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**Marine Sanctuaries Conservation Series MSD-99-1**

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# Multi-species and Multi-interest Management

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**An ecosystem approach to market squid  
(*Loligo opalescens*) harvest in California**

**U.S. Department of Commerce**  
National Oceanic and Atmospheric Administration  
National Ocean Service  
Office of Ocean and Coastal Resource Management  
**Marine Sanctuaries Division**

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Multi-species and Multi-interest Management:  
An Ecosystem Approach to Market Squid (*Loligo opalescens*) Harvest in California

A Panel Discussion facilitated by

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National Oceanic and Atmospheric Administration  
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at the  
Squid Symposium of the  
California Cooperative Oceanic and Fisheries Investigations Conference  
October 28-30, 1997  
Lake Arrowhead Conference Center, California

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## ABSTRACT

Market squid (*Loligo opalescens*) plays a vital role in the California ecosystem and serves as a major link in the food chain as both a predator and prey species. For over a century, market squid has also been harvested off the California coast from Monterey to San Pedro. Expanding global markets, coupled with a decline in squid product from other parts of the world, in recent years has fueled rapid expansion of the virtually unregulated California fishery. Lack of regulatory management, in combination with dramatic increases in fishing effort and landings, has raised numerous concerns from the scientific, fishing, and regulatory communities.

In an effort to address these concerns, the National Oceanic and Atmospheric Administration's (NOAA) Channel Islands National Marine Sanctuary (CINMS) hosted a panel discussion at the October 1997 California Cooperative Oceanic and Fisheries Investigations (CalCOFI) Conference; it focused on ecosystem management implications for the burgeoning market squid fishery. Both panel and audience members addressed issues such as: the direct and indirect effects of commercial harvesting upon squid biomass; the effects of harvest and the role of squid in the broader marine community; the effects of environmental variation on squid population dynamics; the sustainability of the fishery from the point of view of both scientists and the fishers themselves; and the conservation management options for what is currently an open access and unregulated fishery. Herein are the key points of the ecosystem management panel discussion in the form of a preface, an executive summary, and transcript.

**Keywords:** Channel Islands National Marine Sanctuary, market squid, *Loligo opalescens*, ecosystem management, California Cooperative Oceanic and Fisheries Investigations, fishery management, squid fishery

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## PREFACE

The 1997 California Cooperative Oceanic and Fisheries Investigations (CalCOFI) Conference was held on October 28-30, 1997 in Lake Arrowhead, California.<sup>1</sup> The symposium of the conference, *Market Squid: What We Know and What We Need to Know For Effective Management*, was co-sponsored by the California Department of Fish and Game, the California Seafood Council, and the Channel Islands National Marine Sanctuary. The symