands over 100,000 mt per year and generates millions of dollars of income to the state annually from domestic and foreign sales. Most of the harvest is canned or frozen for export; smaller amounts are used domestically for human consumption and as live and dead bait.

The California commercial squid fishery targets spawning aggregations of squid and the major spawning grounds fished in California are found in Monterey Bay and at the Channel Islands. Unlike other squid fisheries worldwide, the California fleet utilizes two vessels in fishing operations; a smaller light vessel is used

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5/ See papers by various authors published during 1979 *in*: Calif. Coop. Oceanic Fish. Invest. Rep. 20: 21-71.

to locate and concentrate squid aggregations using strong lights to attract squid to the surface. A second larger vessel catches the squid, usually employing the use of a roundhaul net. Currently, 98% of the catching vessels use roundhaul nets, either purse or drum. Squid fishing vessels target schools that aggregate in sandy shallow water areas (from 15-50 m in depth) to spawn.

There are two major fishery areas in California; Point Conception divides the northern and southern fisheries. The northern fishery is centered on Monterey Bay and squid is landed at Monterey and Moss Landing. The northern fishery operates predominately within a half-mile of the Monterey Bay shoreline. The southern fishery targets a multitude of fishing spots including the Channel Islands and the coastal area from Point Conception south to La Jolla. Squid are landed at the ports of Ventura, Port Hueneme, San Pedro, and Terminal Island. Detailed information on market squid landings by port area and year may be found in Appendix A, Section 2.0 of the CPS FMP and also in the CPS SAFE.

3.2.3 Current Market Squid Fishery Management by the State of California

Commercial landings of market squid in California more than quadrupled from 1980 to 1997. Concern over the rapid increase in squid harvest and new vessels entering the fishery led to industry sponsored legislation in 1997 asking for management improvements in and placing a moratorium on the number of vessels in the fishery (SB364) and requiring an annual permit to land or to attract squid by using light for purposes of commercial squid harvest. In 1997, the state of California passed legislation which requires possession of special permits to fish for market squid in California waters. The new law applies to both fishing and light boat vessels. A three-year moratorium on the sale of new permits was effective May 1, 1998. Approximately 270 permits were sold by the final purchase deadline of May 31, 1998. Information on the coastwide composition of permit holders is not yet available, but vessel owners from as far north as Alaska have expressed interest in California's squid resource. Reported declines of Pacific herring off Alaska could possibly lead to increased interest in the future.

The California Fish and Game Commission (Commission) adopted interim measures for the market squid fishery under Title 14, §149 (California Code of Regulations). Interim measures included prohibiting the take of market squid for commercial purposes each week between noon Friday and noon Sunday from Point Conception south to the U.S.-Mexico border. The weekend closure extended an existing squid fishery closure for the same time period north from Point Conception to the California-Oregon border (California Fish and Game Code §8420.5). This precautionary measure was adopted to provide spawning squid at least two consecutive nights each week respite from fishing pressure. Another regulatory measure adopted by the Commission required commercial squid vessels and light boats to maintain logbooks detailing fishing and lighting activities. In response to potential negative effects of vessels lighting for squid and nesting seabirds on several of the Channel Islands, the Commission adopted regulations restricting attracting lights to a maximum of 30,000 watts and required that lights be shielded. In 2001, the Commission established a harvest guideline of 125,000 short tons (113,398 mt) for the market squid fishery. The harvest guideline selected was based on the highest seasonal catch level for the fishery and would serve to prevent volumetric growth of the fishery should market demand encourage such expansion. A complete listing of California's market squid regulations may be found in Appendix H of this amendment.

3.3 Predators

Northern anchovy, Pacific sardine, and market squid are probably important as forage to a long list of fish, birds, and mammals, including threatened, endangered, and depleted species (Morejohn *et al.* 1978). Some of the more important squid predators are king salmon, coho salmon, lingcod, rockfish, harbor seals, California sea lions, sea otters, elephant seals, Dall's porpoise, sooty shearwater, Brandt's cormorant, rhinoceros auklet, and common murre.

Coastal pelagic species are eaten by a number of marine mammals, dependence on CPS varying by age from predator to predator. A great deal of information is available about the diets of adult marine mammals, and the total amount of CPS eaten per year has been estimated for a few. It is not currently possible, however, to estimate the total amount of CPS used as forage by all marine mammals in the California Current

ecosystem or the size of CPS populations necessary to sustain predator populations. Some of the species, such as the Pribilof population of the northern fur seal, are listed as depleted, but a local stock at San Miguel Island is not depleted.

Pelagic schooling fish are key components of marine food webs and primary prey of many seabirds. CPS are important to seabirds because of their abundance near the sea surface, relatively small size, fusiform shape, and dense concentration. Seabird populations of the California Current ecosystem and other eastern boundary currents are large relative to areas not driven by large-scale coastal upwelling.

Coastal pelagic species are consumed by a large number of seabirds off the coasts of California, Oregon, and Washington. Availability of anchovies is known to directly affect the breeding success of pelicans, terns, gulls, and auks. It is likely that many predators of anchovies will also eat sardines as the sardine population increases. Owing to their size and occurrence near the surface, Pacific mackerel are likely to be important to seabirds, especially in southern California. Pacific mackerel have been observed in the diet of pelican. Adult jack mackerel are probably less important to seabirds, because of their large size and relatively deep schooling habits. Studies of seabird diet during autumn, however, when small jack mackerel are near shore and more available, may indicate their seasonal importance as forage. Recent increased abundance of sardines off southern California was followed by increased breeding success and abundance of brown pelicans.

4.0 ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION AND ALTERNATIVES

4.1 CPS Fleet Capacity Management

The management actions in Amendment 10 pertaining to the harvesting capacity goal, permit transferability, adjusting permit transferability to maintain the capacity goal, and procedures for issuing new limited entry permits relate solely to the limited entry CPS finfish fishery. Therefore, the analysis of the alternatives under these issues is limited to the potential impacts on the limited entry CPS finfish fleet, consumers of CPS finfish landed by the limited entry fleet, and the fishing communities in which the limited entry fleet makes its finfish landings. In examining the socioeconomic effects of management alternatives, benefits, costs and economic impacts are evaluated at the margin, i.e., changes when moving from the status quo to another alternative. The socioeconomic analyses of management alternatives are primarily theory-informed, qualitative descriptions rather than quantitative assessments (NMFS 2000). This is because adequate economic data to conduct quantitative cost-benefit and economic impact analyses of capacity management alternatives for the limited entry CPS finfish fishery are lacking.

The types of socioeconomic effects that will be considered in the discussions that follow include, (1) changes in net economic benefits within a benefit-cost framework, and; (2) economic impacts, i.e., changes in income and employment in fishing communities. Both are important measures of the socioeconomic effects of management, however they are different and subject to misuse. Misuse of these two measures often leads to inappropriate comparisons of the "values" of various fisheries and/or fishery user groups.

The net economic benefit from the commercial CPS finfish fishery primarily consists of producer surplus, which on an individual vessel basis is the difference between gross exvessel revenues and all fishing costs, including labor costs for captain and crew and a return to the vessel owner. The net economic benefit also includes consumer surplus, which is the net value of CPS finfish products to the consumer. The net benefit to the consumer is the difference between what the consumer actually pays and what they are willing to pay, i.e., the value over and above the purchase price. Producer surplus can increase through decreases in unit harvesting costs (improved economic efficiency), or an increase in exvessel prices received. Consumer surplus can increase through a decrease in prices paid, increases in the quantities consumed, or improvements in product quality. If the inputs used to harvest fish and the resulting landings are traded in competitive markets, then theoretically, consumer and producer surplus can be measured or approximated by market demand and supply curves.

In the analyses which follow, the proposed impacts on producer surplus, given the absence of empirical information, can be reasonably inferred based on economic theory that advances the notion of increased harvesting efficiency associated with management of harvesting capacity in fisheries. However, the proposed impacts on consumers,[6/] while grounded in economic theory, are more conjectural and difficult to affirm in the absence of empirical information. The magnitude and direction of changes in consumer surplus will depend more on observable factors, including, (1) to what extent efficiency gains on the part of harvesters are passed on to consumers; (2) how much product quality is improved by more flexible permit transferability; and (3) whether the final markets for CPS finfish products are foreign or domestic.

6/ In 2000, almost 75% of Pacific sardine landings were exported. Therefore most of the economic benefits realized in the form of consumer surplus would accrue to foreign consumers.

TABLE 4.1. Limited entry fleet CPS finfish landings and exvessel revenues by county for the 1995-2000 period.

Area	1995-2000 Landings (in metric tons)	1995-2000 Revenues (in 2000 dollars)
Los Angeles/Orange County/San Diego Counties	317,023	$60,307,095
Santa Barbara/Ventura County/San Luis Obispo Counties	153,509	$42,018,657
Monterey County	91,212	$12,311,883
Other California Areas	5,041	$3,932,009
Total	566,785	$118,569,644

Economic impacts relate to income and employment effects of alternative management actions. Economic impact analyses provide measures of the changes in economic activity by locale, not measures of net benefits. Regional economic models can be used to estimate economic impacts by evaluating the extent to which growth or decline in fishing affects production, trade and employment throughout the regional economy, as fishers make purchases and as the fish are processed, distributed, and marketed. Revenues from these expenditures filter through local, state, and regional economies. Economic multipliers can be used to calculate change in income and employment resulting from a change in the level or the success of fishing. Details on fisheries contributions to the economic well-being of coastal communities is provided in the Council's draft "Community Descriptions" document, which may be obtained from the Council office (phone 503-820-2280). The most important locales for fishing activity by the CPS finfish LE fleet, in the context of potential economic impacts associated with the Proposed Actions are shown in Table 4.1.

The socioeconomic effects of establishing a limited entry program and establishing a target fleet size for the CPS finfish fishery have previously been discussed in the RIR of the CPS FMP. See the sections on Alternatives for Management of Fishing Effort (CPS FMP-RIR, pp. 4-5), and on Target Fleet Size (CPS FMP-RIR, pp. 6-7). An earlier analysis of the CPS finfish fishery capacity goal/target fleet alternatives is presented in Appendix A to the CPS FMP. The discussion of capacity goal alternatives that follows focuses on the potential environmental and socioeconomic impacts associated with the capacity goal alternatives. It assumes a permit can only be transferred to a vessel, of the same or less harvesting capacity, which is replacing one that was lost, stolen, scrapped, or permanently retired from all federally managed commercial fisheries, (i.e., the No Action, *status quo*, transferability alternative).

New permits may be necessary in the future to address significant changes in market conditions, resource availability, or CPS fleet activity. If such conditions were to occur, industry could raise a point-of-concern under the FMP's socioeconomic framework. The Council could direct the CPSMT to reassess the capacity goal, estimate latent capacity in the fleet, evaluate market conditions and resource availability, and make recommendations as to the number of new permits to issue. The Council could consider placing some restrictions on the new permits, such as making them temporary or non-transferable to accommodate subsequent contractions in the fishery. Exemption from government buyback programs could also be considered.

Section 303.b.6 of the Magnuson-Stevens Act requires that a limited entry system take into account:

(A) present participation in the fishery,
(B) historical fishing practices in, and dependence on, the fishery,
(C) the economics of the fishery,
(D) the capability of fishing vessels used in the fishery to engage in other fisheries,
(E) the cultural and social framework relevant to the fishery and any affected fishing communities, and
(F) any other relevant considerations.

These requirements, where applicable, would presumably pertain to the issuance of additional (new) permits as well. Historical fishing practices in, and dependence on, the fishery (requirement B) seems most relevant in this regard.

Given that the decision to admit a given number of new/additional vessels into the CPS LE fishery has not been made, the discussion of alternative procedures for issuing new permits focuses on how the choice of procedure will effect fleet economic performance and benefits accruing to consumers of CPS finfish products. Under any alternative, temporary status and non-transferability of new permits would address long-term concerns of over-capitalization.

4.1.1 Impacts of No Action (Alternative 1)

This Alternative is composed of options A.4, B.1, C.1, and D.4. It is described in Section 2.1.1.

4.1.1.1 A. Capacity Goal

Currently there is no capacity goal and fleet size is fixed at 65 vessels. No Action would result in similar environmental, net economic benefit, and fishing community effects as expected from the Proposed Action in terms of fleet size and structure, but without the harvesting capacity goal. Without any action affecting fleet capacity there is likely to be an increase in CPS finfish landings by the LE fleet in the near future, primarily due to the resurgence of the sardine biomass, and strengthening markets for sardine. The established LE fleet will have ample harvesting capacity to take the long-term expected aggregate finfish quota with an adequate reserve for periods of exceptionally high biomass and most favorable market conditions. Expansion of CPS fishery activity should stimulate economic activity in CPS-related fishing communities.

4.1.1.2 B. Conditions for Transfer of Existing Permits

In the absence of management action to change the criteria for transferring permits, some vessel modernization is expected to occur over time through upgrading of an existing vessel, or through vessel replacement by one of the same or less harvesting capacity. This would promote specialization in CPS finfish, leading to increased harvesting efficiency and likely improvements in product quality, which would raise producer and consumer surplus. Through either means, fish harvesting capacity would be curbed at its existing level, which is deemed to be adequate in the long term. Because the number of vessels in the CPS finfish fishery and their corresponding harvesting capacities would be locked in, this would foster stability within existing fishery segments and fishing communities. Although this Alternative would seem to be most compatible with attaining a finfish limited entry fleet consisting of a small number of larger, "efficient" CPS finfish "specialists," it would not allow combining up of permits to replace more than one small vessel with a larger vessel. This could be overly constraining in terms of allowing the industry to respond to changing conditions within alternative fisheries, thus, negating the potential increase in net benefits accruing from finfish specialization.

4.1.1.3 C. Adjusting Permit Transferability to Maintain the Capacity Goal

Provisions to adjust permit transferability to maintain the capacity goal would not be applicable under the status quo, because permit transfers (but for limited cases), would not be allowed.

4.1.1.4 D. Procedures for Issuing New Limited Entry Permits

Under the current management regime there are no procedures for issuing new CPS finfish limited entry permits. If additional permits are warranted, but cannot be issued, then any existing excess finfish harvesting capacity would become more fully utilized, i.e., normal harvesting capacity would approach physical capacity. This implies greater harvesting efficiencies (more output for the same amount of inputs) for CPS finfish, an increase in producer surplus and an increase in net economic benefits. To the extent that the CPS finfish fleet has evolved into a collection of highly specialized vessels, this would not detract from the harvest of other species and consumers would unlikely experience any loss in consumer surplus. The increase in CPS finfish fishing activity would stimulate economic activity in CPS-related fishing communities. On the other hand, if CPS finfish harvesting capacity is being fully utilized, then the inability to issue additional permits will mean missed opportunities to increase producer and consumer surpluses, as well as boost economic activity in CPS-related fishing communities.

4.1.2 Impacts of the Proposed Action (Alternative 2)

This Alternative is composed of A.1, B.3, C.4, and D.2. It is described in Section 2.1.2.

4.1.2.1 A. Capacity Goal

The current finfish limited entry fleet of 65 vessels is sufficient to meet the capacity goal of the Proposed Action. Under what might be considered typical or normal operating conditions—harvesting capacity based on average finfish landings per trip and average number of finfish trips per year—the current finfish limited entry fleet would provide sufficient capacity to harvest the expected long-term average aggregate finfish harvest target level (see Appendix C, Table 3). This fleet would also have the physical capacity—harvesting capacity based on maximum finfish landings per trip and maximum number of finfish trips taken per year—to harvest the maximum potential amount of finfish, that amount associated with peak period availability of fish, environmental conditions which are most favorable to stock production, and peak demand for output. This "excess capacity" could otherwise be directed towards the harvest of squid and tuna. In this regard, it is important to note that the ability of vessels participating in the CPS finfish fishery to harvest alternate species lessens the need to reduce the size of the limited entry fleet. CPS finfish purse seine fisheries off California are flexible and accommodate significant changes in resource availability and market demand. When CPS finfish are unavailable or market conditions for CPS finfish are not favorable, CPS purse seine vessels tend to switch to alternative species, primarily market squid, tunas, and herring. There is likely to be growth in CPS finfish landings in the future, mainly due to continued resurgence of the sardine resource and expanded market opportunities for sardine. This means existing harvesting capacity would be more fully utilized, increasing fleet efficiency and net benefits to harvesters, and in turn possibly increasing net benefits to consumers of sardines. Growth in CPS fishing activity in itself will generate additional economic activity in the CPS fishing communities.

4.1.2.2 B. Conditions for Transfer of Existing Permits

The Proposed Action would restrict transferability by not allowing permit transfers on a 1-for-1 basis except in cases of comparable harvesting capacity as measured by vessel GT (described at Section 2.1.2 and below). Transfers from a smaller vessel to a larger vessel would require combining the smaller permit with another permit for placement on the larger vessel (i.e., 2-for-1). This option represents a compromise between the more restrictive transferability that would prevail if *Option B.1* were chosen and full transferability as per *Option B.2*. Under the Proposed Action, harvesting capacity would be fixed at some desired level, but the number of vessels corresponding to that capacity level and initially awarded permits would only be a maximum. By allowing permits to be combined up, the number of vessels initially issued permits could be reduced.

This situation could arise when vessels seek to optimize their operations across the alternative fisheries in which they are capable of participating, market squid being the most likely species in terms of joint optimization. By allowing transferability with the restrictions that are part of the Proposed Action, the emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of joint harvesting opportunities without compromising the desired CPS finfish harvest capacity goal.

The proposed permit transfer mechanism (*Option B.3*) will probably be most satisfactory in terms of harmonizing the CPS finfish limited entry program and California's pending squid limited entry program. At this point, CDFG is recommending full transferability of permits to vessels of comparable capacity (defined as within 5% of the transferor vessel's GT) as an element of California's squid limited entry program. In addition, for vessels wishing to increase capacity, CDFG is considering a 2-for-1 program which involves surrendering a permit if the vessel to be transferred to is in excess of the 5% capacity allowance and lower than 135% of the original vessel's GT. If the replacement vessel's GT exceeds 135% of the original vessel's GT, two permits must be surrendered (i.e., 3-for-1) to upgrade. CDFG's proposed scheme for combining permits is designed to decrease capacity of the initial squid fleet through a reduction in the number of vessels. Since the Proposed Action under Amendment 10 is to maintain the CPS finfish fleet at it's current capacity, *Option B.3* could contain less restrictive exchange rates. For example, a 2-for-1 program for CPS finfish could require surrendering a permit if the vessel to be transferred to is in excess of 110% of the original vessel's GT.

A variation of the 2-for-1 program would require that the permit being surrendered be from a vessel with a GT equal to the net increase in GT of the replacement vessel less the comparable GT allowances. For example, replacing a 50 GT vessel with a 100 GT vessel would require an additional permit from a 40 GT vessel when the comparable GT allowance is 10% (i.e., comparable GT is 110% of the transferor vessel's GT). Allowing permits to be combined up in this manner would enable a fleet to develop that is best suited for participation in both fisheries.

In terms of the CPS physical and normal capacity frontiers (see Figure 18 in Appendix C), the proportional change in harvesting capacity for a given proportional change in gross tonnage (elasticity of harvesting capacity) is less than one over the range of observed gross tonnages. This means that a 100% increase in a vessel's gross tonnage will result in a less than 100% increase in its harvesting capacities. In the case of physical capacity the corresponding increase in capacity is about 90%, and in the case of normal capacity about 75%. Therefore, a 10% GT allowance is not expected to result in a substantial increase in harvest capacity. Additionally, this would allow combining up of a permit that is 10% less than the replacement GT.

The permit transfer mechanism (*Option B.3*) would leave decisions about harvest capacity levels and transferability of permits within the policy arena, but given harvest capacity and transferability parameters, allows industry to determine what the fishery should "look like" in terms of the number of vessels and their corresponding harvesting capacities. *Option B.3* would not impose any restrictions on vessel physical attributes, but would require permits to have a GTendorsement. The CPS finfish harvesting capacity analysis establishes a linkage between a vessel's GT and its harvesting capacity. Therefore, as is being considered for California's squid limited entry program, a vessel's finfish limited entry permit should carry a GT endorsement that denotes its harvesting capacity.

From the capacity analysis, vessels greater than or equal to 115 GT, have a physical harvesting capacity greater than or equal to 125 mt per trip (Appendix C, Figure 18). Therefore, we would not expect to see permits being transferred to vessels with a GT greater than 115, unless vessels of this size are optimum across all fisheries in which they participate.

By allowing permits to be combined up, the number of vessels initially issued permits could be reduced. Increased efficiency would result through reduced fixed costs and variable (operating) costs associated with fewer vessels competing for a fixed harvest. The replacement vessels would be larger and presumably able to operate more efficiently not only in the CPS finfish fishery, but in alternative fisheries as well. This would mean an increase in producer surplus. Price-wise, CPS finfish consumers could benefit from equal or increased landings at lower harvesting costs. If vessels seek to optimize their operations across the suite of fisheries in which they are capable of participating, greater quantities of higher quality fishery products could be made available to consumers, increasing consumer surplus. Vessel owners selling permits in combining up situations are presumably better off through the permit sale, or it would not be sold. Thus, through the sale of a permit, all parties are presumably better off which represents a net gain in social welfare. By allowing transferability within the confines of *Option B.3* the emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of the full range of harvesting opportunities without compromising the desired CPS finfish harvest capacity goal. This aspect of the Proposed Action is not expected to have any effect on fishing communities.

Under the Proposed Action (Option B.3), each LE permit will have an endorsement based on the currently permitted vessel's calculated GT as defined in 46 CFR 69.209 for ship-shaped hulls, where:

GT = 0.67(Length*Breadth*Depth)/100.

The calculated GT endorsement and 10% allowance for each of the current 65 permits is provided in Table 2.2. The original permits and their respective endorsements will remain in effect for the lifetime of each permit, regardless of the GT of a vessel to which it may be transferred. In cases where a permit is transferred to a vessel with smaller GT, the original GT endorsement will remain, and excess GT may not be split out from the original permit configuration and sold. In cases where two or more permits are transferred to a larger vessel, the larger vessel will hold the original permits and may fish for CPS finfish as long as the aggregate GT endorsements, including the 10% allowances, add up to the new vessel's calculated GT. In the event that a vessel with multiple permits wishes to leave the CPS limited entry program, those permits may be sold

together or separately, but the original permit configurations may not be altered. In order to ensure manageability of the permit program and stability of the fleet, only one transfer per permit will be allowed in each calender year. Permits may only be used on the vessel to which they are registered, and permit leasing will not be allowed. Catch history will be tied to the vessel, and not to the permits. Specific examples of permit transfers follow:

(1) Direct permit transfer (1 to 1) to a vessel of similar size.

Direct permit transfer to a vessel of comparable size will be allowed as long as the new vessels' GT does not exceed 110% of the permits' GT endorsement. For example, a 100 GT permit may be sold to a vessel of up to 110 GT. The new 110 GT vessel would own a permit with a 100 GT endorsement will be able to sell the permit to another vessel of up to 110 GT at some later time, but not sooner than the following calendar year. The 10% allowance may only be applied to the original GT endorsement, and is not cumulative over time.

(2) Direct permit transfer (1 to 1) to a vessel of smaller size.

Direct permit transfer to a vessel of smaller size will be allowed. For example, a 100 GT permit may be sold directly to a vessel of 75 GT. The new 75 GT vessel would own a permit with a 100 GT endorsement will be able to sell the permit to another vessel of up to 110 GT at some later time, but not sooner than the next calendar year. The original 100 GT endorsement will remain, and the excess 25 GT may not be split out from the original permit and sold.

(3) Modification to a currently permitted vessels' exterior hull dimensions.

In the event that an owner desires to modify the exterior dimensions (length, breadth, or depth) of the permitted vessels' hull, such modifications will be allowed as long as the new calculated GT for the modified vessel does not exceed 110% of the permit GT endorsement. Vessel modifications resulting in greater than 110% calculated GT will require purchase of an additional permit.

(4) Permit transfer to a vessel larger vessel where one additional permit is required.

Permit transfer to a larger vessel is allowed, but if the new vessels' calculated GT exceeds 110% of the permit endorsement, then the new vessel will need to purchase an additional permit with an adequate endorsement to add up to the new vessels' GT. For example, the owner of a 150 GT vessel would like to enter the CPS LE program and has found a 100 GT permit for sale. The 100 GT permit may be transferred, but the 150 GT vessel will need an additional permit with at least 37 GT endorsement to add up to 150 GT. The combined endorsements, including their respective 10% allowances, must add up to at least 150 GT. The following formula would apply:

$$\text{New Vessel GT} <= (GT_{PERMIT\,1} + GT_{PERMIT\,2}) * 1.10$$

- or in this example -

$$150\ GT <= (100\ GT + 37\ GT) * 1.10$$

The new 150 GT vessel would hold the original two permits with their original endorsement configurations (100 GT and 37 GT), and excess GT could not be split out and sold. The two permits could not be combined into a single permit with a 137 GT endorsement. Should the owner of the 150 GT vessel wish to leave the CPS LE program, he/she would have to wait at least until the calendar year following the purchase to sell the permits. The two permits could be sold to another 150 GT vessel, or could be sold separately to two smaller vessels with qualifying GT.

(5) Permit transfers to a considerably larger vessel where more than two permits are required.

Permit transfer to a considerably larger vessel is allowed, but per the previous example (4), the new vessel will need to purchase additional permits with an adequate endorsement to add up to the new vessels' GT. The combined endorsements, including their respective 10% allowances, must at a minimum add up to the

GT of the larger vessel. The following formula would apply:

$$\text{New Vessel GT} <= (GT_{PERMIT\ 1} + GT_{PERMIT\ 2} + GT_{PERMIT\ 3} + \ldots\ldots + GT_{PERMIT\ X}) * 1.10$$

The new vessel would hold multiple permits each with their original endorsement configurations. Excess GT could not be split out and sold. The permits could not be combined into a single permit with the new vessels' GT as an endorsement. Should the owner of the larger vessel wish to leave the CPS LE program, he/she would have to wait at least until the calendar year following his/her purchase of the permits to sell them again. The permits could be sold together to another vessel of comparable GT, or could be sold separately to smaller vessels on a one for one basis.

4.1.2.3 C. Adjusting Permit Transferability to Maintain the Capacity Goal

The Proposed Action, by incorporating *Option C.4*, provides a means of arresting capacity creep, which could occur if there were no provisions for adjusting transferability (e.g., *Option C.1*). It also avoids a potential mis-allocation of harvesting resources in the CPS finfish fishery. The adjustment process would probably result in a more gradual return to the capacity goal, compared to the 2-for-1 adjustment process under Options C.2 and C.3. Also, because it would allow for continued transfer to vessels of equal or lesser capacity, it would be less restrictive on the industry. Since no two vessels are likely to have the exact same calculated GT, some decrease in GT could be expected upon each transfer. Therefore, one possible negative outcome of this component of the Proposed Action is that removing the 10% transfer allowance could result in a net decrease in average vessel size (GT) and corresponding harvesting capacity. The original GT endorsement would remain attached to the permit, but smaller average vessel size could result in a less efficient fleet relative to the original fleet. This component of the Proposed Action is not expected to lead to a decrease in CPS finfish landings, so CPS finfish consumers should not experience any change in economic benefits. However, a reduction in harvesting capacity resulting from the adjustment process could decrease landings in alternative fisheries (market squid, tuna, etc.), which would diminish consumer benefits associated with the full range of fishing opportunities for CPS finfish vessels. This component of the Proposed Action is not expected to affect fishing communities.

4.1.2.4 D. Procedures for Issuing New Limited Entry Permits

The Proposed Action (incorporating *Option D.2*) takes into account historical participation during the original window-period for the limited entry program in its criteria for issuing new limited entry permits. It would be the most expedient set of criteria for issuance of new permits if the need should arise in the immediate future. Vessels below 70th rank had only landed a relatively small volume of CPS finfish during the 1993-1997 window period, so they are either inefficient at harvesting CPS, or not interested in doing so actively. If the need for new permits should arise five to ten years from now, the original qualifying list could become outdated, resulting in permits being issued to inactive vessels. The fishing industry would not benefit from the addition of inefficient or inactive vessels to the fleet.

However, this Alternative would weight experience in the CPS finfish fishery higher than the *status quo* (Alternative 1–No Action), in that it would assure that the opportunity to participate in the expanded fishery would be offered to those next in line behind the original qualifiers. If the original ranking of finfish vessels in terms of their window period landings has any semblance to their relative operating efficiencies, then this Alternative is more likely to generate greater net economic benefits compared to the status quo. To the extent that it would alleviate the need for new vessel construction, there could be significant savings in investment costs under Alternative 2. While such a reduction in costs would translate into increased net economic benefits from the expansion, it would also mean a foregone increase in fishing community economic activity (employment and income) associated with new vessel construction. There would be some additional administrative expenses incurred in issuing new permits, and qualifying new participants. Since this Alternative would weight experience in the fishery more highly, there is less chance of unrealized expectations concerning increased landings in the fishery. Thus, consumers would be more likely to obtain benefits from increased supplies if this Alternative is adopted.

New permits could be issued on either a temporary or permanent basis, depending on the circumstances surrounding the need for additional fleet capacity. For example, if over time the fleet falls below the capacity

goal, issue of new permanent permits may be a plausible way to return the fleet to the capacity goal. If the point of issuing new permits is to increase fleet capacity above the goal (i.e., to allow greater access to harvest under unusually high stock abundance conditions), then permits may be temporary. So as not to compromise the purpose of having a capacity goal.

If however, the need arises to maintain capacity at the target level and avoid landings shortages, additional permits may need to be issued. Making these permits permanent rather than temporary, and subject to the same conditions of existing permits in terms of transferability and GT endorsement, would assure that long-run harvesting capacity matches long-term expected availability. Increasing the number of limited entry permits to preserve the CPS finfish harvesting capacity goal would tend to maintain and enhance market stability in terms of exvessel supply, and in turn, reduce uncertainty on part of secondary markets with regard to interruptions in supply. With an increase in the number of vessels, harvesting costs are likely to increase which translates into reduced producer surplus. However, no major changes in producer or consumer surplus are expected at the secondary market level. Additional permits would represent an economic windfall to recipients, and would reduce the asset value of existing permits.

Temporary permits would be better suited if conditions warrant issuing new permits to take advantage of a transitory increase in resource availability and market demand. Temporary permits would meet short-run needs for additional landings. Permits could be issued to cover the expected period of increased resource availability and demand. Given the variability in resource availability and market demand for CPS finfish, one year minimum term of issuance, non-transferable, but renewable permits would probably be the best approach towards addressing temporary harvest expansions. Temporary permits of one-year duration would have a minimum asset value. On the other hand, if the expansion is expected to extend beyond a year, multi-year, transferable, renewable temporary permits might be warranted. Transferability increases asset value; however, the asset value of a multi-year temporary permit will decrease over the term of issuance. In terms of economic impacts, temporary permits are justified on the basis of an increase in net national benefits due to a short term boom in resource availability and market demand.

4.1.3 Analysis of Other Possible Management Alternatives (Alternatives 3-7)

Given the range of issues and alternatives for a CPS finfish LE fleet harvesting capacity goal and permit transferability, the following possible and reasonable management alternatives (described in Section 2.1.3) are evaluated. These alternatives allow a more direct comparison of the effects of No Action (analyzed in Section 4.1.1), the Proposed Action (analyzed in Section 4.1.2), and other alternatives representing different combinations of capacity management options (section 2.1.4).[7/]

Without a capacity goal it is still reasonable to consider the full range of permit transferability alternatives, although there would be no need for adjusting permit transferability to correct for overshooting the capacity goal (option set C). With a capacity goal, it seems unreasonable to allow full transferability which would greatly increase the likelihood of exceeding the capacity goal. However, it is reasonable to consider a capacity goal without permit transferability, which would negate the need for any transferability adjustment mechanism.

Alternative 3: No capacity goal (Option A.4), and full permit transferability (Option B.2)

There is no difference from No Action (Alternative 1) in terms of a capacity goal, but if permits are freely transferable, there is likely to be some significant fleet restructuring. This will occur as vessel owners strive to optimize harvesting capacity over the full array of fishing prospects available to CPS vessels, and adjust to whatever management regime California establishes for market squid. The emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of multiple harvesting opportunities. Increases in efficiency can result in benefits to consumers through lower prices—an increase in consumer surplus—or increases in profits to fishermen through reduced costs, which is an

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7/ Alternatives 3-7 could also include any of the options for issuing new limited entry permits (option set D). The impacts of including any of these options can be evaluated by applying each of their expected impacts as described in the No Action Alternative (section 4.1.1.1), the Proposed Action alternative (section 4.1.2.4) and the analysis of other options (section 4.1.3.4).

increase in producer surplus. Unconstrained transferability would also maximize the asset value of a LE permit, which would increase the wealth of the fishing community. Also, to the extent that full transferability results in more vessel transactions, vessel construction and vessel operations, the fishing community benefits from the increase in economic activity.

Alternative 4: No capacity goal (*Option A.4*), with Proposed Action for permit transferability *(Option B.3)*

There is no difference from Alternative 1 (No Action) or Alternative 3 in terms of a capacity goal. Limited permit transferability would allow permits to be combined up. Therefore, the number of vessels initially issued permits could be reduced over time. Increased efficiency would result through reduced fixed costs and variable (operating) costs associated with fewer vessels competing for a fixed harvest. The replacement vessels would be larger and presumably able to operate more efficiently not only in the CPS finfish fishery, but in alternative fisheries as well. This would mean an increase in producer surplus. If vessels seek to optimize their operations across the suite of fisheries in which they are capable of participating, greater quantities of higher quality fishery products could be made available to consumers, which would increase consumer surplus. Vessel owners selling permits in combining-up situations are presumably better off through the permit sale, or it would not be sold. Thus, through the sale of a permit, all parties are presumably better off, which represents a net gain in social welfare. The emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of the full range of harvesting opportunities without compromising the desired CPS finfish harvest capacity goal. This Alternative is not expected to have any effect on fishing communities different from that under the No Action alternative.

Alternative 5: Proposed capacity goal (Option A.1) and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1)

Since the capacity goal under Alternative 2 (Proposed Action) maintains the existing LE fleet, the expected impacts are isolated to those resulting from no transferability. Thus, impacts under Alternative 5 would be similar to those predicted for the No Action Alternative. Further, there would be no need to consider a transferability adjustment alternative under this scenario (option set C).

Alternative 6: Capacity goal (Option A.2) and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1)

The only difference between this Alternative and Alternative 5 deals with the change in the capacity goal. The greatly reduced number of specialized, more efficient, CPS finfish vessels–expected under capacity goal Option A.2–would probably experience increased harvest volumes, which would improve their profitability (i.e., an increase in producer surplus). However, with a significantly reduced fleet there is the potential that the Pacific sardine and Pacific mackerel quotas would not be fully utilized, and there could be significant shortfalls in finfish landings in the event of extremely favorable resource and market conditions. Reduced landings could result in higher prices which translates into a decline in benefits to consumers (I.e., reduced consumer surplus). There would likely be a decrease in regional economic activity due to a smaller number of vessels utilizing fishery support services and infrastructure. Fewer fishermen and support employees involved in the CPS finfish fishery would likely have a negative impact on economic activity on fishing communities. Income and employment would likely decrease, and probably become more concentrated in specific communities if the fishery contracts. There could be substantial spillover effects in alternative fisheries for CPS finfish vessels. Assuming that at least some of the vessels losing their permits under Option A.2 would cease fishing, this option would probably severely limit the amount of harvest capacity that would remain for tuna, and market squid.

Alternative 7: Capacity goal (Option A.3) and no permit transferability–except to vessels of equal or lesser harvesting capacity under extremely limited circumstances (Option B.1)

The difference between this Alternative and Alternative 6 is a larger reduction in the number of vessels that would constitute the limited entry fleet. Thus, there is a greater chance for significantly reduced landings in the CPS finfish fishery and alternative fisheries. Under these conditions, the impacts of Alternative 6 would be greatly magnified.

4.1.4 Analysis of Other Options Considered in Developing Alternatives

For a description of these other options see Section 2.1.4.

4.1.4.1 A. Capacity Goal Options

The four capacity goal options are included in Alternatives 1-7. Descriptions are in Section 2.1.1, 2.1.2, and 2.1.3. Analyses are in 4.1.1, 4.1.2, and 4.1.3.

4.1.4.2 B. Conditions for Transfer of Existing Permits[8/]

The four transferability conditions are included in Alternatives 1-7. Descriptions are in Section 2.1.1, 2.1.2, and 2.1.3. Analyses are in 4.1.1, 4.1.2, and 4.1.3.

4.1.4.3 C. Adjusting Permit Transferability to Maintain the Capacity Goal

Limited entry programs are primarily designed to address economic problems associated with excess harvest capacity in open access fisheries. Implementation of a capacity goal for the CPS fleet has the advantage of preventing overcapitalization and insuring the long-term economic stability of the fleet. There are social, income distributional, or other benefits of greater importance that can be realized by maintaining the capacity goal. The proposed conditions of permit transfer as provided by *Option B.3* (included in the Proposed Action) may result in an accumulation in fleet capacity (total fleet GT) over time. Therefore, mechanisms to adjust permit transferability and maintain the capacity goal are part of option set C, as are trigger points for implementing these mechanisms. Option C.4 is included in the Proposed Action. The following discussion illustrates the range of possible responses that could have been incorporated into the Proposed Action.

Under *Option C.1* no mechanism would exist for adjusting permit transferability once fleet capacity exceeds the goal. In the short term, this option would have no positive or negative impacts on the fishing industry. In the long-term, it could result in overcapacity of the CPS limited entry fleet, through a creeping up of capacity, ultimately leading to socioeconomic hardship in the event of diminished resource availability or unfavorable market conditions. This option would not be consistent with the objective of preventing overcapacity in the CPS limited entry fleet.

Without mechanisms to adjust permit transferability in order to maintain the capacity goal, capacity creep under Option C.1 is likely to occur since vessels are allowed to transfer permits, on a 1-for-1 basis, to another vessel that is within 110% of the transferring vessel's capacity. Over time the capacity goal in the CPS finfish fishery would be exceeded. This would be inefficient from an economic standpoint in that it represents a wasteful mis-allocation of harvesting resources in the fishery. As the fleet's harvesting capacity expanded beyond the harvesting capacity goal there would be a corresponding decrease in net benefits. On the other hand, it might lead to greater efficiency in alternative fisheries, if they were experiencing insufficient harvesting capacity that was not being alleviated by entry of vessels from outside the LE CPS finfish fishery. This could result in greater producer surplus through reduced harvesting costs and increased consumer surplus through increased landings. No impacts on the environment or fishing communities would be expected if Option C.1 were part of the Proposed Action.

The trigger point for adjusting permit transferability differs among the options. Options C.2 (similar to Option C.4 in the Proposed Action) would establish a trigger of 5% over target fleet GT, whereas Options C.3 and *C.5* are based on a trigger of 10% over fleet GT. The two trigger levels can be evaluated with respect to the amount of time it may take to accumulate that amount of excess capacity, and how long the transfer restrictions would need to be in place before the fleet returns to the capacity goal. Take the case where the fleet is at the capacity goal (5,650.9 mt) and a 10% allowance is allowed for each permit transfer. Given an average vessel GT of 87 mt, a one-time maximum of 8.7 mt of GT would accrue with each transfer. If a 10% GT increase were realized with each transfer, it would take at least 32 transfers for the fleet to accumulate 282 mt of excess GT (5% trigger; Options C.2 and C.4), and approximately 64 transfers to accrue 564 mt of

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8/ See Appendix C, pages 31-32 for additional analysis of permit transferability options.

GT (10% trigger; Options C.3 and C.5). It is unlikely that every permit transfer will be 10% over the original GT endorsement, and some transfers will likely be to smaller vessels, so it could take a number of years for the fleet to attain the 5% "overcapacity" trigger. If the 10% fleet trigger were to be implemented (*Option C.3* or *C.5*) and the fleet were to accumulate 564 mt of excess capacity, it would take twice as long to return to target fleet capacity goal.

Alternatives under option set C offer two different mechanisms for returning fleet capacity to the fleet goal (target fleet GT of 5,650.9 mt) when that goal has been exceeded by the specified amount. *Options C.2* and *C.3* would return the fleet to the capacity goal by requiring the combining of permits ("2-for-1 options") for a transfer to occur. *Options C.4* and *C.5* would return fleet capacity to the goal by removing the 10% GT allowance on vessel-to-vessel transfer. Under *Options C.4* and *C.5*, a single permit could only be transferred to another vessel of the same or lesser GT, which is a less restrictive process than the combining-up requirement of 2-for-1 options. This 2-for-1 mechanism could result in more rapid return of the fleet to the capacity goal target fleet GT. Conversely, it might be ineffective if permit prices on the open market are prohibitively high. High permit prices could result in fewer transfers, consequently taking longer to return to the goal. This scenario could place undue burden on the fleet.

The 5% trigger *(Options C.2 and C.4)* would minimize the amount the harvest capacity goal in the CPS finfish fishery would be exceeded before corrective measures were initiated. Compared to no mechanism for adjusting transferability (*Option C.1*) there would be less chance of a significant mis-allocation of harvesting resources in the fishery, and consequently not as great a reduction in net benefits associated with excess capacity. Under a 10% trigger, the expected duration of the adjustment process would be proportionately longer.

The 2-for-1 options (*C.2* and *C.3*), would quickly put the brakes on capacity creep, and could rapidly return the fleet to the desired capacity level, perhaps through only two permit transactions (which results in net retirement of one vessel). However, this requirement is likely to inflate the price of available permits and slow recovery to the desired capacity level. This is because in the course of the capacity buildup some permits would be transferred to new vessels which would be less inclined to subsequently offer them for sale. Thus, there would be fewer permits available for transfer, driving up the price of those that remain procurable. The 2-for-1 adjustment mechanism is not expected to significantly affect the quantity of CPS finfish landed, so consumers of CPS finfish should not be affected. However, by reducing the number of CPS finfish vessels, this type of adjustment process could lead to a drop in landings in alternative fisheries. Therefore, this type of adjustment process could reduce consumer benefits associated with the full range of fishing opportunities for CPS finfish vessels. No significant impacts on fishing communities would be expected from this type of adjustment process.

The adjustment mechanism under Option C.5 is the same as Option C.4, which is incorporated into the Proposed Action, except that the trigger is set at 10% rather than 5%. The reader is directed to the discussion of the impacts of the adjustment mechanism described under the Proposed Action because Option C.5 would have equivalent effects.

4.1.4.4 D. Procedures for Issuing New Limited Entry Permits

With respect to issuing new permits, Option D.1 probably allows the fishing industry the freest hand in responding to positive changes in CPS finfish resources or market conditions. The option may allow new participants into the fishery that do not have a history of CPS fishing, but are strongly interested. But it may not comply with the Magnuson-Stevens Act, because it does not take into account historical participation.

Without qualifying criteria in place it is difficult to foresee what the expanded CPS finfish limited entry fleet would look like in terms of the new additions. At one end of the range, new participants might not have any experience in the fishery which could introduce short-run inefficiencies. This would be counterproductive in terms of meeting the objectives of fishery expansion, and result in a decrease in net economic benefits. At the other end, new participants might include CPS vessels with experience in the open-access fishery north of 39° N, or those with experience in the fishery who failed to qualify for, or otherwise obtain, a permit during the initial offering (i.e., latent capacity with respect to vessels that have been inactive in the fishery), in which case there might not be any reduction in net benefits from the fishery. Any impact on consumers from the

choice of qualifying criteria would be through foregone benefits attributable to inexperienced vessels failing to fulfill the expected expansion in landings. Fishing communities could be impacted differently in terms of changes in economic activity, depending on the makeup of new participants in the CPS, LE finfish fishery. If the expansion is made up of primarily inexperienced fishermen, there could be a net increase in economic activity in fishing communities as these participants gear up for participation. If the expansion is comprised of experienced fishermen the community impacts may be more in the form of a redistribution of economic activity along the coast. There would be some administrative expenses related to issuing permits, but none related to establishing qualifying criteria, and qualifying additional vessels.

Option D.3, an option that was not incorporated into the Proposed Action and does not describe the *status quo*, would allow consideration of new participants into the fishery. Open-access vessels landing smaller volumes of CPS or working outside of the limited entry zone (i.e., Pt. Arena to the U.S.-Canada border) could theoretically qualify if they could demonstrate CPS finfish landings during the new window period. It would require more time to implement than the mechanism for issuing new permits incorporated into the Proposed Action (Option D.2). Decisions would need to be made regarding a new control date and length of the window period.

This option would differ from Option D.1 by requiring vessels to have some experience in the fishery based upon historical landings (from what is now the LE fishery, or from the open-access fishery) and, as per the Proposed Action (Option D.2), would be more likely to achieve greater economic benefits in the fishery. However, the economic benefits associated with prior experience in what is now the LE fishery may not be as great as those expected from the Proposed Action, since the experience would be further removed in time, and potentially outmoded. Alternatively, the window period and minimum landings level could also be structured to allow open-access CPS finfish vessels currently participating in the fishery off Washington and Oregon to qualify for the expanded LE fishery. This option may not reduce the need for new vessel construction as much as under the Proposed Action, but there could still be significant savings in investment costs under this option. While such a reduction in costs would translate into increased net economic benefits from the expansion, it would also mean a foregone increase in fishing community economic activity (employment and income) associated with new vessel construction. There would be significant additional administrative expenses incurred in designing new qualifying criteria, issuing new permits, and qualifying new participants. Because fleet expansion may not encompass the degree of prior experience in the fishery envisioned under the Proposed Action, this option might not yield as great an increase in consumer benefits from the expansion as expected under that Alternative.

4.1.5 Cumulative Impacts of the Capacity Goal and Transferability Proposed Action

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time (Council on Environmental Quality regulations at 40 CFR 1508.7).

Impacts of each capacity-related alternative are presented above (sections 4.1.1-4.1.4). This section provides an overall summary of cumulative impacts associated with the Proposed Action.

Proposed Action: Capacity goal, Option A.1; limited permit transferability, Option B.3; adjustment for exceeding the capacity goal, Option C.4; and, procedure for issuing new limited entry permits, Option D.2.

There is likely to be growth in CPS finfish landings in the near future, mainly due to continued resurgence of the sardine resource and expanded market opportunities for sardine. Under the proposed capacity goal, equivalent to that of the existing 65 vessel fleet, capacity appears more than adequate to accommodate this expected growth. This means existing harvest capacity would be more fully utilized, increasing fleet efficiency and net benefits to harvesters, and potentially to consumers of sardines as well. Growth in CPS fishing activity in itself will generate additional economic activity in CPS fishing communities.

The proposed limited permit transferability action would allow permits to be combined up. Thus, the number of vessels initially issued permits could be reduced, in which case increased efficiency would result through reduced fixed costs and variable (operating) costs associated with fewer vessels competing for a fixed harvest. The replacement vessels might be larger and presumably able to operate more efficiently not only in the CPS finfish fishery, but in alternative fisheries as well. This would mean a possible increase in producer surplus. CPS finfish consumers might benefit from equal or increased landings at lower harvesting costs. If vessels seek to optimize their operations across the suite of fisheries in which they are capable of participating, greater quantities of higher quality fishery products could be made available to consumers, increasing consumer surplus. Vessel owners selling permits in combining-up situations are presumably better off through the permit sale, or it would not be sold. Thus, through the sale of a permit, all parties are presumably better off, which represents a net gain in social welfare. By allowing transferability within the confines of *Option B.3*, the emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of the full range of harvesting opportunities without compromising the desired CPS finfish harvest capacity goal. This Alternative is not expected to have any effect on fishing communities.

The proposed transferability adjustment mechanism, incorporating a 5% overshoot trigger, would minimize the amount the harvest capacity goal in the CPS finfish fishery would be exceeded before corrective measures were initiated. There would be less chance of a significant mis-allocation of harvesting resources in the CPS finfish fishery, and consequently not as great a reduction in net benefits associated with excess capacity. The proposed transferability adjustment action is not expected to lead to a decrease in CPS finfish landings, so CPS finfish consumers should not experience any change in economic benefits. However, consumer surplus associated with the full range of fishing opportunities for CPS finfish vessels could be reduced if the adjustment process results in decreased landings from alternative fisheries for CPS finfish vessels. There are not expected to be any impacts on fishing communities from the proposed adjustment process.

The proposed new permit issuance procedures would assure that the opportunity to participate in the expanded fishery would be offered to those next in line behind those who originally qualified for a limited entry permit when the CPS FMP was implemented in 1999 (see the CPS FMP, December 1998, for details on minimum landing requirements and qualifying ("window period") years). If the original ranking of finfish vessels in terms of their window period landings is similar to their relative operating efficiencies, then this Alternative is more likely to generate greater net economic benefits from the fishery, at least in the near term, compared to the other new permit issuance options. To the extent that it would alleviate the need for new vessel construction, there could be significant savings in investment costs, which would translate into increased net economic benefits from the expansion. However, it would also mean a foregone increase in fishing community economic activity (employment and income) associated with new vessel construction. There would be some additional administrative expenses incurred in issuing new permits, and qualifying new participants. Since this Alternative would weight experience in the fishery more highly than the other options, there is less chance of unrealized expectations concerning increased landings in the fishery. Thus, consumers would be more likely to obtain benefits from increased supplies.

4.2 Market Squid MSY Control Rule

The four alternatives for setting market squid MSY are fully described in Section 2.2 and reflect the culmination of over two years of focused research and subsequent peer review associated with the market squid resource off southern California. These alternatives generally represent options for assessing the relation between harvests and MSY; as such they do not directly affect the human environment. Indirect effects could result from harvest levels set or allowed by fishery managers in response to their understanding of the resource. Control rules are structured decision processes related to this understanding. (The value of a measured variable determines the type and intensity of controls imposed on the fishery.) For this reason, indirect effects are best analyzed in terms of "risk" (i.e., over-harvest or under-harvest): if managers' understanding of resource status is faulty, there is a risk that harvest levels will not approximate MSY. Harvest levels above MSY result primarily in environmental effects due to overfishing (although this can have socioeconomic impacts as well, if yields become reduced over the long-term). If harvest levels are constrained below MSY this can affect economic performance, if inputs (capital and labor) are surplus to

mandated input (e.g., effort) or output (e.g., quota) levels. However, it is important to note that quantitative probabilities for the two types of risks cannot be definitively assigned to each of the alternatives. Instead, both types of risk are evaluated qualitatively below. That is, the overriding difference between Alternatives 1-3 and Alternative 4 is that the latter management approach is based on additional scientific theory and information (specifically, biological data from the squid population) that plausibly, reduces the amount of uncertainty (in this case, risk), to some degree, when determining sustainable exploitation strategies for aquatic resources. This analysis is based mainly on information found in the Reports presented in Appendices D-G.

4.2.1 Alternative 1 (No Action)

Alternative 1: Do not set an MSY or MSY proxy. Under the No Action Alternative, no method for determining MSY is chosen. By default it is assumed that historical harvest levels are at or below MSY, while capital and labor inputs are fully utilized (and that exogenous factors prevent inputs from increasing to an equilibrium harvest level above MSY). There appears to be no short-term over-harvest risk in this approach. However, an increase in inputs (fishing capacity) and/or a substantial reduction in the size of the spawning population could result in detrimental impacts over an extended period due to over-harvest. This may be mitigated by the general consensus from the scientific community that productivity and subsequent abundance of squid are strongly, if not primarily, influenced by environmental conditions. For example, if environmental conditions are unfavorable, MSY (qualitative) is expected to be relatively low, with a relatively high likelihood of over-harvest (if fishing pressure remains generally consistent). Furthermore, it would be reasonable to expect landings to fluctuate in accordance with the inherent variation of the environment. Subsequently, shifts in net economic benefits and related impacts to the fishing industry would be expected to follow the trends observed in the actual landings. Finally, given squid are members of a "lower" animal trophic level of the marine ecosystem, over-harvest over a protracted period could negatively impact animals at "higher" trophic levels. That is, extended periods of severely low squid abundance could lead to reduced abundance of aquatic predators that typically feed, to some degree, on squid, including highly migratory species (such as albacore tuna), marine birds, and marine mammals.

In summary, although squid abundance fluctuates primarily based on environmental variation, researchers are uncertain how fishing pressure during unfavorable ocean conditions will impact the long-term abundance of this species. In this context, Alternative 4 provides additional data regarding the population dynamics of this species, and (along with the landing time series) is expected to provide a management approach that is more risk averse than Alternative 1.

4.2.2 Alternatives 2 and 3

Alternative 2: Set an MSY proxy based on evaluation of historical landings.

Alternative 3: Set an MSY proxy based on evaluation of historical catch by spatial block, along with measures of coastwide (potential) spawning area determined from research trawl survey data.

These two Alternatives make explicit the assumption made under No Action above (i.e., that past landings approximate MSY), but use formal procedures to determine future landings. The types of risk resulting from these approaches are, therefore, generally similar to the No Action Alternative above, but are somewhat mitigated, given the approaches are based on formal evaluations, albeit limited in scope, of historical catches (during time periods that squid population levels are thought to be relatively stable), which result in landing recommendations that serve as proxies for MSY. As stated previously, both estimation methods used in Alternatives 2 and 3 are inherently based on rather simple assumptions concerning the relationship between squid population abundance and observed landing statistics, which could produce misleading projected "potential" harvests.

The relatively high uncertainty that surrounds results generated from either of these two Alternatives translates to generally similar types of risk as described above for Alternative 1. However, risk of over-harvest associated with the two Alternatives is expected to be lower, to some degree, than for Alternative 1 (i.e., harvest-related decisions being based on limited scientific data vs. no harvest-related decisions whatsoever), but higher than for Alternative 4 (harvest-related decisions being based strictly on catch information from the

fishery vs. harvest-related decisions being based on biological data from the population at large, along with catch information from the fishery). There is some amount of added risk of under-harvest resulting from these two Alternatives if harvest controls are unnecessarily imposed (see below).

Management based solely on evaluations of landings, expanded or otherwise, is not typically considered an effective strategy for optimizing yield, particularly, when the goal is evaluated on a long-term time scale. For example, during an ENSO event, the squid largely become unavailable to the fishery, the fishery essentially ceases at these times, and ultimately, landings are substantially reduced. The historical record demonstrates a marked rebound in squid landings immediately following an ENSO event. Consequently, an MSY proxy/control rule based on average recent landings in the fishery, including ENSO years, would significantly understate the amount of squid available for harvest under normal environmental conditions, and impose an unreasonably low limit on annual landings. Relative to the status quo, this could result in a significant reduction in net economic benefits from the fishery – both to fishers and consumers, and in fishing community economic activity. Fishers' would experience a decrease in exvessel revenues, while fixed costs are unlikely to change, leading to a reduction in producer surplus. A decrease in landings would put upward pressure on prices to consumers, reducing their surplus. On the other hand, attempts to determine an MSY based on evaluations of historical catches that did not include ENSO-related years would likely generate an unsubstantiated, elevated MSY proxy that would, at best, provide short-term economic gains, but given the paucity and uncertainty in the available data, could compromise the population's ability to successfully rebound following periods of unfavorable oceanographic conditions.

4.2.3 Alternative 4 (Proposed Action)

Alternative 4: Set fishing mortality at (or below) a level estimated to produce long-term sustainable yields (i.e., establish a baseline MSY proxy, F_{MSY}) based on evaluation of female squid spawning success determined through port sampling programs, coupled with per-recruit analysis theory.

Of the four alternatives, Alternative 4 appears to be the soundest in scientific terms and likely the most precautionary from a risk standpoint. From a management context, Alternative 4 provides a relatively reliable MSY proxy/control rule that allows the fishery to operate with the most flexibility, while most importantly, minimizing the possibility that the stock will be subjected to over-harvest (or under-harvest). That is, if fishery operations remain generally stable into the future, it is expected that the threshold level of egg escapement (i.e., 30%, described in Section 2.2.3) will not be exceeded, which would trigger consideration of additional regulatory constraints on fishing effort. Compared to the status quo, fishing at the F_{MSY} is not expected to result in any significant changes in net economic benefits and fishing community economic activity. Landings are expected to be at or near current levels (keeping in mind that landings are largely market driven and further constrained by California's annual landings cap of 113,398 mt).

However, changes in stock dynamics and/or fishery operations could reduce the long-term abundance of the population, resulting in biological and socioeconomic repercussions. For example, if any of the following scenarios occurred, long-term biological stability of the stock and subsequent benefits to the fishery and consumers are expected to be reduced (these scenarios serve as examples and do not represent all possible situations), (1) stock assessments indicate lower egg escapement levels than recommended in the MSY-proxy; (2) monitoring program shows high proportions of juvenile squid in the landings; or (3) egg survival in the ocean is reduced due to gear intrusion along egg beds. Although Alternative 4 is the most risk averse of the suite of Alternatives, over-harvest cannot be discounted entirely, given the scenarios above and thus, impacts to the environment discussed above for the other Alternatives (e.g., reduced forage for predators that rely on squid in their diets) are applicable here as well. These potential down sides, which are less likely under the Proposed Action relative to the alternatives (see Section 2.3.3), are further mitigated by current federal and state management regimes (see Section 3.2.3)

California state regulations for market squid are summarized in Section 3.2.3 (Appendix H contains the complete regulations). Current state regulations pertinent to the discussion of MSY per this Amendment include a moratorium on new squid limited entry permits, the weekend fishery closure, and a annual harvest cap of 113,398 mt. In addition to existing state measures, the Proposed Action under this federal FMP amendment (Alternative 4), should provide the market squid resource additional protection from overfishing by furnishing a tool for the Council to monitor EE on a regular basis. Ongoing collaborative sampling and

research efforts by CDFG and NMFS will enable the CPSMT to track and report on the status of EE in the CPS SAFE document, submitted in June of each year. In the event that escapement is determined to be below the 30% threshold for two successive years, then a point-of-concern would be triggered under the FMP's management framework and the Council could consider moving market squid from Monitored to Active management status. Current state regulations for squid are not anticipated to change in the near future, however, should existing laws limiting effort or harvest be rescinded, further management actions by the Council could also be considered.

4.2.4 Cumulative Impacts of the MSY-Proxy Proposed Action

Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time (Council on Environmental Quality regulations at 40 CFR 1508.7).

Generally, cumulative impacts are considered with respect to specific resources and human communities within the project area and are the total effect including any direct and indirect impacts that may have been already analyzed. Determining what effects can be meaningfully analyzed is often the most difficult aspect of cumulative impact analysis, especially within the more limited scope of an EA (in comparison to an EIS). Although the Proposed Action (implementing a method to match harvest levels to MSY) could cumulatively affect a variety of resources in combination with other actions and processes, most of the effects cannot be meaningfully analyzed, because of the essentially speculative nature of the indirect effects of the alternatives (bearing in mind that the Proposed Action has no direct effects). Therefore, analysis of cumulative effects focuses on the squid resource and the fishery exploiting it.

The primary cumulative effect results from the addition of the Proposed Action to the current California state management regime governing the market squid fishery. That management regime is described in section 3.2.3 and Appendix H. The additive effect of the Proposed Action is discussed in section 4.2.3. In sum, current regulations include a moratorium on new squid limited entry permits, a weekend fishery closure, and a annual harvest cap of 113,398 mt. The Proposed Action should provide the market squid resource additional protection from overfishing by furnishing a tool to monitor fishery performance and resource status on a regular basis. Combined with the CPS FMP's point-of-concern management framework, the 30% egg escapement threshold (that would be established under the Proposed Action) provides additional means to prevent overfishing from occurring. Current state regulations for squid are not anticipated to change in the near future. However, should existing laws limiting effort or harvest be rescinded, further management actions by the Council could also be considered.

4.3 Other Potential Cumulative Effects

Specific cumulative effects for the limited entry-related Proposed Action and squid MSY-proxy Proposed Action were discussed in 4.1.5 and 4.2.4, respectively. To illustrate other possible effects from Amendment 10, the following discussion describes general environmental and management issues relative to the proposed actions.

Fluctuations in the Ocean Environment

Large scale environmental fluctuations are characteristic of all oceanic ecosystems and have significant effect on the distribution, movement, and habitat of all CPS. Significant sources of inter-annual physical and biological variation are El Niño and La Niña events in the Pacific–with apparent secondary impact on the Atlantic and other world oceans. Regime shifts (e.g., in the North Pacific) have also been identified as having meso-scale impacts on both the physical and biological systems, with concurrent impact on the distribution of oceanic species. There is no evidence to suggest that populations of eastern Pacific CPS are immune to these shifts. Emerging evidence suggests that these environmental and climatological perturbations may have greater influence on the relative abundance of CPS than any of the alternatives reviewed in this EA. However, these environmental events are independent of any of the Proposed Actions, and vice versa.

Food Webs and Ecosystems

The role of CPS in the structure of oceanic ecosystems and the potential ecological effects of their removal is an area of particular concern. These are creatures that, if removed from an ecosystem in significant numbers, may cause existing trophic relationships to be upset, affecting other species' stock abundance or viability. Northern anchovy, market squid, and sardine are forage for at least two bird species (brown pelican and least tern) and four marine mammals (fin whale, humpback whale, sei whale, and Guadalupe fur seals) classified as endangered under the Endangered Species Act (ESA); one marine mammal species (Northern or Steller's sea lion) classified as threatened under the ESA; and one marine mammal species (northern fur seal) classified as depleted under the Marine Mammal Protection Act. In addition, anchovy, sardine, and squid are forage for all depleted, threatened, and endangered salmon stocks along the coast. To the extent the Proposed Actions are designed to promote stability in the CPS fishery, it would have a benign impact in terms of cumulative effects on CPS-based food webs and ecosystems. To the extent the Proposed Actions are designed to monitor market squid fishery performance and prevent overfishing, establishing an MSY-proxy for market squid should have direct cumulative effects on CPS-based food webs and ecosystems. Moreover, the Proposed Actions are consistent with, and enhance achievement of, key objectives of the FMP, namely, attainment of OY, provision of adequate forage for dependent species, and prevention of overfishing (CPS FMP, Appendix B, section 2.1).

Current and Future Regulatory Regimes

Prior to implementation of the CPS FMP, the states of Washington, Oregon, and California managed CPS fisheries. After implementation of federal management, California continues to actively manage the market squid fishery, and CPS finfish fisheries in Oregon and Washington are actively managed by these states (see CPS SAFE, 2002). It is anticipated these regulations will continue to remain in effect and will be complementary to Amendment 10. Several areas currently closed to purse seine fishing are described at Section 5.7 of Appendix D. In the future, federal or state marine protected areas (MPAs) off the West Coast could also become part of the regulatory regime. However, the effects of closed areas and MPAs on CPS finfish and market squid have not been determined and it would be speculative to attempt to describe potential cumulative effects at this time.

Foreign Fisheries and Effective International Management

CPS are transboundary resources shared by the U.S., Mexico, and Canada. Sardine, anchovy, and Pacific mackerel are taken in U.S., Mexican, and Canadian fisheries. No international management of CPS within U.S., Mexican, and Canadian waters currently exists. However, recent collaborative scientific work on sardines with Mexico and Canada may contribute to a more favorable climate for international management of eastern Pacific CPS by the U.S., Mexico, and Canada. Nonetheless, in the absence of effective international management, the abundance of CPS stocks harvested by U.S. fisheries could be negatively impacted and unilateral U.S. actions to conserve and manage HMS stocks might be insufficient.

5.0 CONSISTENCY WITH THE FMP AND MAGNUSON-STEVENS ACT

5.1 Consistency with the FMP

An FMP amendment is designed in part to change some function or intent of the FMP, which means the amendment may not necessarily be consistent with the existing FMP. However, the FMP contains several basic goals and objectives that provide guidance for the entire structure of the FMP and implementing measures. Capacity management measures analyzed in this document are examined here for consistency with those goals and objectives. Goals and objectives for the CPS FMP, as listed in Amendment 8, are:

1. Promote efficiency and profitability in the fishery, including stability of catch.
2. Achieve OY.
3. Encourage cooperative international and interstate management of CPS.
4. Accommodate existing fishery segments.
5. Avoid discard.
6. Provide adequate forage for dependent species.
7. Prevent overfishing.
8. Acquire biological information and develop long term research program.
9. Foster effective monitoring and enforcement.
10. Use resources spent on management of CPS efficiently.
11. Minimize gear conflicts.

FMP goals 1, 2, and 4 would be addressed by setting a capacity goal for the fleet. Establishing and maintaining a capacity goal would promote efficiency and profitability in the fishery (Goal 1) by preventing overcapacity and providing for economical stability. Keeping the limited entry fleet at the current level of 65 vessels is also consistent with Goal 2 (achieving optimum yield), and Goal 4 (accommodate existing fishery sectors). Thus, the proposed capacity goal action (Option A.1) should be consistent with the FMP.

The Council's proposed conditions for permit transfer would allow CPS limited entry permits to be transferred with some restriction on the harvesting capacity of the vessel to which it would be transferred (Option B.3). Allowing permits to be transferred with some level of constraint would be consistent with FMP Goals 1 and 4. The Proposed Action would accommodate existing permit holders (Goal 4) by allowing them to transfer out of the limited entry program if they so desire, and would enable newer, more efficient vessels to enter the fishery, thus providing a higher quality more profitable product (Goal 1).

The Proposed Action would provide a mechanism for adjusting permit transferability in order to maintain the capacity goal (Option C.4). Gradual upward drift in total fleet capacity will be expected over time as transfers to slightly larger vessels occur. It would establish a capacity trigger point for the fleet, and would implement further restrictions on transfers in an effort to bring the fleet back to the capacity goal. This action is consistent with FMP Goal 1, as it will help to maintain the capacity goal and help prevent overcapacity.

The Proposed Action for issuing new LE permits (Option D.2) establishes a procedure for issuing new limited entry permits and should satisfy FMP Goals 1, 2, and 4. New permits may be necessary in the future to address significant, positive, changes in market conditions or resource availability. Issuing additional permits will increase efficiency and profitability in the fishery (Goal 1), help achieve optimum yield (Goal 2), and accommodate existing fishery segments (Goal 4; in this case fish processors who need to meet market orders).

For the market squid MSY measure, the Council's proposes an MSY proxy for market squid based on evaluation of female spawning success through an existing port sampling program. The proposed measure would help prevent overfishing (Goal 7), foster effective monitoring (Goal 9), and use resources spent on management of CPS efficiently (Goal 10).

None of the proposed measures to manage limited entry fleet capacity will directly conflict with the goals of this FMP.

5.2 Consistency with the Magnuson-Stevens Act

The Magnuson-Stevens Act provides parameters and guidance for federal fisheries management, requiring the Councils and NMFS adhere to a broad array of policy ideals. Overarching principles for fisheries management are found in the Act's National Standards. In crafting fisheries management regimes, the Councils and NMFS must balance their recommendations to meet these different national standards.

National Standards (NS) relevant to this FMP amendment include:

NS-1: "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry."

NS-2: "Conservation and management measures shall be based on best scientific information available."

NS-4: "Conservation and management measures shall not discriminate between the residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges."

NS-5: "Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose."

NS-6: "Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches."

NS-8: "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practical, minimize adverse economic impacts on such communities."

The Proposed Action would provide a capacity goal for the CPS LE fleet, providing the Council a measure to gauge harvesting capacity and prevent overcapitalization. The proposed capacity goal and fleet composition takes into account variations in CPS finfish fisheries and resources (NS-6), provides a fleet with adequate capacity to achieve OY (NS-1), takes into account efficiency in utilization of CPS resources (NS-5), while at the same time minimizing adverse economic impacts on the existing fleet (NS-8).

The Proposed Action would allow CPS limited entry permits to be transferred with some restriction on the harvesting capacity of the vessel to which it would be transferred, and would provide a mechanism for returning the fleet to the capacity goal should capacity exceed the specified tolerance level (or "trigger") of fleet GT plus 5%. Allowing permits to be transferred with some level of constraint would be consistent with NS-8 (minimizing adverse economic impacts). The Proposed Action would accommodate existing permit holders by allowing them to transfer out of the limited entry program if they so desire, and would enable newer, more efficient vessels to enter the fishery (NS-4), thus, providing for increased efficiency (NS-5) and a higher quality, more profitable product.

The Proposed Action would provide a mechanism for adjusting permit transferability in order to maintain the capacity goal. Gradual upward creep in total fleet capacity will be expected over time as transfers to slightly larger vessels occur. The Proposed Action would establish a capacity trigger point for the fleet, and would implement further restrictions on transfers in an effort to bring the fleet back to the capacity goal. Maintaining the capacity goal is consistent with the same National Standards cited above in the discussion of capacity goals.

The Proposed Action establishes a procedure for issuing new limited entry permits. New permits may be necessary in the future to address significant, positive, changes in market conditions or resource availability. Issuing additional permits will increase efficiency and profitability in the fishery (NS-5), help achieve optimum yield (NS-1), accommodate existing fishery segments (NS-4), and account for variation in the resource (NS-6).

The Council also proposes to establish an MSY proxy for market squid based on evaluation of female spawning success through an existing port sampling program. The proposed measure would help prevent overfishing (NS-1 and NS-8), and is based on the best scientific information available (NS-2).

6.0 OTHER APPLICABLE LAW

6.1 National Environmental Policy Act

An EA is required by the National Environmental Policy Act (NEPA) of 1969 to determine whether the action considered will result in significant impact on the human environment. If the action is determined not to be significant based on an analysis of relevant considerations, the EA and resulting finding of no significant impact would be the final environmental documents required by NEPA. An EIS need only be prepared for major federal actions significantly affecting the human environment. It contains elements consistent with an EA. An EA must include a brief discussion of the need for the proposal, the alternatives considered, a list of document preparers, and the impacts of the alternatives on the human environment. The purpose and need for the Proposed Action was discussed in Section 1.0 of this document, the Proposed Action and alternatives are found in Section 2, the management alternatives and the potential environmental and socioeconomic effects of those alternatives were discussed in Section 4. A list of agencies and persons consulted during preparation of the EA may be found in Section 7. The results of the analysis of the Proposed Action and its alternatives are summarized in Appendix A, which is the Finding of No Significant Impact (FONSI). The FONSI is a determination that the impacts stemming from the Proposed Action are not significant and, therefore, preparation of an EIS is unnecessary.

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

None of the proposed changes to the FMP would be a significant action according to E.O. 12866. This action will not have a cumulative effect on the economy of $100 million or more, nor will it result in a major increase in costs to consumers, industries, governmental agencies, or geographical regions. No significant adverse impacts are anticipated on competition, employment, investments, productivity, innovation, or competitiveness of U.S.-based enterprises (see RIR below in Section 6.2.1).The Small Business/Entities analysis addresses requirements of the Regulatory Flexibility Act. In addition to the information presented in the EA above, a basic economic profile of the fishery is provided in the Council's annual CPS Stock Assessment and Fishery Evaluation (SAFE) document.

6.2.1 Executive Order 12866 - Regulatory Impact Review (Elements Beyond Those Considered in the Environmental Assessment

The purpose of an RIR is to determine whether any of the Proposed Actions could be considered "significant regulatory actions" according to Executive Order (E.O.) 12866. This analysis has many aspects in common with an EA. Much of the information required for RIR analysis is contained in the EA. Table 6.2 provides references for those required elements of RIR analysis that have already been addresses above.

TABLE 6.2. Regulatory Impact Review - Elements of Analysis

RIR Elements of Analysis	Corresponding Sections in EA
Description of management objectives	1, 4
Description of the fishery	see Appendix A of Amendment 8
Statement of the problem	1
Description of each alternative	2, 4
Economic analysis of the expected effects of each selected alternative relative to *status quo*	4

The key elements of an RIR have been thoroughly addressed in the EA above. From that discussion, it appears the Proposed Actions in this amendment would not have any significant adverse economic effects on consumers and producers of CPS finfish—contrarily, economic effects are expected to be either neutral or positive—relative to the status quo (No Action Alternative).

Establishing a Capacity Goal: Because it would maintain the size and structure of the existing fleet, the economic effects associated with the proposed capacity goal alternative are expected to be no different than those anticipated under the No Action alternative. Under the No Action alternative there is likely to be an increase in CPS finfish landings in the near future, primarily due to the resurgence of the sardine biomass, and strengthening markets for sardine. The established LE fleet will have ample harvesting capacity to take the long-term expected aggregate finfish quota with an adequate reserve for periods of exceptionally high biomass and highly favorable market conditions. Under these conditions, harvesting capacity in the CPS finfish fishery is expected to be more fully utilized which in turn, should lead to efficiency gains in the fishery. There should not be any impact on the operations of vessels landing less than 5 mt of CPS finfish per trip since they are exempted from the LE program.

Conditions for Transfer of Existing Permits: The Proposed action would have significant positive economic effects, i.e., an increase in net economic benefits compared to the No Action alternative. By allowing transferability within the limits of the Proposed Action, the emerging fleet would represent the future expectations of industry members concerning multi-purpose vessels best suited to take advantage of joint harvesting opportunities across the suite of fisheries in which finfish vessels participate, without compromising the desired CPS finfish harvest capacity goal. Because this Alternative would allow more flexibility across all vessel operations, the expected increase in net benefits would be greater than that potentially realized by a fleet of finfish specialists, which would be encouraged under the No Action alternative.

Adjusting Permit Transferability to Maintain the Capacity Goal: The Proposed Action provides a means of arresting harvesting capacity creep, and of avoiding a potential over allocation of harvesting resources in the CPS finfish fishery compared with the No Action alternative. By allowing for a continued 1-for-1 transfer this alternative would be least disruptive in terms of the transferability process, and would result in gradual return to the fleet capacity goal. Since no two vessels are likely to have the exact same calculated GT, some lowering of GT could be expected with each transfer. Unlike the options that would require two permits being transferred to an entering vessel, this Alternative would not artificially inflate the price of permits. This is favorable to permit buyers, but would eliminate potential windfalls to permit sellers.

Establishing Procedures for Issuing New Limited Entry Permits: By adopting the original permit qualifying criteria to accommodate additional vessels in the CPS finfish fishery, the Proposed Action would weight experience in the CPS finfish fishery higher than under the No Action alternative. It would assure that the opportunity to participate in the expanded fishery would be offered to those next in line behind the original permit qualifiers. Because it is likely that the original ranking of finfish vessels, in terms of their window period landings, reflects their relative operating efficiencies then this Alternative should yield greater net economic benefits compared to the No Action alternative. To the extent it would favor existing vessels, it would alleviate the need for new vessel construction. This could mean significant savings in investment costs relative to the No Action alternative.

Establishing an MSY Control Rule for Market Squid: The egg escapement-based squid MSY proxy alternative would most likely produce a reliable and stable MSY proxy/control rule that would allow for market squid landings at or above their current levels. Compared to the No Action Alternative there would not be any significant changes in net economic benefits if the MSY proxy under this Alternative is near current landings levels. If the MSY proxy under this Alternative is greater than current landings then a proportionate increase in net economic benefits, above those anticipated under the No Action alternative, is expected.

Table 6.3 summarizes the analyses of the proposed regulatory actions in terms for the RIR evaluation factors.

TABLE 6.3. RIR Tests of "Significant Regulatory Actions"

E.O. 12866 Test of "Significant Regulatory Actions"	Capacity Goal	Permit Transfer	Adjusting Permit Transferability	Issuing New Permits	Squid MSY
Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs or the environment, public health or safety, or state, local, or tribal governments or communities?	NO	NO	NO	NO	NO
Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency?	NO	NO	NO	NO	NO
Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof?	NO	NO	NO	NO	NO
Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866?	NO	NO	NO	NO	NO

6.2.2 Impacts on Small Entities

The Regulatory Flexibility Act (RFA) requires government agencies to assess the effects that various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those effects. A fish-harvesting business is considered a "small" business by the Small Business Administration (SBA) if it has annual receipts not in excess of $3.5 million. For related fish-processing businesses, a small business is one that employs 500 or fewer persons. For marinas and charter/party boats, a small business is one with annual receipts not in excess of $5.0 million. While there are some fish processors operating in the West Coast CPS finfish fishery that would not be considered small businesses, the vast majority of CPS finfish fishery participants are considered small businesses under the SBA standards. The small entities that could be effected by the regulatory actions being considered under Amendment 10 would consist exclusively of fish-harvesting businesses, i.e., fishing vessels. Effects on fishing vessels of the regulatory actions under consideration are expected to be neutral or positive in consequence.

Characterization of the degree to which the 65 vessels that currently make up the CPS LE finfish fleet depend on CPS finfish resources and could be potentially affected by regulatory changes in the fishery is provided in Table 6.4.

TABLE 6.4. Exvessel revenue and total CPS finfish landings summaries for the period 1995 through 2000, for the 65 vessels with a limited entry permit as of December 31, 2000.

Number of Vessels*	Dependence on CPS Finfish (finfish revenue/ total revenue)	Annual Avg CPS Finfish Landings (mt/vessel)	Annual Avg Revenues ($1,000/vessel)				
			CPS Finfish	Squid	Tuna	Other	All Species
2**	0%	0	$0	$0	Unknown	Unknown	Unknown
12	<5%	46	$3,742	$225,860	$29,184	$21,090	$279,876
5	5-10%	216	$19,563	$197,378	$47	$17,391	$234,379
14	11-25%	795	$74,352	$286,735	$56,671	$12,976	$430,734
17	26-50%	1,668	$157,644	$200,014	$62,721	$7,982	$428,362
7	51-75%	1,286	$134,220	$58,174	$30,051	$691	$223,136
8	76-100%	301	$41,740	$2,768	$1	$94	$44,604

Source: California Department of Fish and Game, C-Master Database

* The fleet now consists of 65 vessels. Forty-five of these vessels initially qualified under the window period and the other 20 vessels were permit transfers.

** There were two permits transferred to vessels without any prior landings history in the CPS finfish and market squid fisheries.

Establishing a Capacity Goal: The Proposed Action is expected to have no effect on small businesses since it represents essentially no change from the No Action Alternative in terms of fish harvesting capacity. Conversely, capacity goal options A.2 and A.3 could effect small vessels—retire them from the fishery—since both alternatives would work the fleet down in numbers to achieve a harvesting capacity level below the No Action Alternative.

Conditions for Transfer of Existing Permits: The Proposed Action would require permits to be combined up in cases where the harvesting capacity of the vessel to which a permit was being transferred exceeded by more than 10% the capacity of the vessel from which the permit was being transferred. Under these circumstances there could be a number of small vessels retired from the fishery whose permits were purchased to make up a harvesting capacity deficit for larger incoming ones. However, vessels selling their permits would be bought out of the fishery at a price which would presumably match or exceed the expected value of their discounted future net earnings. Therefore, the effects of this regulatory action on small vessels would be neutral or positive at best.

Adjusting Permit Transferability to Maintain the Capacity Goal: None of the options for adjusting permit transferability to maintain the capacity goal are expected to adversely effect the vessels that comprise the CPS finfish fleet at the time such action would be necessary. All adjustment mechanisms being proposed would rely on permit transfers to reduce harvesting capacity to the desired level. If a permit were sold to help attain the desired level, the payment to the seller would presumably at least reflect the worth of that permit remaining with the transferring vessel.

Establishing Procedures for Issuing New LE Permits: None of the options for issuing new CPS finfish LE permits would effect the existing fleet. Expansion of the fishery would only occur when economic conditions were favorable for the entry of additional vessels. The procedures for qualifying new vessels would, therefore, not have an impact on the existing fleet; but the options for issuing new permits could have disproportionate effects on vessels vying for entry.

Establishing an MSY Control Rule for Market Squid: Only Alternative 2, an MSY proxy based on historical landings, could potentially have an adverse effect on CPS vessels. This Alternative the greatest risk of substantially reducing landings below levels typically experienced during years when squid are available. By down-weighting the MSY proxy by landings levels in years when squid were not available, vessel profitability in the fishery could be substantially although not disproportionately reduced. The other MSY proxies being considered are likely to enhance vessel profitability.

6.3 Coastal Zone Management Act

Section 307(c)(1) of the Coastal Zone Management Act (CZMA) requires all federal activities that affect the coastal zone to be consistent to the maximum extent practicable with the enforceable policies of approved coastal zone management programs. The Council believes the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of Washington, Oregon, and California. NMFS has corresponded with the responsible state agencies under Section 307 of the CZMA to obtain their concurrence in this finding.

6.4 Listed Species

Effects on endangered species and marine mammals are discussed in the CPS FMP-RIR.

6.4.1 Endangered Species Act

An informal consultation was initiated with the Protected Resources Division, Southwest Region, on January 12, 1999, with regard to the effects of Amendment 8 on endangered and threatened marine mammals and salmon under the jurisdiction of the NMFS. On June 3, 1999, a determination was made that Amendment 8 would not likely adversely affect listed species under NMFS jurisdiction.

On June 8, 1999, NMFS provided the U.S. Fish and Wildlife Service with background information on the harvest strategies in the CPS FMP and their potential impact on other species, and requested that the agency concur with the determination that the CPS FMP would not likely adversely affect any threatened or endangered birds under the jurisdiction of the Fish and Wildlife Service. On June 10, 1999, the Fish and Wildlife Service responded, stating that the CPS FMP would not adversely affect endangered or threatened birds under its jurisdiction.

Consultation was reinitiated with the Protected Resources Division, Southwest Region, following the publication of additional listed species, and on September 2, 1999, a determination was made that the FMP was not likely to adversely affect Central Valley spring-run chinook and coastal California chinook. The fishery has since expanded to Oregon and Washington. Therefore, in accordance with the conditions established in the previous determination, consultation was reinitiated on April 19, 2000. This consultation has not been completed.

6.4.2 Marine Mammal Protection Act

Amendment 10 is not anticipated to have an adverse impact on marine mammals. Marine mammals relative to CPS fisheries are discussed in Section 1.7 of Appendix A to the CPS FMP.

6.4.3 Migratory Bird Treaty Act

The Migratory Bird treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico and Russia to protect a common migratory bird resource.

The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. Only limited information exits quantifying the incidental take of seabirds in west coast CPS fisheries. However, none of the proposed management alternatives in Amendment 10 are likely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act.

Sea birds relative to CPS fisheries are discussed in Section 1.8 of Appendix A to the CPS FMP.

6.5 Paperwork Reduction Act

This amendment does not necessitate additional reporting requirements.

6.6 Executive Order 13132

None of the proposed changes to the FMP would have federalism implications subject to E.O. 13132.

6.7 Executive Order 13175

E.O. 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

The Secretary of Commerce (Secretary) recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. At Section 302(b)(5), the Magnuson-Stevens Act reserves a seat on the Pacific Fishery Management Council for a representative of an Indian tribe with federally recognized fishing rights from California, Oregon, Washington, or Idaho.

The U.S. government formally recognizes that the four Washington Coastal Tribes (Makah, Quileute, Hoh, and Quinalt) have treaty rights to fish for CPS. In general terms, the quantification of those rights is 50% of the harvestable surplus of CPS available in the tribes' usual and accustomed (U and A) fishing areas (described at 50 CFR 660.324). Each of the treaty tribes has the discretion to administer their fisheries and to establish their own policies to achieve program objectives. Accordingly, tribal allocations and regulations have been developed in consultation with the affected tribe(s) and, insofar as possible, with tribal consensus.

6.8 Executive Order 12898

E.O. 12898 requires each federal agency to make achieving environmental justice part of its mission in minority and low-income populations by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations to the greatest extent practicable and permitted by law. Essentially, two questions are raised: (1) are effects disproportionately high and adverse, and (2) would a minority population be disproportionately affected?

The CPS FMP includes demographic and employment data for recreational and commercial CPS fisheries. Below, this demographic information is summarized to describe individuals and the populations involved in CPS fisheries.

Recreational anglers were identified as predominantly non-Hispanic white (85%) and male (91%) with median ages of 25 to 45 years. The highest percentage of recreational fishing households had annual incomes in the range of $30,000 to $40,000 (18%), with sizable fractions in the $40,000 to $50,000 range (15%), and the $20,000 to $30,000 range (13%).

Three California communities are characterized as heavily involved in commercial fisheries for coastal pelagic species: San Pedro, Ventura County, and Monterey County.

San Pedro is the single most important port for CPS in Los Angeles County and along the West Coast. San Pedro's population is mostly white and non-Hispanic (55% in 1990) although the proportion of non-whites (mainly Hispanics) has increased in recent years. Hispanics made up 34% in 1990, blacks made up 5% in 1990. In 1980, 8,500 people, or 13.6% of the total population in San Pedro, were below the poverty line.

Ventura represented the most important region in terms of revenues and the second most important region in terms of landings by the CPS fishery for the 1993 through 1997 period, because of squid. Port Hueneme is the center of CPS fishing activity in Ventura County. In 1990, the white population of Ventura County was

65.8% of the total population. Hispanics were 26.6% in 1990. Although the number of Asians and Pacific Islanders represented only small segments of the population, 4.9% in 1990. The black population was 2.2% of the total population in 1990. American Indians, Eskimos, and Aleutian Islanders constituted 0.5% (3,440) in 1990. The 1996 per capita income increased to $21,144, 13th out of 58 counties in California, and was 102% of the state average, $20,759. In 1995, Ventura's agriculture, forestry, and fishing sector payroll was $45.3 million, a 4.8% decrease from 1993, and was 1.1% of the county's total payroll.

Monterey represents the third most important region in terms of landings and revenues by the CPS fishery. In 1990, the white population of Monterey County was 51.4% of the total population. Hispanics were 33.6% of the population. Asians and Pacific Islanders represented only small segments of the population, 7.8% in 1990. The black population was 6.4% of the total population in 1990. American Indians, Eskimos, and Aleutian Islanders constituted 0.8% of the total population (3,017) in 1990. Of the residential distribution of 128 crew members in the AFL-CIO Fisherman's Union who lived in Monterey County, 79.7% (102) lived in the Monterey city area, and 11.7% in the Seaside area. Income per capita was $20,500 in 1996. In 1995, the County's agriculture, forestry, and fishing sector payroll was $89.7 million and represented 4.7% of the county's total payroll in 1995.

In sum, the FMP characterizes these individuals and populations as predominately white and not low-income populations. Transferability of permits should benefit current fishery participants and those who wish to enter the fishery. This Proposed Action is not imposing any new limitations or restrictions on individuals or populations, rather the Proposed Action provides flexibility to current participants and creates opportunities for individuals to enter the fishery. Essentially, relieving a previous restriction. Setting an MSY proxy for market squid is required by the Magnuson-Stevens Act and is not expected to change the recent history of harvests. Thus, it is not expected that the Proposed Actions will have (1) disproportionately high and adverse human health or environmental effects, nor (2) would minority populations and low-income populations be disproportionately affected.

6.9 Executive Order 13186

E.O. 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), which was issued on January 10, 2001, requires, among other things, that a memorandum of understanding (MOU) be developed and implemented within two years between the U.S. Fish and Wildlife Service and each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations. As of this date, an MOU has not been prepared. However, the CPS FMP supports the conservation intent of E.O. 13186 by integrating bird conservation principles, measures, and practices into the management of CPS fisheries and avoids or minimizes adverse impacts on migratory bird resources to the extent practicable. Forage aspects of CPS are discussed in detail and seabird species known to forage on CPS are listed in the FMP (see CPS FMP, Appendix A, Section 1.8). Actions proposed by this FMP amendment do not substantially alter the nature of CPS fisheries. Thus, impacts on migratory birds beyond those analyzed and accounted for in the FMP are not anticipated.

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7.2 List of Public Meetings

Schedule of Events in Developing Amendment 10

- August 3-4, 1999. Coastal Pelagic Species Management Team (CPSMT) public meeting (preliminary work on squid maximum sustainable yield [MSY]).

- August 24, 1999. Coastal Pelagic Species Advisory Subpanel (CPSAS) public meeting (preliminary work on squid MSY).

- September 1999. Council meeting. The Council directed the CPSMT to evaluate thoroughly the MSY alternatives presented in the CPSMT report; and address the recommendations of the SSC, notably use of the default MSY control rule that sets ABC equal to 25% of the total biomass estimate.

- March 2000. Council meeting. A majority of the CPSAS urged the Council to amend the provisions of the limited entry plan to allow for the free transferability of permits. The Council asked the CPSMT to analyze several issues related to CPS limited entry and permit transferability.

- April 20-21, 2000. CPSMT public meeting.

- June 8, 2000. CPSMT and CPSAS public meetings.

- June 2000. Council meeting. The CPSMT recommended an extension of the transferability provisions in the CPS fishery management plan (FMP) for two years from the current closing date (December 31, 2000). The CPSAS recommended making permits transferable without time constraint. However, the Council reaffirmed its position that permit transferability should not be extended at this time. The Council preferred to wait to address permit transferability after a capacity goal and other procedures are established for the CPS limited entry fishery.

- September 14, 2000. CPSAS public meeting.

- September 2000. Council meeting. Based on the advice of the SSC, CPSMT, and CPSAS, the Council opted to withdraw squid MSY provisions from Amendment 9 and requested a squid STAR Panel be convened. The Council deferred action on alternatives for determining a proxy MSY value for market squid. There are several reasons why the Council deferred action on market squid MSY, (1) the opinion of the SSC and others that the concept of MSY may not be practical for market squid; (2) efforts to date to develop a proxy value for MSY have fallen short, largely due to lack of scientific data; and (3) current research on squid life history and stock status by the state of California, which should provide an improved basis for determining an MSY proxy for market squid. The results of this research should be available in April 2001, with the Council possibly taking preliminary action on squid MSY in June 2001. The Council also supported the SSC recommendation for a squid stock assessment workshop to review the results of California's cooperative research project and consider incorporating this information into the CPS FMP.

- October 18, 2000. CPSAS public meeting.

- October 17-18, 2000. CPSMT public meeting.

- November 2000. Council meeting. The CPSMT presents their capacity analysis to the Council. The Council directed the CPSMT to continue work on establishing a capacity goal for the limited entry finfish fishery and addressing other capacity related issues such as permit transferability. Alternative capacity goals should be constructed following the three options outlined in the CPSMT report. The analysis should include advice on the most preferred option; why it is most preferred; and how permit transferability would help achieve the goal.

- February 1, 2001. CPSAS public meeting.

- January 30-31, 2001. CPSMT public meeting.

- March 9, 2001. CPSMT and CPSAS public meetings.

- April 2001. Council meeting. The Council and SSC reviewed the CPSMT's capacity analysis. CPSAS reported on their March 9, 2001 review. The Council also received an update on squid STAR Panel. The Council adopted the capacity goal and transferability provisions recommended by the CPSMT for inclusion in Amendment 10. The Council directed the CPSMT to develop an amendment to the CPS FMP. The FMP amendment will include the capacity goal, provisions for permit transferability, a process for monitoring fleet capacity relative to the goal, and a framework for modifying transferability provisions as warranted by increases or decreases in fleet capacity. The FMP amendment will include an alternative that would allow transfer of limited entry permits. Under this Alternative, transferability would be restricted to prevent a significant increase in total fleet capacity as measured by the total gross tonnage of the fleet.

- May 14-17, 2001. Market Squid Stock Assessment Review Workshop.

- June 2001. Council meeting. Council received preliminary reports about the squid STAR Panel. The Council requested the CPSMT and CPSAS work together to develop recommended management alternatives for market squid MSY based on the workshop results. These would be completed in time for SSC and Council review in September 2001. At that time, the Council will determine if market squid MSY should be included in Amendment 10. If the Council decides to include squid MSY in Amendment 10, it is possible a public review draft could be prepared by the November meeting, with final action in March 2002.

- August 14-15. 2001 CPSMT public meeting.

- October 10, 2001. CPSMT and CPSAS public meetings.

- October 31, 2001. CPSAS public meeting.

- November 2001. Council meeting. The Council received reports from the squid STAR Panel, CPSMT, and CPSAS. The Council endorsed the egg escapement approach as a proxy for squid MSY, as recommended by the market squid STAR Panel and CPSMT. The Council also directed the CPSMT to continue with their analysis of management alternatives related to capacity and permit transferability in the CPS limited entry fishery. The Council scheduled consideration of adopting Amendment 10 for public review at the March 2002 Council meeting.

- March 2002. Council meeting. The Council adopted draft Amendment 10 to the CPS FMP for public review. The Council provided guidance to the CPS Management Team for minor changes to the draft document.

- June 2002. Council meeting. The Council took final action on Amendment 10 and adopted the EA/RIR documents for transmittal to the Secretary of Commerce.

7.3 List of Preparers

Dr. Paul Crone
National Marine Fisheries Service

Mr. Brian Culver
Washington Department of Fish and Wildlife

Dr. Christopher Dahl
Pacific Fishery Management Council

Dr. Samuel Herrick
National Marine Fisheries Service

Dr. Kevin Hill
California Department of Fish and Game

Ms. Jean McCrae
Oregon Department of Fish and Wildlife

Mr. Jim Morgan
National Marine Fisheries Service

Dr. Paul Smith
National Marine Fisheries Service

Mr. Dan Waldeck
Pacific Fishery Management Council

Ms. Marci Yaremko
California Department of Fish and Game

APPENDIX A: CONCLUSIONS OR FINDING OF NO SIGNIFICANT IMPACT

The Pacific Fishery Management Council has developed Proposed Actions to (1) manage capacity in the limited entry fishing fleet managed under the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) and (2) to establish an MSY control rule for market squid.

National Oceanic and Atmospheric Administration (NOAA) Order (NAO) 216-6 (revised May 20, 1999) provides nine criteria for determining the significance of the impacts of a Proposed Action. These criteria are discussed below:

1. Can the Proposed Action be reasonably expected to jeopardize the sustainability of any target species that may be affected by the action?

The Proposed Actions are not expected to jeopardize the sustainability of the target species or any related non-target stocks that may be affected by the actions. The limited entry-related Proposed Actions establish provisions for ensuring harvest capacity is in balance with resource availability. Moreover, harvest levels for actively managed species (e.g., Pacific sardine and Pacific mackerel) are determined via risk averse harvest control rules established by the CPS FMP. This combination is expected to ensure the sustainability of the target species. The squid MSY-proxy Proposed Action represents a risk averse approach that includes measures that generally ensure the ability of the targeted species to maintain long-term abundance levels.

2. Can the Proposed Action be reasonably expected to allow substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act and identified in FMPs?

The Proposed Actions are not expected to allow substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act and identified in the CPS FMP. The area affected by the Proposed Actions has been previously identified as EFH for managed species and is described in detail in the CPS FMP. The CPS fishery generally uses lampara and purse seine gear, which are generally not associated with adverse impacts to benthic habitat. Therefore, the Proposed Actions are not expected to have an adverse impact on EFH.

3. Can the Proposed Action be reasonably expected to have a substantial adverse impact on public health or safety?

Public health and safety issues related to CPS fisheries are discussed and analyzed in the CPS FMP. Given that the Proposed Actions do not substantially change the attributes of CPS fisheries related to safety (such as time, area, and methods), the Proposed Actions are not expected to have a substantial adverse impact on public health or safety.

4. Can the Proposed Action be reasonably expected to have an adverse impact on endangered or threatened species, marine mammals, or critical habitat of these species?

The Proposed Action is not expected to have adverse impacts on endangered or threatened species, marine mammals, or critical habitat for these species. Potential interactions with protected species and consultation arrangements are discussed in Section 6.4 of the EA. The Proposed Actions are within the scope of the CPS FMP and do not change the basis for the determinations made in previous consultations.

5. Can the Proposed Action be reasonably expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The Proposed Action is not expected to result in cumulative adverse effects that could have a substantial effect on target or non-target species. As described in the CPS FMP, bycatch in CPS fisheries is generally quite minimal because fishing operations generally target aggregations of coastal pelagic species. Moreover, bycatch is generally avoided because it decreases the marketability of the target catch. As the Proposed Actions are not expected to change the nature of the CPS fishery, bycatch of non-target species as a result of the Proposed Actions is expected to be minimal. As noted above, the limited entry-related Proposed Actions establish provisions for ensuring harvest capacity is in balance with

resource availability. Moreover, harvest levels for actively managed species (e.g., Pacific sardine and Pacific mackerel) are determined via risk averse harvest control rules established by the CPS FMP. This combination is expected to decrease the potential for jeopardizing sustainability of the target species. The squid MSY-proxy Proposed Action represents a risk averse approach that includes measures that generally ensure the ability of the targeted species to maintain long-term abundance levels. Thus, cumulative impacts on the targeted species are not expected to be substantial.

6. Can the Proposed Action be reasonably expected to jeopardize the sustainability of any non-target species?

As discussed in the CPS FMP, fisheries under the Proposed Actions are highly selective and bycatch and bycatch mortality of non-target species is generally minimal. The limited entry-related Proposed Actions are not expected to substantially change the nature of the CPS fisheries. Relative to the market squid-related actions, the EA notes "squid are members of a lower animal trophic level of the marine ecosystem and; thus, play an important role as a forage species utilized by animals at higher trophic levels." The proposed MSY-proxy approach accounts for the importance of squid within the ecosystem and is expected to provide precautionary management in tune with ecosystem needs. For these reasons, the Proposed Action is not anticipated to jeopardize the sustainability of any non-target species.

7. Can the Proposed Action be expected to have a substantial impact on biodiversity and ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

As noted above, the Proposed Actions are not expected to substantially change the nature of the CPS fishery, which is currently managed conservatively and in accord with biodiversity and ecosystem function. Also as noted above, the proposed MSY-proxy approach accounts for the importance of squid within the ecosystem and is expected to provide precautionary management. For these reasons, the Proposed Action is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area.

8. Are significant social or economic impacts interrelated with significant natural or physical environmental effects?

Anticipated impacts of the Proposed Actions are discussed in the EA at Sections 4.1.2 and 6.2. Analyses generally indicate that the Proposed Actions are not expected to result in significant social or economic impacts, or significant natural or physical environmental effects.

9. To what degree are the effects on the quality of the human environment expected to be highly controversial?

The limited entry-related Proposed Actions result in capping fleet capacity at current levels and provide for transfer of limited entry permits. These provisions are expected to improve conditions for current and future participants. As noted above, the proposed MSY-proxy approach accounts for the importance of squid within the ecosystem and is expected to provide precautionary management. For these reasons, the measures contained in the Proposed Actions are not expected to be highly controversial. Moreover, through the Council process fishery participants and the interested public have the opportunity to contribute to the development of fishery management measures and controversy may be minimized through this public involvement.

FONSI Statement

Based on the information contained in this EA (Environmental Assessment for Limited Entry Fleet Capacity Management and a Market Squid MSY Control Rule) and summarized here (and in the EIS for the CPS FMP), the Proposed Actions will not significantly affect the quality of the human environment, with specific reference to the criteria contained in Section 6.02 of NOAA Administrative Order NAO 216-6,

Environmental Review Procedures for Implementing the National Environmental Policy Act (NEPA). Accordingly, the preparation of a Supplemental Environmental Impact Statement for the Proposed Action is not necessary.

_____ _____

William T. Hogarth Date
NOAA Assistant Administrator for Fisheries

APPENDIX B: AMENDMENT 8 APPROVAL LETTER

Supplemental Attachment B.1.b.
June 1999

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

JUN 10 1999

F/SWR2:JJM

Mr. Jerry Mallet, Chair
Pacific Fishery Management Council
2130 SW Fifth Avenue, Suite 224
Portland, Oregon 97201

Dear Jerry,

I am pleased to inform you that I have approved Amendment 8 to the Northern Anchovy Fishery Management Plan except for the specification of optimum yield (OY) for market squid and the bycatch provisions. The OY specification for squid was disapproved because the amendment does not provide an estimate of maximum sustainable yield (MSY), the theoretical concept on which optimum yield and overfishing is based under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The bycatch provisions were disapproved because Amendment 8 does not contain a standardized reporting methodology to assess the amount and type of bycatch in the fishery and because there is no explanation of whether additional management measures to minimize bycatch and the mortality of unavoidable bycatch are practicable at this time. I have approved all other elements of Amendment 8.

The Magnuson-Stevens Act requires that optimum yield be based on MSY. There may be sufficient protections in the current management of the fishery to prevent overfishing of squid, but MSY needs to be determined to establish a foundation for management. The Council should provide such an estimate accompanied by whatever qualifiers are necessary. Guidance has been furnished in the past, and we can work with the Council to meet the requirements.

I have disapproved the bycatch provisions. Landing records do not indicate a notable bycatch; however, there are no data to show what happens during fishing operations. There is a potential to capture salmon, striped bass, yellowtail and other species prohibited by State and Federal regulations, but there are no provisions to minimize potential bycatch. The two exempted fishing permits recommended by the Council to allow a small anchovy reduction fishery in a closed area off San Francisco may provide important information; however, the Council needs to develop a reporting system to assess the amount and type of bycatch. Only by properly assessing the bycatch in the fishery, can the Council meet its other responsibility to minimize bycatch and to minimize the mortality of unavoidable bycatch.

I have approved the overfishing definitions for the other species. Experience with coastal pelagic stocks around the world indicates that overfished low biomass conditions usually occur when unfavorable environmental conditions and high fishing mortality rates occur at the same time. The measures in Amendment 8 do not depend on whether low biomass is due to excess fishing or unfavorable environmental conditions. Reductions in fishing mortality are required in either case.

I have approved the fishing communities provisions. The harvest strategies, besides protecting the resources and ensuring forage for dependent species, are designed to provide maximum benefit to the Pacific coast. The limited entry scheme, besides preventing overcapitalization, is designed to protect historic participation in the fishery while providing maximum benefits to all users. Nevertheless, a more deliberative search for fishing communities, especially social and cultural aspects that might play a role in fisheries, would help ensure that a complete analysis has been completed. A proposed project to develop profiles of ports along the Pacific coast may help us better define communities and measure impacts. We can work with the Council to obtain better information so that the impacts can be measured more effectively.

I have approved the essential fish habitat provisions. Essential fish habitat (EFH) for coastal pelagics is defined by a temperature range bordered within the geographic area where a coastal pelagic species occurs at any life stage, where a species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the species. More is known about the requirements for finfish than squid. Although spawning areas of squid are generally known to be shallow semi-protected near-shore areas with sandy or mud bottoms adjacent to submarine canyons, exactly what squid require for spawning habitat is not known. Accordingly, benthic habitats of spawning squid have not been described and identified by the Council as EFH. The Southwest Region is cooperating with the California Department of Fish and Game in research to determine these requirements. The Council should closely follow the research currently underway so that protection can be provided to squid stocks by amending the fishery management plan to add spawning squid EFH as soon as possible. This would enhance conservation of key habitat that may be adversely affected by human activity.

The Council has prepared an important response to the rapid increase in biomass of Pacific sardine following decades of low abundance. How this resource is managed will have significant effects on other coastal pelagic species, the species that depend on coastal pelagics for forage, and on the economics of fishing. I look forward to working with the Council to implement the provisions of the amendment.

Sincerely,

for J. J. Lawson

Rodney R. McInnis
Acting Regional Administrator

APPENDIX C: LIMITED ENTRY CAPACITY GOAL AND TRANSFERABILITY OPTIONS

Capacity Goal for the CPS Finfish Limited Entry Fishery

Background

At its November, 2000 meeting, the Pacific Fishery Management Council directed the CPSMT to continue its analysis on establishing a harvesting capacity goal for the limited entry (LE) finfish fishery and to address other capacity related issues such as permit transferability. Alternative capacity goals should be developed following the three options outlined in the CPSMT's statement on the CPS limited entry fishery issues, capacity goal and permit transferability, presented to the Council at its November, 2000 meeting:

Option 1. Maintain a larger, diverse CPS finfish fleet (current size?) which also relies on other fishing opportunities such as squid and tuna;

Option 2. Work the fleet down to a smaller number of vessels with certain characteristics (e.g., smaller number of larger, 'efficient' vessels; or smaller number composed of CPS finfish 'specialists');

Option 3. Base the fleet size on our expectations of long-term expected yields from the combined CPS finfish species and the number of vessels physically capable of harvesting that yield.

The analysis should include advice on the most preferred option; why it is most preferred; and how permit transferability would help achieve and maintain that goal.

Progress to Date

Profile of the Current CPS Limited Entry Fleet

The window period for CPS permit transferability closed as of 31 December, 2000. The fleet now consists of 65 vessels. Forty-five of these vessels initially qualified under the window period and the other 20 vessels were permit transfers (Table 1). Fifty-five of these boats also hold permits to fish for market squid in California waters, and at least four vessels have been active in the CPS live-bait fishery since 1996. The vessels range in age from 4 to 64 years old, with an average age of 30 years (Figure 1). There are two general age groups in the fleet, with one ranging from 11-30 years, and the other in the 51-70 year old 'vintage' category.

CPS LE vessels range in length from 40 to 95 feet, with an average length of 62 feet (Figure 2). Vessel physical capacity can range widely within length categories depending upon breadth and depth of the hull design. For this reason, we calculated vessel gross tonnage and used this measure in the CPS finfish harvesting capacity analysis as the best proxy for each vessel's capital stock. The calculated gross tonnage incorporates a vessel's length, breadth and depth, which are consistent measures across vessel registration and Coast Guard documentation lists. Net tonnage is a more ambiguous vessel attribute and was not considered a good proxy for a vessel's capital stock.

As described in 46CFR69.209, gross tonnage (GT) is defined: GT=(0.67*length*breadth*depth)/100. CPS LE vessel dimension data were obtained from the Coast Guard database. Gross tonnage for the current fleet ranges from 24 to 225 metric tons, with an average of 87 tons (Figure 3). Three general tonnage classes are apparent, with modes at 61-70 tons, 121-130 tons, and three vessels over 200 tons (Figure 3). This calculated GT may not agree with a vessel's documented gross tonnage reported in Coast Guard documentation lists.

Data Revisions

Since the November Council meeting, a new capacity data set has been compiled which is comprised of comprehensive, individual landings data over the 1981-2000 period for the 65 vessels that acquired finfish limited entry permits. For each year a vessel had landings of any species, not just CPS, these landings and related information are captured in the data set. Because not all 65 vessels fished in each year of the 1981-2000 period, this is an unbalanced panel data set.

The landings data for the finfish limited entry fleet were compiled from vessel landings receipts (fish tickets) maintained in California's CMASTER data base. Each vessel's landings and corresponding ex-vessel revenues on a particular date were summarized and assumed to represent the landings and revenues for a unique trip. If a vessel had two or more fish tickets on the same date, this was considered a split load - - the catch from one trip was delivered to one or more buyers -- and counted as a single trip. Multiple tickets on the same date could actually reflect multiple trips on that date. Although this was deemed a rare event, a "common sense" filter was applied in instances where summarized landings per trip were anomalous (e.g. greatly exceeded the vessel's gross tonnage) to avoid a potential upward bias in landings per trip. The "common sense" filter was also used to deal with apparent fish ticket data entry errors.

The vessel landings data were used to demonstrate the high degree of variability that characterizes CPS fisheries, and to what extent vessels specialize in finfish fisheries compared to squid and fisheries for other species, primarily tuna.

To indicate the degree of variability in the finfish fisheries, plots of fleet-wide annual finfish landings (Figure 4) and annual weighted ex-vessel prices (Figure 5), as well as the relative number of annual finfish, squid and tuna trips per year (Figure 6) and trips per vessel (Figure 7) were generated for the limited entry fleet over the 1981-2000 period. Variability in resource availability is revealed by the pattern of annual landings and relative trips per vessel by species over the period. Variability attributable to fluctuations in market demand is reflected in the pattern of annual ex-vessel prices over the period.

Specialization in finfish was initially examined in terms of the share finfish trips comprised of a vessel's total annual trips. In this case, the greater finfish trips as a share of the vessel's total annual trips, indicates specialization in finfish (Figure 8).

To further indicate their degree of specialization in finfish, the proportion of each vessel's annual finfish revenue of their total ex-vessel revenue was calculated to show their economic dependency on finfish relative to other species, and how consistent the level of dependency on finfish was over the period (Figures 9-14 are shown as examples for each category).

Landings data were supplemented with vessel characteristics data from California fishing vessel registration and Coast Guard vessel documentation files. Vessel length, width and breadth data from these sources was used to calculate each vessel's gross tonnage. Overall, this data set provides a rich history of CPS and other species fishing activity for the limited entry fleet.

In addition to individual vessel data, a time series of CPS finfish biomass estimates was assembled for the 1937-2000 period (Figure 15). The current maximum sustainable yield and harvest target level control rules were applied to each species' annual biomass estimates for each year in the period to obtain harvest target levels (quota) in current time equivalents. These data were then used to project long-term, future aggregate finfish harvest target level (Figure 16).

Capacity Revisions

Background

Capacity is a short-run concept representing the maximum harvest that variable inputs (e.g. fuel and labor) are capable of producing given the observed capital stock. Changes in capacity come about from variations in the capital stock, and represent long-term investment decisions on the part of fishing firms.

A data envelopment analysis (DEA) was conducted using the landings and vessel characteristics data set to estimate finfish harvesting capacity and squid harvesting capacity for the limited entry finfish fleet. DEA is a means to estimate the per trip finfish and squid harvesting capacities for each vessel given its capital stock (fixed input) -- represented by its gross tonnage -- and observed output represented by volume of catch -- landings per trip. DEA determines which vessels, in terms of their gross tonnage, delineate a best-practice frontier. The best-practice frontier defines the maximum level of landings per trip that can be produced by a vessel, of distinct gross tonnage, when there is unrestricted availability and full utilization of variable inputs (fuel, labor, gear, etc.). DEA also provides a measure of capacity utilization (CU): the ratio of observed landings per trip to capacity landings per trip (Figure 17). Dividing each vessel's observed output per trip by its CU measure gives its corresponding capacity output per trip.

Two measures of finfish harvesting capacity per trip and squid harvesting capacity per trip were derived for each vessel (Figure 18): 1) based on the maximum landing of finfish, and maximum landing of squid recorded for the 1981-2000 period; and 2) based on the average landing of finfish and average landing of squid over the period.

The measure of harvesting capacity based on the maximum recorded landing approximates the vessels physical capacity. Physical capacity is a pure technological or engineering measure of the maximum potential output per unit of time. In terms of fish harvesting, physical capacity typically corresponds to the vessel's hold volume. In this sense, physical capacity provides a benchmark, maximum harvesting potential for a given vessel or fleet of vessels. Physical capacity is a fixed measure that will only change with a change in the capital stock; i.e. a change in a particular vessel's physical structure or a change in fleet size or composition.

The second measure of harvesting capacity approximates output per unit of time under what are considered typical or normal operating conditions. This concept of capacity incorporates the fisher's expectations concerning variations in resource availability, environmental conditions, and output demand, and in this case is considered a technological-economic measure of capacity.

Physical capacity is appropriately associated with some peak availability of fish, unique environmental conditions which enhance effort production, or peak demand for output. Technological-economic capacity accounts for typical patterns of resource availability, environmental conditions, and output demand. In cases like CPS, where resource availability, environmental conditions and market conditions are highly variable, there is no such thing as typical conditions, and therefore technological-economic capacity is likewise highly variable.

A vessel's physical harvest capacity and normal harvest capacity is measured on a per trip basis. Annual capacity for each vessel is its per trip capacity multiplied by a measure of its number of trips per year. Therefore annual harvest capacity is dependent on the amount of effort each vessel is expected to generate during the year. As with physical and normal measures of harvest capacity per trip, the amount of effort a vessel produces during the year can be considered in terms of that which is possible from a purely technological or engineering standpoint, versus that which reflects variability in resource availability, environmental conditions and market conditions. The former can be thought of as physical effort, the latter normal effort.

In this analysis, each vessel's physical effort was the maximum number of annual finfish landings (trips) observed over the 1981-2000 period. Each vessel's normal effort was the average number of annual trips over the period. Therefore, each vessel's annual physical harvesting capacity was defined as its physical capacity per trip multiplied by its maximum number of annual trips (physical effort), and each vessel's annual normal harvesting capacity was defined as its normal capacity per trip multiplied by its average number of annual trips (normal effort).

Summing annual vessel capacities provides an estimate of annual capacity for the finfish limited entry fleet (Table 2).

Options

Consider four capacity goals: 1) Normal harvest capacity equal to the long-term expected aggregate finfish target harvest level, 108,306 mt, with physical capacity available to harvest peak period amounts of finfish, 273,507 mt; 2) normal harvest capacity equal to average total finfish landings over the 1981-2000 period, approximately 57,676 mt; 3) physical harvest capacity equal to the long-term expected target harvest level, 108,306 mt, without an excess capacity reserve; and 4) maintain fixed fleet of 65 vessels, with no capacity goal. These capacity goals are analyzed in conjunction with the fleet composition options described above.

Analysis

Option 1 - Capacity Goal 1 (CPSMT Preferred Option)

Maintain a larger, diverse CPS finfish fleet, which also relies on other fishing opportunities such as squid and tuna, with normal harvesting capacity equal to the long-term expected aggregate finfish target harvest level,

approximately 110,000 mt, and with physical capacity available to harvest peak period amounts of finfish, 275,000 mt.

The current finfish limited entry fleet would satisfy Option 1, and capacity goal 1. Under what might be considered typical or normal operating conditions -- harvesting capacity based on average finfish landings per trip and average number of finfish trips per year -- the finfish limited entry fleet would provide sufficient capacity to harvest the expected long-term average aggregate finfish harvest target level (Table 3)[1]. This fleet would also have the physical capacity -- harvesting capacity based on maximum finfish landings per trip and maximum number of finfish trips taken per year -- to harvest the maximum potential amount of finfish, that amount associated with peak period availability of fish, environmental conditions which are most favorable to effort production, and peak demand for output. This "excess capacity" could otherwise be directed towards the harvest of squid and tuna. In this regard it is important to note that the ability of vessels participating in the CPS finfish fishery to harvest alternate species reduces the need to reduce the size of the limited entry fleet. CPS finfish purse seine fisheries off California are flexible and accommodate significant changes in resource availability and market demand. When CPS finfish are unavailable or market conditions for CPS finfish are not favorable, CPS purse seine vessels tend to switch to alternative species, primarily market squid, tunas, and herring.

Option 2 - Capacity Goal 2

Work the fleet down to a smaller number of vessels with certain characteristics (e.g., smaller number of larger, 'efficient' vessels; or smaller number composed of CPS finfish 'specialists'), with normal harvesting capacity equal to average total finfish landings over the 1981-2000 period, approximately 57,676 mt.

A substantially reduced fleet consisting of the 12 vessels identified as finfish specialists and 14 non-specialists ranked in descending order of capacity utilization (Table 3, Option 2-A) would have sufficient normal harvesting capacity to satisfy Capacity goal 2, and have physical capacity to harvest approximately 264,000 mt annually. Instead of including only those vessels considered specialists, the fleet could be reduced along a number of different dimensions (e.g. harvesting efficiency) to match capacity with 20-year average landings. Based on decreasing technical efficiency, increasing age and increasing gross tonnage, a fleet of 33 vessels would have sufficient normal harvesting capacity to satisfy Capacity goal 2, and enough physical capacity to harvest 275,000 mt annually(Table 3, Option 2-B). Assuming that at least some of the vessels losing their permits under Option 2 would cease fishing, this option would probably severely limit the amount of harvest capacity that would remain for tuna, and would probably increase the need for squid specialists.

Option 3 - Capacity Goal 3

Base the fleet size on our expectations of long-term expected yields from the combined CPS finfish species and the number of vessels physically capable of harvesting that yield, 110,000 mt annually, without an excess capacity reserve.

A reduced fleet with physical capacity -- harvesting capacity based on maximum finfish landings per trip and maximum number of finfish trips taken per year -- equal to the expected long-term average aggregate finfish harvest target level, 110,000 mt annually. This fleet would consist of the 12 finfish specialists when vessels are ranked by speciality and decreasing technical efficiency (Table 3, Option 3-A). This 12 vessel fleet would not have the capacity to take peak period amounts of finfish (275,000 mt) unless it made more finfish trips during the year than its observed maximum. If additional trips were made this would likely diminish the ability of these vessels to participate in other fisheries. This option would probably limit the amount of harvest capacity that would remain for tuna, and would probably increase the need for squid specialists. This fleet would have normal harvesting capacity of about 26,000 mt annually (Table 3, Option 3-A). Alternatively, when vessels are ranked by decreasing technical efficiency, increasing age and increasing gross tonnage, a fleet of 11 vessels would have sufficient physical capacity to harvest the expected long-term average aggregate finfish harvest target level, 110,000 mt annually. This fleet would have normal harvesting capacity of 23,000

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[1]When the observed average CPS finfish landing is multiplied by the average number of annual trips for each of the 65 permitted vessels, over the 1981-2000 period, the fleetwide harvest is 60,416 mt. When the observed maximum CPS finfish landing is multiplied by the maximum number of annual trips for each of the 65 permitted vessels, over the period, the fleetwide harvest is 360,520 mt (Appendix Table 3).

mt annually (Table 3, Option 3-B).

Option 1 - Capacity Goal 4
Maintain a fixed fleet of 65 vessels, with no capacity goal. This reflects the status quo where there is no harvest capacity goal. Under conditions of unconstrained permit transferability, this option could result in significant increases in harvesting capacity.

Permit Transferability

Background

Limited entry programs are primarily designed to address economic problems associated with excess harvest capacity or overcapitalization in open access fisheries. In most cases significant economic benefits (efficiency gains) are realized by allowing unconstrained transfer of limited entry permits if the the initial allocation of permits is sub-optimal. Under an open market for limited entry permits, permits would tend to be sold to fishers who use the most efficient harvesting techniques. Fishers who use the most efficient harvesting technology will be able to outbid less efficient competitors. Over time this should lead to efficiency gains and increased profitability through a reduction in fleet harvesting costs. A transferable permit can become a highly valued asset to its holder. Non-transferability can lead to ossification of the fleet if there are no opportunities to replace or sell vessels.

Increased efficiency is not the overriding objective of Amendment 8. The limited entry program for the CPS finfish fishery has multiple objectives. In some cases, there are social, income distributional, or other benefits that may be of greater importance than efficiency, that can be realized by constraining permit transfer to maintain the initial allocation. In the latter cases, the initial allocation may be optimal in terms of preserving a particular pattern of fishing operations, or fishing community structure. It was for these reasons that a 70 vessel fleet was chosen over a more efficient 41 vessel limited entry fleet as the target fleet size, which would best strike a balance between economic and social objectives.

The CPS finfish limited entry program in Amendment 8 qualified 70 vessels for finfish limited entry permits. Permits issued to qualifying vessels were transferable unconditionally for one year following implementation of the limited entry program, January 1, 2000. After one year, transferability is limited to situations where the original vessel is lost, stolen, or no longer able to participate in federal fisheries. The replacement vessel must be of equal or less net tonnage.

The window period for CPS permit transferability closed as of 31 December, 2000. The fleet now consists of 65 vessels. Forty-five of these vessels initially qualified under the window period and the other 20 vessels were permit transfers. These permit transfers may lead to improvements in economic efficiency and economic benefits from improved product quality, since permits would tend to be transferred to fishers who use more efficient or advanced harvesting and handling techniques.

These permit transfers may also reflect the dependency of CPS vessels on alternate species, particularly market squid, where under current conditions a California squid permit cannot be transferred to another vessel. In this case, there is likely to be an overall efficiency gain in terms of optimizing vessel operations over the suite of CPS fisheries opportunities. This is an important consideration in evaluating transferability options, i.e., the ability of vessels participating in the CPS finfish fishery to harvest alternate species when CPS finfish are unavailable, market conditions for CPS finfish are not favorable, or availability and market conditions for alternate species are more favorable. In this spirit, the Team has recommended that CPS finfish permits be freely transferable, and market forces (rather than policy decisions) be the guiding force in determining optimum harvesting capacity and fleet configuration across all CPS vessels' fishing opportunities.

Transferability Options

Option 1 No transferability of permits except 1) if the permitted vessel totally lost, stolen or scrapped, such that it cannot be used in a federally regulated commercial fishery, provided application for the permit originates from the vessel owner who must place it on a replacement vessel of the same or less harvesting capacity within one year of disability of the permitted vessel, or 2) the permit is placed on a replacement vessel of the same or less harvesting capacity provided the previously permitted vessel is permanently retired from all federally managed commercial fisheries for which a permit is required.

Option 2 Allow CPS finfish limited entry permits to be transferred without constraints.

Option 3 (CPSMT Preferred Option) Allow CPS finfish limited entry permits to be transferred with restrictions on the harvesting capacity of the vessel to which it would be transferred to: 1) full transferability of permits to vessels of comparable capacity, and 2) allow permits to be combined up to a greater level of capacity in cases where the vessel to be transferred to is of greater harvesting capacity than the one from which the permit will be transferred.

Analysis

Option 1 represents the status quo. For a given CPS finfish harvesting capacity goal and corresponding target fleet this option allows some modernization to occur while limiting growth of fishing capacity in the long term. It is likely to lead to greater specialization in the CPS finfish fishery since replacement vessels may be relatively inefficient in alternative fisheries. Although this option would seem to be most compatible with fleet ***Option 2 - Capacity Goal 2***, a finfish limited entry fleet consisting of a small number of larger, 'efficient' CPS finfish 'specialists', with normal harvesting capacity equal to average total finfish landings over the 1981-2000 period, it would not allow combining up of permits to replace more than one small vessel with a larger vessel. The number of vessels in the CPS finfish fishery and their corresponding harvesting capacity would be fixed.

Option 2 would allow full transferability by which market forces would determine optimum harvesting capacity and fleet configuration taking into account alternative opportunities for CPS vessels. Full transferability would likely be incompatible with a specified harvest capacity goal for CPS finfish. By allowing a replacement vessel to be of greater harvesting capacity than the originally permitted vessel on a one-for-one permit transfer basis, there would not be any constraint on vessel-level finfish harvesting capacity. A fleet of larger vessels could result in fleet harvesting capacity exceeding the capacity goal. Even with a trip limit in place, larger vessels could possibly make more trips so that the annual CPS finfish harvest would exceed the capacity goal. Although this might result in a sub-optimal fleet with respect to a CPS finfish harvest capacity goal, it would not preclude overall efficiency gains in the context of the full array of fishing possibilities available to CPS vessels.

Option 3 would restrict transferability by not allowing permit transfers on a one-for-one basis except in cases of comparable harvesting capacity. Transfers from a smaller vessel to a larger vessel would require combining the smaller permit with another permit for placement on the larger vessel. Option 3 represents a compromise between more restrictive transferability as per Option 1 and full transferability as per Option 2. Under Option 3, harvesting capacity would be fixed at some desired level, but the number of vessels corresponding to that capacity level initially awarded permits would only be a maximum. By allowing permits to be combined up, the number of vessels initially issued permits could be reduced.

This situation could arise when vessels seek to optimize their operations across the alternative fisheries in which they are capable of participating, market squid being the most likely species in terms of joint optimization. By allowing transferability within the confines of Option 3 the emerging fleet would represent the future expectations of industry members concerning vessels best suited to take advantage of joint harvesting opportunities without compromising the desired CPS finfish harvest capacity goal.

Option 3 will probably be most satisfactory in terms of harmonizing the CPS finfish limited entry program and California's pending squid limited entry program. At this point, California Department of Fish and Game (CDFG) is recommending full transferability of permits to vessels of comparable capacity (defined as within 5 percent of the transferor vessel's gross tonnage (GT) as an element of California's squid limited entry program. In addition, for vessels wishing to increase capacity, CDFG is considering a '2-for-1' program which involves surrendering a permit if the vessel to be transferred to is in excess of the 5 percent capacity allowance and lower than 135 percent of the original vessel's GT. If the replacement vessel's GT exceeds 135 percent of the original vessel's GT, two permits must be surrendered (i.e. '3-for-1') to upgrade. CDFG's proposed scheme for combining permits is designed to decrease capacity of the initial squid fleet through a reduction in the number of vessels. Since the CPSMT's preferred option is to maintain the CPS finfish fleet at it's current capacity, Option 3 could contain less restrictive exchange rates. For example, a '2-for-1' program for CPS finfish could require surrendering a permit if the vessel to be transferred to is in excess of 110 percent of the original vessel's GT. A variation of the 2-for-1 program would require that the permit being surrendered be from a vessel with a GT equal to the net increase in GT of the replacement vessel less the comparable GT allowances. For example, replacing a 50 GT vessel with a 100 GT vessel would require an additional

permit from a 40 GT vessel when the comparable GT allowance is 10 percent (i.e. comparable GT is 110 percent of the transferor vessel's GT). Allowing permits to be combined up in this manner would enable a fleet to develop that is best suited for participation in both fisheries.

In terms of the CPS physical and normal capacity frontiers shown in figure 18, the proportional change in harvesting capacity for a given proportional change in gross tonnage is less than one over the range of observed gross tonnages. This means that a 100 percent increase in a vessel's gross tonnage will result in a less than 100 percent increase in its harvesting capacities. In the case of physical capacity the corresponding increase in capacity is about 90 percent, and in the case of normal capacity about 75 percent. Therefore, a 10 percent gross tonnage allowance is not expected to result in a substantial increase in harvest capacity. Additionally, this would allow combining up of a permit that is 10 percent less than the replacement GT.

Option 3 would leave decisions about harvest capacity levels and transferability of permits within the policy arena, but given harvest capacity and transferability parameters, allows industry to determine what the fishery should "look like" in terms of the number of vessels and their corresponding harvesting capacities. Option 3 would not impose any restrictions on vessel physical attributes, but would require permits to have a gross tonnage endorsement. The CPS finfish harvesting capacity analysis establishes a linkage between a vessel's GT and its harvesting capacity. Therefore, as is being considered for California's squid limited entry program, a vessel's finfish limited entry permit could carry a GT endorsement that denotes its harvesting capacity.

125 Metric Ton Trip Limit

From the capacity analysis, vessels greater than or equal to 115 GT, have a physical harvesting capacity greater than or equal to 125 metric tons per trip (Figure 18). Therefore, we would not expect to see permits being transferred to vessels with a GT greater than 115, unless vessels of this size are optimum across all fisheries in which they participate.

Reevaluation of the Capacity Goal

For whichever transferability option that the Council adopts, it is advisable that conditions and effects of transferability be reevaluated periodically in conjunction with achievement of the capacity goal, and objectives of the FMP. The CPSMT recommends setting a trigger for reevaluation based on an overall change in fleet GT of five percent.

Table 1. Coastal Pelagic Species Limited Entry Permit Vessel Listing

Vessel Name	Vessel Owner	CG #	LE #
Misty Moon	Misty Moon, Inc.,	578511	1
Paloma	Boat Anna Maria	236642	2
St. George II	St. George II Fishing, Inc., Frank Vuoso	238969	3
Barbara H*	David A. Haworth	643518	4
San Antonio	Mazara Inc., Antonino Ingrande	236947	5
Annie D	St. Teresa Fishing, Inc., Stanley DiMeglio	246533	6
San Pedro Pride	San Pedro Pride, Inc., Ercole (Joe) Terzoli	549506	7
Ferrigno Boy	Ferrigno Enterprises Inc., Nicolina Ferrigno	602455	8
King Philip*	King Philip, inc., Sal Tringali	1061827	9
Sea Wave	Sea Wave, Inc., Sal Tringali	951443	10
Mary Louise	Sea Lanes II, Inc., Tony Mattera	247128	11
Bainbridge	Bainbridge Inc., Richard Mirkovich	236505	12
Pioneer	JCJC Incorporated	246212	13
Maria	Brothers C	236760	14
St. Joseph	St. Joseph, Inc., Robert Cigliano	633570	15
Sea Scout	Sea Scout, Inc., Isidoro Amalfitano	248454	16
Retriever*	William Ford Hargrave and John Aiello	582022	17
Atlantis	F/V Atlantis, L.L.C., Christopher C. Peterson	649333	18
G. Nazzareno	Nazzareno, Inc.	246518	19
Sea Queen	Boat Sea Queen, Inc.	582167	20
Pacific Leader	Southern California Bait Co, Inc.	643138	21
Chovie Clipper	Southern California Bait Co., Inc.	524626	22
Tribute	Stanley J. Nelson	613318	23
Ocean Angel I	Ocean Angel I, LLC	584336	24
Maria T	Maria T., Inc.	509632	25
Manana	Manana Bait Co., Inc.	253321	26
Miss Juli	Stephen L. Lovejoy	548223	27
Mineo Bros.	Domenic Mineo	939449	28
Sea Queen	Sea Queen Corporation	583781	29
Little Joe II	Bella Lea, Inc.	531019	30
Caitlin Ann*	Caitlin Ann General Partnership	960836	31
Eldorado	Gaspare F. Aliotti	690849	32
Kristen Gail*	Bruce E. Joyce	618791	33
Fiore D'Mare*	Fiore Enterprises, Inc.	550564	34
Endurance*	Gaspare Aliotti	613302	35
New Sunbeam	Pacific Live Bait, Inc.	284470	36
Calogera A*	John, Nick R, & Anthony J. Alfieri	984694	37
Eileen	South Sound Fisheries, Inc.	252749	38
Pamela Rose	Pamela Rose, Inc., Stephen Greyshock	693271	39
New Stella	Sal Boy, Inc., Richard Aiello	598813	40
Traveler	Baitall Inc., Lawrence Vernand	661936	41
Lucky Star	Nick Jurlin Jr.	295673	42
Ocean Angel II	Ocean Angel II, LLC	622522	43
Mello Boy*	Arthur Mello	1061917	44
Trionfo	Aniello Guglielmo	625449	45
Jenny Lynn*	Vito Terzoli	541444	46
Heavy Duty*	Heavy Duty LLC, C.D. Franklin	655523	47
Aliotti Bros	Joseph D. Aliotti	685870	48
Lady J	Noto Corporation, Francesco Noto	647528	49
Anna's	Matteo M. Sardina	253402	50

Vessel Name	Vessel Owner	CG #	LE #
Endeavor*	SBA Corporation	971540	51
Antoinette W	Oceanside Bait Co., Inc., James Gardner	606156	52
Donna B*	James A. Bunn	648720	53
Papa George*	Volcano Bay, Inc.	549243	54
Mercurio Bros	Sam Mercurio	650376	55
Kathy Jeanne*	Pacific Broadbill, Inc.	507798	56
Merva W	Merva W, Inc., Michael McHenry	532023	57
Santa Maria	Santa Maria Fishing, Inc.	236806	58
Buccaneer	David Crabbe, Sal Tringali	592177	59
Midnight Hour*	William Ford Hargarve and John Aiello	276920	60
Nancy B II*	Nancy B, LLC.	542513	61
Miss Kristina	Joe Fernandez	580843	62
Emerald Sea*	SRS Incorporated	626289	63
Connie Marie*	Kavon Incorporated	624240	64
Theresa Marie*	Harry D. Hofland	629721	65

* permit transfer

Table 2. Annual DEA capacity estimates for vessels with CPS limited entry permits.

A. CPS Finfish Capacity

		Number of Trips	
		Maximum[3]	Average[4]
Capacity Output Per Trip (mt)	Maximum[1]	538,804	282,121
	Average[2]	213,251	111,395

B. Squid Capacity

		Number of Trips	
		Maximum[3]	Average[4]
Capacity Output Per Trip (mt)	Maximum[1]	391,616	184,104
	Average[2]	176,273	82,721

[1]Based on the maximum recorded landings per trip, per vessel over the period,1981-2000.
[2]Based on the average recorded landings per trip annually, per vessel, 1981-2000.
[3]Based on the maximum number of annual trips per vessel over the period, 1981-2000.
[4]Based on the average number of trips annually per vessel, 1981-2000.

Table 3. Number of vessels and corresponding capacity parameters for capacity goals and options.

Option	# Vessels	Physical Capacity (mt)	Normal Capacity (mt)
1	65	538,804	111,395
2-A[1]	26	263,663	58,652
2-B[2]	33	274,939	59,515
3-A[1]	12	107,368	25,682
3-B[2]	11	113,176	22,644

[1]Vessels primarily ranked by finfish specialists, generalists; secondarily by decreasing technical efficiency.
[2]Vessels primarily ranked by decreasing technical efficiency; secondarily ranked by increasing age; tertiary ranked by increasing gross tonnage.

Appendix Table 1. CPS Limited Entry Fleet supplemental information.

Total CPS Permit Holders:	**65**	
Original Qualifiers Remaining:	45	
New Vessels from Transfers:	20	
Vessels with Squid Permits:	55	
Vessels by Category		**Comments:**
CPS "Specialists"	12	5 are transfers; 5 hold squid permits; 3 are CPS 'purists'
Generalists	23	3 are CPS permit transfers; 22 hold squid permits
Squid "Specialists"	26	8 are CPS permit transfers; all hold squid permits
Tuna "Specialists"	3	3 are CPS permit transfers; 2 hold squid permits
Undetermined	1	

Appendix Table 2. Number of vessels taking 95% and 99% of the CPS finfish landings, 1981-2000.

		Number of Vessels	
YEAR	CPS Landings (mt)	95% of harvest	99% of harvest
1981	105,507	37	52
1982	97,833	39	52
1983	55,727	45	61
1984	56,119	45	59
1985	46,279	37	51
1986	54,790	36	50
1987	56,572	36	48
1988	58,596	32	45
1989	61,759	35	49
1990	48,210	38	51
1991	45,311	34	52
1992	38,859	27	41
1993	30,795	26	39
1994	26,145	26	42
1995	52,566	27	40
1996	48,750	32	51
1997	68,522	36	52
1998	65,750	30	42
1999	74,083	38	52
2000	61,343	38	52
Average:	57,676	35	49

Appendix Table 3. Number of vessels and corresponding capacity parameters based on observed maximum and average landings, and observed maximum and average trips per year, 1981-2000.

Option	# Vessels	Physical Capacity[1]	Normal Capacity[2]
1[3]	65	360,520	60,416
2-A[4]	41	328,127	58,067
3-A[5]	7	120,127	16,735

1 Physical capacity based on each vessel's observed maximum finfish trips per year and observed maximum finfish landing per year, 1981-2000.

2 Normal capacity based on vessel's average of observed finfish trips per year and average of observed finfish landing per year, 1981-2000.

3 Capacity estimates for all 65 permitted vessels.

4 Normal capacity equal to average total finfish landings over the 1981-2000 period,58,000 mt per year. Vessels ranked by descending normal harvest capacity per year.

5 Physical capacity equal to long-term expected target harvest level,110,000 mt per year. Vessels ranked by descending physical harvesting capacity per year.

Figure 1. CPS Limited Entry Fleet - Vessel Age

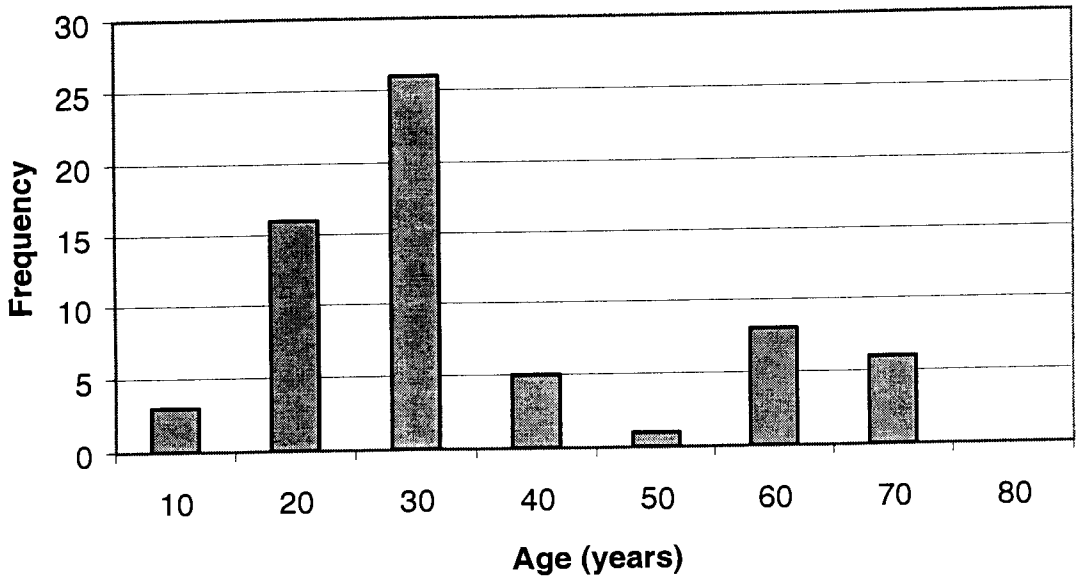


Figure 2. CPS Limited Entry Fleet - Vessel Lengths

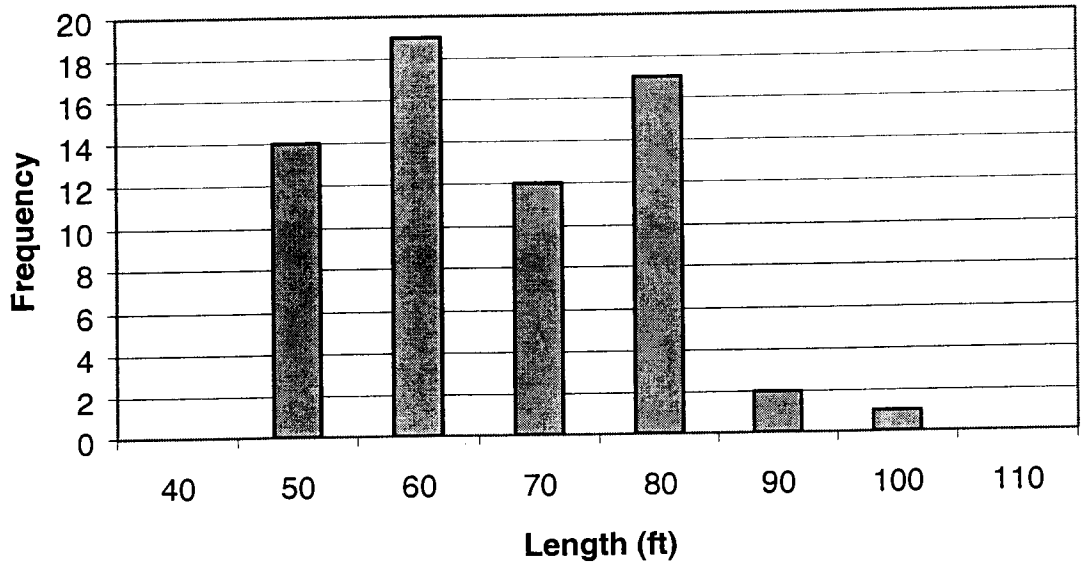


Figure 3. CPS Limited Entry Fleet - Gross Tonnage

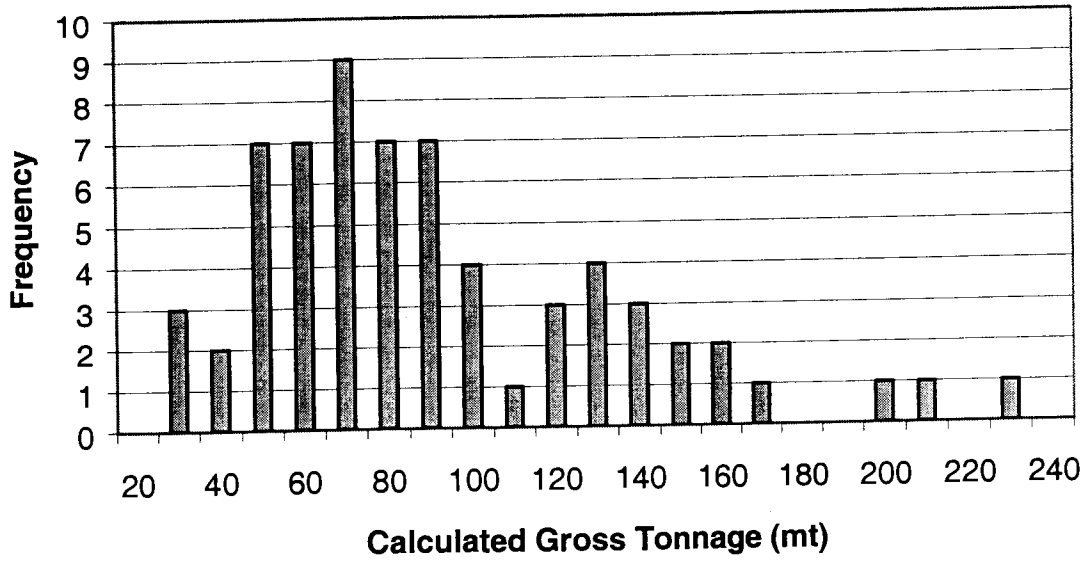


Figure 4. Annual aggregate finfish landings for limited entry fleet, 1981-2000.

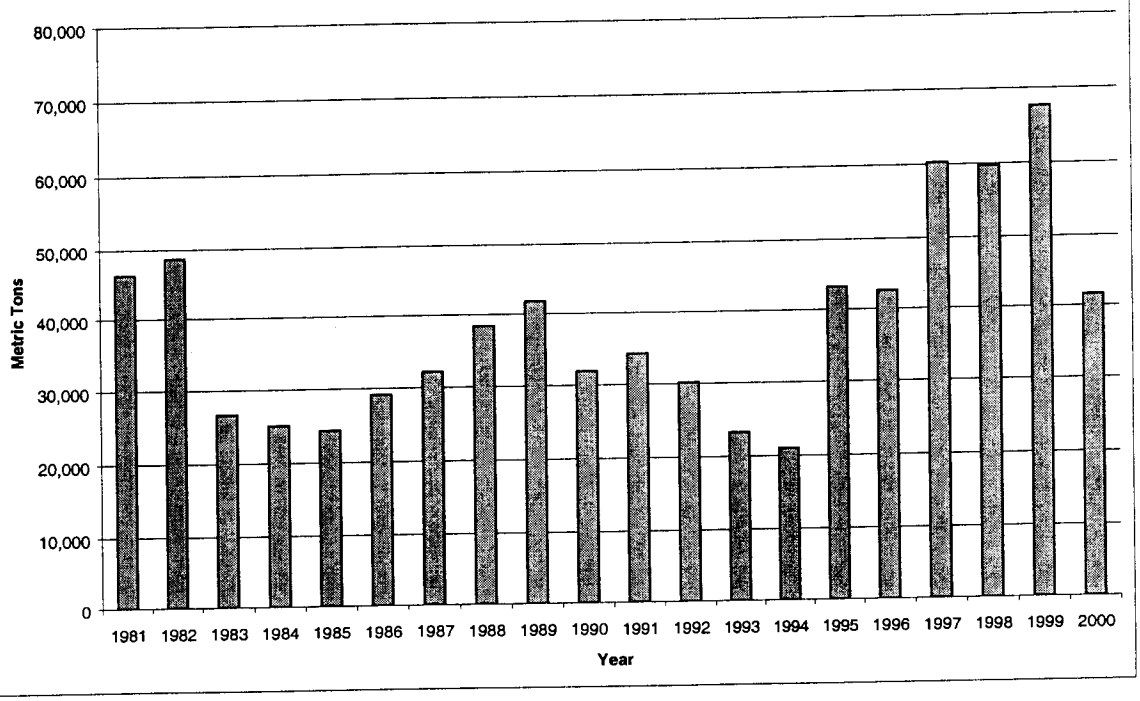


Figure 5. Average weighted price all finfish species in 1999 dollars, 1981-2000.

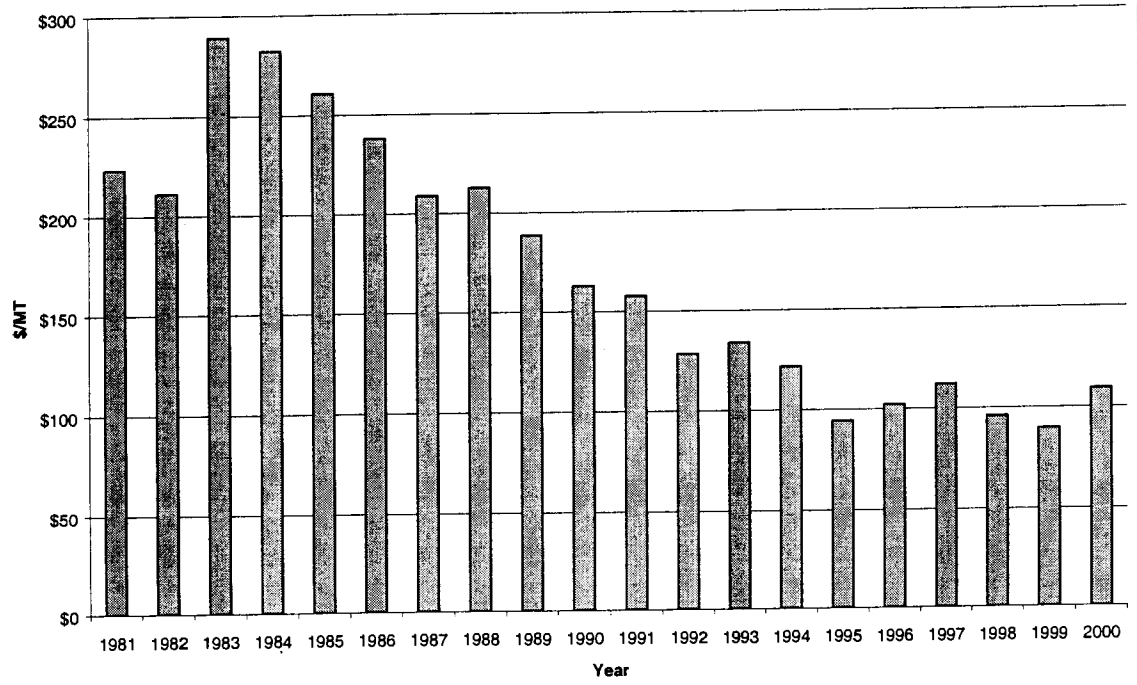
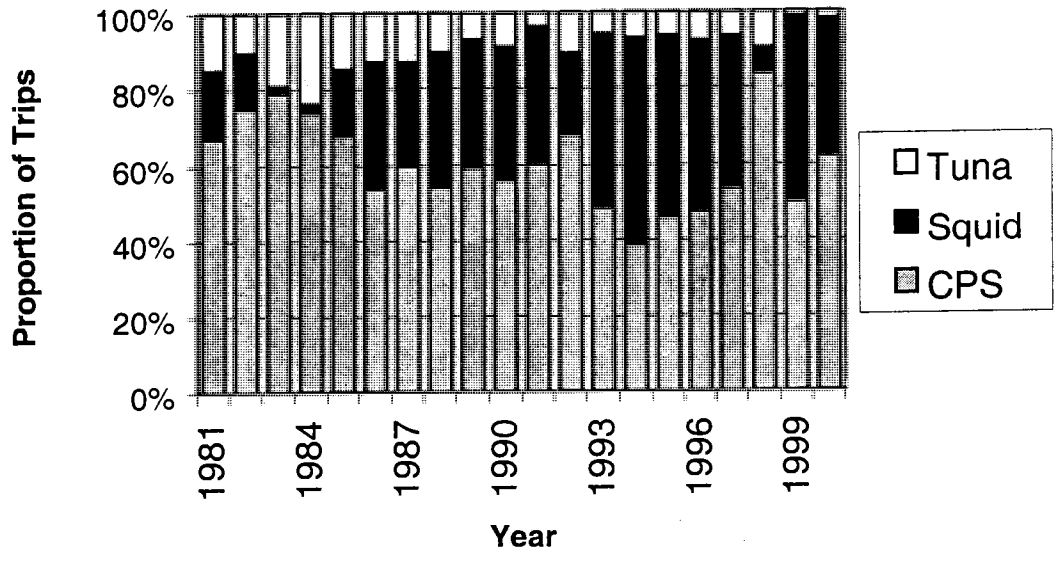


Figure 6. Relative Proportion of Trip Types



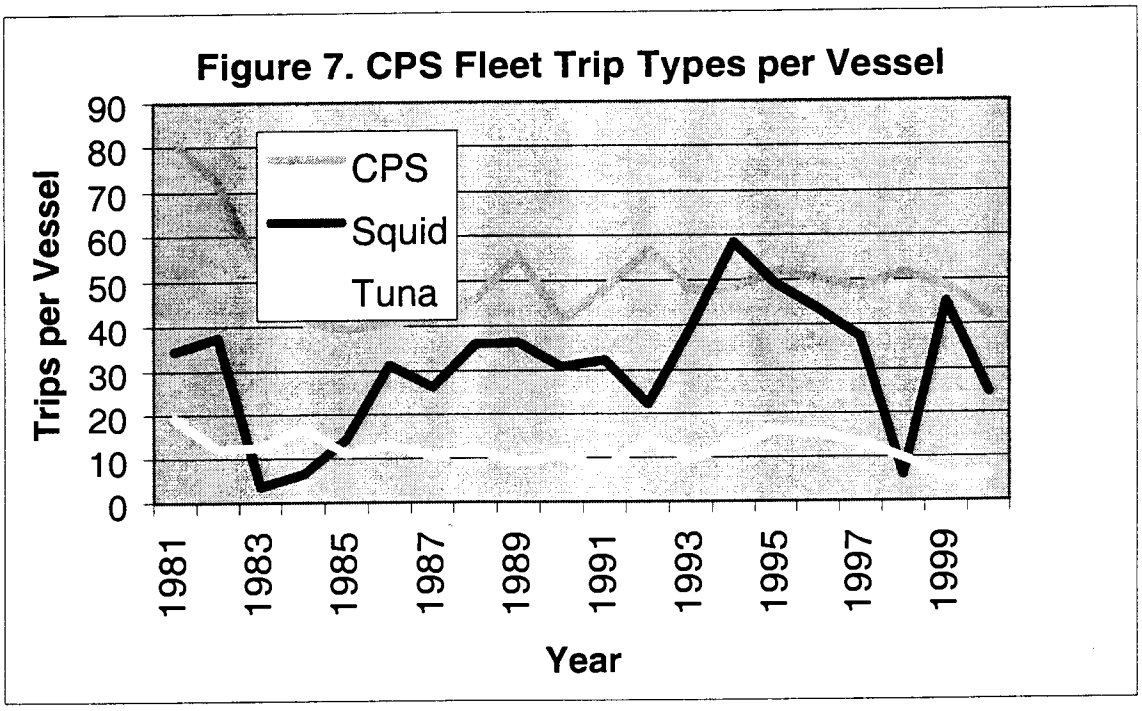


Figure 7. CPS Fleet Trip Types per Vessel
Trips per Vessel
90
80
70
60
50
40
30
20
10
0
CPS
Squid
Tuna
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
Year

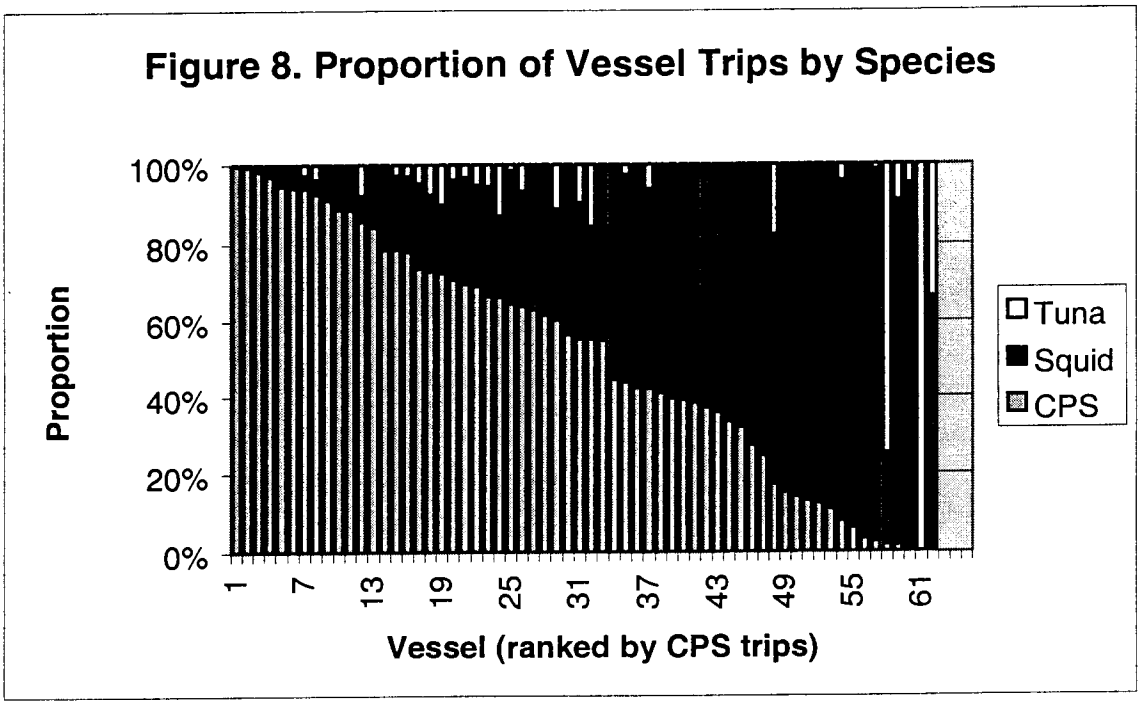


Figure 8. Proportion of Vessel Trips by Species
Proportion
100%
80%
60%
40%
20%
0%
Tuna
Squid
CPS
1
7
13
19
25
31
37
43
49
55
61
Vessel (ranked by CPS trips)

Figure 9. Vessel "AY" - CPS specialist

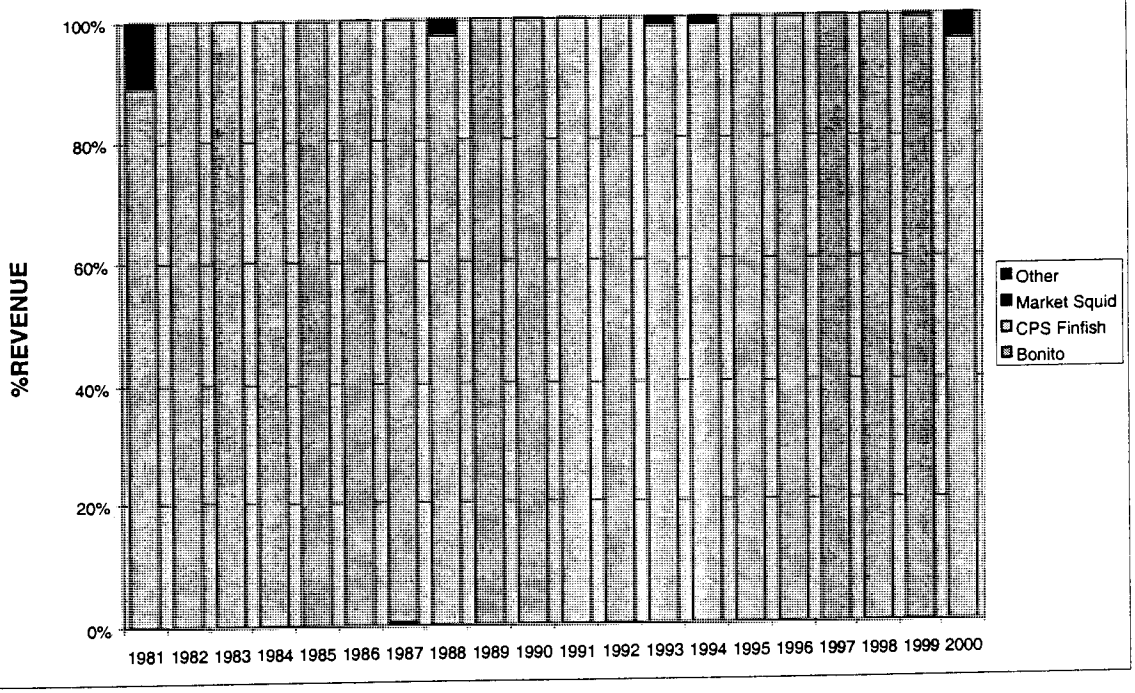


Figure 10. Vessel "BG" - CPS specialist

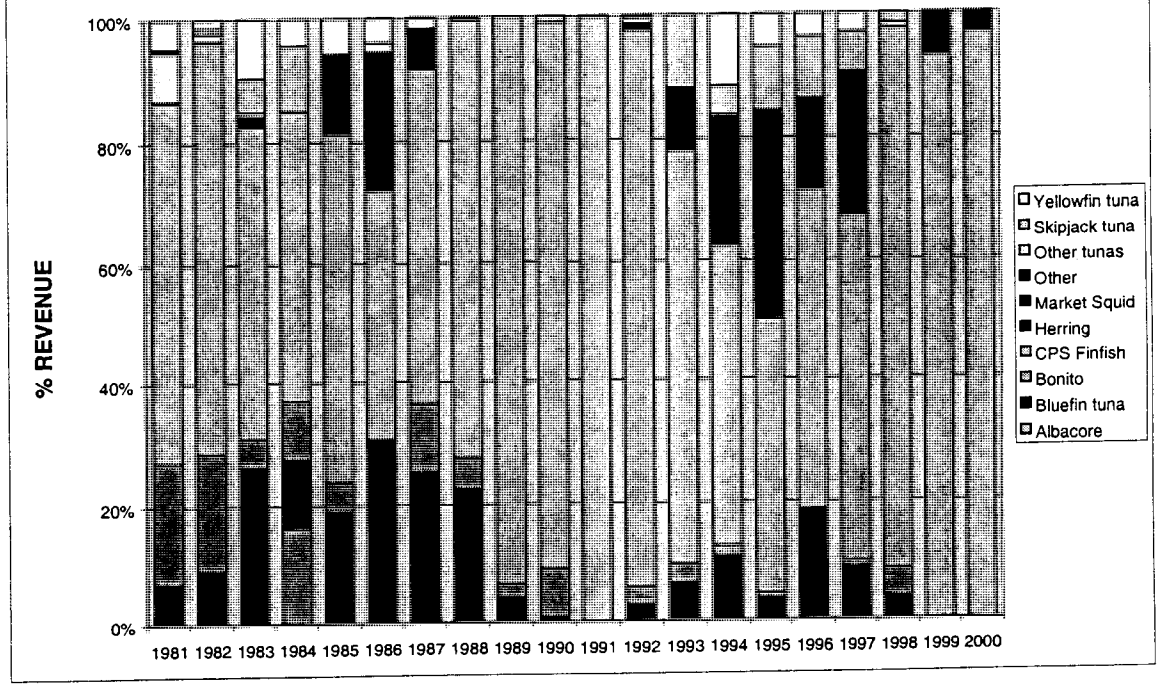


Figure 11. Vessel "A" - Squid specialist

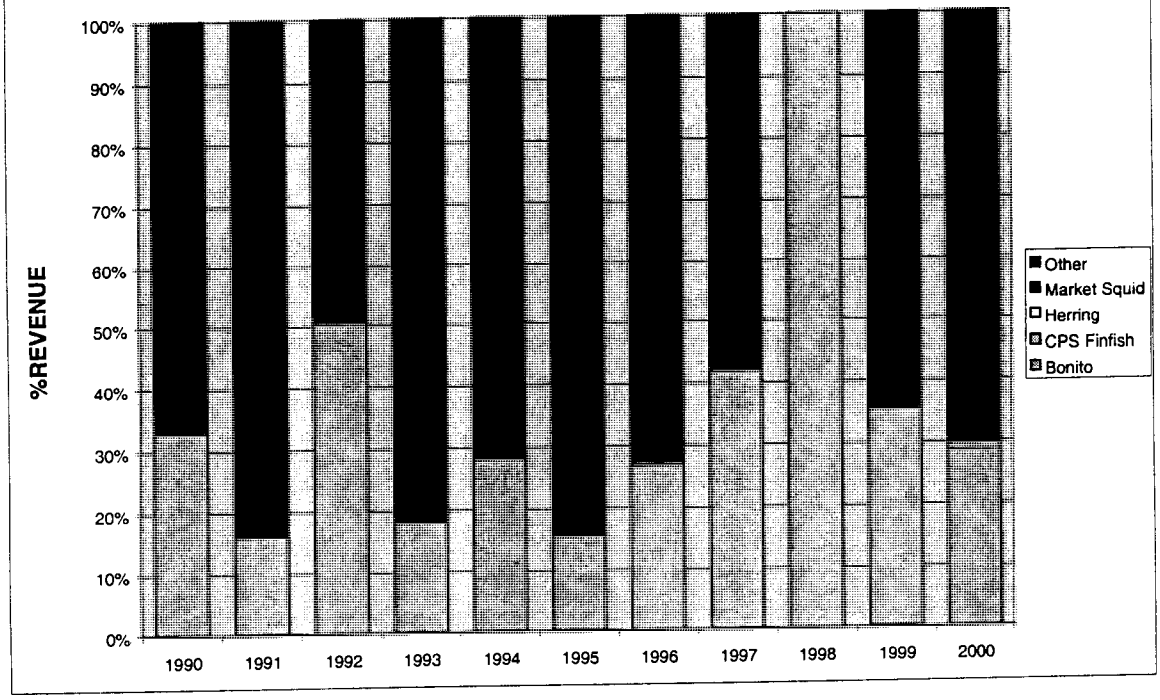


Figure 12. Vessel "BB" - Squid specialist

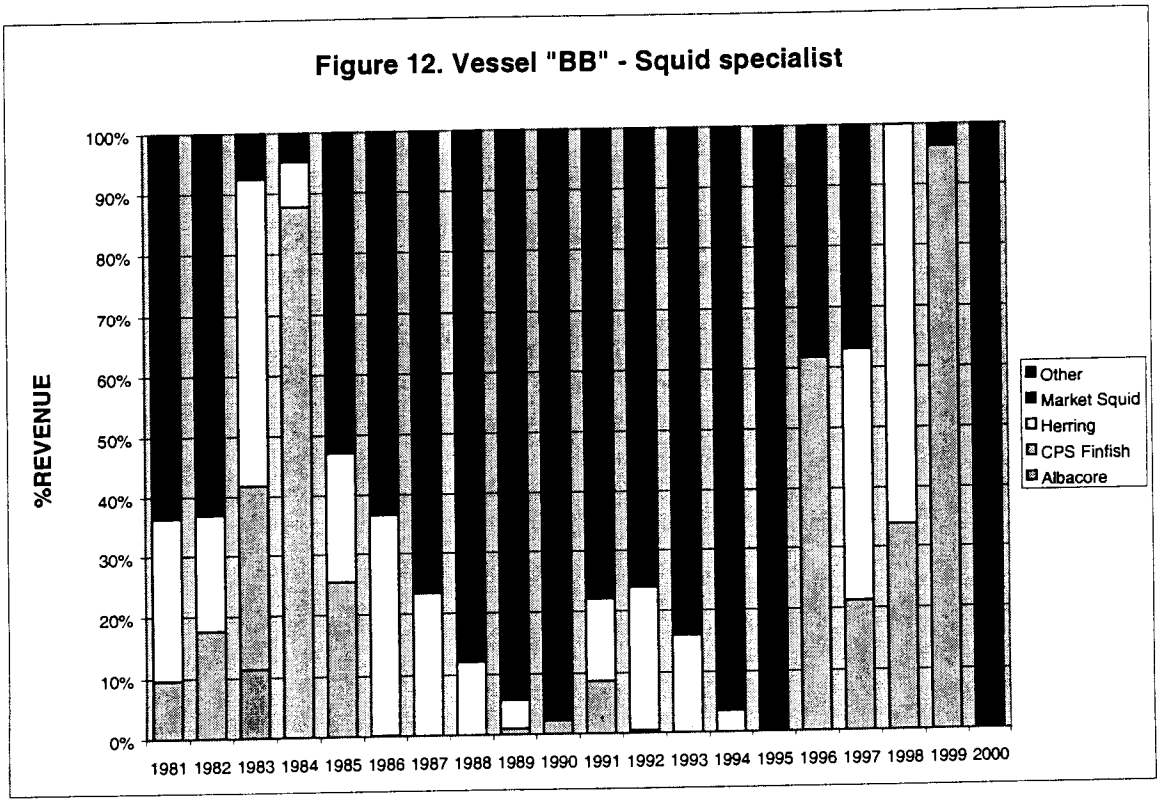


Figure 13. Vessel "AG" - Generalist

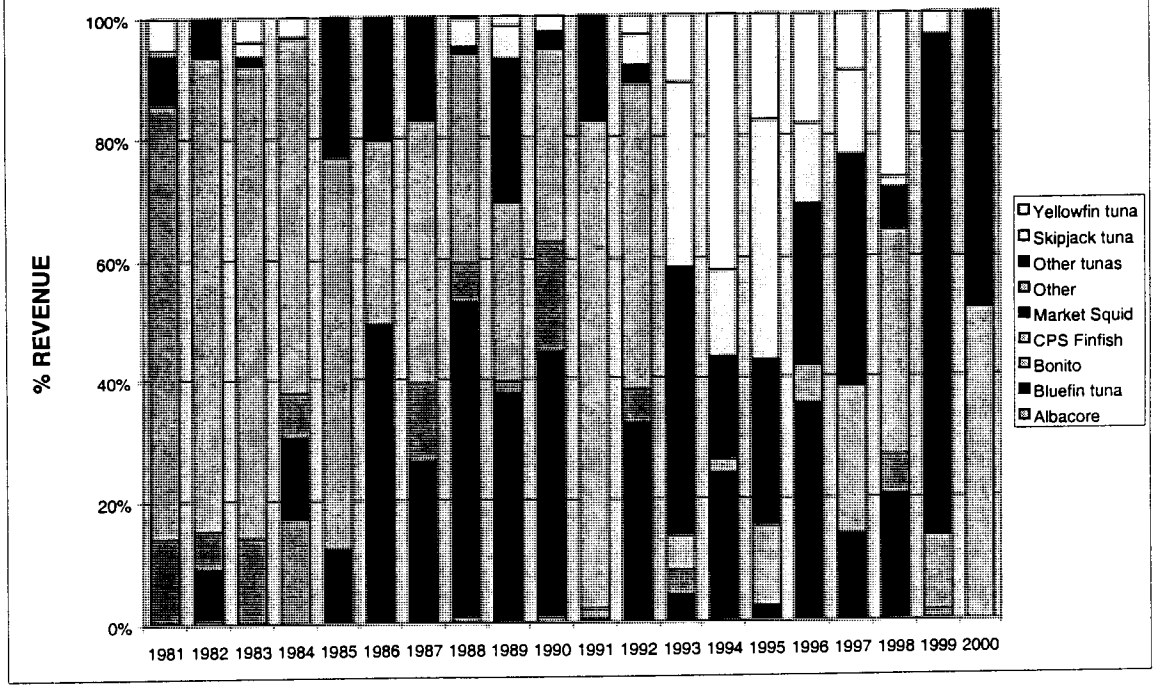


Figure 14. Vessel "J" - Generalist

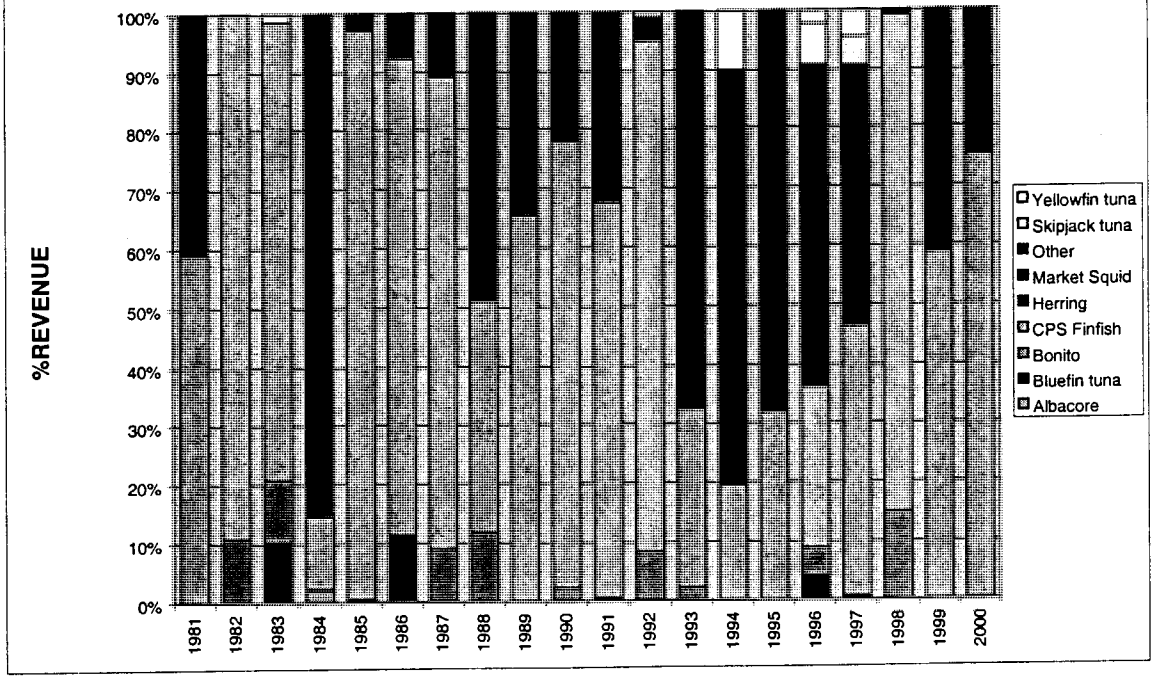


Figure 15. CPS Biomass Estimates

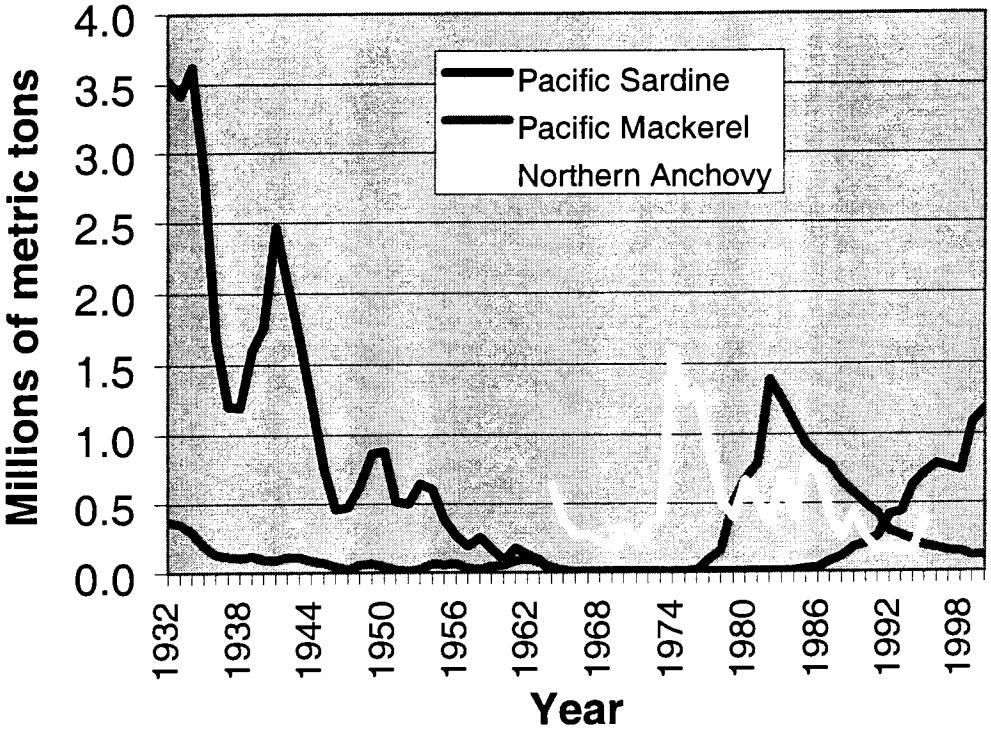


Figure 16. CPS Target Harvest Levels

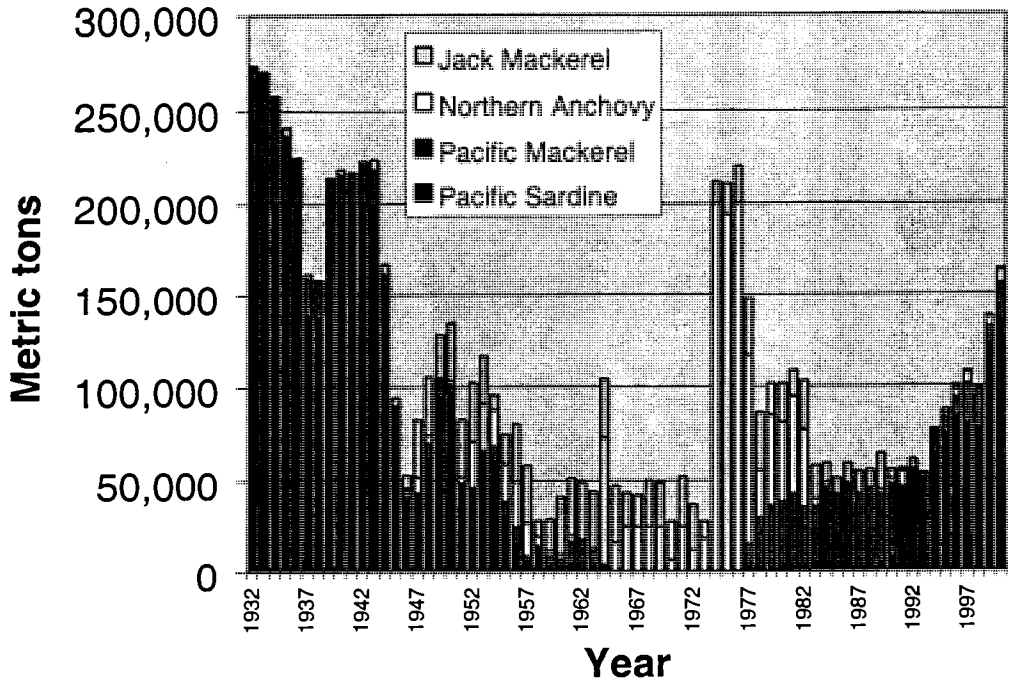


Figure 17. Data Envelopment Analysis - a piecewise linear programming procedure that optimizes on each individual observation to calculate a best-practice frontier.

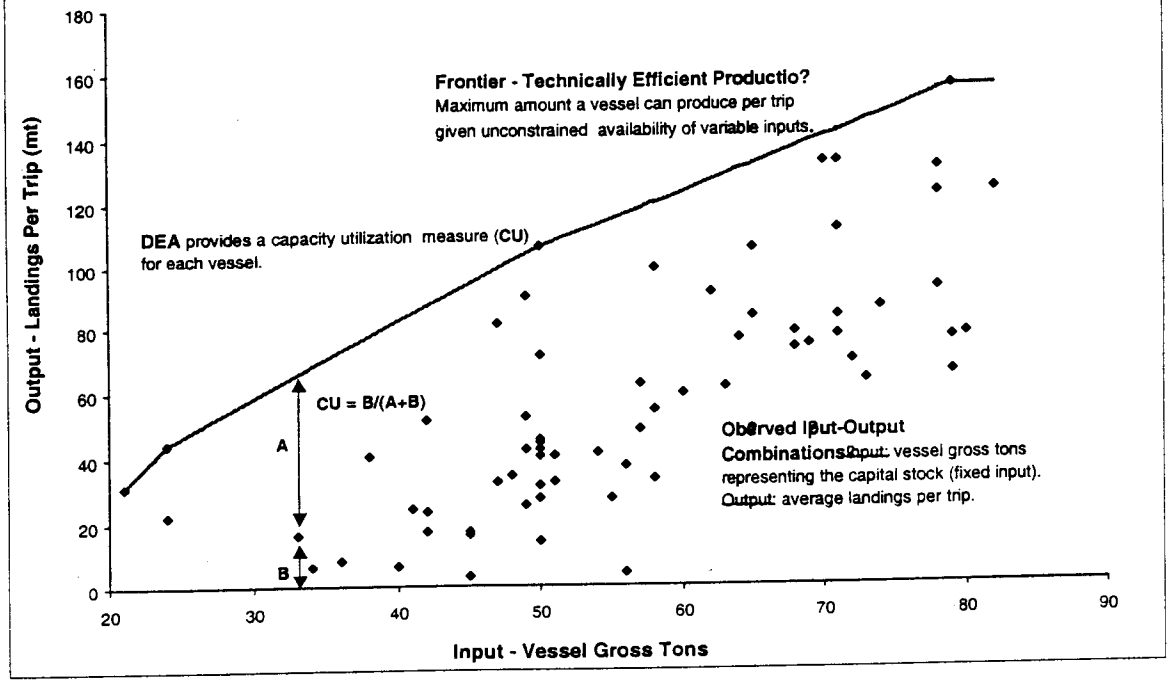
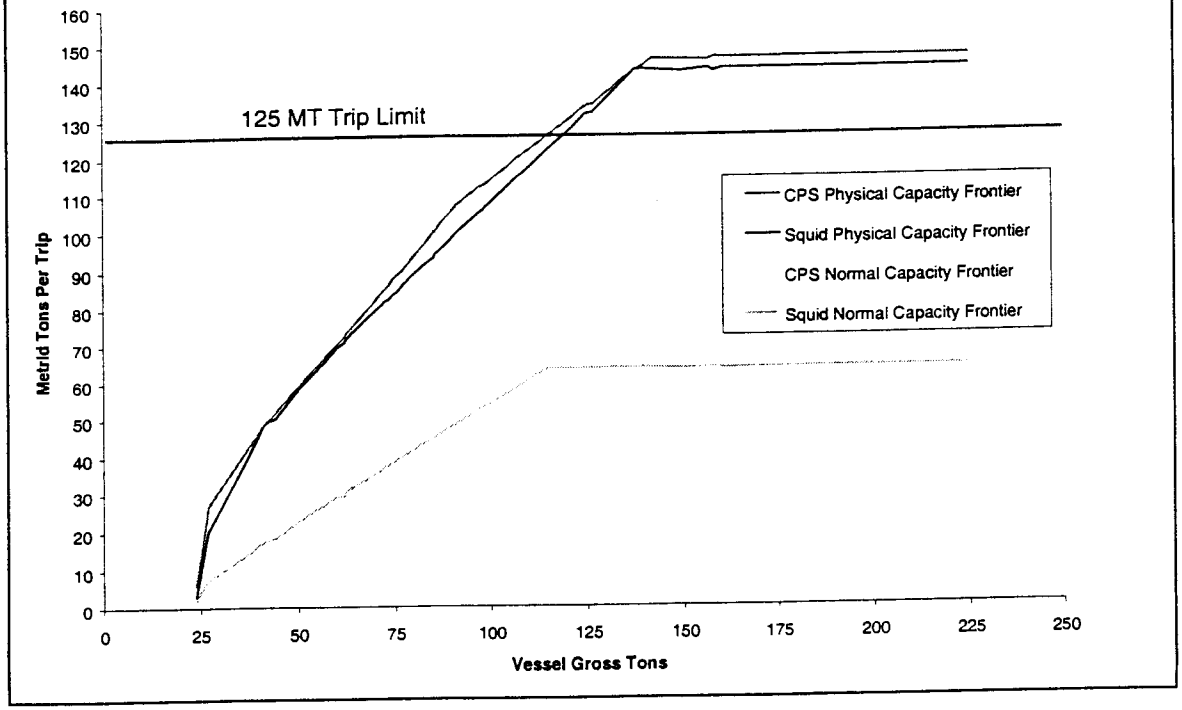


Figure 18. Estimated harvesting capacity per trip for CPS limited entry permittees



APPENDIX D: SQUID MSY ANALYSES FROM REVIEW DRAFT AMENDMENT 9

The following analyses regarding market squid MSY have been excerpted from an early review draft of Amendment 9 (CPS FMP), presented to the PFMC as *Exhibit I.1, Attachment 1, September 2000.* These analyses were subsequently removed from the final draft of Amendment 9, and are presented here for background information. These analyses were drafted by the CPSMT prior to the squid STAR panel.

5.0 Maximum Sustainable Yield for Market Squid

5.1 Purpose and Need for Action

National Standard 1 requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery. OY is based on MSY, or on MSY as it may be reduced according to social, economic, or ecological factors. The most important limitation on the specifications of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing. Each FMP should include an estimate of MSY for each managed species.

At the Council's March 2000 meeting, the SSC and the CPSMT noted that setting an MSY for market squid is impractical for several reasons: (1) fishery and biological data are scarce, (2) markets tend to influence fishing effort, thus landings data are not a reliable indicator of stock abundance; and (3) the short life span of squid combined with its vulnerability to oceanographic variation limits the practicality of the sustainable yield concept. Nevertheless, recent high harvests indicate that squid can be highly productive and have precipitated action by the California Legislature to implement a research and management program for this species.

5.2 Approaches for determining an MSY Proxy

5.2.1 MSY Based on Historical Landings

Because there are not adequate data to make a mathematical MSY determination, guidance was taken from the NMFS publication: Technical Guidelines on the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act (Restrepo et. al., 1998). Those guidelines propose that in data poor situations such as the California market squid fishery, a proxy may be used for MSY, and that it is reasonable to use recent average catch from a time period when there is no qualitative or quantitative evidence of declining abundance. Options for time periods warranting consideration are discussed in section 5.3.

Historic market squid landings suggest that low landing periods correspond with El Niño events when abundance and/or availability of squid to the fishery is greatly reduced. Those events are generally followed by periods of apparent increasing abundance/availability and increasing annual landings until the next El Niño. The market squid fishery is volatile and reliant on the international market and availability of squid from other squid fisheries. In the time period between the last two El Niño events (1993-94 and 1996-97) there was nearly an unlimited demand for California market squid in the Republic of China, a situation that kindled rapid development of fishing and expansion of processing for export from California. The expansion ended with the onset of the two-year 1997-99 El Niño event during which market squid abundance/availability dropped to very low levels and landings plummeted.

The first fishing season following the two-year El Niño event (1999-00), squid landings for the season were the second highest on record. Nearly all of the landings were from the southern portion of the fishery (southern California) with almost no landings to the north (Monterey area). This disparity would not have been predicted given current understanding of market squid abundance and distribution nor in temperature inclusive models, which are being considered for harvest guidelines and have been recommended by the SSC.

The ability of the California market squid fishery to support landings of 112,771 mt in 1996-97 followed by a strong El Niño and then repeat landings of the same magnitude two seasons later suggest that the stock was not being overfished and that the 113,000 mt level achieved is sustainable.

5.2.2 MSY Based on Expanding California Catch Data

Analysis of CDFG landings databases can provide general information on where squid are harvested. The

location of commercial catch is recorded by fishing block, each of which encompasses a 10 by 10 nautical mile area. During the time period 1981-1999, 262 unique blocks were recorded on landing receipts which have been submitted for the sale of California market squid. This number may be used to represent the total available or potential fishing area in the range of the California fishery for any given season. During the expansion of the fishery over this time period, the number of blocks fished has generally increased since 1981. If we assume that market squid had an equal chance of being caught in any of these potential blocks, we can expand the actual catch by the ratio of exploited to unexploited blocks and obtain the maximum catch that might have been caught in that year. Yearly maximums are averaged to obtain an MSY proxy.

Table 1.

Fishing Season (Apr-Mar)	Landings (mt)	Blocks Utilized	% Fishing Area	MSY Proxy
1980	5233	26	0.10	52730
1981	23452	52	0.20	118161
1982	11987	43	0.16	73035
1983	986	27	0.10	9570
1984	1228	33	0.13	9749
1985	13041	41	0.16	83336
1986	23226	40	0.15	152131
1987	22873	36	0.14	166466
1988	43722	31	0.12	369519
1989	29983	30	0.11	261856
1990	29458	38	0.15	203106
1991	35077	56	0.21	164110
1992	17049	45	0.17	99263
1993	49398	67	0.26	193169
1994	57689	114	0.44	132583
1995	85124	105	0.40	212404
1996	112771	105	0.40	281390
1997	9886	47	0.18	55111
1998	10639	67	0.26	41602
**1999	101700	95	0.36	280478

* Landings (mt)/ [blocks utilized/total blocks] = MSY proxy (numbers were transferred to the table from a spreadsheet and rounded).
** Preliminary data (likely to increase with final landings data).

5.2.3 MSY Based on Coastwide Expansion from Midwater Trawl Data

Midwater and trawl data are the only comprehensive source of coastwide information on squid distribution (See Appendix D). Using this information assumes that these surveys can provide a measure of coastwide spawning area. Length information in these databases indicates a size range of 20 to 120 millimeters, which correlates to an age distribution of a few weeks to six months. It is further assumed that there is little or no migration from spawning location to midwater trawl capture location.

MSY values calculated for the California fishery (above) could be expanded to reflect additional unfished areas based on market squid observed in trawl data for the US west coast. Using information on squid density and proportion positive in the Pacific northwest, California and Mexico (assuming all tows were equal and not accounting for year effects), the portion of squid observed in California to the coastwide total equals approximately 71 percent. Scaling the above MSY proxy values for California upward accordingly, coastwide MSY proxy values are estimated in Table 2.

Table 2.

Location	Tows	Positive Tows	Total Squid Caught	Squid per Positive Tow	Proportion Positive	Ratio	Portion in Range
Pacific Northwest	419	111	4955	44.64	0.265	11.826	0.19
California	6009	1553	270837	174.40	0.258	45.072	0.71
Mexico	1410	152	8697	57.22	0.108	6.168	0.10
Total	7838	1816	284489			63.066	

- Squid per positive tow = total squid caught/positive tows
- Proportion positive = positive tows/total tows
- Ratio of total squid caught = squid per positive tow x Proportion positive

5.3 Maximum Sustainable Yield Proxy Alternatives Considered

To determine a time period during which to evaluate catch data and provide alternative MSY proxy values, several factors may be considered, based on varying interpretations of the Restrepo et al. guidelines. A 20 year time span serves to cover the entire period during which the southern California fishery was expanding, as well as several El Nino periods. A ten-year time period spans the more recent expansion period and two El Nino periods. The most recent five-year period incorporates both a strong El Nino and the two highest seasons on record, one of which directly followed an El Nino event. The 1992-1996 time period is based on the Restrepo et al. guidelines in which there was no evidence of declining abundance, assuming that abundance is reflected by catch and nothing else. In 1996, the highest seasonal catch was attained, and using the rationale that no biological information was available to indicate that there was declining abundance, this level of harvest is sustainable. In 1988, the highest California catch expansion value was attained, and likewise there was no evidence of declining abundance.

Table 3 provides a matrix of values for each of the time periods described above using the three approaches outlined in section 5.2 for determining an MSY proxy.

Table 3. MSY Proxy Alternatives

	Landings Only	CA Catch Expansion	Coastwide Expansion (CA = 71%)
1. 20-YEAR (1980-1999)	34226	147988	208434
2. 10-YEAR (1990-1999)	50879	166322	234256
3. 5-YEAR (1995-1999)	64024	174197	245348
4. 1992-1996	64406	183762	258820
5. Highest Landings (1996)	112771	281390	396324
6. Highest Catch Expansion (1988)	N/A	369519	520449

5.4 Discussion of MSY Proxy Alternatives

Although there are occasional landings of market squid in Mexico, Oregon and Washington, there is no information at this time on volume or catch location. Because landings are poorly documented, very low and sporadic, the above calculations assume that there is no utilization of these areas for fishing activity, and therefore all proxy options are based only on landings data from California.

5.4.1 Using Historic Landings

The guidelines provided in Restrepo et al. were not generated with such short-lived species in mind. Current research indicates that squid live a maximum of approximately ten months, and the average age of squid taken in the commercial fishery are just over six months of age, which makes averaging the amount harvested over any period of time potentially ineffective as a way to determine sustainable harvest levels. Additionally, as no effort data is available but there were clearly changes in effort due to expansion of the fishery and El Nino conditions, landings information alone may be less precise to calculate an MSY proxy.

5.4.2 Using Expanded California Catch Data

A criticism of this option is that using a simple sum of all the blocks where catch has been reported is not an accurate method of calculating spawning area. There are vast differences in the productivity of the 262 blocks; therefore, giving each one an equal weighting on an area basis may be erroneous. However, there is no additional biological information at this time that refutes or supports either argument. Although the northern Channel Islands are clearly the most productive areas in terms of catch, this may only be a an effect of increased effort or one driven by market conditions. For example, there are reports that abundance of squid at San Nicholas Island is often very high (from participants in squid and crab fisheries), yet reported squid catch is low. The quality of squid delivered to processors is an important issue, and fishing areas are often limited based on proximity to processing facilities. San Nicholas Island is approximately 70 miles offshore and is generally considered too far from port to catch and deliver a good quality product to the processor.

Additionally, comparison of high-density squid catch areas with high-density squid trawl areas (discounting differences between the sources of midwater and bottom trawl survey data) shows that catch may not be the

best indicator of abundance, as most of the high-density trawls occurred in the areas outside San Francisco Bay, Monterey, Cape Mendocino and southern Oregon, which are generally not the highest density areas for catch. If there were a high correlation between the catch and tow data, an MSY proxy value based on this relationship would warrant consideration.

5.4.3 Using Coastwide Expansion from Midwater Trawl Data

A criticism of this option is that the sources of survey data are different; therefore, lumping them together for treatment is erroneous. Several treatments of these data may be employed to improve the information, such as volume of water passing through the nets (not available at this time) or accounting for differences between the gear used. Seasonal and year effects were not considered in analysis of the trawl survey information, and were aggregated for the time period 1966 through 2000.

In determining a coastwide MSY, ignoring information on spawning area that is beyond the range of the fishery may be erroneous, although regional allocation issues may warrant attention if the resource moves to active management status or within state FMP's.

5.4.4 Other Alternatives Explored

The CPSMT derived catch information from CDFG block data to indicate the range of the California fishery as presented in Table 1, and calculated the portion of squid present in California waters (71%) relative to the entire Pacific coast from midwater trawl data as presented in Table 2. However, several additional methods of data treatment may be employed that could generate other alternatives to the MSY proxy value selected by the team. Following is a summary of other methods of evaluation that were considered; most of which would result in a greater range and much higher MSY proxy values.

1. When calculating the MSY proxy value for areas within California (Table 1), comparison of catch data with tow data reveals that positive tows occurred in areas beyond those ever recording commercial catch. Consequently, it would be possible to further expand the range of squid spawning activity (and thus increase the MSY proxy values) either by expanding the sum number of blocks to a number greater than 262, or by using a measure of area other than the 10x10 nautical mile block.

2. In looking at the midwater trawl data, both calculations of proportion positive and density were considered in determining the portion of distribution within the range of California waters. However, calculating the area of distribution (based on positive tows) would yield different results.

3. Since the CDFG block information spans an area of 10x10 nautical miles, it is unlikely that the entire block was utilized for squid fishing activity. It is known that directed fishing activity on spawning grounds occurs generally in depths shallower than 200 feet. It could therefore be said that any positive midwater trawl tow that occurred in any depth greater than 200 feet (assuming no migration or transport between hatch location and location of capture) would represent area that is unutilized by the fishery. There is anecdotal information to indicate that spawning activity or egg deposition does occur in depths greater than 200 feet, as there are reports of squid egg cases being taken incidentally to the Dover sole, thornyhead, and other bottom trawl fisheries. Consequently, based on the distribution of positive tows, if the bottom area within the 200 foot depth contour were calculated, MSY proxy values could be scaled up to account for additional areas beyond that 200 foot-depth where positive tows occurred and the fishery does not operate. Additionally, as there are shallow areas where positive tows for squid occurred within California waters and no records of catch has ever been made there since 1981, these areas would be included with the deep water as area not utilized by fishing activity but positive for squid occurrence.

5.6 Environmental Consequences

The maximum long-term average yield of squid is likely to be of less use for managing squid than it is for other coastal pelagic species, which also respond dramatically to environmental conditions. Nevertheless, regardless of how catches are averaged, using MSY to obtain optimum yield is inadequate, as optimum harvest of an annual crop is likely to be highly variable from year to year, even when no harvesting occurs. Recent research indicates that Loligo opalescens taken in the fishery are approximately six months in age and are sexually mature and actively spawning. The maximum age of squid is approximately nine to ten months, and they are known to die following the spawning event.

In response to market demands beginning in 1993, squid landings began an unprecedented climb. From fishing seasons 1993 through 1996, landings were 49,398 mt, 57,690 mt, 85,124 mt, and 112,771 mt respectively (Table 1). The harvest during the 1997-98 season was 9,887 mt, which would naturally raise fears that the high harvests in previous years had affected the resource. However, the harvest during the 1999-2000 fishery was 82,613 mt. There was an El Niño during 1997/98, which appears to have prevented squid from significant spawning in the area of the fishery, which has happened during all previous El Niños. If recent high harvests reflect excellent environmental conditions, then perhaps the average harvest of 23,000 mt between 1981 and 1992 reflects poor environmental conditions.

At this time, there is no way to determine how much squid should be harvested in any given year; however, squid are currently harvested only on the spawning grounds off Monterey, California, and in southern California, not on the open sea. Harvest in the remainder of the habitat has been minimal. Also, as noted above, not all areas where squid occur in the area of the fishery are exploited.

Whether large or small, any number picked that puts a limit on harvest is likely to be speculative. While it is true that a very small number will most likely prevent overfishing, it would shut down the fishery. Considering the history of landings in the fishery, this would not be justified and would not be optimal. The examination of habitat through midwater and bottom trawl data has been revealing. After looking at abundance in several different ways, there seems to be a good possibility that the resource may be capable of producing at least twice what has been recently harvested. At this time, the most that can be done for the resource to protect it while maintaining a productive fishery is to assure to the extent practicable that adequate spawning occurs. Ongoing research is likely to reveal other information that will improve on this approach, e.g., beginning the fishing season on a certain date after spawning begins or closing certain areas permanently or temporarily. One approach that might be useful would be to monitor (1) the amount of egg capsules deposited. Some kind of assessment would give managers assurance that spawning is successful, and (2) the amount of habitat exploited by the fishery. Areas where spawning occurs that are not exploited by the fishery would play the role of reserves and would provide a kind of insurance policy for protecting the resource. For the reasons stated above, the CPSMT recommends setting a proxy for MSY at 245,348 mt. This is a guide for the Council to monitor the fishery and does not preclude the Council from using information obtained from ongoing research to take action to protect the fishery as soon as it becomes available.

5.7 Status of State Management Action

Despite having a coastwide distribution, the California market squid resource is commercially landed only in the state of California, although many vessels that participate in the fishery have other home ports. Due to increased demand, the southern California fishery has expanded in recent years, prompting the California Legislature to enact a series of measures to assure sustainability of the resource, which is also an important forage item. In 1998, a permit requirement was established both for vessels landing and lighting squid for commercial purposes, and in order to renew the permit in subsequent years, the applicant must have been issued a permit the preceding year. By April 2001, recommendations for a market squid conservation and management plan will be submitted to the Legislature, which will include information on whether a limited access plan is necessary, whether time and or area closures are advisable, what research and monitoring is necessary to assure sustainable harvests, what gear restrictions or modifications may be necessary, what coordination may be necessary with the federal CPS FMP, and what regulations may be warranted for light boats.

Beginning in 1998, the Legislature provided authority to the California Fish and Game Commission to adopt interim regulations for the fishery prior to development of the state FMP. In 2000, four interim measures were adopted, including a) A logbook requirement was imposed on vessels participating in the fishery to provide better information on fishing effort; b) Closure of the fishery throughout the state on weekends to allow for periods of uninterrupted spawning activity; c) A maximum wattage requirement was established for vessels employing lights used to attract squid; d) A requirement that these lights must be shielded to prevent illumination of the light outward onto land.

Although not part of the process to develop a squid management plan, the state of California has existing regulations on round-haul activity and has designated other areas as closed to all fishing activity which may serve as additional reserve areas. Section 2.2.5.2 in Amendment 8 to the CPS FMP provides a summary of these specific closures for California, Oregon and Washington.

General Closure Areas for Ocean Fishing – California State Code – TITLE 14.

Duxbury Reef Reserve (Marin Co.).

In the Duxbury Reef area in Marin County no fish except abalone, Dungeness crabs, rock crabs, rockfish, lingcod, cabezon, surfperch, halibut, flounder, sole, turbot, salmon, kelp greenling, striped bass, monkeyface-eel, wolf-eel, smelt and silversides may be taken between the high tide mark and 1,000 feet beyond the low tide mark at any place on the coastline or any reef or rock situated between the westerly extension of the southerly boundary of the Pt. Reyes National Seashore and the southerly extension of the centerline of Kale Road in Bolinas Beach. All other fish and forms of aquatic life are protected and may not be taken without a written permit from the department issued pursuant to Section 650 of these regulations.

Gerstle Cove Reserve (Sonoma Co.).

No form of marine life may be taken within 600 feet of the high water line in the most northerly portion of Gerstle Cove, Sonoma Co., without a written permit from the department issued pursuant to Section 650 of these regulations.

Point Reyes Headlands Reserve (Marin Co.).

No form of marine life may be taken from the ocean area within 1,000 feet of the high tide mark in the Pt. Reyes Headlands bounded on the west by a line extending due west (true) from Pt. Reyes Lighthouse and on the east by a line extending due east (true) from Chimney Rock, without a written permit from the department issued pursuant to Section 650 of these regulations.

Estero de Limantour Reserve (Marin Co.).

No form of marine life may be taken below the high water mark in Estero de Limantour without a written permit from the department issued pursuant to Section 650 of these regulations. Estero de Limantour includes all tideland waters to high water mark in an easterly direction from a line drawn due north (true) from the extreme westerly point of Limantour Spit issued pursuant to Section 650 of these regulations.

Lover's Cove Reserve, Santa Catalina Island (Los Angeles Co.).

No form of marine life may be taken in those waters adjacent to Catalina Island beginning at the most southeasterly corner of the Cabrillo Wharf (the wharf for ocean-going vessels on the seaward side of the peninsula), then extending a line seaward, perpendicular to the seaward face of the wharf, to a point approximately 100 yards from the mean tide line, then turning in a southeasterly direction and following the alignment of the mean tide line at a distance of 100 yards from the mean tide line continuing through Lover's Cove, around Abalone Point, and continuing to a point approximately 430 feet easterly of Abalone Point, commonly known as "Ring Rock," then returning to shore on a line perpendicular to the Pebble Beach Road.

Pismo Invertebrate Reserve (San Luis Obispo Co.).

No invertebrate may be taken between the high tide mark and 1,000 feet beyond the low tide mark in that portion of a beach commonly known as Pismo-Ocean Beach lying between the Grand Avenue ramp and a point .3 mile north of the Grand Avenue ramp.

Point Cabrillo Reserve (Mendocino Co.).

No form of marine life may be taken from the ocean area within 1,000 feet of the high tide mark in the vicinity of Point Cabrillo U.S. Coast Guard Lighthouse, bounded by lines extending due west (magnetic) 2,500 feet north and 1,600 south of the lighthouse.

Point Loma Reserve (San Diego Co.).

Between a point approximately 300 yards easterly from the Point Loma Light and a point approximately ½ mile northwesterly of the light, no plant or invertebrate marine life may be taken between the high tide mark and 150 feet beyond the mean lower low tide mark.

Robert W. Crown Reserve (Alameda Co.).

No plant or invertebrate marine life may be taken between the high tide mark and 150 feet beyond the mean lower low tide mark in that portion of Robert W. Crown Memorial State Beach between the base of the jetty on the northwesterly corner of Crab Cove and a point approximately 2,800 feet southeasterly along the shoreline of Crab Cove opposite the bath house/restroom complex. Hook-and-line fishing is permitted in this area for fin fish only.

5.8 Proxy MSY Value and Risk of Overfishing

In addition to initial regulatory measures taken by the state of California as described above, there are additional constraints that may serve to protect squid from excessive harvest and may warrant consideration in determining an MSY proxy value.

Based on coastwide distribution and abundance of California market squid from midwater and bottom trawl surveys, the population is only utilized for commercial purposes over a fraction of its range. Over 90 percent of California landings occur in southern California, mostly in the vicinity of the Channel Islands. However, the survey data indicates squid are in greatest abundance off areas of northern California and southern Oregon, where little or no fishing activity occurs. Additionally, squid are only fished on spawning aggregations at depths traditionally shallower than 30 meters, yet mature individuals and egg cases have been collected in bottom trawls at significantly deeper depths. At this time, there is no biological or genetic information to indicate if there are geographically distinct stocks and what mixing may or may not occur over the range of the population. Within the scope of the state FMP process, area-specific MSY's could determined if warranted and additional biological information were available. Severe reductions in catch were observed during the 1983-84 and 1997-98 seasons as a result of El Nino events. If this temporary collapse in the fishery is due to a decline in stock size generated by poor environmental conditions, unavailability of the resource on the fishing grounds may offer protection against excessive harvest. Moreover, low availability of squid on the traditional fishing grounds does not precipitate fishing effort in non-traditional areas where squid may be abundant during these times.

Although little is known about vertical migration of squid and what portion of the stock may be vulnerable to fishing in shallow spawning areas at any given time, deep water areas may serve as an unexploited refuge, since the fishery operates by attracting squid with lights near the surface. Additionally, there are several known spawning areas for squid in southern California that are not utilized by the fishery due to proximity from port, such as Cortez Banks and San Nicholas Island. As the product quality can deteriorate rapidly, offloading quickly is essential, and fuel expenses make fishing these regions cost-prohibitive if the market price is not high. Although there appears to be a substantial portion of the biomass that is unutilized for fishing activity in Baja, northern California and Oregon, the likelihood is that these areas will continue to serve as reserves, as purse-seining is not practical much of the time in those northern areas due to weather, and large-scale processing facilities are not established in these locations.

Considering the status of knowledge regarding market squid, establishing a number that purports to represent an MSY would be groundless. If the number were low, however that would be defined, an assumption might be made that the resource would be protected, but unless there were evidence that spawning was not occurring, closing the fishery based on present knowledge would also be groundless. Setting a high number, however that would be defined, may pose a greater risk of depleting the resource, but that number most likely depends on whatever environmental variables influence squid. The number itself is likely to vary widely from year to year. This FMP establishes, for want of a better term, a proxy MSY that is not regarded as a sustainable yield in any respect, but rather a benchmark to keep in mind while the fishery and the resource is observed. If the fishery expands to new areas as the benchmark is approached, that may be important information to take into account and could lead to some kind of management action. Likewise, the amount of spawning activity occurring as the benchmark is approached may also be significant information to take into account.

This FMP will not establish any number that might be regarded as a harvest limit without other protections. There are area closures, regulated and de facto, that protect certain areas from harvest. The fishery is closed two days out of every week. Market squid are widely distributed along the Pacific coast, far beyond the historical fishery. As long as the range of the fishery is confined as it has been in the past and as long as the method of harvest does not change, there is good reason to believe that the recommended approach will

protect the resource.

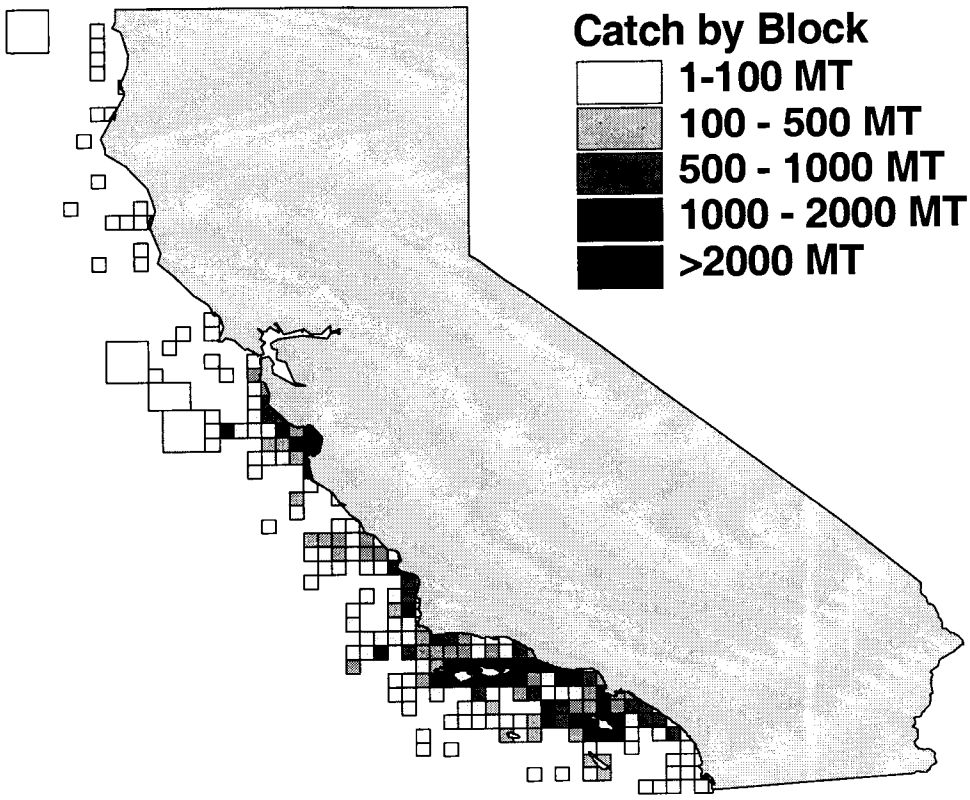
Other Considerations

1. Applying a definition of MSY to be 'the largest amount of catch that can be obtained on a continuing basis by applying a constant harvest rate' is ineffective for squid based on inadequate effort information. At this time, calculations of a harvest rate are not possible, although a logbook program has recently been implemented in the fishery for both light and purse seine vessels in order to attain better data for future management. Landing receipt information in CDFG databases can provide data on where, when and how much catch was taken by a particular vessel, but provides noting in terms of search time or area searched for no catch. Additionally, determining harvest rate proxies such as catch rates per boat, number of vessels participating, or number of days fished would be largely erroneous because of the impact that market conditions have upon landings information. For example, in recent years, markets have imposed trip limits on vessels, have restricted the number of vessels they will employ, and will often encourage vessels to switch target species to other coastal pelagic species based on order demand. Additionally, because this fishery depends largely on the efforts of light boats, and no catch or effort information is available for these vessels, one landing made by a purse seiner could represent the efforts of zero to several light vessels on a given night. Based on these inadequacies, the CPSMT concluded that applying data-poor guidelines outlined in Restrepo, et al to use information on catch was the most appropriate method for developing proxy MSY values.

2. Regarding the assumption that all blocks are treated equally in the expansion calculation despite the fact that landings data clearly show that densities between positive blocks vary significantly, there is not adequate information to say that squid are more or less abundant in those areas. It is assumed that catch is more abundant, although taking using this information without knowledge of effort again would be problematic. On the contrary, information from tow data sources do not show that commercial catch is strongly correlated with local abundance. Therefore, it seems more accurate to assume a constant density given these conflicting sources of information.

INFORMATION ON COASTWIDE DISTRIBUTION OF MARKET SQUID

I. Catch location information from California Fish and Game landing receipt data, 1981-1999.



II. Midwater Trawl Information

Several sources of midwater trawl survey data yielded information on market squid taken independently of the survey's target efforts. Summary information and comparison of these surveys is provided here. Market squid was considered a significant bycatch in all surveys included.

	Tiburon Groundfish Survey	Kenny Mais Sea Survey	CDFG Sea Survey 2000	Oregon Predator Survey	Oregon Salmon Survey
Target Species	chilipepper (Sebastes goodei) and widow rockfish (S. entomelas).	Northern Anchovy	Market Squid, Sardine, mackerel, Northern Anchovy	Salmonids consumed by predators: Pacific Hake, chub mackerel jack mackerel, herring, anchovy, sardines	Salmonids tagged and released
Significant Bycatch	Market Squid	Market Squid	Market Squid	Market Squid	Market Squid
Survey Type	Midwater Trawl	Midwater Trawl	Midwater Trawl	Midwater Trawl	Midwater Trawl
Amount of Wire Out	depth dependent	depth dependent	30-35 fm	100 fm	depth dependent
Tow Depth	~5 fm or 16 fm	10-50 fm	10 fm	surface to ~10 fm	< 3.2 fm
Tow Time	15 mins.	20 mins.	20 mins.	30 mins.	30 mins.
Tow Speed	2.5 knts	2.5-3.1 knts	2.5 knts	4 knts	4 knts
Gear Type	Stauffer Modified Cobb	Mais Anchovy Trawl Net	Mais Anchovy Trawl Net	nordic 264 rope trawl	nordic 264 rope trawl
Mesh Size	Variable along net	Variable along net	Variable along net	Variable along net	Variable along net
Cod End Liner size	9 mm	12.7 mm	12.7 mm	8 mm	8 mm
Cod End mesh size	unknown	38.1 mm	38.1 mm	89 mm	89 mm
Mouth Opening Width	12 m	13.72 m	13.72 m	30 m	30 m
Mouth Opening Depth	12 m	11.58 m	11.58 m	20 m	20 m
Survey Date(s)	1986-99	tri-annually 1966-1988	Feb-00	1997-1999	1998-1999
Survey Hours	Night	Night	Night	Day & Night	Day
Area of Operation	Farallons to Monterey Bay	Central CA into Baja Mexico	Pt. Conception to Mexican boarder	Mouth of Columbia River	Mouth of Columbia River

A. Tiburon Juvenile Rockfish (Groundfish) Survey

In order to develop a recruitment index for rockfish, in 1986 the Groundfish Analysis Branch began conducting standardized annual midwater trawl surveys to provide information on the abundance and distribution patterns of young-of-the-year (YOY) pelagic juvenile rockfish off central California. Since it takes several years for rockfish to reach catchable size, sufficient data are just becoming available from fishery statistics to examine correlations between the recruitment indices and actual recruitment to the fishery. The Branch has used the indices in the past in the assessment on bocaccio (Sebastes paucispinis) and found them to be an effective source of fishery independent information on recruitment.

B. CDFG Kenny Mais Sea Survey

The survey purpose was to make acoustic and midwater trawl surveys of the Northern Anchovy, Engraulis mordax, population for estimation of biomass and age composition. Areas surveyed were northern Baja, southern California, and central California. Trawl surveys were done using a 14-meter mouth opening

midwater trawl fished at night along acoustic positive transects conducted during daylight hours. Speed of trawls was between 2.5 – 3.1 knots. This technique yielded many bycatch species that were also recorded. (Taken from: Mais, K F. 1974. Pelagic Fish Surveys in the California Current. CDFG Fish Bull. 162. 1-79).

C. CDFG Sea Survey 2000

Similar procedures were followed as above, less the acoustic surveys. Survey location was limited to the southern California bight.

D. Oregon Predator Survey

To better understand the role of large marine fishes as a potential source of mortality of juvenile salmon, this survey used a Nordic 246 rope trawl to collect fish along the surface and midwater. From April through September several species of fish and their stomach contents were collected and analyzed. The survey area was directly in front of the mouth of the Columbia River and within the river plume. This study used several different trawl nets experimentally (commercial hake trawl, rock hopper, #4 rope trawl, and Nordic 246) before selecting the Nordic net as the optimal gear type. Both the Oregon Predator Survey and the Oregon Salmon Survey differ from the other midwater surveys in the size of the area swept, as the nets used for these two surveys have a larger mouth opening (20m x 30m) than the others.

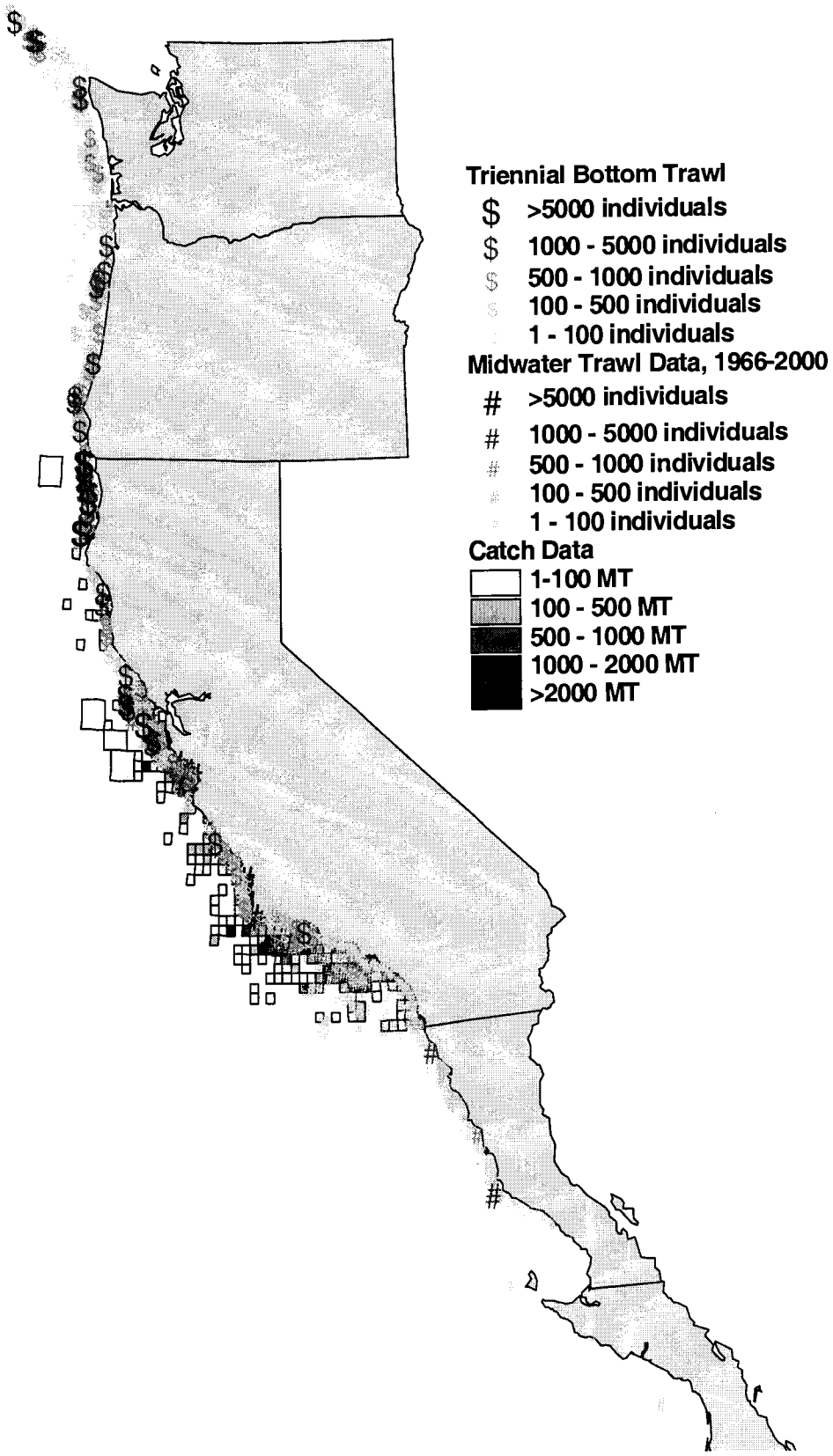
E. Oregon Salmon Survey

Similar in scope to above survey, but designed to be long term (10 years) and to also evaluate oceanographic factors such as food availability, coastal circulation regime, temperature, salinity, and smolt movement. Specific methodology and gear details are the same as the predator survey except that this survey targets salmonids rather than their predators.

III. Bottom Trawl Information

A. Groundfish Triennial Survey

The Resource Assessment and Conservation Engineering (RACE) Groundfish Assessment Program conducts and reports results of triennial surveys designed to establish time series estimates of the distribution and abundance of groundfish resources in waters off the coast of California north to the Bering Sea. Results of the surveys are used to support NMFS fishery management responsibilities for the fishery resources in the U.S. EEZ and to meet U.S. international fishery management commitments for the Convention on the Conservation and Management of Pollock in the Central Bering Sea and for transboundary management with Canada. This survey targets three depth zones, 55-183 m, 184-366 m, and 367-500 m over an area of operation from Alaska to Pt. Conception, California. The time series spans 1977-1998.


Triennial Bottom Trawl
$ >5000 individuals
$ 1000 - 5000 individuals
$ 500 - 1000 individuals
$ 100 - 500 individuals
$ 1 - 100 individuals
Midwater Trawl Data, 1966-2000
>5000 individuals
1000 - 5000 individuals
500 - 1000 individuals
100 - 500 individuals
1 - 100 individuals
Catch Data
1-100 MT
100 - 500 MT
500 - 1000 MT
1000 - 2000 MT
>2000 MT

APPENDIX E: SQUID STOCK ASSESSMENT REVIEW WORKING PAPER 9

Reproductive (egg) escapement model and management recommendations for the market squid fishery.

(Working Paper #9, Squid Stock Assessment Review)

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Preface

This is the second draft of this document. The first draft was written as a revision of Maxwell and Crone (STAR Working Paper #8) after the squid STAR meeting in May 2001. In the first draft, two versions of an eggs per recruit model (EPR) were developed from classical spawning stock biomass per recruit theory. The text and modeling of the first draft are retained in this current draft. In the first draft, a range of values for two important parameters -- natural mortality (M) and egg laying rate (v) -- were explored because of the considerable uncertainty surrounding the estimation of both parameters. The completed first draft was reviewed by the Coastal Pelagic Species Management Team (CPSMT) in August 2001. The CPSMT made four recommendations:

1. Version 1 is currently preferable to Version 2. Version 2 incorporates more biological complexity in terms of variability in juvenile growth rates and age-at-recruitment, but the available data on these processes are too incomplete.
2. Daily natural mortality is to be set at $M = 0.15$.
3. Daily egg laying parameter is to be set at $v = 0.45$.
4. Threshold egg escapement (EE^*) is to be set at $EE^* = 0.3$.

The current draft incorporates these recommendations, and alerts the reader to them when appropriate.

Abstract

This document recommends a management strategy based on reproductive (egg) escapement for the market squid *Loligo opalescens*. A modeling approach based on this squid's life history is presented, with focus on the mortality and spawning rate of sexually mature females. Specifically, an eggs per recruit model is developed, based on spawning stock biomass per recruit theory. Model performance was measured in terms of the mean standing stock of eggs per harvested female (mean SSPF), eggs per recruit (EPR), and egg escapement (EE). The model was quite sensitive to daily natural mortality (M) and the rate of egg laying (v). Other factors, such as the maturation rate of females and gear selectivity, can profoundly affect eggs per recruit, but may go undetected in standing stock data. Fishing mortality, and associated levels of eggs per recruit and egg escapement, may be estimated from empirical data on the standing stock of eggs in harvested females, but measures of egg abundance must be developed to detect changes in egg productivity by the harvested population. Adopting the values of $M = 0.15$ and $v = 0.45$ as suggested by the Coastal Pelagic Species Management Team, egg escapement for squid in the Southern California Bight is estimated at 46% of the unfished condition. Data requirements for the application of this management strategy are discussed.

I. Recommended management strategy: reproductive (egg) escapement

This recommendation for a management strategy for the market squid is closely tied to the squid's life history. In the Southern California Bight, this squid completes its life cycle in less than one year (CDFG 2001; Butler et al., MS; Maxwell, MS). Adults can reach sexual maturity by four or five months after hatching (Maxwell, MS), and females may lay a substantial fraction of their lifetime egg output in their first night of spawning (Macewicz et al., MSa). Therefore, a primary factor that influences the abundance of squid on the spawning grounds in a particular year is the spawning success of the adults in the previous year (Beddington et al. 1990; Rosenberg et al. 1990; Pierce and Guerra 1994).

Given these life history characteristics, this paper proposes a strategy that ensures sufficient reproductive escapement during the operation of the fishery. "Reproductive escapement" can be interpreted in at least two ways: 1) allowance of a certain quantity of spawning adults to escape harvest, or (2) allowance of a certain quantity of eggs to be laid. The former approach has been adopted for fisheries on two squid stocks off the Falkland Islands: *Loligo gahi* (Agnew et al. 1998; Hatfield and Des Clers 1998), and *Illex illecebrosus* (Rosenberg et al. 1990; Beddington et al. 1990; Basson et al. 1996). This author advocates the second approach, i.e., ensuring that a sufficient quantity of eggs is laid by each cohort affected by the fishery.

This egg escapement approach links detailed histological work on the ovaries of commercially harvested females (Macewicz et al., MSa) to an "eggs per recruit" model, which is a modification of spawning stock biomass per recruit (SSB/R; Gabriel et al. 1989) analysis in Maxwell (MS). Central to this approach is the ability to estimate the maximum lifetime reproductive output or "potential fecundity" of females captured by the commercial fleet. The model in the following section demonstrates how fishing mortality can be estimated from the eggs remaining in captured females. This estimated fishing mortality then indicates the reproductive output, in terms of eggs laid, of a population of females. To gauge the fishery's impact on the squid population, the estimated reproductive output of the harvested population is then compared to the population's output in the absence of fishing.

The proposed egg escapement strategy offers advantages for squid fishery management. First, it allows for "real-time" management of the fishery, without an unnecessarily large investment in management personnel or regulations. In the simplest scenario, in-season egg escapement for individual females may be relatively quickly estimated from the gross body measurements (described below; see also Macewicz et al., MSb). Second, this strategy clarifies the role and importance of data on age, reproductive anatomy, and fishing effort. Although such data are important to understanding the operations of any fishery, they cannot be viewed as "luxury" items for this management strategy.

The Leslie-DeLury model has been widely advocated for the management of squid fisheries, with a focus on ensuring escapement of a fraction of the spawning stock (Rosenberg et

al. 1990; Brodziak and Rosenberg 1993; Basson et al. 1996; Agnew et al. 1998). The Leslie-DeLury model allows for within-season management. An attempt to fit a Leslie-DeLury model to data for the market squid yielded equivocal results (Maxwell, MS). Reliable data on fishing effort are crucial to this particular analysis, and therefore the Leslie-DeLury model should be revisited when better effort data for the market squid fishery become available. A considerable drawback to the Leslie-DeLury model is that reliable results typically require a fairly lengthy time series of within-season population abundance (Agnew et al. 1998). Thus, estimated spawner escapement may not be calculated until late in the fishing season.

II. Model: eggs per recruit (EPR)

Rationale.

This model builds from data that can be measured for all sexually mature females taken by the fishery, such as mantle length and eggs remaining in the body at capture (i.e., eggs in the oviduct plus ovarian oocytes). Important to this model is the estimation of a female's potential fecundity from such data. "Potential fecundity" is defined as the number of oocytes in a fully mature female's ovary just before she lays her first clutch of eggs (after Macewicz et al, MSa). Female *L. opalescens* do not appear to regenerate oocytes after they have laid their first clutch of eggs (Knipe and Beeman 1978; Macewicz et al, MSa). For modeling purposes, then, a female's potential fecundity can be viewed as the maximum number of eggs that she can lay when sources of mortality are negligible.

Macewicz (MSa,b) present methods of estimating a female's potential fecundity. For simplicity, I use the equation that involves only mantle length (Equation 2 in Macewicz et al, MSa):

$$F_{p,L} = 29.8 \times L, \qquad (1)$$

where $F_{p,L}$ = equals potential fecundity for a female of mantle length L (mm). More precise equations involving more parameters (e.g., ovary weight, mantle condition) appear in Macewicz et al, (MSb). The present Equation 1 is sufficient for heuristic purposes.

Given that potential fecundity can be estimated for any measured female, each female's standing stock of eggs at capture (SS; eggs remaining in oviduct and oocytes at capture) can be expressed as a fraction of her potential fecundity. Thus,

$$\text{Fraction of potential fecundity remaining at capture} = \phi = SS / F_{p,L}. \quad (2)$$

The parameter ϕ indicates the magnitude of fishing mortality. When fishing mortality is high, newly-mature females will tend to be captured soon after they first arrive on the spawning grounds, which will result in many females with a large fraction of their potential fecundity retained in their bodies at capture. Furthermore, sustained heavy fishing mortality will capture females before they reach the end of their reproductive careers, resulting in few females with a small fraction of potential fecundity retained at capture.

It is important to note that the mean ϕ calculated for a harvested population is not a direct measure of egg escapement. At any given time during the fishing season, females that have been captured by fishermen represent a subset of an initial number of recruits. Some of these recruits may have avoided natural and fishing mortality up to that point in time. Others may have died due to natural mortality alone, and hence do not contribute to the catch. The following two versions of the egg-per-recruit model incorporate these three basic outcomes.

The first version of the model (Version 1) depicts the exponential decline of a population of harvested females as in spawning stock biomass per recruit theory (SSB/R; Gabriel et al. 1989). A fundamental assumption is that a female recruits onto the spawning grounds as soon as she is fully mature (i.e., ready to lay her first clutch of eggs). Port-sample data indicate that nearly all landed squid are sexually mature (Maxwell, MS). Furthermore, it is assumed that, once a female recruits onto the spawning grounds, she is equally vulnerable to fishing mortality for each day of the remainder of her life. In Version 1, all females mature and recruit onto the spawning grounds at the same age.

Version 1 differs from SSB/R in terms of egg output within a time step. In Gabriel et al.'s (1989) SSB/R model, all females that are alive when spawning begins are assumed to lay all of their expected egg clutch within the time step. Version 1 incorporates possible interruption of egg laying by fishing gear, as seems likely on the market squid's spawning grounds. In Version 1, two parameters describe what fraction of a female's expected egg output for a given day is laid

before she succumbs to either fishing or natural mortality events (s_F and s_M, respectively). Version 1 yields numerically identical results to Gabriel et al.'s (1989) SSB/R model (as performed in the software FACT, National Marine Fisheries Service, Woods Hole, MA) when $s_F = s_M, = 1$ in Version 1 and c = d = 0 in FACT, where c and d refer to the fraction of fishing and natural mortality that occur before spawning occurs within a time step, respectively.

Version 2 follows the computations of Version 1, except that female age of maturation/recruitment is variable. Version 2 starts a population of immature females of the same age. As time advances, a small fraction of this immature "pool" matures and recruits onto the spawning grounds at the start of each day. Version 2 includes immature natural mortality and gear selectivity for immature and mature females.

Version 1: fixed age of maturity.

This model posits that a number of newly-mature females (N_0, where N_0 is arbitrarily set to 1,000 for modeling purposes) simultaneously arrive at the spawning grounds and recruit into the fishery. For simplicity, the females are of the same age and mantle length. Their actual age is not critical for this model version. Their mantle length (L) determines their potential fecundity. I set L = 129 mm based on data for females landed after the 1997-98 El Nino (i.e., landed from January 1999 through June 2000): mean ± SE mantle length = 128.6 ± 0.3 mm, n = 1,277 females. Thus, $F_{p,129}$ = 3,844 eggs.

The females all arrive at the spawning grounds at the beginning of day 0 (t = 0), and thereafter experience natural and fishing mortality (M and F, respectively). Time steps are daily, because it is possible that an individual female lays a substantial proportion of her eggs within one or two weeks, and may not live much longer than one month after maturity. Data from two cohorts of laboratory-reared market squid reveal that all egg laying by both groups occurred over a span of 50-60 days (Yang et al. 1986).

The initial number of females (N_0) declines daily by the exponential equation:

$$N_{t+1} = N_t \times e^{-(M+F)}, \qquad (3)$$

where N_t = number of females at the beginning of day t, and t = 0, 1, ..., t_{max}. Note that t_{max} = 300 in order to encompass a broad range of M and F values. The actual persistence of the female

population is determined by the sum M+F. The number of females caught during a given day t, C_t, equals:

$$C_t = [N_t - N_{t+1}] \times [F/(F+M)] . \quad (4)$$

The number of females that succumb to natural mortality but are not caught in fishing gear, D_t, equals:

$$D_t = [N_t - N_{t+1}] \times [M/(F+M)] . \quad (5)$$

Note that the number of females that survive through a given day t equals N_{t+1}, or:

$$\text{\# females that survive through day t} = N_{t+1} = N_t - C_t - D_t . \quad (6)$$

At day 0, each female's standing stock of eggs equals her potential fecundity (i.e., $SS_0 = F_{p,129}$). Over time, the female lays these eggs. For simplicity, egg laying is depicted as a continuous exponential shedding of eggs:

$$SS_{t+1} = SS_t \times e^{-v} , \quad (7)$$

where SS_t = standing stock of eggs at the beginning of day t, and v = egg-laying parameter. The expected number of eggs that a female will lay over the course of day t, Ω_t, equals:

$$\Omega_t = SS_t - SS_{t+1} . \quad (8)$$

A female, however, may not lay her expected clutch for a given day, because she might die from natural or fishing mortality. The parameters s_M and s_F indicate what fraction of Ω_t that a female lays before she dies from natural or fishing mortality, respectively, during a given day. In all model runs, s_M and s_F are set to 0.5 to incorporate the interruption of egg laying. The total number of eggs laid by the female population during day t, E_t, equals:

$$E_t = \Omega_t \times [s_M D_t + s_F C_t + N_{t+1}] . \quad (9)$$

Two management benchmarks are the mean standing stock of eggs per female in the catch (mean SSPF) and eggs per recruit (EPR). To calculate mean SSPF, the fraction of potential fecundity remaining at capture for each day, ϕ_t, is first determined:

$$\phi_t = [SS_t - s_F\Omega_t] \; / \; F_{p,129} . \quad (10)$$

Mean SSPF is then found by:

$$\text{mean SSPF} = \sum_{t=0}^{t\,\max} \phi_t \times C_t \; / \; \sum_{t=0}^{t\,\max} C_t . \quad (11)$$

Equation 11 is analogous to finding the mean ϕ by Equation 2 when data for standing stock of eggs are summarized as a frequency distribution. The EPR equals:

$$EPR = \sum_{t=0}^{t\,max} E_t \,/\, N_0 . \qquad (12)$$

Equation 12 yields the absolute number of eggs produced per initial female recruit. For a given level of fishing mortality (F > 0), EPR can be expressed as a fraction of egg production in the absence of fishing (EPR @ F=0). This fraction is "egg escapement":

$$\text{Egg escapement} = EE = EPR\ @\ F{>}0 \,/\, EPR\ @\ F{=}0 . \qquad (13)$$

Egg escapement is called the "escapement rate" in Macewicz et al. (in prep) and is denoted R therein.

Management decisions can be formulated by examining the responses of mean SSPF, EPR, and EE to different levels of fishing mortality. Because natural mortality (M) and the egg-laying parameter (v) are poorly known for *L. opalescens,* an initial sensitivity analysis explored a range of plausible values. High daily M values of 0.45 and 0.15 are suggested by energy expenditure during spawning (Macewicz et al, MSa), and are used in Macewicz et al. (in prep). A lower daily M was set to 0.01. This value corresponds to a lower-bound estimate of monthly M = 0.3 in Maxwell (MS), and matches monthly M $\approx$ 0.3 as estimated for other *Loligo* spp. (Brodziak 1998; Agnew et al. 1998). The daily egg-laying parameter v = 0.45 is derived by fitting the laying of 36% of a female's potential fecundity in her first clutch (Macewicz et al., in prep) to Equation 7 (i.e., $SS_1 = 0.64 = 1.0 \times e^{-0.45}$). The egg-laying period is lengthened in model runs by setting v = 0.225.

Responses of mean SSPF, EPR, and EE to increasing daily fishing mortality (F) under the six combinations of daily natural mortality (M) and egg-laying (v) values appear in Figure 1. The values of M = 0.15 and v = 0.45 recommended by the CPSMT are highlighted. When daily natural mortality (M) is high and egg laying (v) occurs relatively slowly, the females are captured with a large fraction of their potential fecundity retained (e.g., M = 0.45, v = 0.225 in Figure 1a). The standard errors associated with the mean SSPF values in Figure 1 and all other figures are less than 0.02, so are not presented in the interest of ease of viewing. The retention of eggs is a manifestation of females laying relatively few eggs per recruit (e.g., M = 0.45, v = 0.225 in

Figure 1b). On the other hand, the females lay nearly all of their potential fecundity when daily natural mortality is low, egg laying occurs quickly, and daily fishing mortality is low (e.g., upper left portion of M = 0.01, v = 0.45 curve in Figure 1b). Eggs per recruit values are expressed as egg escapement (EE, Equation 12) in Figure 1c.

The laying of egg clutches can be depicted as a discrete process (a "step function") rather than as a continuous daily process. That is, once a female lays a clutch of eggs, her standing stock of eggs remains constant until the next clutch. This appears to reflect the biological pattern of egg laying more accurately, as indicated for *L. pealeii* in Maxwell and Hanlon (2000). From Maxwell and Hanlon (2000), it was specified in the model that egg clutches are spaced 4 days apart, and that a female partitions her potential fecundity into 6 expected clutches. Specifically, 36% of her potential fecundity is laid in the first clutch, with the remaining 64% being divided equally among the subsequent 5 clutches. This hypothesized discrete pattern of egg laying yielded results that were very similar to the cases when v = 0.225, so are not presented.

Version 2: variable age of maturity.

This version incorporates variability in the females' age of maturity and recruitment into the fishery, as well as gear selectivity. Here, the model begins with an initial number of immature females (N_0) that are all 120 days old. At the beginning of day 120, a fraction of the immature females, p_t, become mature, arrive on the spawning grounds, and are thereafter subject to fishing mortality. Once mature, a female lays eggs as in the above version of the model. In the current version, two time scales are monitored: the females' biological age (t), and the day of maturity (d) for each subset of females that matures at a given age, where d = 0 denotes the first day of maturity. So, the number of newly-mature females at the beginning of a given day t, $Nm_{0,t}$, equals:

$$Nm_{0,t} = Ni_t \times p_t , \qquad (14)$$

where Ni_t = number of immature females at the beginning of day t, and t = 120, 121, ..., 360. The parameter p_t is found by the maturation schedule in Table 1; this table is derived from Maxwell (MS). Equation 3 becomes modified to describe the decline of this maturation "cohort":

$$Nm_{d+1,t+1} = Nm_{d,t} \times e^{-(Mm + PFM \times F)} , \qquad (15)$$

where $Nm_{d,t}$ = number of females of maturity day d at the beginning of day t, Mm = natural mortality for mature females, PF_M = gear selectivity for mature females, and d = 0, 1, ..., 300. The number of immature females declines by:

$$Ni_{t+1} = [Ni_t - Ni_t p_t] \times e^{-(Mi + PFI \times F)}, \quad (16)$$

where Mi = natural mortality for immature females and PF_I = gear selectivity for immature females.

Similar to Equation 15, the number of females of maturity day d that are caught during a given day t, $Cm_{d,t}$, equals:

$$Cm_{d,t} = [Nm_{d,t} - Nm_{d+1,t+1}] \times [PF_M F / (PF_M F + Mm)]. \quad (17)$$

The number of immature females caught during day t, Ci_t, equals:

$$Ci_t = [Ni_t - Ni_{t+1}] \times [PF_I F / (PF_I F + Mi)]. \quad (18)$$

Relevant to egg production is the number of females of maturity day d that succumb to natural mortality but are not caught in fishing gear during day t. This quantity, $Dm_{d,t}$, equals:

$$Dm_{d,t} = [Nm_{d,t} - Nm_{d+1,t+1}] \times [Mm / (PF_M F + Mm)]. \quad (19)$$

Potential fecundity at a female's first day of maturity (d = 0) is determined by Equation 1. For simplicity, mantle length at maturity is fixed at 129 mm for all females. Mantle length shows a slight increase with age for mature females (Figure 2); the low r^2 value, however, casts doubt on the significance of this relationship. Egg laying (i.e., the decrease in standing stock of eggs) occurs by:

$$SS_{d+1,t+1} = SS_{d,t} \times e^{-v}, \quad (20)$$

and the expected number of eggs that a female of maturity day d will lay over the course of day t, $\Omega_{d,t}$, equals:

$$\Omega_{d,t} = SS_{d,t} - SS_{d+1,t+1}. \quad (21)$$

The total number of eggs laid by females of maturity day d during day t, E_t, equals:

$$E_{d,t} = \Omega_{d,t} \times [s_M Dm_{d,t} + s_F Cm_{d,t} + Nm_{d+1,t+1}]. \quad (22)$$

Equations for the calculation of management benchmarks follow:

$$\phi_{d,t} = [SS_{d,t} - s_F \Omega_{d,t}] / F_{p,129}; \quad (23)$$

$$\text{mean SSPF} = \sum_{d=0}^{300} \sum_{t=120}^{360} \phi_{d,t} \times Cm_{d,t} \; / \; \sum_{d=0}^{300} \sum_{t=120}^{360} Cm_{d,t} \; ; \quad (24)$$

$$\text{and EPR} = \sum_{d=0}^{300} \sum_{t=120}^{360} E_{d,t} \; / \; N_0 \, . \quad (25)$$

Egg escapement (EE) is calculated as in Equation 12.

Sensitivity analyses of variable age of maturity and gear selectivity appear in Figure 3 for the preferred values M = 0.15 and v = 0.45. Daily natural mortality for immature females (Mi) is set to 0.01. Switching from Version 1 (fixed age of maturity) to variable age of maturity has no effect upon mean standing stock of eggs per female (mean SSPF; Figure 3a) or egg escapement (EE; Figure 3c). Eggs per recruit, however, noticeably decreases when age of maturity is variable (Figure 3b). Similarly, decreasing gear selectivity for matures to 0.8 and increasing selectivity for immatures to 0.2 has little to no effect upon mean SSPF (Figure 3a), but can have dramatic effects on eggs per recruit (Figure 3b). Egg escapement shows sensitivity only to increasing gear selectivity for immatures (Figure 3c).

Conclusions.

Sensitivity analyses of both model versions point to important lessons. First, management based solely on the monitoring of the standing stock of eggs for females in the catch can be misleading. The harvesting of immatures may not affect data on female egg standing stock, especially if immatures are excluded from such analyses *a priori.* Fishing mortality exerted on immatures, however, can greatly effect eggs per recruit and egg escapement.

Second, a measure of absolute egg production, such as eggs per recruit, should be considered along with the relative value of egg escapement. Hatfield and Des Clers (1998) draw attention to management based on absolute reproductive escapement as opposed to relative reproductive escapement. For example, if a management goal is to keep harvested squid populations above 0.3 egg escapement, then fishing would continue unbridled in all of the scenarios in Figure 1c. If, however, it was determined that the goal is to maintain populations above 2,000 eggs per recruit, then several of the scenarios in Figure 1b would be affected by fishing regulations.

Measuring absolute reproductive output raises the question of the appropriate unit of "reproduction." The modeling approach in this paper has equated reproduction to the laying of fertilized eggs. But population persistence, especially for the short-lived market squid, depends upon many processes after egg deposition. Not all zygotes may hatch, due to biological factors, such as unequal oxygen availability within communal egg beds, and to fishery-related factors, such as damage or removal of eggs by gear. After hatching, density-dependent effects, such as competition and cannibalism within and between life stages, can act to loosen the relationship between hatchling number and adult number, as well as between adult number and egg number (Agnew et al. 2000).

III. Application of the egg escapement strategy

Management based on egg escapement could operate as follows. At one or more times during the squid season, landed females will be randomly sampled. Body measurements such as mantle length, mantle tissue dry weight, and weights of ovaries and oviducts will be taken from these females. Potential fecundity and the standing stock of eggs will then be estimated for each female, following analyses presented in Macewicz et al. (MSa,b). Ideally, these body measurements will provide accurate estimations of potential fecundity and standing stock. It is important, however, that detailed histology be periodically performed on a subset of females to ground-truth these parameters that are estimated from the body measurements.

With potential fecundity and standing stock estimated for each female, the mean fraction of potential fecundity remaining at capture (mean ϕ by Equation 2, or mean SSPF by Equations 11 and 24) can be calculated for the females. By way of example, Macewicz et al. (in prep) report a mean ± SE fraction of remaining potential fecundity of 0.656 ± 0.004 for harvested females sampled from the Southern California Bight (n = 1,217). Plotting this on the SSPF vs. F curve of the preferred M = 0.15 and v = 0.45 for model Version 1, this mean fraction corresponds to daily F = 0.74 (Figure 4a). This estimated value of daily F corresponds to EPR = 1334 and EE = 0.46 (Figure 4b). Management may stipulate that the estimated eggs per recruit (EPR) or egg

escapement (EE) is to exceed a critical threshold (EE^*). Applying the CPSMT's recommended threshold of $EE^* = 0.3$, the fished population lies above this threshold (Figure 4b), so harvesting may continue at the current level of fishing mortality. If the population had fallen below the threshold, then fishing mortality might be adjusted to return to the threshold level of escapement. Tracking the change in egg escapement or eggs per recruit along the F-curve indicates the required amount of change in fishing mortality.

An important consideration is the translation of fishing mortality (F), which is a unitless parameter in the model's equations, into a "real-world" control parameter (f), such as number of fishing nights or number of boats in operation, in order to effectively manage the fishery. Suppose that the egg escapement curve in Figure 5 describes the squid population. Furthermore, suppose that the current estimate of egg escapement was 0.1, and managers wanted to raise egg escapement to 0.3. From logbook data, suppose that the level of fishing effort (f) associated with the escapement value of 0.1 was 15,509 boat-nights. Positing a relationship between F and f (i.e., $F = qf$, where q = catchability coefficient) converts F into boat-nights. In this case, managers would have to reduce boat-nights to 8,022 to bring egg escapement to 0.3 (Figure 5).

IV. Data requirements

The egg per recruit model approach rests on several assumptions: 1) immatures are not harvested; 2) potential fecundity and standing stock are reliably measured; 3) life history parameters, such as natural mortality and egg-laying rates, are accurately estimated, or at least vary within reasonable limits; and 4) instantaneous fishing mortality (F) translates into usable, practical units. The data described below address these assumptions, and, hence, are crucial to the successful implementation of the egg escapement strategy.

1. Composition and location of the catch. Data on the ages and maturity stages of harvested squid are needed to continuously verify whether immature squid are being captured. Additionally, the locations of hauled squid need to be accurately recorded to detect whether new

or deeper waters are being harvested. Data on harvest location are important because harvesting beyond the shallow-water spawning grounds may change the proportion of spawning females in the catch.

2. Potential fecundity and standing stock of eggs.

   a. Body measurements (e.g., mantle length, mantle tissue dry mass, ovary and oviduct mass) of landed females are required to estimate potential fecundity and standing stock of eggs. Additionally, potential fecundity and standing stock should be periodically estimated by detailed histology to verify the robustness of estimation via body measurements.

   b. Fine-tuning. Questions about reproductive biology raised by Macewicz et al. (MSa) remain unknown, but can potentially alter the method by which to estimate potential fecundity and standing stock.

      1. Increasing the sample size of mature, pre-spawning females. Analyses in Macewicz et al. (MSa,b) involve a small subset of mature pre-spawning females. These females are crucial to the estimation of potential fecundity, and more of these are needed for histological work.

      2. Ground-truthing inferred spawning history with living females. Maintaining reproductive females in captivity will indicate whether previous spawning may go undetected in histological examinations. This is crucial to the accurate estimation of standing stock of eggs. Additionally, rearing immature females will yield known mature, pre-spawning females, which will help refine the fecundity analysis (see #2.a.1, above).

3. Life history parameters. At least three of the model's parameters -- natural mortality, egg-laying rate, and recruitment rate into the spawning population -- have important influences on the model's results.

a. Natural mortality. Age data will help resolve natural mortality for immatures and adults. Catch-curve analysis (Ricker 1975) is appropriate for immatures; such an analysis requires age data and a sampling program that captures large immatures. With regard to adults, individual daily movement patterns to and from the actual spawning site partly determine mortality rate, and mortality rate is reflected in the length of an individual's reproductive career. Observational work at spawning sites (e.g., visual recordings via ROV) can address daily movement patterns. Mark-and-recapture work will help address the length of reproductive careers, but marking methods may be difficult to develop for the market squid. Alternatively, the length of reproductive career could be addressed through the examination of post-ovulatory follicles, or the possible use of a bioenergetic model of egg development and deposition.

b. Egg laying rate. This question seems best answered by observations of live animals, ideally by integrating observations in nature with work in captivity. Egg laying rates could also be estimated through a bioenergetic model with appropriate sensitivity analysis.

c. Recruitment rate into the spawning population. A sampling program that randomly takes all ages and sizes over the course of one or more years will address the age and size distribution of sexually mature squids, and changes in the proportion of sexually mature squid over time.

4. Reliable and accurate effort data. Squid fishermen are currently required to maintain logbooks. Effort data will enable management to respond to changes in egg escapement. Additionally, catch and effort data can be used to construct CPUE indices of population abundance for alternative modeling approaches.

It is important to measure egg abundance at the fished spawning grounds. Lacking direct measures of egg abundance, measures of the abundance of the spawning population are necessary. Obtaining both pieces of data will allow for the detection of density-dependence in

egg production, which may occur in *Loligo gahi* (Agnew et al. 2000). Furthermore, an operational assumption of the eggs per recruit model is that the vast majority of a stock's adults spawn at sites that are targeted by the fishery. Spawning refugia probably exist for the market squid, so the spatial patterning of population abundance should be systematically measured within the squid's spawning habitat. Additionally, indices of population abundance can be used in alternative modeling approaches, such as Leslie-DeLury models, should such modeling be desired in the future. The following are various indices of egg and population abundance.

1. ROV surveys of egg beds. Visual recordings of egg beds *in situ* are non-intrusive, non-destructive observations of spawning habitat and egg abundance. This is an ideal, low-impact, direct method to estimate egg abundance.

2. Commercial catch per unit effort. When derived from the logbooks, CPUE is a potentially low-cost and fine-scale (in both space and time) indicator of population abundance. CPUE, however, is potentially confounded by market orders and/or trip limits.

3. "Controlled effort" program. A more rigorous use of commercial data is to design a sampling program with cooperative fishermen. Light boats would shine lights for carefully measured periods of time, and all of the squid attracted would be captured. The sampling design would involve repeated visits to fishing grounds over the course of the season. This program would provide spatially- and temporally-replicated indices of population abundance at potentially low cost.

4. Trawl surveys. Midwater trawl surveys could be continued to maintain continuity with earlier surveys. Net avoidance by the squid, however, may reduce these surveys' usefulness in estimating population biomass. Given that the fishery typically lands mature adults, fishery-independent trawls are probably the best method to obtain data for immatures in the ocean, especially large immatures.

5. Acoustic surveys. Similar to ROV surveys, acoustic surveys are non-destructive to the squid and habitat. Acoustic surveys would require a period of ground-truthing to verify the signals of squid schools and egg beds.

6. Other ancillary sources. The fecal and stomach samples of "biological" samplers such as predators and scavengers provide some indication of squid abundance. This author cautions that these data should be used as complements to data obtained from randomized sampling programs.

V. Acknowledgments

Earlier versions of this model greatly benefited from the thoughts and input of Paul Crone, Larry Jacobsen, and Ray Conser. My gratitude extends to discussions with John Hunter, Paul Smith, and Nancy Lo. I especially thank the following for access to crucial data on squid age, fecundity, and biometry: Bev Macewicz, Annette Henry, John Butler, and Marci Yaremko.

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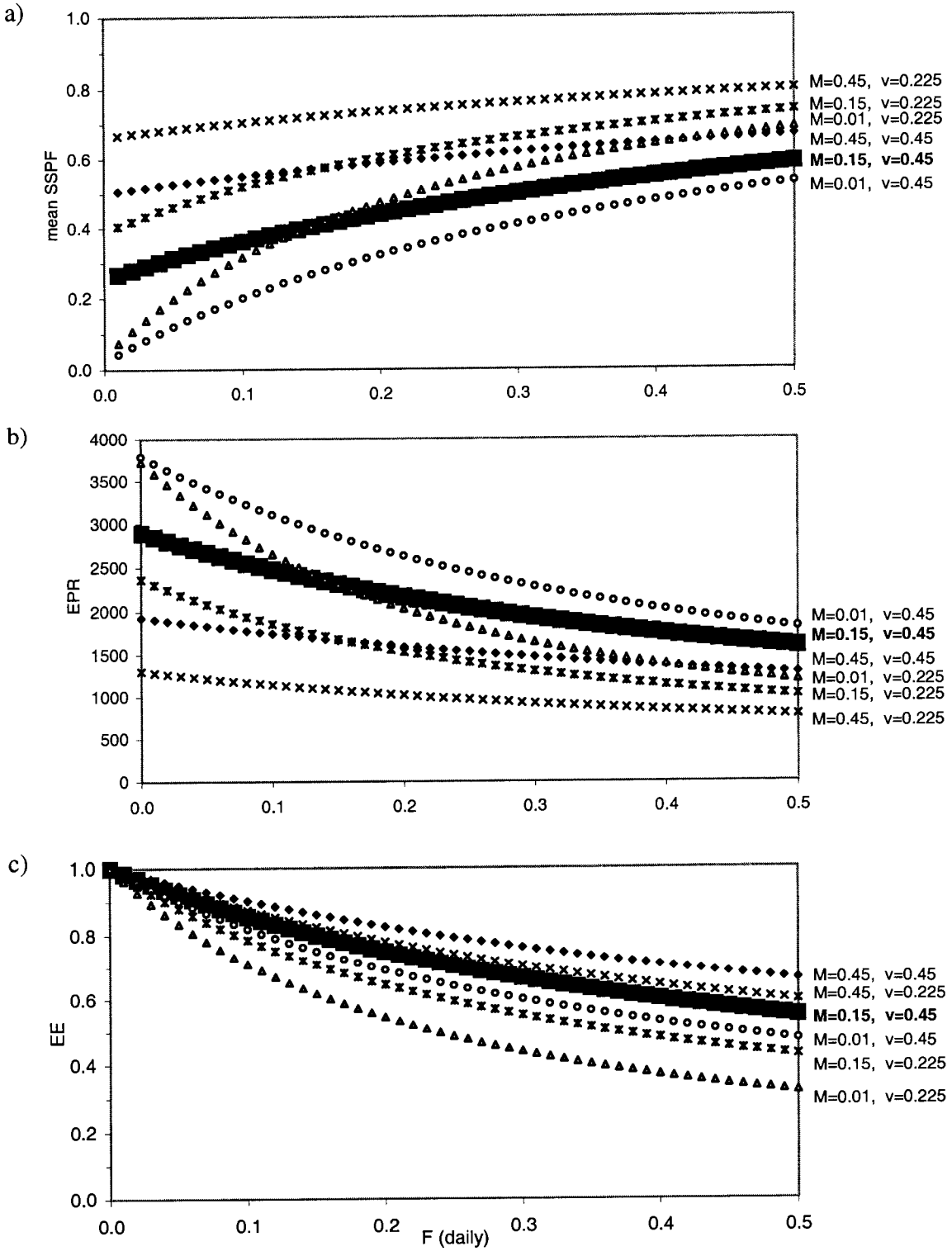


Figure 1. Management benchmarks for values of daily natural mortality (M) and egg-laying parameter (v); curve for recommended M = 0.15 and v = 0.45 is highlighted. a) Mean standing stock of eggs per female in catch (mean SSPF); b) eggs per recruit (EPR); c) egg escapement (EE).

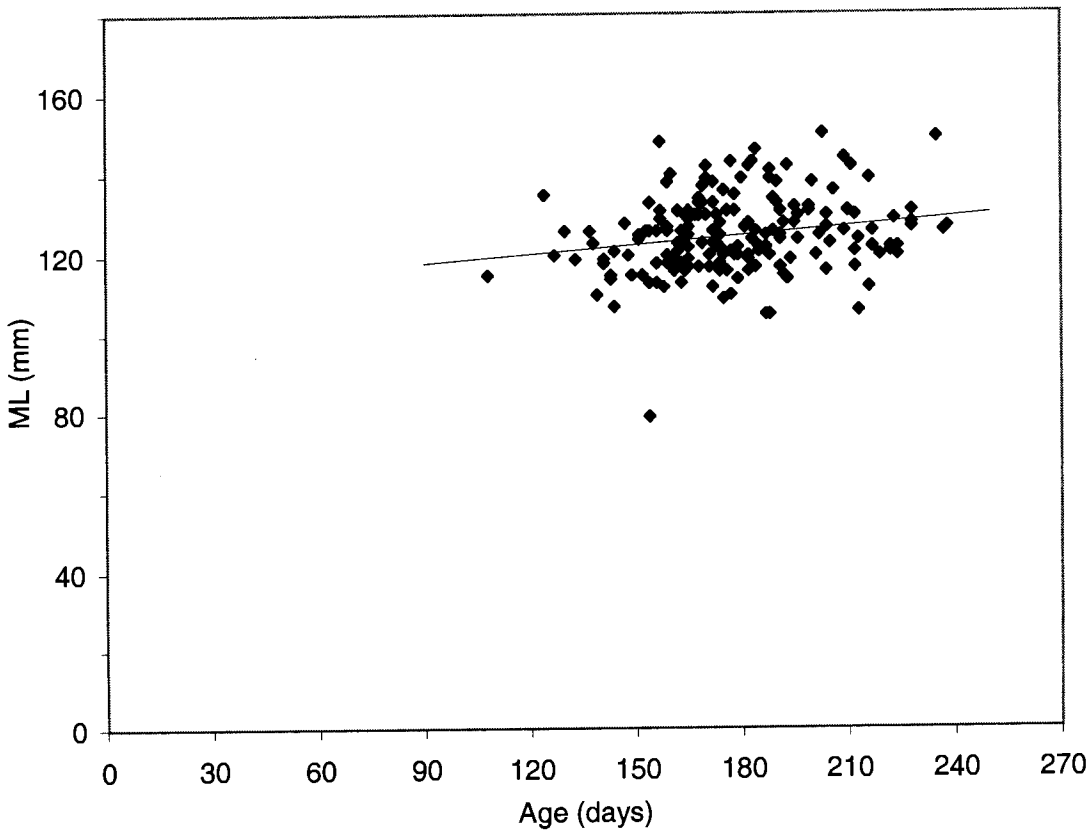


Figure 2. Mantle length (mm) vs. age (days) for mature females captured in Southern California Bight, January 1999 through June 2000. Regression line: ML = Age*0.08 + 111.30; $r^2 = 0.04$, $p < 0.05$, n = 177.

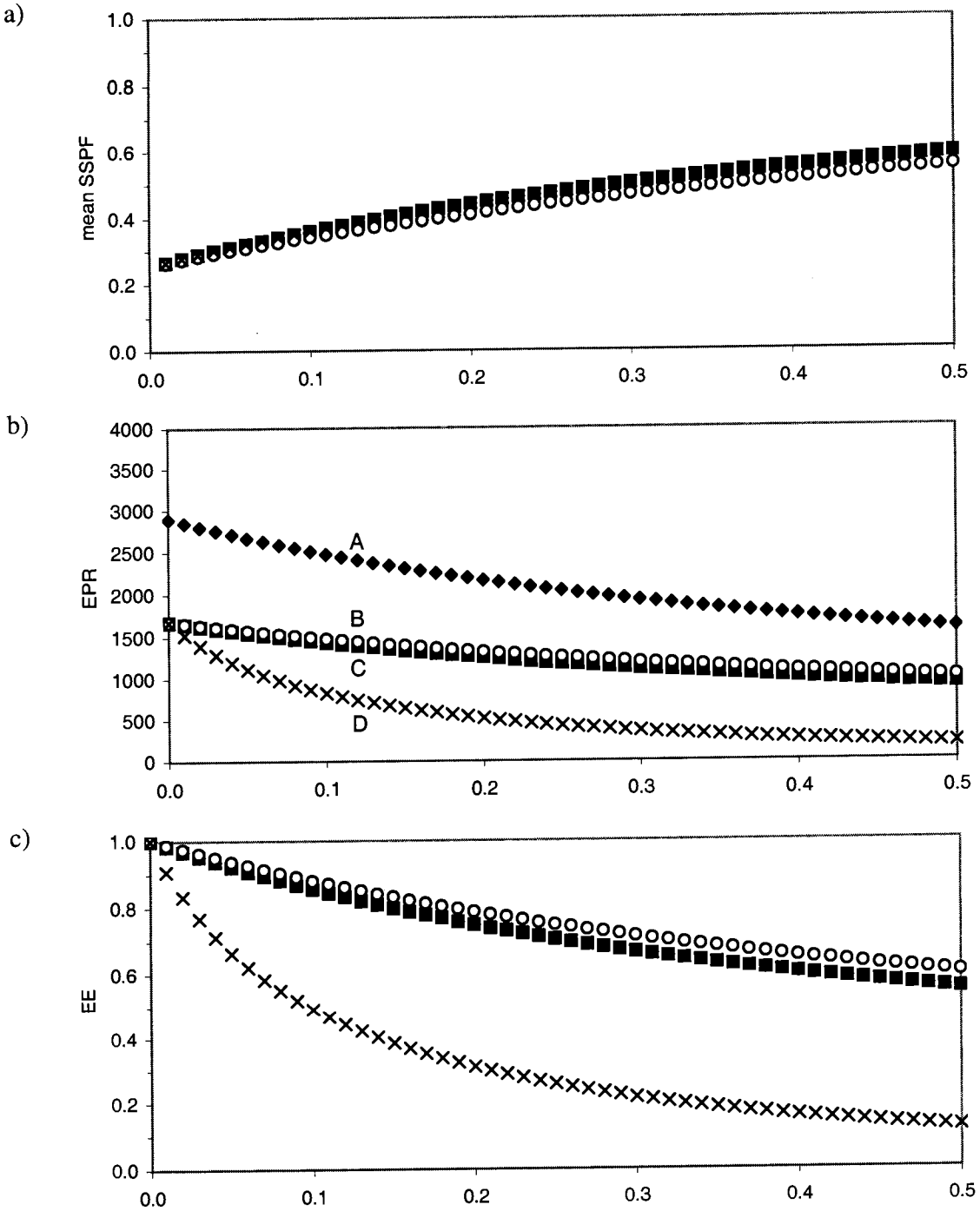


Figure 3. Effect of maturation rate and gear selectivity (PF_I and PF_M) on a) mean SSPF, b) EPR, and c) EE for the recommended values M = 0.15 and v = 0.45. For all frames:

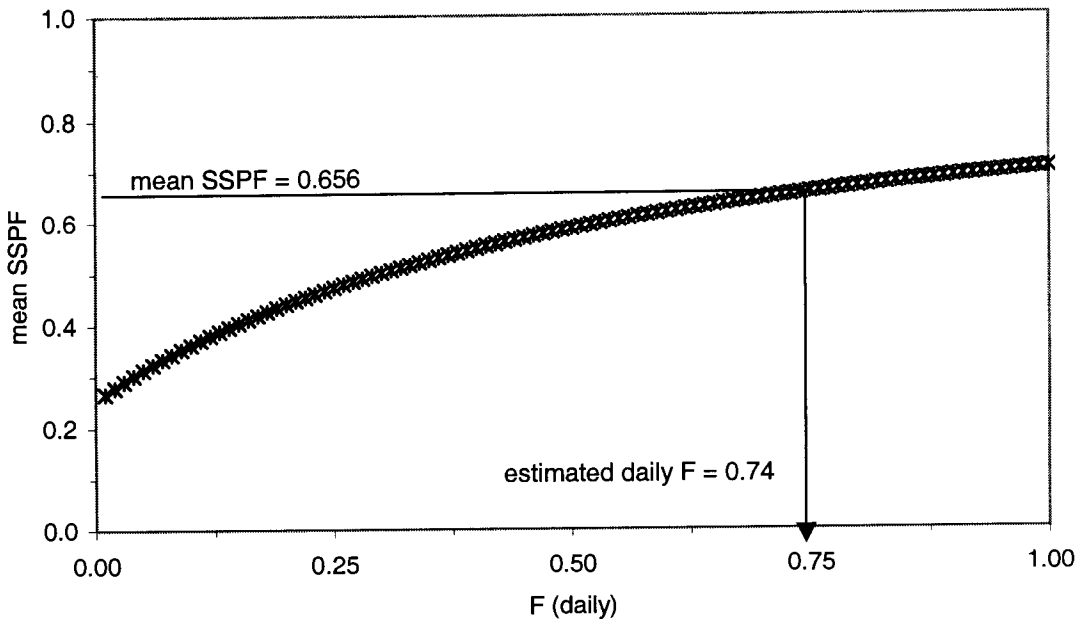
A (diamonds): model Version 1 (fixed age of maturity); $PF_I = 0.0$; $PF_M = 1.0$

B (squares): model Version 2 (variable age of maturity, Table 1); $PF_I = 0.0$; $PF_M = 1.0$

C (circles): model Version 2 (variable age of maturity, Table 1); $PF_I = 0.0$; $PF_M = 0.8$

D (Xs): model Version 2 (variable age of maturity, Table 1); $PF_I = 0.2$; $PF_M = 1.0$

a)



b)

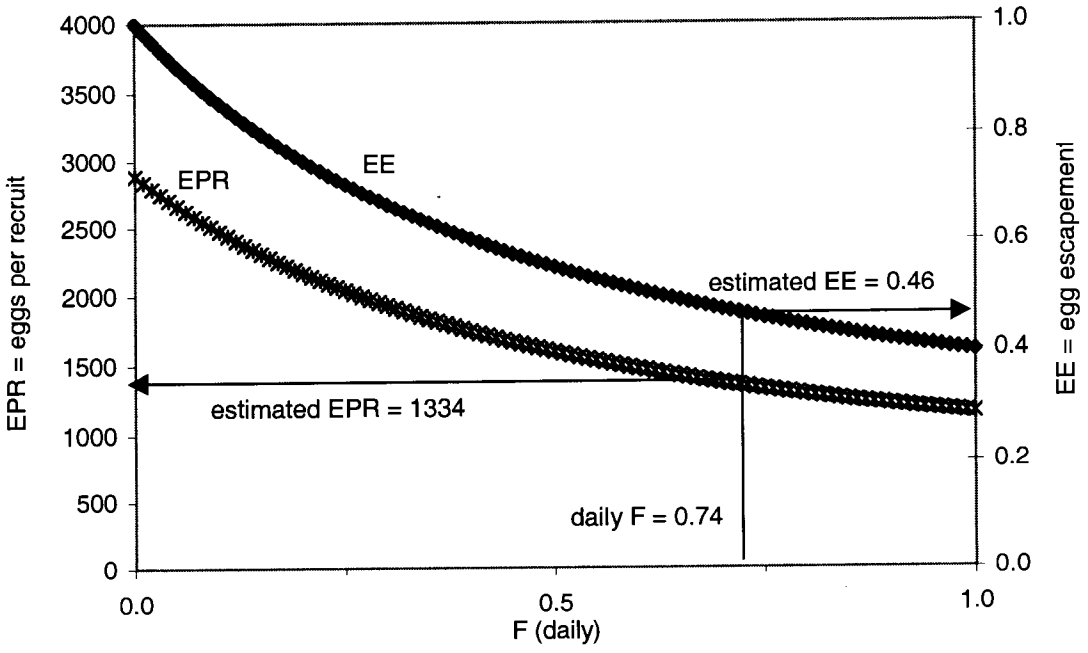


Figure 4. SSPF curve (a) and EPR and EE curves (b) for recommended values (M = 0.15 and v = 0.45) to illustrate the estimation of fishing mortality (F) and EPR and EE from empirical data for SSPF.

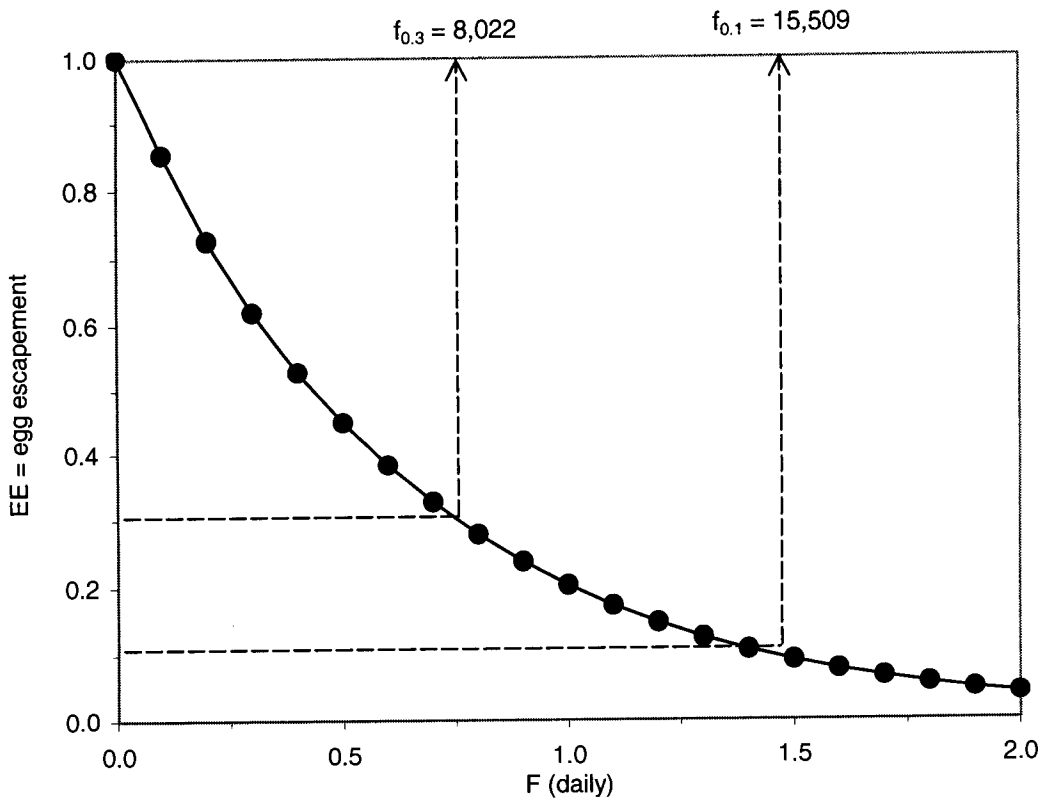


Figure 5. Hypothetical egg escapement curve and fishing mortalities associated with escapement levels of 0.1 and 0.3.

Table 1. Maturation schedule, derived from Maxwell (MS). Within each 30-day period, the daily fraction of immatures that become mature equals: $[CP(i+1) - CP(i)]^{1/30}$.

Day (i)	Cumulative proportion that are mature, CP(i)
120	0.000
150	0.375
180	0.750
210	0.813
240	0.875
270	0.938
300+	1.000

Table 2. Management benchmarks for six scenarios in Figure 1. Values M = 0.15 and v = 0.45 recommended by CPSMT boldfaced. In this table, calculations are bounded by 0.00 < daily F < 0.50.

Observed mean SSPF	M (daily)	v	Est. F (daily)	Est. EPR	Est. EE	Yield (kg) per Recruit
0.656	0.45	0.450	0.44	1334	0.69	21.8
0.656	**0.15**	**0.450**	**> 0.50**	**< 1594**	**< 0.55**	**> 34.0**
0.656	0.01	0.450	> 0.50	< 1813	< 0.48	> 43.2
0.656	0.45	0.225	< 0.01	~ 1295	~ 0.99	< 1.0
0.656	0.15	0.225	0.29	1326	0.56	29.1
0.656	0.01	0.225	0.43	1326	0.36	43.1

APPENDIX F: SQUID STAR PANEL REPORT

Report of the Stock Assessment Review (STAR) Panel for Market Squid

May 14-17, 2001

Southwest Fisheries Science Center
La Jolla, California

1. Introduction

In 1999, the Department of Commerce rejected portions of Amendment 8 to the Pacific Fishery Management Council's (Council) Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) on the grounds that the amendment did not include an estimate of maximum sustainable yield (MSY) for market squid. In September 2000, the Council's Scientific and Statistical Committee (SSC) reviewed newly derived estimates of MSY for market squid. Because of the uncertainties surrounding these estimates and more generally, ongoing concern regarding the appropriateness of defining MSY for this species, the SSC did not recommend an MSY value.

Fortunately, recent research conducted on market squid life history (including growth, maturity, and fecundity) along with enhanced fishery-dependent data (port sampling and logbooks) have provided significant new information. The SSC recommended (and the Council concurred) that the SSC should work with the National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (CDFG) to organize a stock assessment review (STAR) panel for market squid during 2001.

The STAR Panel met May 14-17, 2001 at the NMFS Southwest Fisheries Science Center, La Jolla, CA. A principal goal of the STAR was to integrate the ongoing market squid research into the Council's CPS FMP. Terms of reference for the STAR panel addressed the MSY issue as well as control rules for practical management of the market squid fishery (Appendix A) . The Panel members were:

Tom Barnes	CDFG & Council's GMT
Ray Conser (co-chair)	NMFS & Council's SSC
Larry Jacobson	NMFS - Woods Hole (outside reviewer)
Tom Jagielo (co-chair)	WDFW & Council's SSC
Heather Munro	Munro Consulting & Council's CPSAS
Paul Smith	NMFS & Council's CPSMT

An agenda and eight working papers (WP) were prepared for the STAR and distributed to Panel members and other interested parties on May 1, 2001 (Appendices B and C, respectively). The WP authors presented their work to the Panel and were available throughout the week to consult with the Panel, provide additional information and data, and to carry out additional analyses, as needed. In addition to the Panel members and WP authors, the STAR discussion and participation was open to all interested parties. In total, approximately 25 participants were involved in the process (Appendix D). Excellent facilities and support were provided by the NMFS and CDFG staff in La Jolla.

Considerable interaction occurred throughout the STAR meeting among STAR Panel members, WP authors, and other participants. In some cases, this 'give and take' resulted in alternative interpretations of data as well as modelling improvements. Additional model runs were carried out during the meeting and the results were tabled for discussion. Consequently, some important aspects of the STAR Panel consensus were based on the modelling work done during the course of the meeting. The Panel requested that WP8 be revised after the meeting to reflect and fully document the analyses carried out during the STAR Panel meeting. The analyses and results contained in WP9 reflect the STAR Panel consensus at the end of its meeting with respect to the most appropriate modelling and management control rules.

2. Biology and Life History Findings

The STAR panel considered new results about the biology of the market squid. Together these findings are crucial for beginning the consideration of rational management techniques for controlling the future direction of the fishery from the standpoint of sustainable yield over time. There are also elements in the biology and life history which represent exotic departures from the usual fishery management principles and approaches and these deserve special attention. Thus it is the task of this report to consider the wide range of biology and life history results, and focus on those which provide the most information for management and supply questions which must eventually be considered. The headings under which these will be considered are age and growth, temperature controlled development rates, genetics, fecundity, and some behavioral aspects of the El Niño phenomenon.

The fundamental distinction in the squid fishery, versus fisheries on long-lived multiple spawning fishes, is that little or no fishing precedes spawning and consequently, substantial population spawning has occurred before any adults are caught. Thus, the management approach can be based directly on the status of spawning from the appearance of past spawning in the squid catch. It is common to both of the squid fisheries in California (Monterey and Southern California) that there are substantial periods in the year in which spawning most likely has occurred for which there is no fishery. Similarly, the height of the fishery within each year is restricted to a few months. If the life cycle is materially less than one year, there will be interspersed reproductive episodes with only natural mortality occurring.

Lastly, the catch records for both Monterey and Southern California show cataclysmic decline of landings during El Niño Southern Oscillation (ENSO) events. Since the fishery is on adults, some degree of reproductive success has already occurred. Subsequent fishing seasons will reflect either deficiencies in reproductive success or changes in the availability of squid. If the subsequent season is low in catch, also, one would tend to think of depletion of that cohort of spawners; if the subsequent season is high in catch, one would have to infer reproductive recovery to that extent or introduction of squids which have not been affected adversely by ENSO.

2.1 Age and Growth

Growth of squid paralarvae is slow. Juvenile growth accelerates as the animal approaches maturity as described with a power function:

$$\mathbf{DML = a\,T^{\,b}}$$

Where DML is dorsal mantle length and T is age in days. In a single cohort, the reported 'a' was 0.001342 and the exponent 'b' was 2.132. The average age of females sampled in the fishery was 186 days following hatching and feeding. The male average age was essentially the same at 190 days. It is not known whether age rings in the statolith continue after maturation or if continuing rings are visible.

If one assumes that daily rings continue to be formed and can be counted, a display at monthly interval in the 1998-99 fishery shows that squid age composition in the catch ranges from 5 to 9 months with a mode which is at either six or seven months. (WP3, Figure 2). Since statolith rings form in the week between hatching and disappearance of yolk, about 2 months can be added to the period between generations, 8-9 months. The seasonality of catches in both habitats may not reflect the progression of cohorts from short seasons in an annual cycle but may merely reflect the economic factors or availability of shallow spawning aggregations. Cohort formation, if any, may be smeared with temperature, by the depth distribution of hatching, and subsequent variations of rates of growth to maturity.

The key uncertainties with respect to market squid age and growth are:

[i] variations of growth rate following maturity;
[ii] interannual and intra-cohort variations in juvenile growth rate;
[iii] interannual and intra-cohort variations in maturation by age;
[iv] a more complex growth model may be needed to adequately represent growth throughout the full life

history, especially for mature animals; and

[v] accuracy of daily statolith ring counts after the onset of maturity.

2.2 Temperature Dependent Incubation

Temperature controlled incubation time at 7 degrees C exceeded 90 days; at about 12.5 C, squid eggs hatched in 50 days; and at 20 C hatching time was as fast as 24 days. The 25 C temperature was lethal and hatching at 6 C temperature was not lethal but did not complete development. Since all ages are from hatching without knowing the temperature at incubation, the incubation period appears to range from 1 to 3 months with a mean approaching 2 months. The yolk-sac may persist a week. The key uncertainties are: [i] temperature distribution at spawning; [ii} possible change in depth during ENSO; and [iii] possible transport or migration of adjacent stocks after ENSO.

2.3 Genetic Separation of Stocks

The degree of genetic mixing of squid between the Monterey and the Southern California Bight fisheries is not well established but there may be short-term isolation sometimes referred to as 'viscous' dispersal. Coast wide genetic studies are now being conducted to which the local studies reported so far from Monterey and Southern California Bight may be referred. Uncertainties are [i] the local depletion and resupply rates and [ii] the scale and degree of genetic mixing

2.4 Dynamic Fecundity

Potential fecundity may be obtained from oocytes as the gonadal tissue is formed. Maturation begins with the investment of a mode of oocytes with yolk. Ovulation onset is detected by empty follicles in the ovary and the presence of eggs in the oviducts. There appear to be more than one batch of eggs spawned by most females. By far the majority of females sampled in the commercial catch have some evidence of spawning. The dynamics of fecundity are controlled by temperature, size of female, and age of female. Only small numbers of females so far sampled have greater than 3 post-ovulatory follicular stages. Signs of multiple spawning waves in the ovary are accompanied by changes in mantle condition. There are also signs of wide area synchrony in modes of mantle condition which may be more useful in determining actual age than statolith rings after maturity. Uncertainties are: [i] the relationship between potential and residual fecundity at the population scale; [ii] the persistence of detectable post-ovulatory follicles; and [iii] the relationship between mantle condition and environment.

2.5 Aspects of El Niño

Within most decades of fishery management, we can expect one or two ENSO events. Based on previous ENSO's in the modern market squid fishery, we can expect, at least, wide disruption in the availability of squid on the spawning grounds, and perhaps increases in natural mortality as well. To date, the recovery of the fishery following ENSO's has been remarkably fast. The key El Niño issues with respect to squid management are:

[i] Does ENSO change the risk of overfishing?

[ii] Should the first year after recovery from ENSO be managed differently?

[iii] Do management models require additional parameters to account for the environmental effects?

[iv] Are there other organisms in the ecosystem approach which need to be considered in this light?

3. Fishery and Fishery-Independent Data

The STAR panel discussed a number of fishery and fishery independent data sources with potential for use in the assessment of market squid (Table 1). The data sources in the present assessment (WP7, WP8, and WP9) came primarily from fishery and survey information sampled in the S. California Bight. The additional data sources listed in Table 1 were discussed by STAR panel members as potential sources of information for future assessments.

Catch data, summarized by blocks from which the squid were taken, were obtained from CDFG landing receipt information. Samples from CDFG 1998-2000 port sampling were used to characterize mantle length, body mass, and sexual maturity of the landed catch. Age composition of the catch was derived from a sub-sample of 908 port sampled squid. Biological samples from a CDFG midwater trawl cruise in 2000 were used to supplement the port sample data. Presently, port sampling data are also used to estimate the bycatch of immature squid in the fishery; the assumption is that few discards are made at sea because squid are pumped directly from the seine net to the vessel hold without at-sea sorting.

WP7 presented three indices of squid abundance: 1) a CPUE index of abundance, 2) a midwater trawl survey index of abundance, and 3) a sea lion scat index. The CPUE index of abundance utilized catch per block information from fish landing receipts, and a time series of fishing effort which was obtained from analyzing satellite images of the S. California Bight (1992-2000). Light pixels on the satellite images were quantified and used as an index of fishing effort; a positive relationship was apparent when light pixels for each night were compared with catch landed the following morning. A project to ground truth the light pixel – fishing effort relationship with night time flyovers of the S. California Bight (1999-2000) is underway. Because light shields are now required on light boats, satellite data may not be useful for future effort estimation. In the future, it may be possible to use information from fishery logbooks to establish a new index of fishing effort. The midwater trawl survey index of abundance was derived from the Mais surveys (1966-1988). Tows were filtered by depth, duration, and location criteria, and an index for the S. California Bight was prepared. Squid abundance in each survey was described in terms of the proportion of tows that caught one or more squid of mantle length 80 mm or longer (proportion positive). The sea lion scat index was derived from scat samples taken from San Nicolas and San Clemente Islands. The trend in squid abundance was quantified as the proportion of scat samples that contained squid beaks per calendar quarter for each island (proportion positive).

The STAR panel noted that non-linear relationships can exist between stock abundance and both types of indices used for market squid, i.e. catch rate indices and proportion positive indices. Non-linear relationships in catch rates can result from saturation for schooling species, and proportion positive indices may be nonlinear because they are bound between zero and one (see Section 5.2, below). The STAR panel also pointed out that using CPUE as an index of abundance is problematic for a schooling animal such as squid. In the squid fishery, light boats locate spawning aggregations and attract squid to the surface for subsequent capture by the round haul fishing vessels, and unqualified CPUE is not likely to be directly proportional to abundance. A mandatory fishery logbook program was instituted in 2000, and logbook data are now available for both the light boat and fishing boat components of the fishery. Logbook data, if properly standardized, hold potential as a tool to estimate effective fishing effort. It will be important to take into account factors such as search time, changes in catchability, and market factors which could bias the results.

The SSB/R fecundity escapement management, as described in WP1, WP2, WP8, and WP9, approach would require reliable estimates of 1) age composition of the landed catch, 2) egg escapement from harvested and unharvested components of the population, 3) growth and maturation rates, 4) adult vulnerability to the fishery, and 5) fishery effort data. Biological data will be required from both survey and fishery samples to characterize mantle length, mantle condition factor, fecundity, and proportion mature by age. Reliable estimates of total catch and effort will be required to estimate egg take by the fishery.

Finally, the SSB/R approach as described in WP8 and WP9 assumes that the great majority of the stock's adults spawn at sites that are targeted by the fishery. There is a need to quantify the full extent of the squid spawning distribution, to evaluate the escapement of squid eggs from the unfished components of the

population. Midwater trawl surveys, ROV surveys, and paralarvae surveys are tools which could potentially be used to characterize the full distribution of the squid resource.

4. Stock Assessment-Related Models and MSY Estimation

4.1 Maximum Sustainable Yield

Working papers with results from several different approaches to estimating MSY were made available to the Panel (WP7 and WP8). Assessment authors presented the data, methods, and results for one of the approaches. Group discussion focused on the technical strengths and weaknesses of their work, and whether the basic MSY concept was appropriate to a species that is very short lived and exhibits wide year-to-year fluctuations in availability and/or abundance.

Results from a surplus production model were presented, using the ASPIC software where the stock was not assumed to be in equilibrium. Input data were catch for the southern California Bight, effort on the primary fishing grounds, and three auxiliary tuning indices. The auxiliary indices were proportion positive for squid in a midwater trawl survey, and proportion positive for squid beaks in California sea lion scats at two separate locations. Assessment authors explained that the auxiliary data were included despite a caveat that the data were suspect and might introduce bias. The CPUE and effort data met a primary assumption for surplus production because CPUE decreased with increasing effort. Also, use of satellite images of lightboats (number of pixels) suggests a good approximation to lightboat effort.

The MSY range for the Southern California Bight was 30,000-60,000 mt. Considerable discussion was given to whether surplus production results from a time series that included obvious habitat response (i.e. El Niño years) was appropriate for estimating MSY. There was a consensus that resulting MSY estimate represented an intermediate or average value across a range of environmental conditions. Such an average MSY estimate would not represent stock conditions in most individual years, and would be impractical for use in year-to-year fisheries management. In response to that concern, the assessment authors informed the Panel that an attempt had been made to estimate MSY with no El Niño years in the data, but the range of results was so wide that they were not useful. There was general agreement that the use of auxiliary indices in the model had the potential benefits, but squid were not rare in some of the auxiliary data and therefore it appeared that the indices might be saturated.

The Panel recommended that the surplus production model be further explored when substantial new data such as a logbook time series become available, with particular attention to: 1) accounting for environmental effects; and 2) transformation of the auxiliary index data. However, the Panel did not request additional surplus production model work by the assessment authors during the meeting because it was thought that their efforts could be better spent investigating more promising harvest control rules in the limited time available.

Some additional approaches to MSY proxies were available from an Environmental Assessment to Amendment 9 of the CPS-FMP (WP5). The data and methods were presented to the Panel with the caveat that these approaches had already been reviewed by the Council's SSC and were not found to provide useable estimates of MSY for market squid. The Panel briefly discussed some of the alternatives in WP5, but did not think that they warranted further investigation at this time. A major concern was that although the approaches were straightforward and easy to understand, they require several tenuous assumptions and do not utilize much of the recently available data on biology, life history, and reproduction.

4.2 Estimation of Mortality Coefficients (Z)

During the Panel meeting, a catch curve was constructed from southern California catch and age data during December 1998 through June 1999. Daily age data were pooled to estimate catch composition by age in months. Log transformed catch at age estimates suggested that full recruitment occurred at age 6 months, and data from age 6-10 months were used to estimate Z. Two approaches for estimating Z resulted in a range of $Z = 0.3\text{-}0.6$ per month. The assessment authors suggested that monthly M is therefore less than 0.6. Considering the atypical life history of market squid, it is unclear if catch curve assumptions about constant

recruitment were violated. Further, and perhaps more importantly, market squid ageing via daily ring counts appears to be problematic after the onset of maturity.

4.3 Leslie-DeLury (Modified Depletion) Model

A Leslie-DeLury depletion model was explored by in WP7, but the results were equivocal. The Panel thought that the approach was not appropriate for market squid at this time, in part because of uncertainty surrounding recruitment. In particular, there do not appear to be any viable recruitment indices currently available. The model would also benefit greatly from improved effort data such as a mandatory logbook time series. The Panel suggested that the model be further explored when such data become available.

4.4 Panel Recommendations on MSY for Market Squid

The Panel concluded that current attempts to estimate MSY were not defendable as a basis for managing the fishery, and there was doubt that technical refinements to this approach would change the determination. Major conceptual problems inherent in applying this approach to market squid remain to be addressed, such as: a life span of less than one year duration; strong environmental effects on availability and/or abundance; potentially biased or saturated auxiliary indices of abundance; harvest centered on terminal spawning grounds; and high variability in recruitment. Although correcting problems in the surplus production approach may be worth pursuing, the Panel believes that a more robust and promising prospect for harvest control rules lies in further investigation and development of spawning escapement targets with respect to SSB/R, along the lines of the data and analyses that were presented as an alternative to MSY (see Section 5, below).

5. Control Rules and Other Management Measures

As discussed in Section 4,above, the concept of MSY as a constant level of catch is problematic for most species, including market squid. The potential policy importance of MSY in management of market squid is heightened because stock assessment models, data and biological reference points to guide management actions under the MSFCMA are lacking. If suitable biological reference points and models were available, they could be used qualitatively (e.g. in making decisions about "active" vs. "monitored only" management) or quantitatively as management targets and management thresholds in overfishing definitions, harvest control rules, calculation of ABC or short-term management of fishing effort.

Approaches based on biological reference points are more effective in terms of maintaining high catches and conservation than trying to manage a fishery towards a static MSY catch level. The panel therefore concentrated on developing approaches for calculating biological reference points, evaluating the probability of overfishing in the current fishery for market squid, developing approaches to collecting data from the fishery for comparison to biological reference points, and in developing conceptual approaches to harvest control rules that might be applicable to market squid.

5.1 Biology and Fishery Considerations

The following are key points (not prioritized) concerning the biology and fishery for market squid are important in considering technical and policy aspects of biological reference points and harvest control rules.

a. In the current fishery, market squid are caught almost entirely while aggregated on spawning grounds. This fact has several important implications:
   i. Landings are almost entirely composed of sexually mature market squid.
   ii. There is little or no fishing mortality on immature individuals.
   iii. Maturity and recruitment to the fishery occur at the same time for market squid living in an area where fishing occurs.

b. Market squid appear to live 6-12 months under natural conditions. Thus, natural mortality rates for market squid are uncertain, but the average lifetime natural mortality rate is much higher than for most finfish. These characteristics have several important implications:
   i. Recruitment and future catches in each year or generation depend on successful and

adequate spawning in each preceding year or generation.

ii. The persistence of the fishery depends entirely on new recruits to the spawning population. The catch is composed entirely of new recruits to the spawning population.

iii. The fishery and stock are potentially sensitive to environmental factors or fishing that might reduce spawner abundance or survival of eggs over short periods of time. However, sensitivity to these factors has not been clearly demonstrated.

c. Market squid are determinate spawners whose potential lifetime fecundity appears to be fixed at maturity. This means that individual market squid would not replace oocytes and eggs after they are spawned.

d. According to the best available information and opinion of experts at the STAR Panel meeting, individual market squid probably die shortly after their potential fecundity is exhausted and spawning is completed. The duration of spawning, number of spawning bouts and time to death for individual spawning market squid are uncertain and possibly variable. Duration of spawning and time to death are believed to be on the order of days to weeks. Longer spawning periods seem less likely but cannot be ruled out completely. Thus, market squid appear to be functionally semelparous with natural mortality rates that are high on average (to account for the short life span). Moreover, natural mortality rates may increase substantially when market squid become sexually mature and recruit to the fishery.

e. Relatively high fishing mortality rates are probably necessary to catch market squid in terminal spawning ground fisheries before they die of natural causes. This characteristic is due to high natural mortality rates in general, and is likely reinforced by increases in natural mortality rate around the time of spawning.

f. There are spawning grounds where no fishing currently occurs. The size of these areas is unknown but may be significant.

g. Discard appears to minor for market squid.

h. Fishing activities are currently prohibited on weekends (29% of the fishing season).

i. Market squid are a valuable fishery.

j. Landings data suggest that availability of market squid to California fisheries is affected strongly during El Niño periods. This may be due to reductions in abundance, to displacement of the stock away from the fishery, or both factors. Presently, data are not available to prove or disprove either hypothesis.

k. With the exception of El Niño periods, market squid have consistently supported high levels of catch over the last twenty years while markets were favorable. Thus, the current level of average catch appears sustainable under current environmental conditions with no El Niño.

l. Availability and markets have changed over time making long-term trends in landing data difficult to understand.

m. Relatively smooth short-term, inter-annual trends in landings data suggests that catch in the market squid fishery tends to be relatively consistent from year to year, with the exception of El Niño periods. The relationship between abundance and catch is uncertain, however, and short-term abundance may be more variable than catch.

n. Recent increases in landings correspond to a period of warm water conditions in the California Current and strong markets. Hypotheses about the climate-induced trends in abundance are difficult to evaluate based on landings data due to changes in markets.

o. The market squid fishery is currently regulated by license moratorium. A limited entry system is under

consideration. These measures may reduce the probability of dramatic increases in fishing effort over the short term.

p. Market squid paralarvae can be taken in plankton nets throughout the year indicating that spawning occurs throughout the year. Birth dates of recruits to the fishery spanned a range of at least eight months during one season of sampling (1998-1999).

5.2 Approaches to Developing Biological Reference Points

Preliminary attempts to estimate biological reference points (MSY, F_{MSY}, and B_{MSY}) from surplus production models were not fruitful (WP7; Section 4, above). In reviewing modeling efforts, the STAR panel noted that stock assessment models should use all available information to the extent possible and that nonlinear relationships between abundance and indices expressed as commercial catch rates or proportions (e.g. proportion mid-water tows positive for market squid) should be considered.

a. Catch rates are often nonlinear for schooling species due to "saturation". The relationship between abundance and catch rates for schooling species is often, for example, expressed as a nonlinear power function $cpue=qB^x$, where cpue is the catch rate, B is market squid biomass, and q and x are parameters. Values of the exponent parameter around x=0.5 are common for pelagic fish.

b. Proportions are nonlinear because they are confined to the range between zero and one. Depending on the frequency of a positive sample, the number of samples and other factors, indices based on proportion positive data (e.g. proportion tows positive for market squid) are often best modeled based on likelihood calculations for binomial or Poisson variables.

In view of difficulties with surplus production models for market squid, and because new information on reproductive biology was available (WP1), the STAR panel focused attention on reference points based on egg escapement, and related concepts. Egg escapement, for example, is the number (or proportion) of a female squid's potential lifetime fecundity that she is able to spawn, on average, before being taken in the fishery.

At least two traditional escapement approaches are potentially useful for squid. The first is based on depletion models and real-time management. This approach has been used in the Falkland Islands for *Illex argentinus* with some success. It attempts to manage a fishery so that some fraction of abundance or spawning biomass (a proxy for egg production) escapes the fishery. Fishing effort, season length and other management measures are established prior to the fishing season, based on data from the previous years and any additional information that might be available (e.g. results from a preseason trawl survey). Once the fishery is opened, catch rates and other data are monitored closely. The fishery is closed if escapement is likely to fall below the management target. Preliminary attempts to fit depletion models to market squid data were not fruitful (WP7; Section 4, above). The market squid fishery is a terminal spawning ground fishery with high natural mortality rates and continuous recruitment of newly matured individuals so that trends in catch rates would be difficult to evaluate. Real time management is data and analysis intensive, and likely not applicable to the market squid fishery at this time because data and modeling resources are limited. For these reasons, the STAR panel does not consider depletion model approaches to be potentially useful for market squid at this time.

The second traditional reference point approach for egg escapement is based on conventional yield- and spawning biomass "per recruit" models used in many other fisheries. The second approach, or variants described below, is more useful for market squid. The idea was proposed in WP8 where preliminary model runs were carried out. Refinements and extensions are in WP9.

The most typical approach is to use a spawning biomass per recruit model to calculate the lifetime spawning biomass expected from an average female recruit to the fishery, at various levels of fishing mortality. Biological reference points based on fishing mortality rates and expected spawning biomass per recruit from model results are chosen by policy makers. A common biological reference point in squid fisheries is F40%, the fishing mortality rate that reduces a females expected lifetime spawning biomass to 40% of the expected value if no

fishing were to occur.

Using new biological information presented for the first time at the STAR Panel meeting, conventional spawning biomass per recruit models for market squid can be parameterized to calculate egg production (egg escapement) over the life of an average female, rather than spawning biomass. Egg production is a better measure of reproductive output than spawning biomass for market squid and most other species.

Information required to fit per recruit models was available from working papers, participants at the STAR panel meeting and published sources. The required information includes estimates of growth (size at age, WP3), natural mortality (WP 3 and 7), maturity and fecundity at age (WP1), and fishery selectivity. The available information was reliable enough for "ballpark" calculations at the STAR Panel meeting. This modelling is documented in WP9.

Market squid biology and the market squid fishery are unique and it was important to configure per recruit models in appropriate ways:

a. Recruitment to the spawning stock (maturity at age) and recruitment to the fishery (fishery selectivity at age) were assumed the same because the fishery operates on spawning aggregations.

b. Mortality rates are extremely high, particularly for spawners, so short time steps (i.e. one day) were used in calculations.

c. Mature individuals (spawners recruited to the fishery) may have a higher natural mortality rate than immature individuals. Therefore, models incorporating potential changes in natural mortality with spawning are required.

d. Average lifetime egg production must be less than the average standing stock of oocytes in newly mature virgin females (WP1).

Two models for calculation of egg escapement per recruit and yield per recruit were used at the STAR panel meeting (see WP9). The models were both based on traditional Thompson and Bell (1934) per recruit calculations. Both per recruit models were run with a range of parameter values to accommodate uncertainty in key parameters. Similar results were obtained using both approaches.

Model 2 had the potential advantage of being more biologically realistic, but the potential disadvantage of greater complexity and the greater cost of requiring estimates for more biological and fishery parameters. Model 1 may be more appropriate given uncertainty about biological and fishery parameters in squid and consequently, this model will be relied upon more heavily in the discussion that follows, However, use of two models allowed the STAR panel to verify calculations and the robustness of conclusions to different model structure.

Based on discussions at the STAR panel meeting, new biological information about fecundity and the possibility of measuring fecundity in port samples, per-recruit models for market squid were modified to calculate standing stock of eggs per female in the catch (SSPF) as a function of fishing mortality (see equations in WP9 and Figure 4 in WP9 for illustration of the concept). There are two novel aspects to this approach: 1) use of fecundity in each age group rather than egg production, and 2) calculations per surviving spawning female rather than per female recruit. In the context of SSPF, "daily fecundity" means the standing stock of eggs and oocytes in the ovary and oviduct at time of capture of spawning female market squid. It is important to distinguish between daily fecundity in the context of SSPF (a measure of the standing stock of eggs and oocytes in female market squid), and daily reproductive output or egg production (a measure of eggs spawned per day) in the context of traditional egg per recruit analysis. SSPF may be more useful than daily egg production for market squid because fecundity can be measured in field samples directly or indirectly using proxies such as mantle condition (WP1).

SSPF is a new concept developed at the STAR meeting, but the idea is analogous to using average size of fish in the catch or population as a measure of fishing mortality (Ricker 1975). For comparison, egg production per recruit was calculated as well. SSPF can be calculated with a few simple modifications to the traditional Thompson and Bell (1934) per-recruit model (WP9 Fig 4). The STAR panel recommends that this approach be explored as the basis of control rules for market squid management.

Status of the Stock Relative to Commonly-Used Reference Points (such as F40%)
F40% has not been established as either a management target or threshold for the market squid fishery. However, it is used as a biological reference point in other fisheries for short-lived squid species and maybe an adequate proxy reference point for a future threshold overfishing definition or management target.

The conclusion, based on sensitivity analysis and other considerations, that current F in the market squid fishery is likely less than F40% (see WP9) is due primarily to high natural mortality rates for spawners and determinate fecundity. Basically, the preliminary sensitivity analysis suggests that natural mortality occurs so quickly that it is difficult for a fishery on the spawning grounds to "keep up" and remove spawners before a substantial fraction of their eggs are spawned. Rapid spawning of a substantial fraction of potential egg production is due, in part, to determinant fecundity in female market squid (eggs are not replaced after spawning). This result is a preliminary and qualitative one, but likely robust given the life history of market squid, current fishing practices, and the results of sensitivity analyses. However, more extensive sensitivity analysis, particularly involving assumptions about daily fecundity, spawning duration and natural mortality rates of mature individuals should be carried out.

It is important to remember that conclusions about the probability that F exceeds F40% in the market squid fishery depend on current fishing practices and, in particular, on the assumptions that almost all fishing occurs on terminal spawning aggregations and that squid are short lived with determinate fecundity. The resilience of the fishery may change significantly if a substantial fishery develops for immature squid.

Finally it should be noted that F40% was used in sensitivity analysis for demonstration purposes only, and is not proposed by the STAR panel as a policy for market squid. The STAR panel did not evaluate the potential suitability of F40%.

6. Conclusions and Recommendations

The analyses carried out during the STAR panel and described more fully in WP9 indicate that average fecundity of market squid from port samples could be compared to reference points from per recruit analysis cast in units of fecundity per spawner (SSPF), if assumptions about determinate spawning are valid, if fecundity in fishery samples can be practically measured, and if the fishery continues to operate on terminal spawning aggregations. There appears to be a direct correspondence between equilibrium fecundity per spawner, equilibrium fishing mortality, and equilibrium egg escapement calculated using per recruit models. The utility of equilibrium reference points seems as valid for market squid as for finfish, where they are commonly used, although this is a topic for future research given the unusual life history of squid. Thus, in principle, it should be possible to find a fecundity based reference point that corresponds to a fishing mortality rate goal or egg escapement goal, and that can be compared to data from samples of catch in the market squid fishery.

The practical problems that still need to be answered include: 1) refinement of biological parameters for per recruit modeling; 2) development of port sampling protocols for measurement of fecundity on a routine basis (e.g. mantle condition samples requiring laboratory analysis will likely be required); 3) evaluation of the precision of reference points and fecundity estimates; and 4) recommendation of options for management target and thresholds in the market squid fishery. Additional consideration and review of the concept of using fecundity samples in stock status determinations for market squid is required because the approach is new and untried. For example, the fecundity-based approach may not provide adequate sensitivity to reliably detect significant changes in stock status in a timely enough manner to implement an appropriate management response. Empirical validation of the performance of this method through several El Niño cycles will be

necessary to document the viability and responsiveness of this new management approach for market squid.

Once biological reference points for management targets and thresholds are specified, conventional control rule approaches for actively managed fisheries could be readily employed. It should be possible to use threshold reference points in defining overfishing for market squid and defining overfished stock conditions. It may be possible to achieve target egg escapement levels by regulating the number of days fished, even in the hypothetical circumstance of very high fishing mortality rates on all spawning grounds. This approach or one based on seasonal closure could, theoretically, make more complex harvest control approach unnecessary. However, socio-economic factors would have to be considered as well. For example, the simple weekend closure presently in place has the advantage of allowing for escapement throughout the fishing season, regardless of year to year variations in spawning timing, and in theory could afford unimpeded escapement of approximately 28% of the full spawning potential annually. As a topic of future research, it is important to determine if control rules for market squid should be adjusted to allow more or less harvest in the face of unusual environmental events (e.g. El Niño), ecosystem factors (predator requirements), unusual stock conditions (e.g. evidence or recruitment failure), or changes in the operation of the current fishery (e.g. fishing on immature market squid). As described above, the most important potential change would be the development of substantial fishing pressure on immature squid.

Operationally, there are a number of approaches to changing fishing mortality in the context of achieving management targets in routine management of an actively managed stock with a control rule (e.g. see WP9, Figure 5). The STAR panel cannot recommend specific measures to increase or decrease fishing mortality. However, the list of candidate measures includes changes to trip limits, changes to the number of boats fishing, changes to the days per week when fishing occurs, changes in the fishing season, or changes in areas where fishing occurs, etc. Many of these examples appear practical and likely to be effective.

In principle, fecundity estimates from port samples might be used to indirectly determine the status of the market squid fishery with respect to F-based biological reference points used as management targets and thresholds in the market squid fishery. However, it would be more desirable to use a modern stock assessment model that incorporated all available data (including catch, fecundity, abundance index trends, etc.) to calculate fishing mortality rates directly for comparison to F-based biological reference points. This will become increasingly important as additional data sources (e.g. logbooks) and new research surveys come online. This type of modelling could also be instrumental in assessing the overall performance of the fecundity-based per recruit management approach, discussed above.

7. Research and Data Needs

A number of questions were raised at the STAR panel meeting as to data requirements for management of the market squid fishery and, in particular, if it is necessary to continue collecting age samples and other data from port samples and logbooks. These important practical questions are closely related to choice of reference points and control rules. However, given uncertainties about the nature of the eventual management approach and likely rapid development of new modeling approaches, it was impossible to provide definite advice. The STAR panel therefore recommends that current fishery data collection procedures be maintained in the near term as appropriate, until management approaches and data requirements become more clearly established or until data needs can be prioritized. Issues related to fishery sampling should be discussed with the full range of stakeholders.

As described above, there are a number of biological parameters with imprecise and uncertain estimates. Many of these parameter estimates are important and could be improved with additional fishery independent surveys, enhanced sampling, and analyses. The most important areas requiring additional work include questions about reproductive biology (a key area of uncertainty) that include potential fecundity of newly mature virgin females, duration of spawning, egg output per spawning bout, temporal pattern of spawning bouts, growth of relatively large immature squid, and growth of mature market squid. Important questions about growth might be addressed through SEM studies of statoliths.

The potential use of target egg escapement levels is partly predicated on the assumption that the spawning which takes place prior to capture is not affected by the fishery and contributes to future recruitment. However, since the fishery takes place directly over shallow spawning beds, it is possible that incubating eggs are disturbed by the fishing gear, resulting in unaccounted egg mortality. It is also possible that the process of capturing ripe squid by purse seine might induce eggs to be aborted, which could also affect escapement assumptions. A comparatively small-scale program to obtain at-sea observations could provide information on the degree to which these concerns are a factor in the fishery.

The CalCOFI ichthyoplankton collections contain approximately 20 years of unsorted market squid specimens that span at least two major El Niños. This untapped resource might be useful in addressing questions about population response to El Niño conditions.

Table 1. Fishery independent and fishery dependent data sources for market squid stock assessment and management.

Fishery Independent Data			
Data Type	**Data Source**	**Coverage**	**Notes**
Midwater trawl survey	Kenny Mais CDFG	Central CA - S. Baja up to 8 times annually 1966-1988	In 2000, CDFG conducted a survey with similar methods Examined by Maxwell (Doc#7) as auxilliary index of abundance for surplus production modeling Summarized by population positive tows
Midwater trawl survey	NMFS-Tiburon	Farralons to Monterey Bay 1987 - present	
Midwater trawl survey	Oregon predator and Salmonid surve	Mouth of Columbia River 1997-1999 to present?	
Midwater trawl survey	NMFS-AFSC Whiting survey		
Sea lion scat data	Lowry and Carretta 1999	San Clemente and San Nicholas Islands 1981 - present	Proportion of scat samples containing squid beaks per calander quarter Examined by Maxwell (Doc# 7) as auxilliary index of abundance for surplus production modellin
ROV transects	CDFG	Fishing grounds in S. CA and Monterey Bay 1999 - present	Sampled known spawning grounds to observe egg case attachment and distribution.
ROV transects	NMFS-SWFSC	Fishing grounds in S. CA, 2000?	Sampled at depths beyond fishing grounds
Paralarval survey	CalCOFI Bill Hamner, UCLA	S. California Bight 1999 - present	Bongo net tows
Bottom Trawl survey	NMFS-AFSC Triennial shelf survey	BC, WA, OR, CA to Point Conception 1977 - present	
Bottom Trawl survey	CDFG Halibut survey		
Power plant impingement			Samples from power plant water intakes
Sanitary district otter trawls			Samples from areas around sewer outfalls
Areal spotter survey	CDFG	Fishing grounds in S. CA	

Fishery Dependent Data			
Data Type	**Data Source**	**Coverage**	**Notes**
Commercial fishery port samples	CDFG	Fishing grounds in CA November 1998 - present	Sexual maturity, age-at-length, species composition, observed bycatch, landings, fecundity
Fishery logbook	CDFG, CA commercial fishery	Fishing grounds in CA November 1998 - present	Effort data, fishing location, bycatch information
Fishery landing receipts	CDFG, CA commercial fishery	Fishing grounds in CA 1929-1980 by port; 1981-present by block	tonnage, price, location, and gear type (1981-present); tonnage by port only (1929-1980)
Satellite imagery	NOAA, CDFG	Fishing grounds in S. CA	Effort data (1992-2000); problematic going forward due to light boat shielding requirements Used in surplus production and Leslie-DeLury modelling.

Appendix A. Terms of Reference

The following terms of reference for the Market Squid STAR Panel were approved by the Pacific Fisheries Management Council at its April 2001 meeting:

[1] Review recent findings on the biology and life history of market squid, including the assessment-related aspects of age and growth, maturity, fecundity, spawning behavior, longevity, habitat, and environment.

[2] Review newly developed fisheries-related data, including catch history, effort data, and port sampling protocols as they relate to estimation of key biological, population parameters.

[3] Review all aspects of MSY estimation, as required by the Magnuson-Stevens Fishery Conservation and Management Act for all FMPs, and address the concept of MSY as it relates to a species that is short-lived and whose abundance/availability is largely environmentally determined.

[4] Consider management measures for market squid, including operationally-practical control rules, long-term monitoring programs, and in-season adjustment mechanisms.

[5] Prepare a report for the SSC detailing the findings of the review, practical management recommendations, and the key research & data needs.

Appendix B. Agenda for the Market Squid Stock Assessment Review (STAR)

Southwest Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, CA 92038
May 14-17, 2001

Monday, May 14th

08:00	Welcome, introductions, and logistics
08:15	Review terms of reference and agenda. Assignment of rapporteurs.
08:30	Presentation of working papers
12:00	Lunch
13:00	Presentation of working papers -- continued
14:30	Discussion of recent biological findings as they relate to stock assessment & management (Section 2 of the STAR Panel Report). Requests for additional information and/or data from working paper authors (as necessary).

Tuesday, May 15th

08:00	Discussion of newly developed fisheries-related data as they relate to stock assessment & management (Section 3 of the STAR Panel Report). Requests for additional information and/or data from working paper authors (as necessary).
10:00	Discussion of MSY estimation for squid and the SFA requirements (Section 4). Requests for additional analysis and/or data from authors (as necessary).
12:00	Lunch
13:00	Discussion of management measures including operationally-practical control rules, long-term monitoring programs, and in-season adjustment mechanisms (Section 5). Requests for additional analysis and/or data from authors (as necessary).
15:00	Review additional data and analyses, as requested from working paper authors.

Wednesday, May 16th

08:00	Review additional data and analyses, as requested from working paper authors.
10:00	Review draft rapporteur's report on biology and life history findings (Section 2).
11:00	Review draft rapporteur's report on fisheries-related data (Section 3).
13:00	Continue review of additional data and analyses, as requested from working paper authors, as necessary.
14:00	Review draft rapporteur's report on MSY estimation (Section 4).
15:00	Review draft of rapporteur's report on control rules & other management measures (Section 5).
16:00	Drafting session for full STAR Panel draft report.

Thursday, May 17th

08:00	Drafting session for full STAR Panel draft report -- continued
10:00	Discussion of research and data needs (Section 6 of the STAR Panel Report).
10:30	Review full STAR Panel draft report.
12:30	Discuss procedures for completion of the final STAR Panel report.
13:00	Adjournment

Appendix C. Working Papers Presented to the Market Squid STAR Panel

WP1 Macewicz, B. J., J. R. Hunter, N. C. H. Lo, and E. L. LaCasella. 2001. Lifetime fecundity of the market squid, *Loligo opalescens. Working Paper 1.*

WP2 Macewicz, B. J., J. R. Hunter, and N. C. H. Lo. 2001. Validation and monitoring of the escapement fecundity of market squid. *Working Paper 2.*

WP3 Butler, J., J. Wagner, and A. Henry. 2001. Age and growth of *Loligo opalescens. Working Paper 3.*

WP4 California Department of Fish and Game (CDFG). 2001. Status of the market squid fishery with recommendations for a conservation and management plan. M. Yaremko (editor). *Working Paper 4.*

WP5 Coastal Pelagic Species Management Team (CPSMT). 2001. Coastal pelagic species fishery management team working review: market squid optimum yield and maximum sustainable yield working plan. *Working Paper 5.*

WP6 Isaac, G., N. Neumeister, and W. F. Gilly. 2001. The effects of temperature on early life stages of the California squid (*Loligo opalescens*). *Working Paper 6.*

WP7 Maxwell, M. R. 2001. Stock assessment models for the market squid, *Loligo opalescens. Working Paper 7.*

WP8 Maxwell, M. R., and P. R. Crone. 2001. Management recommendations for the market squid fishery. *Working Paper 8.*

WP9* Maxwell, M. R. 2001. Reproductive (egg) escapement model and management recommendations for the market squid fishery. *Review Summary Paper.*

* WP9 is a revision of WP8 requested by the STAR Panel to document the analyses carried out during the STAR Panel meeting. The analyses and results contained therein reflect the STAR Panel consensus at the end of its meeting with respect to the most appropriate modelling and management control rules

Appendix D. Participants

Last Name	First Name	Affiliation	
Amoroso	Orlando	San Pedro Purse Seine Vessel Owners	May 17 only
Barnes	Tom	CDFG, La Jolla	
Butler	John	SWFSC, NMFS	
Conser	Ray	SWFSC, NMFS	
Crone	Paul	SWFSC, NMFS	
Garrison	Karen	NRDC, San Francisco	May 15 only
Henry	Annette	CDFG, La Jolla	
Herrick	Sam	SWFSC, NMFS	
Hill	Kevin	CDFG, La Jolla	
Hunter	John	SWFSC, NMFS	
Jacobson	Larry	NEFSC, NMFS – Woods Hole, MA	
Jagielo	Tom	WDFW, Olympia, WA	
Klingbeil	Rick	CDFG, Los Alamitos	May 15 & 17
Lo	Nancy	SWFSC, NMFS	
Lutz	Steven	USC	
Maxwell	Mike	UCSD, Scripps Institution of Oceanography	
Munro	Heather	Munro Consulting	
Oliver	Chuck	SWFSC, NMFS	May 14-15
Smith	Paul	SWFSC, NMFS	
Vetter	Russ	SWFSC, NMFS	May 14 only
Wagner	John	UCSD, Scripps Institution of Oceanography	May 14 only
Wertz	Steve	CDFG, Los Alamitos	May 14 only
Yaremko	Marci	CDFG, La Jolla	

APPENDIX G: CPSMT REPORT - RECOMMENDATIONS FOR MARKET SQUID MANAGEMENT AND RESEARCH

Exhibit H.2.b
CPSMT Report
November 2001

Recommendations for Market Squid Management and Research

Coastal Pelagic Species Management Team

Preface

The Coastal Pelagic Species Management Team (CPSMT) convened from August 14-15, 2001 to address management and research issues associated with the market squid (*Loligo opalescens*) resource off the California coast. The overall goal of this CPSMT meeting was to review information generated from the recently conducted Stock Assessment Review (STAR) session for squid held in May 2001. Specifically, the CPSMT focused on the following objectives during the two-day meeting: (1) develop consensus regarding important points concluded in the STAR Panel's Report; (2) determine if the suite of model configurations based on the *Egg Escapement* (EE) method could be further reduced into a tractable subset (Maxwell 2001); (3) further evaluate important parameters of the EE approach (e.g., population 'threshold' levels) in efforts to establish maximum sustainable yield (MSY)-based management schemes; and (4) develop sampling, laboratory, and analysis schedules that support the EE approach in particular, and also discuss the merits of gathering auxiliary data that would improve understanding of squid population dynamics. The following synopsis presents the CPSMT's recommendations.

Summary

First and foremost, the CPSMT generally supports the findings of the STAR Panel and in particular, its conclusion that the EE method can provide an effective framework for monitoring/managing the squid population in the future (see objective (1) in Preface). That is, the current port sampling program implemented by the California Department of Fish and Game (CDFG), along with newly developed laboratory and analysis procedures conducted by the National Marine Fisheries Service (Southwest Fisheries Science Center, SWFSC), will provide an objective method for establishing Maximum Sustainable Yield (MSY)-based management goals for the squid resource, e.g., for developing biological reference points. In practical terms, the EE approach can be used to evaluate the effects of fishing mortality (F) on the spawning potential of the stock and in particular, to examine the relation between the stock's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}). However, it is important to note that this approach does not provide estimates of historical or current total biomass and thus, a definitive yield (i.e., quota or Acceptable Biological Catch) cannot be determined at this time. Ultimately, the EE approach can be used to assess whether the fleet is fishing above or below an a priori-determined sustainable level of exploitation and in this context, can be used as an effective management tool. Reasons for adopting the EE method for monitoring/managing the squid population, rather than other analytical approaches (e.g., surplus production and depletion models), are presented in STAR (2001).

A critical underpinning of this recommendation is that the fishery continues to concentrate strictly on squid spawning grounds–the fishing fleet attracts mature squid using lights deployed during the evening hours. This *spawning-grounds* squid fishery appears to have the following characteristics: (1) historically, harvests have consisted almost entirely of mature animals that have had an opportunity to spawn, i.e., lay some or all of their eggs before capture; (2) recruitment and future catches in each fishing season largely depend on successful and adequate spawning in the preceding season; (3) the squid are determinate spawners, with potential lifetime fecundity fixed at maturity; (4) the squid die soon after laying their full complement of eggs, i.e., semelparous reproduction; and (5) interpretable, anatomical evidence of spawning must be able to be estimated from commercial harvest data, which can be routinely collected through an ongoing port sampling program. The fact that evidence of spawning can be derived from commercially landed specimens offers a unique opportunity to implement an EE method for fishery monitoring/management. Ultimately, estimates of past spawning, coupled with per-recruit analysis theory, can provide the necessary statistics for determining the relationships between important equilibrium-based fishery descriptors, e.g., for determining how fishing mortality (F) influences residual eggs at time of capture, eggs per recruit, and EE.

Although the CPSMT is supportive of such an approach for this fishery and recommends beginning efforts for its implementation, there still exist areas of uncertainty that would greatly benefit from further evaluation. In this regard, the following areas of squid biology are only generally understood at this time and thus, were treated through 'sensitivity' analysis at the modeling stage: (1) maturation rate; (2) duration of spawning; (3) egg-laying rate; and (4) natural mortality rate.

The CPSMT recommends that the squid resource be formally reviewed again in 2004. Thus, a research/management sequence should be started for completion by early 2004. Important areas of work include: (1) rigorous monitoring of the landed catch for the occurrence of immature squid; (2) collection of fishermen logbook data that will allow changes in fishing techniques and success to be accurately measured;

and (3) initiating studies that shed light on areas of squid biology still unresolved (see above). An extensive research/management list is presented in Maxwell (2001) and summarized in STAR (2001).

Finally, the following discussion (see Additional Notes) addresses pertinent decisions made by the CPSMT to develop a workable monitoring/management plan for the squid fishery based on the EE method, i.e., the STAR Panel (STAR 2001) provided general recommendations regarding analytical methods and left determination of specific model configurations and other management-related parameters to the CPSMT.

Additional Notes

The following discussion briefly describes technical decisions made by the CPSMT regarding the squid stock assessment conducted in 2001 in general and the EE method in particular (see Maxwell 2001). The discussion is partitioned into four general areas: (1) selection of a 'preferred' model scenario; (2) selection of a 'threshold' level of egg escapement (EE value) that can be considered a warning flag when tracking the status of the population; (3) fishery operations in (and after) El Niño/Southern Oscillation (ENSO) events; and finally, (4) necessary management-related constraints.

Preferred Model Scenario

The CPSMT largely relied on researchers familiar with squid biology to identify a 'preferred' (most plausible) model scenario from the suite proposed in the overall analysis. First, given that *model version 1* was the more general of the two proposed versions and adequately captured what is known (at this time) regarding the maturation schedule of this species, the CPSMT recommended that this version be focused on when deriving final estimates. Further, two important areas of squid biology that were treated in sensitivity analysis during modeling exercises included hypothesized rates of natural mortality (M) and egg laying (v). The CPSMT recommended that the preferred model scenario be based on $M = 0.15$ and $v = 0.45$ (both are daily rates), given: (1) data on the energetics of egg production and longevity of sexually mature adults indicate higher values of M are more likely than lower values; and (2) anatomical examinations of reproductive organs of young spawning females support egg-laying rates that are roughly equivalent to $v = 0.45$. It is important to note that rates of natural mortality (M), as well as fishing mortality (F), are generally believed to be much higher for this marine animal than that estimated for species of fish; however, mortality associated with squid should be interpreted in the context of this species' life history strategy, namely, it's relatively short life span and associated high productivity.

Threshold Level of Egg Escapement

A 'threshold' level of egg escapement can be practically interpreted as a level of 'reproductive' (egg) escapement (EE) that is believed to be at or near a minimum level that is considered necessary to allow the population to maintain it's level of abundance into the future (i.e., allow for 'sustainable' reproduction year after year). It is important to note that a threshold level of egg escapement applicable to this species is not known in strict terms at this time (and likely not a fixed value on an annual basis), but rather, determined from evaluating general patterns of harvest observed in the squid fishery off California, as well as examining similar reference points relied upon in other squid fisheries as approximate guidelines. The CPSMT recommended that a threshold value of 0.3 (30%) be used initially, given: (1) a reproductive escapement threshold of roughly 0.4 (40%) has been used effectively in other squid fisheries (e.g., Falkland Islands fishery)–keeping in mind that the Falkland Island fishery harvests primarily juveniles; (2) not all of the squid spawning grounds off the California coast are subject to fishing pressure; (3) an existing weekend closure allows two days per week for spawning in the absence of fishing; and (4) the daily mortality of females during spawning is likely quite high.

Given the reasons above, it is certainly possible that a more appropriate threshold level is even lower than 0.3; however, the CPSMT does not recommend a lower level of egg escapement, given: (1) this is a new approach that should be monitored for some time before adopting a lower threshold; (2) there are some uncertainties about the retention of eggs in the females after capture; (3) there may be unevaluated fishery-dependent sources of mortality after spawning, such as fishing gear destruction of egg beds; (4) squid are members of a lower animal trophic level of the marine ecosystem and thus, play an important role as a forage species utilized by animals at higher trophic levels; and (5) sample data indicate that it is not likely that the recommended threshold will hamper the operations of the fishery as observed since the mid 1990s.

ENSO Events

The CPSMT deferred consideration of the effects of ENSO conditions on the squid population and ultimately, the fishery itself, until studies that focus on the influence of such oceanographic phenomena on squid abundance and distribution generate useful management advice. A consistent observation during such events is a temporary cessation of availability to the fishery. Although researchers generally believe this 'disappearance' is due to both reduced reproduction by the population and movement out of the established spawning grounds and into favorable habitat, the extent and magnitude of each response are not clearly defined at this time. Most importantly, there is no indication from the post-ENSO landings of long-term detrimental damage to the population's ability to sustain itself, i.e., the population has recovered relatively quickly following El Niño events. Although catches by the fleet dramatically decline during such periods and in effect, 'self-regulate' the fishery, the CPSMT cautioned that further restrictions on catch may be warranted in the future, given the broad impact that these oceanographic conditions have on many marine animal populations distributed along the U.S. Pacific coast.

Monitoring and Management Issues

Most importantly, the CPSMT concurred with the STAR Panel that the current squid fishery should remain under the immediate jurisdiction of the state of California (i.e., CDFG)–keeping in mind the federal-based policies inherently in place for all U.S.-based fisheries. The newly adopted EE method should be considered a joint effort between the CDFG and NMFS (see Summary above). Additionally, sample data (e.g., catch-related statistics) are currently being collected by the Oregon Department of Fish and Wildlife (ODFW) and the Washington Department of Fish and Wildlife (WDFW), with the possibility that in the future, ODFW and WDFW, along with CDFG, may assist in collection of information directly related to the EE method.

The CPSMT recognized that the management measures already in place by the CDFG for the squid fishery are effective tools for controlling the amount of fishing pressure exerted on the population, e.g., weekend closures and protected (no fishing) areas along the coast. In this regard, the CPSMT recommended that management-related exercises that may be needed in the future (via the EE method, e.g., falling below a threshold of 0.3) be implemented by the CDFG using similar, but somewhat more rigorous, regulations as those in place currently. Finally, the CPSMT strongly recommended that the recent CDFG-proposed annual landings cap on the total harvest of squid be supported. This management measure should not be considered a trivial constraint, given many of the conclusions drawn from the overall squid assessment were based on past fishing practices of the fleet and the dynamics of the population may indeed change if subjected to uncharacteristically high catches (also, see *spawning grounds* squid fishery in Summary above for related point).

References

Maxwell, M. R. 2001. Reproductive (egg) escapement model and management recommendations for the market squid fishery. Summary Paper from *Stock Assessment Review (STAR)* Meeting, NOAA/NMFS/SWFSC, May 14-17, 2001. 27 p.

Stock Assessment Review (STAR) Panel. 2001. Report of the Stock Assessment Review (STAR) panel for market squid. Panel Report from *Stock Assessment Review (STAR)* Meeting, NOAA/NMFS/SWFSC, May 14-17, 2001. 18 p.

APPENDIX H: STATE OF CALIFORNIA CODE AND REGULATIONS PERTAINING TO MARKET SQUID

STATE OF CALIFORNIA - FISH AND GAME CODE
DIVISION 6. FISH
PART 3. COMMERCIAL FISHING
CHAPTER 2. PARTICULAR VARIETIES OF FISH
ARTICLE 9.7 MARKET SQUID

SECTION 8420-8429.7

§8420. (a) The Legislature finds and declares that the fishery for market squid (Loligo opalescens) is the state's largest fishery by volume, generating millions of dollars of income to the state annually from domestic and foreign sales. In addition to supporting an important commercial fishery, the market squid resource is important to the recreational fishery and is forage for other fish taken for commercial and recreational purposes, as well as for marine mammals, birds, and other marine life. The growing international market for squid and declining squid production from other parts of the world has resulted in an increased demand for California market squid, which, in turn, has led to newer, larger, and more efficient vessels entering the fishery and increased processing capacity.

(b) The Legislature finds that the lack of research on market squid and the lack of annual at-sea surveys to determine the status of the resource, combined with the increased demand for, and fishing effort on, market squid could result in overfishing of the resource, damaging the resource, and financially harming those persons engaged in the taking, landing, processing, and sale of market squid.

(c) The Legislature further finds that some individuals, vessels, and processing plants engaged in the market squid fishery have no other viable alternative fisheries available to them and that a decline or a loss of the market squid resource would cause economic devastation to the individuals or corporations engaged in the market squid fishery.

(d) The Legislature declares that to prevent excessive fishing effort in the market squid fishery and to develop a plan for the sustainable harvest of market squid, it is necessary to adopt and implement a fishery management plan for the California market squid fishery that sustains both the squid population and the marine life that depends on squid.

(e) The Legislature finds that a sustainable California market squid fishery can best be ensured through ongoing oversight and management of the fishery by the commission. With regard to the market squid fishery, the Legislature urges that any limited entry component of a fishery management plan, if necessary, should be adopted for the primary purpose of protecting the resource and not simply for the purpose of diminishing or advancing the economic interests of any particular individual or group.

§8420.5. North of a line extending due west magnetic from Point Conception, market squid may be taken for commercial purposes only between noon on Sunday and noon on Friday of each week.

§8421. (a) On or after April 1, 1998, no person shall use a vessel to take or land market squid with dip nets (commonly referred to as scoop nets), purse seine nets, or lampara nets for commercial purposes unless the owner of that vessel has been issued a commercial market squid vessel permit by the department that has not been suspended or revoked.

(b) A commercial market squid vessel permit shall be issued only for vessels employing dip, purse seine, or lampara nets for the taking of market squid for commercial purposes. No permit is required for any vessel taking or landing market squid for commercial purposes if the amount taken by the vessel does not exceed two tons landed in a calendar day or if the squid taken is used for live bait only. No other nets shall be used for the taking of market squid from a vessel for commercial purposes. Furthermore, it is unlawful to possess in excess of two tons of incidentally taken squid per trip.

(c) A commercial market squid vessel permit shall be issued to a person only if that person is the owner of record of the commercial fishing vessel for which the permit is issued and the vessel is registered with the department pursuant to Section 7881.

(d) A commercial market squid vessel permit shall be issued only to the person who owns the vessel at the time of application for that permit. For purposes of this subdivision, an owner includes any person who has a lease-purchase agreement for the purchase of a vessel.

(e) No person who is issued a commercial market squid vessel permit shall sell, trade, or transfer the permit to another person.

(f) A commercial market squid vessel permit shall be issued annually, commencing with the permit for the 1998-99 permit year.

(g) A violation of this section does not constitute a misdemeanor; however, pursuant to Section 7857, the commission may revoke or suspend the commercial market squid vessel permit or commercial fishing

license held by any person who violates this section.

(h) Squid landed in excess of the limit specified in subdivision (b) of Section 8421 without a permit shall be forfeited to the department by the signing of an official release of property form. The squid shall be sold or disposed of in a manner to be determined by the department. The proceeds from all sales shall be paid into the Fish and Game Preservation Fund.

§8421.5. If a commercial market squid vessel permit is issued for a vessel that is owned by a bona fide partnership or corporation, that partnership or corporation shall designate the individual who is the operator and shall provide that information to the department annually at the time of issuing the permit. If there is a dissolution of the partnership or the corporation, the partnership or corporation shall notify the department of the name of the partner or shareholder who is the successor permitholder and the department shall reissue the permit to that partner or shareholder.

§8422. (a) The fee for a commercial market squid vessel permit shall be four hundred dollars ($400).

(b) All applications for a commercial market squid vessel permit for the 1998-99 permit year shall be received by the department on or before April 30, 1998, or, if mailed, shall be postmarked by April 30, 1998. In order to renew a permit, an applicant shall have been issued a commercial market squid vessel permit in the immediately preceding year. Applications for renewal of the permit shall be received by the department on or before April 30 of each year, or, if mailed, shall be postmarked by April 30 of each year.

(c) Notwithstanding Section 7852.2, a penalty of two hundred fifty dollars ($250) shall be paid in addition to the fee required under subdivision (a) for applications that do not meet the deadline specified in subdivision (b) but that are received by the department on or before May 31 of any year.

(d) The department shall deny all applications received after May 31 of each year, and the application shall be returned to the applicant who may appeal the denial to the commission. If the commission issues a permit following an appeal, it shall assess the late penalty prescribed by subdivision (c).

§8423. (a) No person shall operate a squid light boat unless the owner of the boat has been issued a commercial squid light boat owner's permit by the department and a permit number is affixed to the boat in the manner prescribed by the department.

(b) The department shall issue a commercial squid light boat owner's permit to a person who submits an application, pays the permit fee, and meets the other requirements of this section.

(c) The department may regulate the use of squid light boats consistent with the regulations established for commercial squid vessels.

(d) For the 2002-03 permit year, the fee for a commercial squid light boat owner's permit is four hundred dollars ($400).

(e) It is unlawful for a person to engage in the following activities, unless the vessel used for the activity has been issued a commercial market squid vessel permit or the person holds a commercial squid light boat owner's permit:

(1) Attracting squid by light displayed from a vessel, except from a vessel deploying nets for the take, possession, and landing of squid or except from the seine skiff of the vessel deploying nets for the take, possession, and landing of squid.

(2) Attracting squid by light displayed from a vessel whose primary purpose is other than the deployment, or assistance in the deployment, of nets for the take, possession, and landing of squid.

(f) A commercial squid light boat owner's permit shall be issued to a person who is the owner of record of a vessel that is registered with the department pursuant to Section 7881. For purposes of this subdivision, an owner includes any person who has a lease-purchase agreement for the purchase of a vessel.

(g) No person who is issued a commercial squid light boat owner's permit shall sell, trade, or transfer the permit to another person.

§8423.5. (a) All applications for a commercial squid light boat owner's permit for the 1998 permit year shall be received by the department on or before April 30, 1998, or, if mailed, shall be postmarked by April 30, 1998. In order to renew a permit, an applicant shall have been issued a commercial squid light boat owner's permit in the immediately preceding year. Applications for renewal of the permit shall be received by the department on or before April 30 of each year, or, if mailed, shall be postmarked by April 30 of each year.

(b) Notwithstanding Section 7852.2, a penalty of two hundred fifty dollars ($250) shall be paid in addition to the fee required under subdivision (a) for applications that do not meet the deadline specified in subdivision (b) but that are received by the department on or before May 31 of any year.

(c) The department shall deny all applications received after May 31 of each year, and the application shall be returned to the applicant who may appeal the denial to the commission. If the commission issues a

license following an appeal, it shall assess the late penalty prescribed by subdivision (b).

§8424. (a) No person shall purchase squid from a vessel or vessels unless that person holds a license issued pursuant to Section 8032 or 8033, employs a certified weighmaster, and the facilities operated by the person are located on a permanent, fixed location.

(b) Notwithstanding any other provision of law, this section shall not apply to the transfer at sea of squid for live bait in an amount less than 200 pounds in a calendar day.

§8425. (a) On or before December 31, 2002, the commission, after consideration of the report and recommendations prepared by the department pursuant to subdivision (c) of Section 8426, and, after public hearings, shall adopt a market squid fishery management plan and regulations to protect the squid resource and manage the squid fishery at a level that sustains healthy squid populations, taking into account the level of fishing effort and ecological factors, including, but not limited to, the species' role in the marine ecosystem and oceanic conditions. The management plan shall be consistent with the requirements of Part 1.7 (commencing with Section 7050). Development of the plan shall be coordinated with the federal Coastal Pelagic Species Fishery Management Plan.

(b) On and after January 1, 2002, the commission shall manage the squid fishery in accordance with the requirements of Part 1.7 (commencing with Section 7050).

§8426. (a) The director shall be responsible for the development of research protocols and the development of recommendations for the management of the squid fishery as set forth in subdivision (c) and for the conduct of public hearings to receive information on the resource and the fishery. The director may establish a Squid Research Scientific Committee consisting of persons with scientific knowledge or expertise on the squid resource or fishery, who may be employed by academic institutions, public or private research institutions, or the private sector. The committee, if established, shall assist in the development of research protocols and the preparation and review of the market squid conservation and management plan as described in subdivision (c). The department shall pay, from revenues derived pursuant to this article, the necessary costs of the committee, including a per diem to all members, as determined by the department.

(b) The director may establish a Squid Fishery Advisory Committee consisting of members representing licensed squid fishermen, squid processors, the recreational fishing industry, squid light boat owners, marine conservation organizations, and the Sea Grant Marine Advisory Program.

(c) The director shall hold public hearings to take testimony on interim measures, squid research needs, and the development of the management recommendations to be included in the report to the Legislature. Notwithstanding Section 7550.5 of the Government Code, on or before April 1, 2001, in consultation with the Squid Fishery Advisory Committee, if established, and following public hearings, the director shall submit to the Legislature a report on the status of the market squid fishery with recommendations for a market squid conservation and management plan, including, but not limited to, the following information:

(1) Whether a limited access plan to manage the amount of fishing effort in the market squid fishery is necessary and, if so, what criteria should be used to determine who may participate in the fishery, what the optimum number of vessels should be in the fishery, and the overall fleet capacity.

(2) Whether it is necessary or advisable to reduce the number of days of the week that market squid may be taken for commercial purposes in specified areas of the state to protect the squid resource.

(3) Whether there are areas, if any, that should be declared harvest replenishment areas for squid where the taking of squid would not be permitted.

(4) A research and monitoring program of the market squid resource as may be needed to assist in the management of the market squid fishery to assure sustainable harvests on an annual basis and funding for that program.

(5) The regulation of squid light boats.

(6) Coordination that may be necessary with a federal coastal pelagic species management plan, should one be adopted.

(7) Whether it is necessary or advisable to modify the method of take or the use of fishing gear.

§8427. (a) A commercial market squid vessel permit issued pursuant to Section 8422 or a commercial squid light boat owner's permit issued pursuant to Section 8423 may be transferred to another vessel owned by the permitholder, if the vessel is of comparable capacity as determined by United States Coast Guard documentation papers, and only if the permitted vessel was lost, stolen, destroyed, or suffered a major mechanical breakdown.

(b) The department shall not issue a permit for a replacement vessel if the permitted vessel was reported as lost, stolen, destroyed, or damaged for fraudulent purposes.

(c) Only the permitholder at the time of the loss, theft, destruction, or mechanical breakdown of the vessel may apply for the transfer of the vessel permit. Proof that a vessel is lost, stolen, or destroyed shall be in the form of a copy of the report filed with the United States Coast Guard or any other law enforcement agency or fire department investigating the loss.
(d) The vessel owner shall submit an application for the transfer to the department on a form provided by the department and shall pay a nonrefundable transfer fee of two hundred fifty dollars ($250) for each transfer of a market squid vessel permit or a commercial squid light boat owner's permit.
(e) The permit for the permitted vessel shall be current, and the owner of the permitted vessel shall make assurances in the transfer application that any renewal of the permit which becomes due during the application processing period will be made.
(f) The owner of the permitted vessel shall submit evidence with the transfer application sufficient to establish that he or she is the owner of the permitted vessel and the owner of the replacement vessel at the time of the application for transfer.
(g) The vessel owner shall sign the transfer application under penalty of perjury and shall certify that the information included in the application is true to the best of his or her knowledge and belief.

§8428. Commencing April 1, 2003, and annually thereafter, the fees for a commercial market squid vessel permit and for a commercial squid light boat owner's permit shall be established by the commission. The total amount of fees collected pursuant to this section, including any revenue derived from any other appropriate source, as determined and allocated by the commission, shall not exceed the department's and the commission's costs for managing the market squid fishery pursuant to Section 8425. The fees collected pursuant to this article shall be used only for the management of the market squid fishery pursuant to Section 8425.

§8429. Any statement made to the department, orally or in writing, relating to a permit issued under this article, shall be made under penalty of perjury. The commission shall revoke the commercial fishing license, the commercial boat registration of any vessel, and, if applicable, any licenses issued pursuant to Section 8032, 8033, or 8034 that are held by any person submitting material false statements, as determined by the commission, for the purpose of obtaining a commercial market squid vessel permit or a commercial light boat owner's permit.

§8429.5. Notwithstanding any other provision of law, nothing in this article shall prohibit or otherwise limit the authority of the director or the commission under any other law.

§8429.7. Sections 8420.5 to 8423.5, inclusive, and Sections 8426 and 8427 shall become inoperative upon the adoption by the commission of a market squid fishery management plan and the adoption of implementing regulations pursuant to Section 8425, and are repealed six months thereafter.

CALIFORNIA CODE OF REGULATIONS
TITLE 14. NATURAL RESOURCES
Division 1. Fish and Game Commission--Department of Fish and Game

§149. Commercial Taking of Market Squid.

(a) Fishing days. North of a westerly extension of the United States -- Republic of Mexico boundary line, market squid may not be taken for commercial purposes between 1200 hours (noon) on Friday and 1200 hours (noon) on Sunday of each week. This regulation applies to vessels catching squid or attracting squid with lights for the purpose of catching. This regulation does not apply to vessels pursuing squid for live-bait purposes only.

(b) Records. Pursuant to Section 190 of these regulations, any person who possesses a valid market squid vessel permit or squid light boat owners permit shall complete and submit an accurate record of his/her squid fishing/lighting activities on a form (Market Squid Vessel Logbook - DFG 149a (4/99), or Market Squid Light Boat Logbook - DFG 149b (4/99), which are incorporated by reference herein) provided by the department, as appropriate to the type of fishing activity.

(c) Maximum Wattage. Each vessel fishing for squid or lighting for squid will utilize a total of no more than 30,000 watts of lights to attract squid at any time.

(d) Light Shields. Each vessel fishing for squid or lighting for squid will reduce the light scatter of its fishing operations by shielding the entire filament of each light used to attract squid and orienting the illumination directly downward, or providing for the illumination to be completely below the surface of the water.

(e) Seasonal Harvest Guideline. For the period from April 1 through March 31 of the following year, a total of not more than 125,000 short tons of market squid may be taken by vessels permitted under Section 8421 of the Fish and Game Code, with the fishery closure implemented as follows:

(1) The department shall estimate, from the current trend in landings, when the market squid harvest guideline will be reached, and will publicly announce the effective date of closure of the directed fishery on VHF/channel 16 between the hours of 10:00 p.m. and 12:00 a.m. (midnight). It shall be the responsibility of all operators of permitted market squid vessels to monitor VHF/channel 16 to determine when the harvest guideline is expected to be reached and the fishery closed. Any announcement issued or made by the department on VHF/channel 16 shall constitute official notice.

(2) Whenever the market squid harvest guideline has been reached, market squid may be taken for commercial purposes until April 1 only pursuant to Section 8421(b) of the Fish and Game Code.

APPENDIX I: AMENDED CPS FMP

The following text incorporates the actions embodied in Amendment 10 into the Coastal Pelagic Species Fishery Management Plan. Amended text is denoted by **bold** where text has been added and ~~strikeout~~ where text has been deleted. In addition, section 5.2.1 of the CPS FMP contained an errant definition of the northern fishery segment. A technical correction was made to this section.

TABLE OF CONTENTS

1.0 INTRODUCTION

Amendment 8 updates the fishery management plan (FMP) for northern anchovy to manage the entire coastal pelagic species (CPS) fishery along the West Coast of the United States, including Pacific sardine, northern anchovy, Pacific (chub) mackerel, jack mackerel, and market squid. The amendment also changes the name of the plan from the *Northern Anchovy Fishery Management Plan* to the *Coastal Pelagic Species Fishery Management Plan.* Stocks and fisheries are described in Appendix A. All options considered by the Council and analysis of those options is in Appendix B. Costs involved in this FMP are estimated in Appendix C. Essential fish habitat is described in Appendix D. References are included in Appendix E.

1.1 History of the Fishery Management Plan

The Council initiated the development of the FMP for northern anchovy in January of 1977. A final draft of the plan was approved and submitted to the U.S. Secretary of Commerce (Secretary) in June of 1978. Regulations implementing the FMP for northern anchovy were published in the *Federal Register* on September 13, 1978. Subsequently, the Council has considered seven amendments.

The first amendment changed the method of specifying the domestic annual harvest for northern anchovy and added a requirement for an estimate of domestic processing capacity and expected annual level of domestic processing. Approval for this amendment was published in the *Federal Register* on July 18, 1979.

The second amendment, which became effective on February 5, 1982, was published in the *Federal Register* on January 6, 1982. The purpose of this amendment was to increase the domestic fishing fleet's opportunity to harvest the entire optimum yield (OY) of northern anchovy from the U.S. exclusive economic zone (EEZ).

During the spring of 1982, the Council considered a third amendment that divided the quota for northern anchovy into two halves and made release of the second half conditional on the results of a mid-season review of the status of the stock. The methods proposed for the mid-season assessment were considered too complex to implement, and the amendment was not approved.

The fourth amendment, which had two parts, was published in the *Federal Register* on August 2, 1983 and became effective on August 13, 1983. The first part abolished the five-inch size limit in the commercial fishery and established a minimum mesh size of 5/8 inch for northern anchovy. The mesh size requirement did not become effective until April 1986 in order to give the fleet additional time to comply without undue economic hardship. The second part established a mid-season quota evaluation that was simpler in design than the method proposed in Amendment 3.

The fifth amendment in 1983 incorporated advances in scientific information concerning the size and potential yield of the central subpopulation of northern anchovy. In addition, the fifth amendment included changes to a variety of other management measures. Two or more alternative actions were considered in each of seven general categories (1) OY and harvest quotas; (2) season closures; (3) area closures; (4) quota allocation between areas; (5) the reduction quota reserve; (6) minimum fish size or mesh size; and (7) foreign fishing and joint venture regulations. The alternatives for the fifth amendment were reviewed by the Council during 1983. The final rule on the fifth amendment measures was published in the *Federal Register* on March 14, 1984.

The sixth amendment in 1990 implemented a definition of overfishing for northern anchovy consistent with National Standard 7 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

The Council began developing the seventh amendment as a new FMP for CPS in 1990. A complete draft was available in November of 1993, but the Council suspended further work, because NMFS withdrew support due to budget constraints. In July of 1994, the Council decided to proceed with the plan through the public comment period. NMFS agreed with the decision on the condition that the Council also consider the options of dropping or amending the anchovy FMP. Thus, four principal options were considered for managing CPS (1) drop the anchovy FMP (no federal or Council involvement in CPS); (2) continue with the existing FMP for anchovy (status quo); (3) amend the FMP for northern anchovy; and (4) implement an FMP for the entire CPS fishery. In March of 1995, after considering all four principal options, the Council decided

to proceed with the FMP for CPS. Final action was postponed until June 1995 when the Council adopted a draft plan that had been revised to address comments provided by NMFS and the Scientific and Statistical Committee (SSC). Amendment 7 was submitted to the Secretary, but rejected by NMFS Southwest Region as being inconsistent with National Standard 7 of the Magnuson-Stevens Act. NMFS announced its intention to drop the FMP for northern anchovy (in addition to FMPs for other species) in the *Federal Register* on March 26, 1996, but the action was never completed.

Development of Amendment 8 began during a June 23-25, 1997 Council meeting where the Council directed the Coastal Pelagic Species Plan Development Team (CPSPDT) to amend the FMP for northern anchovy to conform to the recently revised Magnuson-Stevens Act and to expand the scope of the FMP to include the entire CPS fishery.

1.2 Fishery Management Unit

Stocks managed under this FMP include:

Common Name	Scientific Name
Pacific sardine	*Sardinops sagax*
Pacific (chub) mackerel	*Scomber japonicus*
Northern anchovy	*Engraulis mordax*
Central and northern subpopulations	
Market squid	*Loligo opalescens*
Jack mackerel	*Trachurus symmetricus*

Stocks may be added or removed from the management unit through the framework process described in Section 2.0.

1.3 Categories of Management

The CPS FMP includes two management categories for CPS fish stocks: "Active" management and "Monitored" management. "Active" is for stocks and fisheries with biologically significant levels of catch, or biological or socioeconomic considerations requiring relatively intense harvest management procedures. The second category, "Monitored", is for stocks and fisheries not requiring intensive harvest management and where monitoring of landings and available abundance indices are considered sufficient to manage the stock.

The purpose of Active and Monitored management is to use available agency resources in the most efficient and effective manner while satisfying goals and objectives of the FMP. The distinction enables managers and scientists to concentrate efforts on stocks and segments of the CPS fishery that need greatest attention or where the most significant benefits might be expected.

Active management may be characterized by periodic stock assessments, and/or periodic adjustments of target harvest levels based on maximum sustainable yield (MSY) control rules. Monitored management, in contrast, involves tracking trends in landings and qualitative comparison to available abundance data, but without periodic stock assessments, or periodic adjustments to target harvest levels. Species in both categories may be subject to management measures such as catch allocation, gear regulations, closed areas, closed seasons, or other forms of Active management.

Explicit MSY control rules, definitions of overfishing and overfished stocks must be developed for all Actively managed species. Monitored management, in contrast, may use "generic" or general definitions of overfishing and overfished stocks that do not have specific fishing mortality or biomass cutoffs. Essential fish habitat (EFH) must be described for all stocks in the management unit, including Actively managed and Monitored species.

The Coastal Pelagic Species Management Team (CPSMT) will review all CPS stocks annually and make recommendations to the Council and agencies regarding appropriate management categories for each stock ("Active" or "Monitored"). Changes to the appropriate management category for each species can be made annually by the Council based on all available data, including acceptable biological catch (ABC) levels and MSY control rules, and the goals and objectives of this FMP. Changes in a management category may be

accomplished according to any of the four procedures for establishing and adjusting management measures described below in Section 2.0. In addition, CPS in the Monitored management category can be reassigned to Active management on short notice under the point-of-concern framework.

1.4 Operational Definitions of Terms

Actively managed species (AMS) means CPS the Secretary has determined to require federal management by harvest guideline or quota according to the provisions of the FMP.

Biomass means the estimated amount, by weight, of a CPS population. The term biomass means total biomass (age one and above) unless stated otherwise.

Capacity goal means 5,650.9 metric tons (mt), which is the goal for the total gross tonnage of all vessels participating in the limited entry fishery established by Amendment 10 to the FMP.

Coastal pelagic species (CPS) means northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), Pacific sardine (*Sardinops sagax*), jack mackerel (*Trachurus symmetricus*), and market squid (*Loligo opalescens*).

Coastal Pelagic Species Advisory Subpanel (CPSAS) the CPSAS is comprised of members of the fishing industry and public appointed by the Council to review proposed actions for managing the coastal pelagic species fisheries.

Coastal Pelagic Species Management Team (CPSMT) means the individuals appointed by the Council to review, analyze, and develop management measures for the CPS fishery.

Comparable capacity means gross tonnage as determined by the formula in 46 CFR 69.209(a) for a vessel not designed for sailing plus 10 percent of the vessel's calculated gross tonnage.

Council means the Pacific Fishery Management Council, including its CPSMT, CPSAS, SSC, and any other committee established by the Council.

Egg Escapement Approach means a market squid fishery management approach used to evaluate the effects of fishing mortality (F) on the spawning potential of the stock and in particular, to examine the relationship between the population's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}).

Finfish means northern anchovy, Pacific (chub) mackerel, Pacific sardine, and jack mackerel.

Fishery Management Area means the EEZ off the coasts of Washington, Oregon, and California between three and 200 nautical miles offshore, bounded in the north by the Provisional International Boundary between the United States and Canada, and bounded in the south by the International Boundary between the United States and Mexico.

Gross tonnage means gross tonnage as determined by the formula in 46 CFR 69.209(a) for a vessel not designed for sailing (.67 x length x breadth x depth/100). A vessel's length, breadth, and depth are those specified on the vessel's certificate of documentation issued by the U.S. Coast Guard or state.

Harvest guideline means a specified numerical harvest objective that is not a quota. Attainment of a harvest guideline does not require complete closure of a fishery.

Harvesting vessel means a vessel involved in the attempt or actual catching, taking or harvesting of fish, or any activity that can reasonably be expected to result in the catching, taking or harvesting of fish.

Limited entry fishery means the fishery comprised of vessels fishing for CPS in the CPS management zone under limited entry permits issued under this FMP.

Live bait fishery means fishing for CPS for use as live bait in other fisheries.

Monitored species (MS) means those CPS the Secretary has determined not to need management by harvest guidelines or quotas according to the provisions of the FMP.

Nonreduction fishery means fishing for CPS for use as dead bait or for processing for direct human consumption.

Owner, as used in this subpart, means a person who is identified as the current owner in the Certificate of Documentation (CG-1270) issued by the U.S. Coast Guard for a documented vessel, or in a registration certificate issued by a state or the U.S. Coast Guard for an undocumented vessel.

Person, as used in this subpart, means any individual, corporation, partnership, association or other entity (whether or not organized or existing under the laws of any state), and any federal, state, or local government, or any entity of any such government that is eligible to own a documented vessel under the terms of 46 U.S.C. 12102(a).

Processing or to process means the preparation or packaging of CPS to render the fish suitable for human consumption, pet food, 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 does not mean heading and gutting unless there is additional preparation.

Quota means a specified numerical harvest objective for a single species of CPS, the attainment (or expected

attainment) of which causes the complete closure of the fishery for that species.

Reduction fishery means fishing for CPS for the purposes of conversion into: fish flour; fish meal; fish scrap; fertilizer; fish oil; other fishery products; or byproducts for purposes other than direct human consumption.

Regional Administrator means the Administrator, Southwest Region, NMFS, or a designee.

Reserve means a portion of the harvest guideline or quota set aside at the beginning of the year for specific purposes, such as for individual harvesting groups to ensure equitable distribution of the resource or to allow for uncertainties in preseason estimates of DAP and JVP.

Sustainable Fisheries Division (SFD) means the Assistant Regional Administrator for Sustainable Fisheries, Southwest Region, NMFS, or a designee.

Threshold level of egg escapement means a level of reproductive (egg) escapement that is believed to be at or near a minimum level necessary to allow the population to maintain its level of abundance into the future (i.e., allow for "sustainable" reproduction year after year).

Totally lost means that the vessel being replaced no longer exists in specie, or is absolutely and irretrievably sunk or otherwise beyond the possible control of the owner, or the costs of repair (including recovery) would exceed the repaired value of the vessel.

1.5 Goals and Objectives

Goals and objectives for the CPS FMP (not listed in order of priority):

1. Promote efficiency and profitability in the fishery, including stability of catch.
2. Achieve OY.
3. Encourage cooperative international and interstate management of CPS.
4. Accommodate existing fishery segments.
5. Avoid discard.
6. Provide adequate forage for dependent species.
7. Prevent overfishing.
8. Acquire biological information and develop long term research program.
9. Foster effective monitoring and enforcement.
10. Use resources spent on management of CPS efficiently.
11. Minimize gear conflicts.

2.0 FRAMEWORK MANAGEMENT

The framework approach to management of coastal pelagic species (CPS) allows changes and modifications to management procedures to be made in a timely and efficient manner without need to amend the fishery management plan (FMP). The FMP establishes two framework procedures through which the Council is able to recommend establishment and adjustment of management measures. The "point-of-concern" framework allows the Council to develop management measures in response to resource conservation and ecological issues. The "socioeconomic" framework allows the Council to develop management measures in response to social and economic issues.

Management measures may be imposed, adjusted, or removed at any time during the year. Management measures may be imposed for resource conservation, social, or economic reasons consistent with FMP procedures, goals, and objectives.

Analyses of biological, ecological, social, and economic impacts will be considered when a particular change is proposed. As a result, time required to take action will vary depending on the type of action (see below), its impacts on the fishing industry, resource, and environment, as well as review of these impacts by interested parties. Satisfaction of legal requirements for other applicable laws (e.g., the Administrative Procedure Act, Regulatory Flexibility Act, Executive Order 12866, etc.) for actions taken under this framework requires analysis and public comment before measures may be implemented by the U.S. Secretary of Commerce (Secretary).

Management measures addressing resource conservation or ecological issues must be based on the point-of-concern framework consistent with procedures and criteria listed in Section 2.1.2.

Management measures addressing social or economic issues must be based on the socioeconomic framework consistent with procedures and criteria described in Section 2.1.3.

2.1 Types of Actions and Procedures

Under the point-of-concern or the socioeconomic frameworks, there are four different types of management actions, requiring slightly different processes. Management measures may be established, adjusted, or removed using any of these four actions:

1. **Automatic Actions** may be initiated by the National Marine Fisheries Service (NMFS) Regional Administrator without prior public notice, opportunity to comment, or a Council meeting. These actions are non-discretionary and the impacts must previously have been taken into account. Examples include closure of the directed fishery when the directed portion of the harvest guideline is attained, an inseason release of geographic allocations (all species and fishery segments), or closure of the fishery when the total harvest guideline is attained. The Secretary will publish a single notice in the *Federal Register* making the action effective.

2. **"Notice" Actions** require at least one Council meeting and one *Federal Register* notice. These include all management actions other than automatic actions that are either non-discretionary or have probable impacts that have been previously analyzed.

   Notice actions are intended to have temporary effect and the expectation is that they may need frequent adjustment. They may be recommended at a single Council meeting, although the Council will provide as much advance information to the public as possible concerning the issues it will be considering. The primary examples are management actions defined as routine in Section 2.1.1. These include release of surplus incidental catch harvest guideline to the directed fishery (if necessary), and inseason changes to incidental catch allowances. In addition, annual specifications, including the total harvest guideline consisting of a directed and incidental portion, and any specifications for joint venture processing (JVP) or total allowable level of foreign fishing (TALFF) will be 'notice' actions as described in Section 4.8. Previous analysis must have been specific as to species and gear type before a management measure can be defined as routine and acted upon at a single Council meeting. If recommendations are approved, the Secretary may waive, for good cause, the requirement for prior notice and comment in the *Federal Register* and will publish a single notice in the *Federal Register* making the action effective. This category of actions presumes the Secretary will find that the extensive notice and opportunity for comment along with other information provided by the Council will serve as good cause to waive the need for additional

prior notice and comment in the *Federal Register*.

3. **Abbreviated Rulemaking Actions** normally require at least two Council meetings and one *Federal Register* rule. These include all management actions intended to have permanent effect and be discretionary in nature with impacts that have not been previously analyzed. The Council will develop and analyze the proposed management actions over the span of at least two Council meetings and provide public advance notice and opportunity to comment on proposals and analysis prior to and at the second Council meeting. If the NMFS Regional Administrator approves the Council's recommendation, the Secretary may waive, for good cause, the requirement for prior notice and comment in the *Federal Register* and publish a final rule in the *Federal Register* which will remain in effect until amended. If a management measure is designated as routine by final rule under this procedure, specific adjustments of that measure can subsequently be announced in the *Federal Register* by notice as described in this FMP. The Secretary may waive the opportunity for prior notice and comment in the *Federal Register*.

   The primary purposes of the previous two categories of notice and abbreviated rulemaking procedures are (1) to accommodate the Council's meeting schedule for developing annual management recommendations; (2) to satisfy the Secretary's responsibilities under the Administrative Procedures Act; and (3) to address the need to implement management measures by a specified date each fishing year.

   The two-Council meeting process refers to two decision meetings. The first meeting to develop proposed management measures and their alternatives, and the second meeting to make a final recommendation to the Secretary. Identification of issues and the development of proposals normally will begin at a Council meeting prior to the first decision meeting.

4. **Full Rulemaking Actions** normally require at least two Council meetings and two *Federal Register* rules (Regulatory Amendment). These include any highly controversial management measure. The Council will follow the two meeting procedures described for the abbreviated rulemaking category. The Secretary will publish a proposed rule in the *Federal Register* with an appropriate period for public comment followed by publication of a final rule in the *Federal Register*.

2.1.1 Routine Management Measures

Routine management measures are those the Council determines likely to be adjusted annually or more frequently. Measures are classified as routine by the Council through either full or abbreviated rulemaking process. In order for a measure to be classified as routine, the Council will determine that the measure addresses an issue at hand and may, in the near future, require further adjustment to achieve its purpose.

Once a management measure has been classified as routine through the abbreviated or full rulemaking procedures, it may be modified thereafter through the single meeting notice procedure if (1) modification is proposed for the same purpose as the original measure; and (2) impacts of the modification are within the scope of the impacts analyzed when the measure was originally classified as routine. Analysis need not be repeated when the measure is subsequently modified if the Council determines impacts do not differ substantially from original analysis. The Council may change a routine classification for an action without following any prespecified procedure.

Any measure designated as routine for one specific species, species group, or gear type may not be treated as routine for a different species, species group, or gear type without first having been classified as routine through the rulemaking process.

To facilitate this process, the Coastal Pelagic Species Management Team (CPSMT) will make recommendations to the Council and agencies regarding assessment or management needs.

The following measures are classified as routine measures at the outset of this FMP:

1. Reallocation of surplus incidental harvest guideline to the directed fishery (all species and fishery segments).
2. Inseason changes in the incidental catch allowance.
3. Specification of annual harvest guidelines or quotas.

2.1.2 Point-of-Concern Framework

The point-of-concern process is the Council's primary tool (along with setting harvest guidelines and harvest quotas) for exercising resource stewardship responsibilities. The process is intended to foster continuous and vigilant review of Pacific Coast CPS stocks and fisheries. The process is also to prevent overfishing or any other resource damages. The CPSMT will monitor the fishery throughout the year, and account for any new information on status of each species or species group to determine if a resource conservation or ecological issue exists. Point-of-concern criteria are intended to assist the Council in determining when a focused review on a particular species is warranted and may require implementation of specific management measures. This framework provides the Council authority to act based solely on a point-of-concern. Thus, the Council may act quickly and directly to address resource conservation or ecological issues. In conducting this review, the CPSMT will utilize the most current catch, effort, abundance and other relevant data from the fishery.

In the course of the continuing review, a "point-of-concern" occurs when one or more of the following is found or expected:

1. Catch is projected to exceed the current harvest guidelines or the harvest quota.
2. Any adverse or significant change in the biological characteristics of a species (age composition, size composition, age at maturity, or recruitment) is discovered.
3. An overfishing condition appears to be imminent or likely within two years.
4. Any adverse or significant change in the availability of CPS forage for dependent species or in the status of a dependent species is discovered.
5. Developments in a foreign fishery occur that affect the likelihood of overfishing of CPS.
6. An error in data or a stock assessment is detected that significantly changes estimates of impacts due to current management.
7. Maximum sustainable yield (MSY) control rule (harvest policy) parameters or approach require modification.
8. Projected catches for a Monitored species are expected to exceed the acceptable biological catch (ABC) using either a species-specific control rule or the default control rule. This could require moving a Monitored species to the Actively managed classification.

Once a point-of-concern is identified, the CPSMT will evaluate current data to determine if a resource conservation or ecological issue exists and will provide its findings in writing at the next scheduled Council meeting. If the CPSMT determines a resource conservation or ecological issue exists, it will provide its recommendation, rationale, and analysis for appropriate management measures that will address the issue.

Direct allocation of a resource between different segments of a fishery is, in most cases, not the appropriate response to a resource conservation or ecological issue. Council recommendations to directly allocate the resource will be developed according to criteria and processes in the socioeconomic framework described in Section 2.1.3 and Section 2.1.4.

After receiving the CPSMT report, the Council will take public testimony and, if appropriate, recommend management measures to the NMFS Regional Administrator accompanied by supporting rationale and analysis of impacts. The Council analysis will include a description of (1) resource conservation or ecological issues consistent with FMP objectives; (2) likely impacts on other management measures and other fisheries; (3) socioeconomic impacts; and (4) costs and benefits to commercial and recreational segments of the CPS fishery. The recommendation will explain the urgency in implementation of the measure(s), if any.

The NMFS Regional Administrator will review the Council's recommendation and supporting information and will follow appropriate implementation processes described in this FMP, following public notice and comment. If the Council contemplates frequent adjustments to the recommended measures, it may classify them as "routine" through the appropriate process described in Section 2.1.1.

If the NMFS Regional Administrator does not concur with the Council's recommendation, he/she will notify the Council in writing of the reasons for rejection. Nothing prevents the Secretary from exercising authority to take emergency action under Section 305 (c) and (d) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Nothing precludes or limits Council access to the point-of-concern framework.

2.1.3 The Socioeconomic Framework

Nonbiological issues may arise which require the Council to recommend management actions to address certain social or economic conditions in the fishery or to achieve FMP objectives. Resource allocation, fishing seasons, or landing limits based on market quality and timing, safety measures, and prevention of gear conflicts are examples of possible management issues with a social or economic basis. Actions that are permitted under this framework include all categories of actions authorized under the point-of-concern framework with the addition of direct resource allocation and access-limitation measures.

If the Council concludes that management action is necessary to address a social or economic issue, it will prepare a report containing the rationale supporting its conclusion. The report will include proposed management measures, a description of viable alternatives, and analyses addressing (1) achievement of FMP goals and objectives, (2) likely impacts on other fisheries and other management measures, (3) sociobiological impacts, (4) socioeconomic impacts, and (5) costs and benefits to the CPS fishery.

The Council, following review of the report, supporting data, public comment and other relevant information, may recommend management measures to the NMFS Regional Administrator accompanied by relevant background data, information, and public comment. The recommendation will explain the urgency in implementation of the measure(s), if any.

The NMFS Regional Administrator will review the Council's recommendation, supporting rationale, public comments and other relevant information and, if it is approved, will undertake the appropriate method of implementation. Rejection of the recommendation will be explained in writing.

Procedures specified in this FMP do not affect authority of the Secretary to take emergency regulatory action under Section 305(c) or (d) of the Magnuson-Stevens Act.

If conditions warrant, the Council may designate a management measure developed and recommended to address social and economic issues as a routine management measure provided that the criteria and procedures in Section 2.1.1 are followed.

2.1.4 Allocation

In addition to other requirements in this FMP, the Council will consider the following factors when considering direct allocation of the resource:

1. Present participation in and dependence on the fishery, including alternative fisheries.
2. Historical fishing practices in, and historical dependence on, the fishery.
3. Economics of the fishery.
4. Agreements or negotiated settlements between the affected participants in the fishery.
5. Potential biological impacts on any species affected by the allocation.
6. Consistency with the Magnuson-Stevens Act national standards.
7. Consistency with the goals and objectives of this FMP.

Modification of a direct allocation cannot be designated as "routine" unless the specific criteria for the modification have been established in the regulations.

2.1.5 Procedures for Specifying Maximum Sustainable Yield and Optimum Yield

As data become available, improve, or are updated, MSY control rules and OY specifications or procedures for setting MSY control rules or OY specifications may need to be modified. Changes and additions to these formulas are authorized by the FMP and may be accomplished through the point-of-concern mechanism or the socioeconomic mechanism.

2.1.6 Management Agreements with Other Nations

In the event that a management agreement between the U.S. and a foreign nation concerning CPS occurs, this FMP authorizes changes or modifications to any management measure through Council processes described herein.

2.1.7 Management Measures to Protect Noncoastal Pelagic Species

CPS fishing activities may directly impact certain non-CPS species including birds, marine mammals, and other fishes. This FMP authorizes implementation of measures to control CPS fishing to support conservation objectives identified under overfishing definitions adopted by the Council, the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), or other applicable law, while minimizing disruption of the CPS fishery. Any measures described in this FMP may be employed to control fishing impacts on non-CPS species. However, allocation may not be the primary intention of any such regulation.

The process for implementing and adjusting such measures may be initiated at any time under the point of concern or socioeconomic frameworks. In addition, measures to protect non-CPS may be designated as routine as described in Section 2.1.1, which will allow adjustment at a single meeting based on relevant information available at the time if (1) modification is proposed for the same purpose as the original measure, and (2) impacts of the modification are within the scope of the impacts analyzed when the measure was originally classified as routine.

Generally, the Council will initiate the process of establishing or adjusting management measures when a resource problem with a non-CPS is identified, and it has been determined that CPS fishing regulations will reduce the total impact on that species or stock. It is anticipated this will generally occur when a state or federal resource management agency (such as the U.S. Department of the Interior, NMFS, or a state fishery agency) presents the Council with information substantiating its concern for a particular species. The Council will review the information and refer it to the Scientific and Statistical Committee, CPSMT or other appropriate technical advisory group for evaluation. If the Council determines that management measures may be necessary to address requirements of the ESA, MMPA, international agreements, or other relevant federal law or policy, it may implement appropriate management measures in accordance with the procedures identified in Section 2.1. The intention of the measures may be to share conservation burdens while minimizing disruption of the CPS fishery, but under no circumstances may the intention be simply to provide more fish to a different user group or to achieve other allocation objectives.

2.2 Other Management Measures

2.2.1 Generic

These management measures apply to all vessels participating in the CPS fishery.

2.2.1.1 Observers

All fishing vessels operating in this management unit, including catcher/processors, at-sea processors, and vessels that harvest in Washington, Oregon, or California and land catch in another area, may be required to accommodate NMFS certified observers on board to collect scientific data. An observer program will be considered only for circumstances where other data collection methods are deemed insufficient for management of the fishery. Implementation of any observer program will be in accordance with appropriate procedures outlined under this framework.

As determined by the NMFS Regional Administrator, there may be a need for observers on at-sea processing vessels to collect data normally collected at shore-based processing plants. Processing vessels must accommodate on board observers and may be required to provide the NMFS certified observers prior to issuance of any required federal permits. Observers are required on foreign vessels operating in U.S. waters.

2.2.1.2 Essential Fish Habitat

The Magnuson-Stevens Act requires Councils to include descriptions of essential fish habitat (EFH) in all federal FMPs. In addition, the Magnuson-Stevens Act requires federal agencies to consult with NMFS on activities that may adversely affect EFH. Appendix D of this FMP includes a description of EFH for the five CPS included in this plan (northern anchovy, Pacific [chub] mackerel, jack mackerel, market squid, and Pacific sardine), fishing effects on EFH, non-fishing effects on EFH, and options to avoid or minimize adverse effects on EFH or promote conservation and enhancement of EFH.

Magnuson-Stevens Act Directives Relating to EFH

Magnuson-Stevens Act directives and NMFS guidance on implementation are addressed in greater detail in

Appendix D. The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." To clarify this definition, the following interpretations are made: "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers the full life cycle of a species. The definition of EFH may include habitat for an individual species or an assemblage of species, whichever is appropriate to the FMP.

The Magnuson-Stevens Act requires councils to describe in FMPs any fishing activities that may adversely affect EFH. The Magnuson-Stevens Act also requires FMPs to include management measures that minimize adverse effects on EFH from fishing, to the extent practicable.

In addition, the EFH regulations require identification of non-fishing adverse impacts on EFH. The Magnuson-Stevens Act specifies that councils may comment on and make recommendations to the Secretary and any federal or state agency concerning any activity authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken, by any state or federal agency that, in the view of the Council, may affect the habitat, including EFH, of a fishery resource under its authority. If the Secretary receives information that an activity of a state or federal agency would adversely affect EFH, the Secretary shall recommend to such agency measures that can be taken by such agency to conserve such habitat. Nonfishing impacts on EFH and corresponding potential conservation measures are included in Appendix D.

Definition of Essential Fish Habitat for CPS

The CPS fishery includes four finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel) and the invertebrate, market squid. CPS finfish are pelagic (in the water column near the surface and not associated with substrate), because they generally occur or are harvested above the thermocline in the upper mixed layer. For the purposes of EFH, the four CPS finfish are treated as a complex because of similarities in their life histories and similarities in their habitat requirements. Market squid are also treated in this same complex because they are similarly fished above spawning aggregations.

The definition of EFH for CPS finfish is based on a thermal range bordered by the geographic area where CPS occur at any life stage, where CPS have occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by CPS. The identification of EFH for CPS accommodates the fact that the geographic range of CPS varies widely over time in response to the temperature of the upper mixed layer of the ocean.

The east-west geographic boundary of EFH for CPS is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10°C to 26°C. The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10° C isotherm, which varies seasonally and annually. Appendix D provides a more detailed description of this variability.

Management Measures To Minimize Adverse Impacts on EFH from Fishing

The Council may use any of the following management measures to minimize adverse effects on EFH from fishing, if there is evidence that a fishing activity is having an identifiable adverse effect on EFH. Currently, there is not evidence that a fishing activity is having an identifiable adverse effect on CPS EFH. Such management measures shall be implemented under the point-of-concern framework as described in Section 2.1.2.

- Fishing Gear Restrictions
- Time/Area Closures
- Harvest Limits, or other applicable measures

In determining whether it is practicable to minimize an adverse effect from fishing, the Council should consider whether, and to what extent, the fishing activity is adversely impacting EFH, including the fishery; the nature and extent of the adverse effect on EFH; and whether management measures are practicable. This determination should take into consideration the long and short term costs and benefits to the fishery and

EFH, along with other appropriate factors, consistent with National Standard 7 (conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication).

2.2.1.3 Vessel Safety Considerations

The Council will consider and may provide, after consultation with the U.S. Coast Guard and persons utilizing the fishery, temporary adjustments for access to the fishery by vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels.

2.2.1.4 Limited Entry

This FMP authorizes changes and modifications to any effort limitation programs established herein and development of additional effort limitation programs. Changes may include, but are not limited to, requirements for obtaining, maintaining, and renewing permits in any effort limitation system.

2.2.2 Domestic Commercial Management Measures

All measures, unless otherwise specified, apply to all domestic vessels regardless of whether catch is landed and processed on shore or processed at sea.

2.2.2.1 Permits

Federal permits may be required for individuals or vessels that harvest CPS, and for individuals or facilities (including vessels) that process CPS or purchase live CPS. In determining whether to require a harvesting or processing permit, and in establishing the terms and conditions for issuing a permit, the Council may consider any relevant factors including whether a permit:

1. Will enhance the collection of biological, economic, or social data.
2. Will provide better enforcement of laws and regulations, including those designed to ensure conservation and management and those designed to protect consumer health and safety.
3. Will help achieve the goals and objectives of the FMP.
4. Will help prevent or reduce overcapacity in the fishery.
5. May be transferred, and under what conditions.

Separate permits or endorsements may be required for harvesting and processing, or for vessels or facilities based on size, type of fishing gear used, species harvested or processed, or such other factors that may be appropriate. The permits and endorsements are also subject to sanctions, including revocation, as provided by Section 308 of the Magnuson-Stevens Act.

In establishing a permit requirement, the Council will follow the rulemaking procedures as described in Section 2.1.

2.2.2.2 Permit Revocation and Reinstatement

This FMP allows National Oceanic and Atmospheric Administration (NOAA), under procedures of 15 CFR Part 904, to revoke or suspend any permit issued under authority of the CPS FMP.

2.2.2.3 Catch Restrictions

This FMP authorizes the commercial and recreational harvest of CPS and provides for limiting the harvest of CPS managed under this plan. Catch restrictions may be modified under the framework provisions.

2.2.2.4 Prohibited Species

This FMP does not authorize the taking, retaining, or possessing of any species by CPS gears, if such taking or possessing is prohibited by other state or federal regulations. Species identified as prohibited must be returned to the sea as soon as practical with a minimum of injury after allowing for sampling by an observer, if any. Exceptions may be made for recovery of tagged fish.

This FMP authorizes the designation of other prohibited species in the future, or the removal of a species from this classification, consistent with other applicable law for that species.

2.2.2.5 Gear Restrictions

This FMP authorizes the use of net gear, hook-and-line, pots (traps), longlines, and any other type of gear as legal gear for the commercial harvest of CPS, unless such gear is specifically prohibited by state law. A complete listing of current state regulations in Washington, Oregon, and California is in Appendix B.

Implementation and modification of specific management measures regarding gear, such as definitions of legal gear, mesh size restrictions, gear marking, or other gear restrictions are authorized by this FMP. Gear restrictions may be established, modified, or removed under the point-of-concern or socioeconomic frameworks. Any changes in gear regulations should be scheduled to minimize costs to the fishing industry, insofar as this is consistent with achieving the goals of the change.

2.2.2.6 Closed Fishing Areas

Currently, there are certain areas closed to commercial round-haul fishing or fishing for reduction processing (Figure 1). Those areas were originally closed by the State of California to avoid commercial fishing conflicts with sport fisheries and reduce potential impacts on sport fish and salmon. This FMP authorizes the issuance of exempted fishing permits in Section 2.2.8 for fishing in closed areas consistent with the goals and objectives of the FMP.

Closed areas shall be implemented or changed through the procedures described in Section 2.1.

2.2.2.7 Reporting Requirements

This FMP authorizes domestic annual harvest (DAH) survey, exempted fishing permit (EFP) application, and foreign vessel reporting and records keeping requirements. This FMP authorizes other domestic vessel permit applications and reporting requirements in the future.

Surveys to Determine Domestic Annual Harvest

Surveys of the domestic industry will be conducted by NMFS at the appropriate time to determine amounts of fish not needed by the domestic processing industry, which then may be made available to joint venture or foreign fishing.

Other Reporting and Record Keeping Requirements

Catch, effort, biological, and other data necessary for implementation of this FMP will continue to be collected by the states of Washington, Oregon, and California under existing state data collection provisions. Federal reporting requirements, such as logbooks, will be implemented only when data collection and reporting systems operated by state agencies fail to provide the Secretary with statistical information for adequate management. Any special reporting requirement should be imposed only if it is expected to enhance the Council's and NMFS' ability to manage the CPS fishery more effectively.

Conditions may develop in the CPS fishery that make current state reporting requirements insufficient. For example, a large capacity vessel such as a factory trawler might operate within state waters but outside the area of limited entry trip limit restrictions (i.e., north of 39° N latitude), harvest substantial amounts of CPS, and either unload catch after a period of delay or outside the management area. It is possible that delays in obtaining catch data or missing catch data could affect stock assessments or other management efforts. To address these potential future problems, the FMP authorizes implementation of federal reporting requirements in addition to those of the various states. The purpose of these measures would be to enhance Council's ability to manage CPS stocks effectively. Additional reporting requirements would be developed under framework management procedures and announced in the *Federal Register*.

2.2.2.8 Vessel Identification

The FMP authorizes vessel identification requirements which may be modified as necessary to facilitate enforcement and vessel recognition.

2.2.3 Domestic Recreational

Measures described in this section apply to domestic recreational fisheries only, although most measures

could be used to manage foreign recreational fisheries as well.

2.2.3.1 Permits

Washington, Oregon, and California have state laws concerning recreational licenses and permits. In the event that a federal licenses or permits become necessary, they may be required under this FMP.

2.2.3.2 Catch Restrictions

This FMP authorizes establishment of catch restrictions on the recreational fishery consistent with FMP goals and objectives and national standards established by the Magnuson-Stevens Act.

2.2.3.3 Gear Restrictions

There are no federal restrictions on legal recreational gear for CPS. Existing state regulations apply in Washington, Oregon, and California. This FMP authorizes federal recreational regulations for CPS.

2.2.4 Domestic Vessels in a Joint Venture

U.S. vessels operating in joint ventures on the West Coast are domestic vessels and traditionally have been treated the same as U.S. vessels delivering to shore facilities. However, conditions in the fishery could warrant separate treatment in the future. Although all U.S. vessels have been subject to the same regulations, joint venture catcher operations may be affected indirectly by restrictions (such as closed areas) placed on the foreign processing vessels that receive U.S. catch at sea.

2.2.5 Foreign Vessels in a Joint Venture or Foreign Fishery

These measures apply to foreign vessels that process fish taken by U.S. catcher-boats under joint venture processing or to foreign vessels that operate in a fishery directed at a species for which there is a TALFF. The CPS FMP provides authority to establish, modify or remove future regulations including, but not limited to, harvest guidelines, harvest quotas, seasons, area closures, incidental harvest restrictions, trip and landing limits, and gear restrictions.

2.2.5.1 Permits

All foreign vessels operating in this management area shall have on board a permit issued by the Secretary pursuant to the Magnuson-Stevens Act.

2.2.5.2 Target Species

A foreign nation may conduct joint venture operations only for species for which there is a JVP and only using boats with appropriate permits. Directed fishing is allowed only for species for which the foreign nation has received an allocation of TALFF.

2.2.5.3 Incidental Catch

Incidental catch refers to CPS which are unavoidably caught while fishing for another species. It is recognized that incidental harvest of domestically fully utilized CPS is unavoidable in joint venture and foreign fisheries. Minimal incidental allowances consistent with the status of the stocks and the efficiency of the joint venture or foreign fisheries will usually be allowed. These incidental allowances are not to be considered as surpluses to domestic processing needs and are allowed only to provide for full utilization of the species targeted in the joint venture or foreign fishery.

Allowances for incidental harvest in joint ventures or foreign fisheries may be percentages or some other quantity at the Council's discretion. Incidental allowances may be changed at any time during the year, but are published at least annually, concurrent with the annual specifications of JVP.

The Council may modify incidental catch allowances inseason to reflect changes in the condition of the resource and performance of the U.S. industry. The Council will consider public testimony and consider the following factors before establishing or changing incidental allowances, (1) observed catch rates in any previous joint venture or foreign fishery; (2) current estimates of relative abundance and availability of species

caught incidentally; (3) ability of the foreign vessels to take the JVP or TALFF; (4) past and projected foreign and U.S. fishing effort; (5) status of stocks; (6) impacts on the domestic industry; and (7) other relevant information. Inseason changes will be made as a routine management measure.

2.2.5.4 Prohibited Species

Prohibited species means salmonids or any species of fish that a joint venture or foreign vessel is not authorized to retain. Prohibited includes fish received in excess of any authorization, landing limit, or harvest guideline. These species must be immediately returned to the sea with a minimum of injury after allowing for sampling by an observer, if any. This FMP authorizes the designation of other prohibited species in the future, or the removal of a species from this classification if consistent with the applicable law for that species.

2.2.5.5 Season and Area Restrictions

There is no season restriction unless otherwise specified according to this FMP. There is no area restriction, unless otherwise specified according to this FMP. Joint venture and foreign fisheries for CPS may not be conducted within the limited entry area south of 39° N latitude.

Season and area restrictions for foreign vessels operating in a joint venture or foreign fishery may be established, modified, or removed at any time during the year in accordance with the procedures in Sections 2.1.2 and 2.1.3 or by foreign vessel permit conditions.

2.2.5.6 Reporting and Record Keeping Requirements

Foreign nations receiving U.S. harvested fish in a joint venture or participating in a foreign fishery are required to submit detailed reports of fishing effort, location, amount, and disposition by species or species group, and transfer of fish or fish products, as needed for monitoring and management of the fishery. Reports may be required at specified time intervals. The NMFS Regional Administrator may require daily reports when a specified fraction of JVP, TALFF, or incidental allowance is reached. In addition, each country may be required to report arrival, departure, and positions of each of its vessels, as specified under the regulations and permit conditions, as needed for monitoring fleet deployment. Logbooks may be required to fulfill fishery conservation, management, and enforcement purposes of Magnuson-Stevens Act. These logs may include, but are not limited to, communications logs, transfer logs, or daily joint venture logs with haul by haul and daily receipt data, effort, and production information.

2.2.5.7 Dumping

Foreign and other vessels are prohibited from dumping pollutants and fishing gear which would degrade the environment or interfere with domestic fishing operations.

2.2.5.8 Fishery Closure

A joint venture or directed foreign fishery shall cease each year when, (1) the JVP or TALFF is reached; (2) the maximum incidental catch allowance for that nation of any species or species group is reached; (3) the overall harvest guideline or harvest quota for the allocated species is reached; (4) the applicable open season is ended; or (5) as necessary for resource conservation reasons under the point-of-concern mechanism.

2.2.5.9 Observers

Observers shall be placed on each foreign vessel while it is operating in a foreign or joint venture fishery, as provided by Title II of the Magnuson-Stevens Act. The law provides for the following exceptions to this requirement:

1. If observers are aboard motherships of a mothership/catcher vessel fleet.
2. If the vessel is in the exclusive economic zone (EEZ) for such a short time that at observer would be impractical.
3. If facilities for quartering an observer are inadequate or unsafe.
4. For reasons beyond the control of the Secretary an observer is not available.

2.2.5.10 Other Restrictions

The Secretary may impose additional requirements for the conservation and management of fishery resources covered by the vessel permit or for national defense or security reasons. These restrictions include, but are not limited to, season, area, and reporting requirements.

The highest priority of this FMP is to provide for conservation of the resource. Any restriction on the joint venture fishery may be modified under the point-of-concern mechanism for resource conservation reasons.

2.2.6 Foreign Recreational

Foreign recreational fishing refers to any fishing from a foreign vessel not operated for profit or scientific research, and not involved in the sale, barter, or trade of any part of the catch. This FMP authorizes establishment of catch restrictions on the foreign recreational fishery which are consistent with the goals and objectives of this FMP and the national standards established by the Magnuson-Stevens Act.

2.2.7 Limited Entry

Research and monitoring programs may need to be developed and implemented for the CPS fishery so that information required in a limited entry program is available. Such data should indicate the character and level of participation in the fishery, including but not limited to, (1) investment in vessel and gear; (2) the number and type of units of gear; (3) the distribution of catch; (4) the value of catch; (5) the economic returns to the participants; (6) mobility between fisheries; (7) purchase or sale prices of limited entry permits; various social and community considerations.

2.2.8 Exempted Fishing

"Exempted fishing" is defined to be fishing practices that are new to the fishery or not allowed under the FMP. Under this FMP, the NMFS Regional Administrator may authorize the targeted or incidental harvest of CPS for experimental or exploratory fishing that would otherwise be prohibited. The NMFS Regional Administrator may restrict the number of experimental permits by total catch, time, or area. The NMFS Regional Administrator may also require any level of industry-funded observer coverage for these experimental permits.

Exempted fisheries are expected to be of limited size and duration and must be authorized by an EFP issued for the participating vessel in accordance with the criteria and procedures specified in 50 CFR §600.745. The duration of EFPs will ordinarily be one year. Permits will not be renewed automatically. An application must be submitted to the Regional Administrator for each year. A fee sufficient to cover administrative expenses may be charged for EFPs. An applicant for an EFP need not be the owner or operator of the vessel(s) for which the EFP is requested as long as the proposed activity is compatible with limited entry and other management measures in the FMP.

This FMP authorizes mandatory data reporting and mandatory on-board observers with exempted fishing permits. Installation of vessel monitoring units aboard vessels with exempted fishing permits may be required.

Nothing in this FMP is intended to exclude or to limit use of CPS, markets, or processing methods as long as the process in question is compatible with measures and intentions of this FMP.

Priorities for issuing EFPs are as follows:

1. Domestic boats delivering to domestic processors and domestic factory trawlers (with equal priority).
2. Domestic catcher-boats delivering to a foreign offshore processor.

Boats already involved in developing a fishery for an underutilized species (i.e., boats with a catch history or previous EFP) should receive highest priority in applying for and renewing permits.

2.2.9 Other Fees and Permits

Nothing in this FMP is intended to exclude use of additional fees or permits in the future as long as the fee or permit is consistent with applicable law, management measures, and intent of this FMP. It may, for example, become desirable to issue permits for processing CPS in onshore plants or processing vessels offshore. It may be desirable to charge fees sufficient to cover administrative costs of issuing additional types

of permits. Changes in requirements for obtaining, maintaining, and renewing permits are authorized.

2.3 Scientific Research

Nothing in this FMP is intended to inhibit or prevent any scientific research involving CPS which is acknowledged by the Secretary through procedures set out in 50 CFR §600.745.

Proposed activity is not scientific research unless it is submitted in writing to the Secretary in the form of a research proposal which addresses all of the factors below. An activity may be acknowledged as scientific research if its primary objective, purpose, or product is the acquisition of data, information, or knowledge as determined by consideration of all of the following factors:

1. The proposed program will result in information useful for scientific or management purposes.
2. The application of existing knowledge alone is insufficient to solve the scientific or management subject or problem presented by the scientific research proposal.
3. Facts/data/samples will be collected or observed and analyzed in a scientifically acceptable manner and the results will be formally prepared and available to the public.
4. Recognized scientific experts, organizations, or institutions with expertise in the field or subject matter area are conducting, sponsoring or are otherwise affiliated with the activity.

Secretarial Acknowledgment of Scientific Research

If the Secretary agrees that an activity constitutes scientific research involving CPS, a letter of acknowledgment should be issued to the applicant and operator or master of the vessel conducting the scientific research. The letter will include information on the purpose, scope, location, and schedule of the acknowledged activities. Any activities not in accordance with the letter of acknowledgment should be subject to all provisions of the Magnuson-Stevens Act and its implementing regulations. The Secretary should transmit copies of letters of acknowledgment to the Council, state or federal administrative and enforcement agencies to ensure they are aware of the research activities.

CPS taken under the scientific research exclusion may be sold to offset all or part of the cost of carrying out the research plan including costs associated with operating the research vessel.

2.4 Restrictions on Other Fisheries

For each non-CPS fishery, a reasonable limit on the incidental CPS catch may be established that is based on the best available information. The objectives of restrictions on other fisheries under this framework are to:

1. Minimize discards in the non-CPS fishery by allowing retention and sale, thereby increasing fishing income.
2. Discourage targeting on CPS by the non-CPS fleet.

Incidental limits may be imposed or adjusted in accordance with appropriate procedures described in this FMP. The Secretary may accept or reject but not substantially modify the Council's recommendations.

2.5 Procedures for Reviewing State Regulations

This FMP acknowledges that state regulations are a fundamental part of CPS management. All existing state regulations at the time of implementation of this plan are consistent with this FMP. Those regulations are listed in Section 2.2.5.2 of Appendix B.

This FMP establishes a review process by which any state may obtain a determination that its regulations are consistent with the FMP and the national standards. As necessary, the Council may also recommend to NMFS that duplicate or different federal regulations be implemented in the EEZ. While the Council retains the authority to recommend federal regulations be implemented in the EEZ, the preference is to continue to rely on state regulations in that area as long as they are consistent with the FMP.

While states are not required to submit regulations which they wish to apply in the EEZ to the Council for a consistency determination, regulations which have not received a consistency determination run the risk of being declared inconsistent and invalid if challenged in a state law enforcement proceeding. The Council

invites submission of all present and future state fishery regulations relating to the harvest of species managed under this FMP which are to apply in the EEZ.

Review Procedure

Any state may propose that the Council review a particular state regulation for the purpose of determining its consistency with the FMP and the need for complementary federal regulations. Although this procedure is directed at the review of new regulations, existing regulations affecting the harvest of CPS managed by the FMP may also be reviewed under this process. The state making the proposal will include a summary of the regulation in question and concise arguments in support of consistency.

Upon receipt of a state's proposal, the Council may make an initial determination whether or not to proceed with the review. If the Council determines that the proposal has insufficient merit or little likelihood of being found consistent, it may terminate the process immediately and inform the petitioning state in writing of the reasons for its rejection.

If the Council determines sufficient merit exists to proceed with a determination, it will review the state's documentation or prepare an analysis considering, if relevant, the following factors:

1. How the proposal furthers or is not otherwise consistent with the objectives of the FMP, the Magnuson-Stevens Act, and other applicable law.
2. Likely effect on or interaction with any other regulations in force for the fisheries in the area concerned.
3. Expected impacts on the species or species group taken in the fishery sector being affected by the regulation.
4. Economic impacts of the regulation, including changes in catch, effort, revenue, fishing costs, participation, and income to different sectors being regulated as well as to sectors which might be indirectly affected.
5. Any impacts in terms of achievement of harvest guidelines or harvest quotas, maintaining year-round fisheries, maintaining stability in fisheries, prices to consumers, improved product quality, discards, joint venture operations, gear conflicts, enforcement, data collection, or other factors.

The Council will inform the public of the proposal and supporting analysis and invite public comments before and at the next scheduled Council meeting. At its next scheduled meeting, the Council will consider public testimony, public comment, advisory reports, and any further state comments or reports, and determine whether or not the state regulation is consistent with the FMP and whether or not to recommend implementation of complementary federal regulations or to endorse state regulations as consistent with the FMP without additional federal regulations.

If the Council recommends the implementation of complementary federal regulations, it will forward its recommendation to the NMFS Regional Administrator for review and approval. The NMFS Regional Administrator will publish the proposed regulation in the *Federal Register* for public comment, after which, if approved, he/she will publish final regulations as soon as practicable. If the Regional Administrator disapproves the proposed regulations, he/she will inform the Council in writing of the reasons for disapproval.

3.0 LIMITED ENTRY

This fishery management plan (FMP) establishes a limited entry program for coastal pelagic species (CPS) finfish including northern anchovy, Pacific (chub) mackerel, jack mackerel, and Pacific sardine landed south of 39° N latitude.

3.1 Problem Addressed by Limited Entry

Prior to implementation of the FMP, v~~V~~essels ~~currently~~ participating in the CPS finfish fishery **were**~~are~~ capable of harvesting more CPS finfish than is available under current or likely future biomass conditions. Fisheries characterized by excess harvesting capacity are described as overcapitalized in terms of the number of vessels, and the amount of gear and equipment devoted to harvesting. As fisheries become overcapitalized, harvesting costs increase while catches remain the same. This situation represents an economically inefficient use of society's productive resources, and causes several problems for managers and the fishing industry when abundance declines and catches are reduced. As harvest capacity in the fisheries increases, problems arising from the need for more restrictive management measures and resolution of allocation issues become more acute. No relief from these problems will occur if harvest capacity continues to rise.

It was estimated that ~~There were~~ 640 vessels **landed** ~~with~~ CPS finfish **during** ~~landings for~~ the period January 1, 1993 through November 5, 1997. Forty-one of these vessels, six percent, accounted for more than 95% of finfish landings for the five-year period (Appendix B, Table 3.8.7-1). Available information indicate~~d~~**s** that present participants could harvest at least as much CPS finfish as would be available under conditions of greater availability. **At the time,**~~Current~~ capacity **was estimated to**~~may~~ be as much as 20% greater than the combined maximum sustainable yield (MSY) for anchovy, Pacific (chub) mackerel, and sardine (about 400,000 mt per year).[1/] ~~Recent~~ **e**Experience in the fishery and some crude calculations indicate that about 75 vessels would have sufficient harvesting capacity to take almost all of the CPS finfish likely to ever be available.

In addition to current CPS finfish participants, newcomers are likely to be attracted to the fishery, because of the expanding sardine biomass and squid fishery, and as competition in other Pacific Coast fisheries becomes more intense. In the latter instance, nearly all groundfish stocks are now fully harvested by domestic fishers in the Pacific Coast groundfish fishery. Potential participants in the CPS finfish fishery consist of fishers leaving other West Coast and North Pacific fisheries that have grown increasingly more restrictive and overcrowded relative to available harvests.

In the Pacific Coast CPS finfish fishery, excess harvest capacity is likely to result in an increasing number and complexity of regulations. Accordingly, the Council will face increased pressure to balance the conflicting need to protect the resource with the need to provide sufficient allowable catch to sustain the fishery.

Increased number and complexity of regulations have many adverse impacts in such areas as fleet costs, resource utilization, safety, enforcement costs and effectiveness. Moreover, there is a point beyond which additional regulations, which interfere with day to day vessel operations (e.g., trip limits or mesh size regulations), will not improve the Council's ability to accomplish its management goals. Pressures on industry arise not only from management measures which restrict operations, but also from increased competition for the allowable catches among larger numbers of vessels.

For these reasons, the FMP established a limited entry fishery south of 39° North latitude (as described at Section 3.5.2). Operational aspects of the limited entry fishery are described in subsequent sections.

3.2 Goals and Objectives for Finfish Limited Entry

The goals and objectives for this FMP are presented in Section 1.5. The most important of these in the context of limited entry are:

1/ The estimate 400,000 mt per year is the sum of estimated MSY for each stock reduced by a crude estimate of the fraction of the stock in U.S. waters. It is unlikely that all stocks would be abundant at the same time and that 400,000 mt of catch would be available in any one year.

A. Promote efficiency and profitability in the fishery.
B. Achieve optimum yield (OY).
C. Accommodate existing fishery segments.
D. Use resources spent on management of CPS efficiently.

Not all these objectives are complementary. The challenge is to create a limited entry program which strikes a balance between increasing net returns from the fishery, achieving OY, accommodating participation by those with substantial investments in the fishery, and efficiently using management resources.

3.2.1 Capacity Goal

The purpose of the capacity goal is to ensure fishing capacity in the CPS limited entry fishery is in balance with resource availability. The limited entry fleet capacity goal is 5,650.9 mt as represented by cumulative gross tonnage (GT) of the limited entry fleet of vessels.

This level of capacity results in a larger, diverse CPS finfish fleet, which also relies on other fishing opportunities such as squid and tuna, with normal harvesting capacity equal to the long-term expected aggregate finfish target harvest level, approximately 110,000 mt, and with physical capacity available to harvest peak period amounts of finfish, 275,000 mt. The current (June 2002) fleet of 65 vessels satisfies this goal. Estimated normal harvesting capacity for the current (June 2002) fleet ranged from 60,000 mt to 111,000 mt per year; physical harvesting capacity ranged from 361,000 to 539,000 mt per year. Total calculated Gross Tonnage (GT) for the current (June 2002) fleet is 5,650.9 mt. Therefore, 5,650.9 mt of GT represents the current fleet capacity goal.

3.3 Achievement of Goals and Objectives and Need for Additional Measures to Reduce Capacity

The limited entry program for CPS finfish adopted under this amendment to the northern anchovy FMP will not in itself immediately accomplish the goals and objectives the Council has established for the fishery. It is a first step that may slow or prevent the worsening of conditions which impede the Council from achieving the overall goals and objectives for the fishery. The limited entry fleet size and transferability provisions represent a balance between the limited entry goals of accommodating existing fishery participants (goal C) and promoting efficiency and profitability in the fishery (goal A). Establishment of this limited entry system will provide a starting point for any future programs which may be necessary to further reduce harvest capacity.

3.3.1 Maintaining the Capacity Goal

Conditions and effects of transferability will be reevaluated periodically in conjunction with achievement of the capacity goal, and objectives of the FMP. The Council established a trigger for reevaluation based on an overall change in fleet GT of 5%. The CPSMT will evaluate capacity in the CPS finfish fishery relative to the capacity goal every two years starting in 2003. In the annual CPS SAFE, the CPSMT will include a report to the Council on the status of fleet capacity and, if necessary, recommendations regarding the capacity goal and permit transferability.

3.4 Nature of the Interest Created

CPS limited entry permits confer a privilege to participate in the West Coast CPS finfish fishery in accordance with the limited entry system established under this FMP and implementing regulations, or any future amendment to the FMP and implementing regulations. Future amendments to the FMP may modify or even abolish the limited entry system. The permits are also subject to sanctions including revocation, as provided by the Magnuson-Stevens Act, 16 USC 1858(g) and 15 CFR part 904.

3.5 Scope of Limited Entry

3.5.1 Species within the Scope of Limited Entry

The provisions of this chapter apply only to CPS finfish, including northern anchovy, Pacific (chub) mackerel, jack mackerel, and Pacific sardine.

3.5.2 Geographic Scope of Limited Entry

The provisions of this chapter establish a CPS finfish limited entry program for the fishery south of 39° N latitude (approximately Point Arena, California). In the context of limited entry, fishing for and landing CPS finfish south of 39° N latitude is defined as landing CPS finfish. Fishing for and landing of CPS finfish north of 39° N latitude is not affected by limited entry requirements. CPS finfish fishing in the northern area would be managed as an open access fishery. This does not preclude effective management or future extension of limited entry in the north.

3.6 Limited Entry Permits

3.6.1 Initial Issuance of Limited Entry Permits

1. Each qualifying vessel will entitle the current owner to one limited entry permit.
2. A vessel qualifies for a limited entry permit by meeting the initial issuance criteria in Section 3.6.1.1.
3. A given vessel cannot receive more than one limited entry permit.
4. Fees may be charged to cover National Marine Fisheries Service (NMFS) administrative costs associated with issuance or transfer of permits.
5. Permits are assigned to one vessel at a time.
6. The vessel owner is responsible for maintaining the permit and any other documentation required on board each vessel with a permit to fish for CPS.
7. A limited entry permit may not be used with a vessel unless it is registered for use with that vessel.
8. Limited entry permits will be registered for use with a vessel and a registered vessel may be changed only according to procedures outlined in the FMP and regulations.
9. If the permit will be used with a vessel other than the one registered on the permit, a registration for use with the new vessel must be obtained from the Regional Director and placed aboard the vessel before the vessel is used to fish for CPS.

3.6.1.1 Initial Issuance Criteria

The owner of a CPS vessel will receive a limited entry permit if, during the window period of January 1, 1993 to November 5, 1997, the vessel landed or delivered a cumulative total of 100 mt of CPS finfish. No more than one limited entry permit will be issued for each qualifying vessel. The permit will be issued only to the current owner of the vessel, unless (1) the previous owner of a vessel qualifying for a permit has, by the express terms of a written contract, reserved the right to the permit, in which case the permit will be issued to the previous owner based on the catch history of the qualifying vessel; or (2) a vessel that would have qualified for a limited entry permit was totally lost before a permit was issued. In this case, the owner of the vessel at the time it was lost retains the right to the permit, unless the owner conveyed the right to another person by the express terms of a written contract.

3.6.1.2 Ownership Restriction

Only entities (human beings, corporations, etc.) qualified to own a U.S. fishing vessel may be issued or may hold (by ownership or otherwise) a limited entry permit.

3.6.1.3 Limited Entry Permit Held by Owner of Record of the Vessel

1. The vessel owner is responsible for acquiring and holding a limited entry permit for each vessel that is required to have a limited entry permit to catch CPS finfish under this limited entry section.
2. The vessel owner is responsible for maintaining NMFS required documentation of the limited entry permit on board the vessel.
3. The limited entry permit will be used with one vessel only. That vessel must be declared and registered with the NMFS issuing authority. Registration is incomplete and limited entry permits may not be used until acknowledged in writing by NMFS.
4. A vessel owner may not use a vessel, or allow a vessel to be used, to catch any Council-managed CPS finfish under the limited entry regulations unless the vessel owner holds a limited entry permit which explicitly allows such catch and the limited entry permit has been registered with NMFS for use with that vessel.

3.6.1.4 Loss of a Vessel Prior to Permit Issuance

1. A limited entry permit will be issued for a vessel which qualified for a permit but is lost before permits are issued. The vessel must be replaced within two years of the loss unless otherwise determined by the

NMFS Regional Director. The replacement vessel must be of equal or less net tonnage.

2. For a vessel that would qualify an owner for a limited entry permit, in the case of a vessel's sinking or total loss, all rights to a permit from the fishing history of the vessel prior to the sinking or total loss remain with the owner unless specifically transferred.

3.6.1.5 Appeals Process

If an application for a permit is denied, the applicant may appeal the denial to the NMFS Regional Administrator. The appeal must be in writing, state the action being appealed, and reasons. The appellant may request an informal hearing before a hearing officer and the NMFS Regional Administrator will decide if a hearing is required. If required, hearings will be carried out in a timely fashion (normally within 30 days of the receipt of sufficient information).

The NMFS Regional Administrator will decide the appeal in accordance with the criteria for limited entry permits specified in this FMP and implementing regulations. The NMFS Regional Administrator will consider the information submitted by the appellant, the summary record of the hearing and hearing officer's recommendation (if any) and other relevant information.

3.6.2 Permit Renewal Procedures

1. Permits must be renewed every two calendar years in order to remain valid for the following calendar year. The renewal date for limited entry permits will be January 1 at two year intervals beginning in the year after implementation.
2. Notice of upcoming renewal periods will be sent at the appropriate time every two years to the most recent address as provided to the permit issuing authority by the permit holder. It shall be the permit holder's responsibility to provide the permit issuing authority with address changes in a timely manner.
3. An annual fee will be charged which reflects the administrative costs of maintaining the permit system.
4. Failure to renew during this period will result in expiration of the permit at the end of the calendar year.
5. Once a permit has expired because of failure to renew during the renewal period, it may not subsequently be renewed or reissued, except through a process as specified in Section 3.6.1.5.

3.6.3 **Conditions for Transfers of Existing Permits** ~~Permit Transfers~~

~~Limited entry permits are affixed to the vessel. Within one year from implementation of the limited entry program, permits are transferable to another vessel one time only.~~

~~After the first year, permits become nontransferable, except in cases where:~~

~~1. The permitted vessel is stolen, lost, or no longer will participate in a federally managed commercial fishery.~~
~~2. The application for the permit transfer to a replacement vessel originates from the vessel owner who must place it on a replacement vessel of the same or less net tonnage within one year of disability of the permitted vessel.~~

~~Procedures for Transferring Permit to Replacement Vessel~~

~~After the first year of the program, and if the conditions in Section 3.6.3 (a) and (b) are met, the following procedures for transfer must be followed:~~

~~1. Limited entry permits may be transferred by the owner only if the vessel is lost, stolen, or will not participate in any federally managed fishery in the future.~~
~~2. When an owner wishes to transfer a limited entry permit to a different vessel, he or she must notify the NMFS issuing authority of the intent to change.~~
~~3. The owner will demonstrate to NMFS that the original vessel was lost or stolen, or the owner will demonstrate that the original vessel will no longer participate in a federally managed fishery. Although there is currently no way to demonstrate and or enforce that a vessel will not participate in a federally managed fishery, if a mechanism to do so is developed, this provision will be incorporated by regulation.~~
~~4. The owner will demonstrate that the replacement vessel is of equal or less net tonnage than the original vessel.~~
~~5. The NMFS will approve the transfer when the NMFS Regional Administrator determines all requirements have been met.~~

~~6. A permit transfer is not effective until the new permit has been issued.~~
~~7. Nothing in these provisions prevents a permit owner from modifying the original vessel to which the permit was issued.~~

CPS finfish limited entry permits may be transferred with restrictions on the harvesting capacity of the vessel to which it would be transferred. These restrictions are as follows: 1) full transferability of permits to vessels of comparable capacity (vessel GT +10% allowance), and 2) allow permits to be combined up to a greater level of capacity in cases where the vessel to be transferred to is of greater harvesting capacity than the one from which the permit will be transferred.

Each limited entry permit will have an endorsement based on the currently permitted vessel's calculated gross tonnage (GT) as defined in 46 *CFR* 69.209 for ship-shaped hulls, where:

GT = 0.67(Length*Breadth*Depth)/100.

The original permits and their respective endorsements will remain in effect for the lifetime of each permit, regardless of the GT of a vessel to which it may be transferred. In cases where a permit is transferred to a vessel with smaller GT, the original GT endorsement will remain, and excess GT may not be split out from the original permit configuration and sold. In cases where two or more permits are transferred to a larger vessel, the larger vessel will hold the original permits and may fish for CPS finfish as long as the aggregate GT endorsements, including the 10% allowances, add up to the new vessel's calculated GT. In the event that a vessel with multiple permits wishes to leave the CPS limited entry program, those permits may be sold together or separately, but the original permit endorsement may not be altered.

To ensure manageability of the permit program and stability of the fleet, only one transfer per permit will be allowed in each calender year. Permits may only be used on the vessel to which they are registered, and permit leasing will not be allowed. Catch history will be tied to the vessel, and not to the permits.

3.6.3.1 Adjusting Permit Transferability to Maintain the Capacity Goal

When the upper threshold of fleet GT (fleet GT plus 5%, or 5,933.5 mt) is reached, fleet capacity will be restored to the capacity goal (5,650.9 mt) by restricting conditions for permit transfer. Under this mechanism, once the trigger point (5,933.5 mt) is met or exceeded, permits could only be transferred to vessels with equal or smaller GT and the 10% vessel allowance is removed. The 10% allowance could be reconsidered once total fleet GT is reduced to the 5,650.9 mt target.

3.6.4 Procedures for Issuing New Limited Entry Permits in the Future

~~The Council may issue new limited entry permits consistent with the parameters of a framework that may be developed in the future.~~

If, in response to positive changes in CPS finfish resources or market conditions, it is determined that new limited entry permits should be issued the qualifying criteria originally established in the FMP (Section 3.6.1.1) would be used for issuance of these new permits. It is expected that this would entail continuing down the list of vessels having landings during the 1993-97 window period in order of decreasing window period landings. For example, the next permit awarded would go to the 71st of the 640 vessels identified in the original analysis (Amendment 8) with window period finfish landings if this vessel were to apply for a new permit. Each vessel on the list would need to have its harvest capacity evaluated so that in aggregate the new capacity target was not exceeded. New permits could be issued on either a temporary or permanent basis, depending on the circumstances surrounding the need for additional fleet capacity. Prior to issuance of new permits, the Council or the Regional Administrator would need to determine if the new permits would be either temporary or permanent.

3.6.5 Coastal Pelagic Species Fishing Exempted from Limited Entry

3.6.5.1 Exempted Landings

Vessels landing small quantities of CPS finfish on a per trip basis do not require a limited entry permit. The Council will set, by regulation, a level of landings per trip that is exempt from limited entry. This level must be between one mt and five mt per trip. The level specified by the Council will remain in place until changed by rulemaking.

3.6.5.2 Recreational Fishing

Recreational fishing for CPS finfish does not require a limited entry permit. However, the Council may choose to restrict recreational harvest quotas, implement area closures or impose any other type of management measure.

3.6.5.3 Live Bait Coastal Pelagic Species Fishing

Fishing CPS species for use as live bait does not require a limited entry permit. This includes live bait harvested for use in recreational and commercial fisheries.

3.6.6 Additional Management of the Limited Entry Fishery

3.6.6.1 Trip Limit

The Council may set a trip limit, by regulation, of up to 125 mt on landings of CPS finfish. In this context, a trip is defined as any activity (e.g., catching, landing, transporting or delivering) by a vessel that harvests CPS finfish with a limited entry permit; (i.e., a possession limit that applies to harvesting operations only). Also in this context, a trip limit should not be confused with trip limits used in other fisheries (e.g., groundfish) to lengthen the season without exceeding harvest guidelines or to manage bycatch.

4.0 OPTIMUM YIELD, MAXIMUM SUSTAINABLE YIELD CONTROL RULES, AND OVERFISHING DEFINITIONS FOR THE COASTAL PELAGIC SPECIES FISHERY

This fishery management plan defines optimum yield (OY), maximum sustainable yield (MSY) control rules, and defines overfishing and overfished stocks. All aspects of harvest policies for coastal pelagic species (CPS) including the MSY control rule, definition of overfishing, definition of overfished stocks and rebuilding criteria can be modified using framework procedures described in Section 2.0.

4.1 Definition of Optimum Yield

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) defines the term "optimum", with respect to the yield from a fishery, as the amount of fish which:

(A) 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;
(B) is prescribed on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant social, economic, or ecological factor; and
(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery [50 CFR §600.310(f)(1)(i)].

OY for a CPS stock is defined to be the level of harvest which is less than or equal to acceptable biological catch (ABC) estimated using a MSY control rule, consistent with the goals and objectives of this fishery management plan (FMP), and used by the Council to manage the stock. The ABC is a prudent harvest level calculated based on an MSY control rule (see below). In practice, OY will be determined with reference to ABC. In particular, OY will be set less than ABC to the degree required to prevent overfishing.

4.2 Definition of Maximum Sustainable Yield, MSY Control Rules, and Acceptable Biological Catch

For CPS, an MSY control rule is defined to be a harvest strategy that provides biomass levels at least as high as the F_{MSY} approach while also providing relatively high and relatively consistent levels of catch. According to federal regulations (50 CFR §600.310(b)(1)(ii)), an MSY control rule is "a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY." Similarly, MSY stock size "means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, that would be achieved under an MSY control rule in which the fishing mortality rate is constant." The definition of an MSY control rule for CPS is more general, because it includes the definition in National Standard 1. The definition for CPS is more conservative, because the focus for CPS is oriented primarily towards stock biomass levels at least as high as the MSY stock size. The primary focus is on biomass, rather than catch, because most CPS (Pacific sardine, northern anchovy, and market squid) are very important in the ecosystem for forage.

4.3 Definition of Overfishing

By definition, overfishing occurs in a fishery whenever fishing occurs over a period of one year or more at a rate that is high enough to jeopardize the capacity of the stock to produce MSY on a continuing basis if applied in the long term. Overfishing in the CPS fishery is "approached" whenever projections indicate overfishing will occur within two years. The definition of overfishing is in terms of a fishing mortality or exploitation rate. Depending on the exploitation rate, overfishing can occur when CPS stocks are at either high or low abundance levels. The Council must take action to eliminate overfishing when it occurs and to avoid overfishing when exploitation rates approach the overfishing level.

In operational terms, overfishing occurs in the CPS fishery whenever catch exceeds ABC and overfishing is approached whenever projections indicate that fishing mortality or exploitation rates will exceed the ABC level within two years. The definition of an overfished stock is an explicit part of the MSY control rule for CPS stocks.

4.4 Definition of an Overfished Stock

By definition, an overfished stock in the CPS fishery is a stock at a biomass level low enough to jeopardize the capacity of the stock to produce MSY on a continuing basis. An overfished condition is approached when projections indicate that stock biomass will fall below the overfished level within two years. The Council must take action to rebuild overfished stocks and to avoid overfished conditions in stocks with biomass levels

approaching an overfished condition.

4.5 Rebuilding Programs

Management of overfished CPS stocks must include a rebuilding program that can, on average, be expected to result in recovery of the stock to MSY levels in ten years. It is impossible to develop a rebuilding program that would be guaranteed to restore a stock to the MSY level in ten years, because CPS stocks may remain at low biomass levels for more than ten years even with no fishing. The focus for CPS is, therefore, on the average or expected time to recovery based on realistic projections. If the expected time to stock recovery is associated with unfavorable ecosystem conditions and is greater than ten years, then the Council and the U.S. Secretary of Commerce (Secretary) may consider extending the time period as described at 50 CFR §600.310(e).

Rebuilding programs for CPS may be an integral part of the MSY control rule or may be developed or refined further in the event that biomass of a CPS stock reaches the overfished level.

4.6 Maximum Sustainable Yield Control Rules

MSY control rules in the CPS fishery may vary depending on the nature of the fishery, management goals, assessment and monitoring capabilities, and available information. Under the framework management approach used for CPS, it is not necessary to amend the CPS FMP in order to develop or modify MSY control rules or definitions of overfishing.

The use of an MSY control rule for Actively managed stocks is to provide managers with a tool for setting and adjusting harvest levels on a periodic basis while preventing overfishing and overfished stock conditions. All Actively managed stocks must have stock-specific MSY control rules, a definition of overfishing and a definition of an overfished stock.

The main use of an MSY control rule for a Monitored stock is to help gauge the need for Active management. MSY control rules and harvest policies for Monitored CPS stocks may be more generic and simple than those for Actively managed stocks with significant fisheries. Any stock supporting catches approaching the ABC or MSY levels should be Actively managed unless there is too little information available or other practical problems.

4.6.1 Default CPS MSY Control Rule

The Council may use the default MSY control rule, defined below, for Monitored species unless a better species-specific rule is available. The default MSY control rule can be modified under framework management procedures.

The default MSY control rule (intended primarily for a stocks that are Monitored) sets ABC for the entire stock (U.S., Mexico, Canada, and international fisheries) equal to 25% of the best estimate of the MSY catch level. Overfishing occurs whenever the total catch (U.S., Mexico, Canada, and international fisheries) exceeds ABC for the or whenever fishing occurs at a rate that is high enough to jeopardize the capacity of the stock to produce MSY. Overfishing of a Monitored CPS stock is "approached" whenever projections or estimates indicate that the overfishing will occur within two years.

In making decisions about Active management, Council may choose to consider ABC and catches in U.S. waters only. ABC in U.S. waters is the ABC for the entire stock prorated by an estimate of the fraction of the stock in U.S. waters. Active management may not be effective if U.S. catches are small and overfishing is occurring in Mexico, Canada, or in international waters outside the jurisdiction of federal authorities.

General MSY Control Rule for Actively Managed Species

The general form of the MSY control rule utilized for the California CPS fisheries was designed to continuously reduce the exploitation rate as biomass declines. The general formula used is :

$$H = (\text{BIOMASS-CUTOFF}) \times \text{FRACTION}$$

H is the harvest target level, CUTOFF is the lowest level of estimated biomass at which directed harvest is allowed and FRACTION is the fraction of the biomass above CUTOFF that can be taken by the fishery.

BIOMASS is generally the estimated biomass of fish age 1+ at the beginning the season. The purpose of CUTOFF is to protect the stock when biomass is low. The purpose of FRACTION is to specify how much of the stock is available to the fishery when BIOMASS exceeds CUTOFF. It may be useful to define any of the parameters in this general MSY control rule so that they depend on environmental conditions or stock biomass. Thus, the MSY control rule could depend explicitly on the condition of the stock or environment. The formula generally uses the estimated biomass for the whole stock in one year (BIOMASS) to set harvest for the whole stock in the following year (H) although projections or estimates of BIOMASS, abundance index values or other data might be used instead. BIOMASS is an estimate only, it is never assumed that BIOMASS is a perfect measure of abundance. Efforts to develop a harvest formula must consider probable levels of measurement error in BIOMASS which typically have CVs of about 50% for CPS.

The general MSY control rule for CPS (depending on parameter values) is compatible with the Magnuson-Stevens Act and useful for CPS that are important as forage. If the CUTOFF is greater than zero, then the harvest rate (H/BIOMASS) declines as biomass declines. By the time BIOMASS falls as low as CUTOFF, the harvest rate is reduced to zero. The CUTOFF provides a buffer of spawning stock that is protected from fishing and available for use in rebuilding if a stock becomes overfished. The combination of a spawning biomass buffer equal to CUTOFF and reduced harvest rates at low biomass levels means that a rebuilding program for overfished stocks may be defined implicitly. Moreover, the harvest rate never increases above FRACTION. If FRACTION is approximately equal to F_{MSY}, then the MSY control rule harvest rate will not exceed F_{MSY}. In addition to the CUTOFF and FRACTION parameters, it may be advisable to define a maximum harvest level parameter (MAXCAT) so that total harvest specified by the harvest formula never exceeds MAXCAT. MAXCAT is used to guard against extremely high catch levels due to errors in estimating biomass, to reduce year to year variation in catch levels, and to avoid overcapitalization during short periods of high biomass and high harvest. MAXCAT also prevents the catch from exceeding MSY at high stock levels and spreads the catch from strong year classes over a wider range of fishing seasons.

Other general types of control rules may be useful for CPS and this FMP does not preclude their use as long as they are compatible with National Standards and the Magnuson-Stevens Act.

Transboundary Issues

Management of transboundary stocks is one of the most difficult problems in management of CPS. Ideally, transboundary CPS stocks would be managed cooperatively by the U.S., Canada, and Mexico on the basis of common policy. At present, there are no cooperative management agreements with Mexico or Canada.

In the absence of a cooperative management agreement, the default approach in the CPS FMP sets harvest levels for U.S. fisheries by prorating the total target harvest level according to the portion of the stock resident in U.S. waters or estimating the biomass in U.S. waters only. In practice, this approach is similar to managing the U.S. and Mexican portions of a stock separately since harvest for the U.S. fishery in a given year depends ultimately on the biomass in U.S. waters.

Other approaches that may be developed in the future are not precluded by this default. If the portion of the stock in U.S. waters can not be estimated or is highly variable, then other approaches may be used. It may be more practical, for example, to use of a high CUTOFF in the MSY control rule to compensate for stock biomass off Mexico or Canada.

4.6.2 MSY Control Rule for Pacific Sardine

The MSY Control Rule for Pacific sardine sets ABC for the entire sardine stock based on an estimate of biomass for the whole sardine stock, a CUTOFF equal to 150,000 mt, a FRACTION between five percent and 15% (depending on oceanographic conditions as described below), and MAXCAT of 200,000 mt. The U.S. ABC is calculated from the target harvest for the whole stock by prorating the total ABC based on proportion of total biomass in U.S. waters.

FRACTION in the MSY control rule for Pacific sardine is a proxy for F_{MSY} (i.e., the fishing mortality rate for deterministic equilibrium MSY). FRACTION depends on recent ocean temperatures because F_{MSY} and productivity of the sardine stock is higher under ocean conditions associated with warm water temperatures (Appendix B, Section 4.2.3.4). An estimate of the relationship between F_{MSY} for sardine and ocean temperatures is:

$$F_{MSY} = 0.248649805\ T^2 - 8.190043975\ T + 67.4558326$$

where T is the average three season sea surface temperature at Scripps Pier, California during the three preceding seasons. The MSY control rule for sardine sets the control rule parameter FRACTION equal to F_{MSY} except that FRACTION is never allowed to be higher than 15% or lower than five percent.

Although F_{MSY} may be greater or lesser, FRACTION can never be greater than 15% or less than five percent unless the MSY control rule for sardine is revised, because five percent and 15% are policy decisions taken by Council based on social, economic, and biological criteria. In contrast, relationships between FRACTION, F_{MSY} and environmental conditions are technical questions and estimates or approaches may be revised by technical teams to accommodate new ideas and data.

4.6.2.1 Definition for Overfished Stock for Sardine

An overfished sardine population is one with an 1+ stock biomass on July 1 of 50,000 mt or less. No directed fishing is allowed in any year or season while the stock is overfished. The Council is required to minimize fishing mortality on an overfished stock to the extent practicable and to undertake a rebuilding program which may be implicit to the MSY control rule or explicit.

4.6.2.2 Live Bait Harvest Between the Definition of Overfishing and CUTOFF

The small live bait fishery which supplies live CPS to recreational and commercial fisheries will be allowed to operate when estimated biomass falls below the CUTOFF, which is currently set at 150,000 mt (and other directed fishing is precluded) but is still above the definition of an overfished stock, currently set at 50,000 mt. This does not prevent the Council from undertaking any measure authorized under this FMP that may be necessary to manage the live bait fishery and sardine stock. The live bait fishery could, for example, be managed by harvest guideline or quota, season, or gear restrictions at any point under the framework management process.

4.6.3 Maximum Sustainable Yield Control Rule for Pacific (Chub) Mackerel

The MSY control rule for Pacific mackerel sets the CUTOFF and the definition of an overfished stock at 18,200 mt and the FRACTION at 30%. Overfishing is defined as any fishing in excess of ABC calculated using the MSY control rule. No MAXCAT is defined because the U.S. fishery appears to be limited to about 40,000 mt per year by markets. The target harvest level is defined for the entire stock in Mexico, Canada, and U.S. waters (not just the U.S. portion), and the U.S. target harvest level is prorated based on relative abundance in U.S. waters.

4.6.4 Monitored Stocks

Northern anchovy (northern and central subpopulations), jack mackerel and market squid will be monitored at the outset of the CPS FMP. The default MSY control rule and overfishing specifications will be used for Monitored stocks.

4.6.4.1 Northern Anchovy-Central Subpopulation

The central subpopulation of northern anchovy ranges from approximately San Francisco, California, to Punta Baja, Mexico. The default MSY control rule gives an ABC of 25% of the total biomass estimate. The resulting ABC would then be prorated by the portion of the stock in U.S. waters to arrive at ABC in U.S. waters.

4.6.4.2 Northern Anchovy-Northern Subpopulation

The northern subpopulation of anchovy ranges from San Francisco north to British Columbia with a major spawning center off Oregon and Washington that is associated with the Columbia River plume. The northern subpopulation supports small but locally important bait fisheries and is likely an important source of forage to local predators, including depleted and endangered salmonid stocks.

The recommended default MSY control rule gives an ABC for the entire stock equal to 25% of MSY catch but MSY catch has not been estimated. The portion of the northern subpopulation of northern anchovy resident in U.S. waters is unknown. It is likely that some biomass occurs in Canadian waters off British Columbia. ABC is U.S. waters cannot be calculated at this time.

4.6.4.3 Jack Mackerel

The ABC level for jack mackerel is calculated by age/area from mid-range potential yield values. ABC in U.S. waters will be prorated according to the portion of the stock in US waters. If jack mackerel catches increase and become significant, managers may decide to address management of different age groups and areas independently. This question does not need to be addressed at this time because catches are low (generally less than 2,000 mt per year since 1990).

4.6.4.4 Market Squid

~~The default MSY control rule gives an ABC for the entire stock equal to 25% of MSY catch, but MSY catch for market squid has not been estimated. The portion of the market squid stock resident in U.S. waters is unknown. It is likely that some biomass occurs in Mexican waters off Baja California and Canadian waters off British Columbia. ABC is U.S. waters cannot be calculated at this time, because basic information about life history and fisheries biology is not yet available for market squid (Appendix A, Section 1.5).~~

~~Scientific research currently underway, improvements to squid port sampling, and the moratorium on new squid permits under California state law (Appendix A, Section 1.5.5) constitute a plan for stock assessment and close monitoring of fishing effort that will make it possible to manage the market squid fishery if conditions change and Active management is required.~~

~~The Council makes decisions about Active and Monitored management for CPS annually based on socioeconomic framework management procedures (Section 2.1.3). State managers under state law and federal managers under this FMP can be expected to manage the fishery intensively when sufficient data indicate a need.~~

The MSY Control Rule for market squid is founded generally on conventional spawning biomass "per recruit" model theory. Specifically, the MSY Control Rule for market squid is based on evaluating (throughout a fishing season) levels of egg escapement associated with the exploited population. The estimates of egg escapement are evaluated in the context of a "threshold" that is believed to represent a minimum level that is considered necessary to allow the population to maintain its level of abundance into the future (i.e., allow for "sustainable" reproduction year after year). In practical terms, the Egg Escapement approach can be used to evaluate the effects of fishing mortality (*F*) on the spawning potential of the stock and in particular, to examine the relation between the stock's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}).

The fishing mortality (F_{MSY}) that results in a threshold level of egg escapement of at least 30% will be used initially as a proxy for MSY. However, it is important to note that the level of egg escapement will be reviewed on an intermittent basis as new information becomes available concerning the dynamics of the stock and fishery, to ensure that the proposed threshold meets its objective as a long-term, sustainable biological reference point for this marine resource. This is not a trivial exercise, given the need for ongoing research regarding the biology of this species, which may result in revised recommendations in the future. Ultimately, the market squid fishery can operate freely, within the constraints of currently adopted regulations as dictated by the CDFG (e.g., annual landings cap, weekend closures, closed areas) and NMFS, as long as egg escapement is equal to, or greater than, the threshold value—assessments will be conducted on a yearly basis for the first two years (2002-04) and on a multi-year basis beginning in 2005. In the event that egg escapement is determined to be below the 30% threshold for two successive years, then a point-of-concern would be triggered under the FMP's management framework and the Council could consider moving market squid from Monitored to Active management status. Current state regulations for squid are not anticipated to change in the near future, however, should existing laws limiting effort or harvest be rescinded, further management actions by the Council could also be considered.

As noted, the Council and state authorities will continue to monitor squid landings ~~while research continues~~. If landings increase or a biological risk to the stock develops, **the** Council can be expected to promote squid to Active management quickly under the "point-of-concern" framework management procedures (Section 2.1.2).

4.7 Stock Assessment and Fishery Evaluation Report

The Coastal Pelagic Species Management Team (CPSMT) will prepare an annual Stock Assessment and Fishery Evaluation (SAFE) report describing the status of the CPS fishery. The SAFE report provides information to the Councils for determining annual harvest levels for each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. This includes landings, prices, revenues, and economic, biological or environmental conditions not covered elsewhere in assessments for Actively managed species. In particular, the SAFE report shall include:

1. Current status of CPS resources.
2. A description of the maximum fishing mortality threshold and the minimum stock size threshold for each stock or stock complex, along with information by which the Council may determine:
   (a) Whether overfishing is occurring with respect to any stock or stock complex, whether any stock or stock complex is overfished, whether the rate or level of fishing mortality applied to any stock or stock complex is approaching the maximum fishing mortality threshold, and whether the size of any stock or stock complex is approaching the minimum stock size threshold.
   (b) Any management measures necessary to provide for rebuilding an overfished stock or stock complex (if any) to a level consistent with producing the MSY in such fishery.
3. The total and U.S. target levels, if calculated, along with all available information about bycatch, domestic annual harvest (DAH), domestic annual processing (DAP), joint venture processing (JVP), and total allowable level of foreign fishing (TALFF) used to specify harvest guidelines or quotas.
4. Recent and historical catch statistics (landings and value).
5. Recommendations for use of harvest guideline or quotas by species.
6. A brief history of the harvesting sector for the fishery.
7. A brief history of CPS management.
8. A summary of recent economic conditions, including information such as **status of fleet capacity,** number of vessels and performance by gear type, including recreational and commercial fishing interests, fishing communities, and fish processing interests.
9. Safety considerations.
10. Ecosystem information.
11. Bycatch summary.
12. Any necessary expansions to previous environmental and regulatory impact documents, and ecosystem and habitat descriptions.
13. Other relevant biological, sociological, economic, and ecological information that may be useful to the Council.

The Council will make SAFE reports available to the public by such means as mailing lists and newsletters and will provide copies on request.

Monitored Species

The annual SAFE report prepared by the CPSMT will include all available information that may be used to determine if a point-of-concern exists (e.g., overfishing) or if a stock should be considered for Active management or for Monitored management. At a minimum, the report should contain landings' data for Monitored stocks and any available information about trends in abundance.

4.8 Annual Specifications and Announcement of Harvest Levels

Each year, the Secretary will publish in the *Federal Register* the final specifications of (1) OY for U.S. fisheries in the form of a target harvest level, (2) DAH, (3) DAP, (4) JVP, and (5) TALFF for all CPS Actively managed by the Council. The total U.S. harvest will be allocated to the various fisheries as harvest guidelines or as quotas.

In calculating harvest guidelines and quotas for each species, an estimate of the incidental catch of each species caught while fishermen are targeting other species will be taken into account. Therefore, the total harvest guideline will consist of an incidental catch portion and a directed fishery portion. This will be done to minimize the chances of exceeding the target harvest level.

If the harvest guideline for the directed fishery is reached the directed fishery will be closed by an automatic action and incidental catch will continue to be allowed under the incidental catch allowance, which is

expressed in an amount of fish or a percentage of a load (Section 5.1). If the estimated incidental catch portion of the harvest guideline has been set too high, resulting in the probability of not attaining the target harvest level by the end of the fishing season, the remaining incidental catch portion may be allocated to the directed fishery through the "routine" management procedures. This reallocation of the remaining incidental catch portion of the harvest guideline to the directed fishery is not likely to be necessary unless substantial errors are discovered in calculations or estimates.

4.8.1 General Procedure for Setting Annual Specifications

The intent of the management approach under the FMP is to reassess the status of each Actively managed species at frequent intervals and preferably every year (although a full analytic stock assessment may not be necessary or possible in some cases). The general procedure for making the annual specifications for CPS is as follows:

1. The CPSMT will produce a SAFE report as specified in Section 4.7, that documents the current estimates of biomass for each coastal pelagic species assessed and status of the fishery. In the report, the CPSMT will recommend either harvest guidelines or quotas for Actively managed species, including a directed portion and an incidental portion, an initial incidental catch allowance to be used when harvest guidelines are reached together with an estimate of total incidental catch, and will make all calculations of the specifications as required by this FMP.

2. Documents will be sent to the NMFS Regional Administrator, Southwest Region, the Council, members of the Council's Scientific and Statistical Committee (SSC), members of the Coastal Pelagic Species Advisory Subpanel (CPSAS), and all interested parties for review.

3. A public meeting or meetings will be announced in the *Federal Register* and held with the CPSMT and the CPSAS to discuss the proposed annual specifications and to obtain public comments.

4. At its first opportunity, the Council will review all information compiled for the annual specifications, consult with its SSC, CPSMT, CPSAS, and hear public comments. The Council also will review any important social and economic information at that time, then make a recommendation to the NMFS Regional Administrator on the final specifications, including OY levels, harvest guidelines, quotas, allocations, and other management measures for the fishing season.

5. Following the Council meeting, the NMFS Regional Administrator will consider all comments and make a determination of the final specifications. This determination will be published in the *Federal Register* with a request for additional public comment.

6. Alternate Procedure: If assessment and season schedules warrant, the NMFS Regional Administrator may make preliminary OY, harvest guideline, and/or quota specifications quickly (without prior discussion at a Council meeting) to allow fishing to begin without delay. As soon as practicable, the Council will review all background documents contributing to the determination of the biomass estimates and make a final recommendation for the resulting target harvest level, harvest guidelines and quotas. Following the meeting of the Council, the NMFS Regional Administrator will consider all comments and make a determination of whether any changes in the final specifications are necessary. If such changes are warranted, they will be published in the *Federal Register*.

   If assembling the data and producing a report would require enough time that permitting a complete public review before the beginning of the fishing season could reduce the season, then this alternate procedure should be used.

7. NMFS will monitor the fishery throughout the year, tracking incidental catch and harvest guidelines and quotas. If a harvest guideline or quota for any species is or is likely to be reached prematurely, a "point of concern" will occur, triggering a mandatory review of the status of the stock. If the directed harvest portion of a harvest guideline or quota is reached, then directed fishing will be prohibited and the prespecified incidental trip limit will be imposed as an automatic action through publication of a notice in the *Federal Register*.

The NMFS Regional Administrator would be responsible for setting the harvest guidelines based on the estimated biomass and the standards set in the FMP. This is the same process that has been used in the northern anchovy fishery and would be adapted for Actively managed CPS. The formulas used to set harvest

guidelines for CPS are straightforward and provide little latitude for judgement, therefore, there is less discretion involved in setting annual specifications for CPS than for other fisheries.

Harvest guidelines for CPS are based on the current biomass estimate multiplied by a fixed harvest rate. The portion of the resource in U.S. waters may change over time, but in any one year is the best estimate available. The amount of the harvest guideline needed for incidental trip limits when the fishery is nearing closure will vary depending on when the harvest guideline is projected to be achieved, but the incidental amount and the amount harvested directly must equal the total harvest guideline.

Following the determination of the estimated biomass, a public meeting would be held between the CPSMT and CPSAS. The biomass estimate and resultant harvest guideline would be reviewed, public comments obtained, and all information forwarded to the Council. At its meeting, the Council, after hearing public comments, would either adopt the annual specifications or recommend changes, accompanied by a justification for why the change should be made.

The intention of the proposed regulations is to have public review of and a Council recommendation on the estimated biomass and harvest guidelines before the fishing season begins; however, the NMFS Regional Administrator is not precluded from announcing the harvest guidelines in the *Federal Register* before the process is completed so that fishermen can plan their activities and begin harvesting when the fishing season begins.

4.8.2 Factors Considered

The following factors will be considered when making the annual specifications:

1. The current estimated biomass and any other biological information.
2. The MSY control rule described in the FMP, which is specific for each Actively managed species.
3. Results of comments of domestic processors and joint venture operations about processing capacity and planned utilization.
4. Results of an analysis of the fishing capacity and planned utilization of recent years modified by new information and comments by the fishing industry relating to intended use.
5. Any relevant historical information on the utilization of CPS resources.

All data used to make annual specifications will be available for public inspection during normal business hours at the Southwest Regional Office of NMFS.

4.8.3 Guidelines for Choosing Between a Harvest Guideline and Quota

Quotas are specified numerical harvest objectives, the attainment of which results in automatic closure of the fishery for that species. Retention, possession, and landing of a species after attainment of its quota is prohibited. A quota is a single numerical value, not a range.

Harvest guidelines are specified numerical harvest objectives that differ from quotas in that closure of a fishery (i.e., prohibition of retention, possession, and landing) is not automatically required upon attainment of the objective. A harvest guideline may be either a range or a point estimate.

The preferred approach for managing domestic coastal pelagic resources is by harvest guideline. Foreign fisheries will normally be managed by quotas. Harvest guidelines are used for the domestic fishery because bycatch of one coastal pelagic species is common when fishing for another, and curtailing the harvest of one species may limit the harvest of another and prevent achieving target harvest levels.

Harvest guidelines will be used as long as the following conditions are met:

1. Allowing an imprecise cap on total harvest will still ensure long term productivity of the resource and the economic well-being of the fishery and dependent species.
2. Unavoidable bycatch would occur after a quota was reached and further landings prohibited, curtailing the harvest of other resources or creating discards.
3. Fishing in excess of a harvest guideline is not expected to significantly affect future yields.
4. Overfishing is not likely to occur.

Generally, a quota will not be used for domestic fisheries unless extra protection of an individual species

becomes important. Foreign fishing allocations (TALFFs) will generally be quotas. Quotas should be used for domestic fisheries when:

1. A high degree of protection of one species is needed to ensure the future well-being of the fishery or dependent species.
2. Permitting bycatch after a harvest guideline is reached cannot be accepted if the objectives of the FMP are to be met.
3. Fishing in excess of a harvest guideline would significantly affect future yields.
4. Overfishing may occur and is less likely under quota management.

The choice of a numerical specification of a harvest guideline or quota is based on a balance of its social, economic, and biological effects as stated above.

4.9 Annual Assessment and Management Cycles

This FMP specifies that annual schedules for Actively managed CPS be developed based on the Council's workload and meeting schedule, opportunity for industry and technical review of biomass estimates and harvest guidelines or quotas, seasonal patterns in the fishery, collection and processing of CalCOFI data during the peak spawning season, collection of other data, time required for notification of fishers, and workload of the CPSMT and CPSAS. The FMP does not specify what those schedules will be, since they will be implemented through regulations.

The annual assessment and management cycles determine the start and close date (season) for each Actively managed fishery. These may be changed by abbreviated rulemaking as described in Section 2.1.

5.0 BYCATCH, INCIDENTAL CATCH, AND ALLOCATION

This fishery management plan (FMP) establishes incidental catch allowances for coastal pelagic species (CPS) and a geographic allocation for Pacific sardine.

5.1 Incidental Catch Allowances

"Bycatch" is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as "fish which are harvested in a fishery, but not sold or kept for personal use and includes economic discards and regulatory discards". In the CPS fisheries, fish are caught and sold incidental to catching other species, because they sometimes school together. Incidental catch allowances permit fishermen to land a certain percentage of fish that would otherwise be considered bycatch. Incidental catch allowances can be expressed as an amount or percentage of catch, landings, or deliveries.

Incidental catch allowances will be set by the Council, based on recommendation from the Coastal Pelagic Species Management Team (CPSMT), and consistent with Sections 5.1.1 through 5.1.6 of this FMP. Estimates of total incidental catch expected under the incidental catch allowances will be factored into harvest guidelines and quota recommendations. As described in Section 4.8, estimates of total incidental catch will normally be combined with the directed fishery harvest guideline to arrive at a total optimum yield (OY). The purpose of this adjustment is to ensure that overfishing does not occur due to incidental catch.

Incidental catch allowances are the primary method for managing bycatch in the CPS fishery. Other management approaches, such as fishing seasons or area restrictions, might also be required to reduce bycatch or incidental catch. The incidental catch allowances described here do not exclude the possibility of trip limits or other regulations imposed to reduce bycatch, prolong the directed fishery, or for other purposes.

5.1.1 Incidental Catch Allowances When Stocks are Overfished

When a stock is overfished according to the definition of overfishing in this FMP, incidental catch allowances for commercial fishing shall be set at zero percent to 20% of landed weight, as recommended by the Council.

5.1.2 Incidental Catch Allowances When Stocks are Not Overfished

When a stock is not overfished according to the definition of overfishing in the FMP, incidental catch allowances for commercial fishing shall be set at zero percent to 45% of landed weight, as recommended by the Council.

5.1.3 Pacific (chub) Mackerel Landed Incidentally

When the Pacific (chub) mackerel resource is not overfished, and total landings for the directed fishery established under a harvest guideline have been caught, the Council may set an allowable incidental trip limit of one mt or lower.

5.1.4 Incidental Catch Allowances for Live Bait When Stocks are Overfished

When a stock is overfished according to the definition of overfishing in the FMP, incidental catch allowances for live bait fishing shall be set to no more than 15% of landed weight, as determined by the Council.

5.1.5 Incidental Catch Allowances for Live Bait When Stocks are Not Overfished

When a stock is not overfished according to the definition of overfishing in the FMP, no restrictions are placed on live bait harvest.

5.1.6 Guidelines and Criteria For Setting Incidental Catch Allowances

In setting incidental catch allowances, Council will consider existing regulations, goals and objectives of this FMP, best available data, scientific and management advice available, guidelines given below, and other policies established by the Council. If decision by the by the NMFS Regional Administrator about incidental catch allowances is necessary due to time constraints, it will be made based on consultation with the Council Chair, Director of the California Department of Fish and Game, CPSMT, Coastal Pelagic Species Advisory Subpanel (CPSAS), other representatives appointed by the Council, and interested parties as appropriate.

5.1.6.1 Overfished Stocks

In order of priority, the Council's goals in setting incidental catch allowances for overfished stocks should be to (1) minimize fishing mortality on overfished stocks, and (2) minimize discards of overfished stocks. Incidental catch allowances for overfished stocks should approximate rates of incidental catch when fishing is conducted in a manner that minimizes catch of the overfished stock.

The Council must set incidental catch allowances for all overfished stocks. Once set, incidental catch allowances for overfished stocks remain in force until they are changed. Incidental catch allowances for overfished stocks can be revised during the fishing season if conditions warrant or new information becomes available.

5.1.6.2 Stocks Not Overfished

Incidental catch allowances for stocks that are not overfished are enforced once a the directed fishery harvest guideline has been reached, and the directed fishery has been closed. Goals in setting incidental catch allowances for stocks that are not overfished should be to (1) avoid unnecessary discard, (2) ensure that optimum yield is taken, but not exceeded, and (3) promote efficiency and profitability in the fishery. Estimates of total incidental catch (based on past or current incidental catch rates, incidental catch allowances, harvest guidelines and other conditions in the fishery) are normally considered when harvest guidelines are set. Thus, incidental catch allowances should be set at the same time and in concert with harvest guidelines.

Incidental catch allowances are meant to accommodate catches that are difficult to avoid during normal fishing directed at other species. Therefore, incidental catch allowances should be set at levels that approximate incidental catch rates during normal fishing activities.

5.2 North-South Allocation for Directed Fishery

This FMP authorizes allocations of Pacific sardine harvest guideline to participants by northern and southern areas (defined below). Nothing in this FMP precludes additional allocations based on other geographic areas or other factors developed under the authority of this FMP.

5.2.1 Definition of Northern and Southern Fishery Segments

The division between northern and southern areas for the U.S. Pacific sardine fishery is Point Piedreas Blancas (35°40' N latitude). Landings (or catches if their location is known) north of Point Piedreas Blancas and south of **the U.S.-Canada border** ~~39° N latitude~~ apply to the northern area. U.S. landings (or catches if their location is known) south of Point Piedreas Blancas apply to the southern area.

5.2.2 Formulas for Allocating Pacific Sardine

The northern area allocation is 33% of the of Pacific sardine harvest guideline, and the southern area allocation is 66% of the of Pacific sardine harvest guideline. Nine months after the start of the fishing season, any uncaught portion of the harvest guideline will be totaled and reallocated with 50% of the total allocated to the northern area and 50% of the total allocated to the southern fishery area. Reallocation will be carried out by the NMFS Regional Administrator as an automatic measure as described in Section 2.1.

Add to References –

PFMC. 2002. *Status of The Pacific Coast Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches, Stock Assessment and Fishery Evaluation –2002.* (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council. Portland, Oregon.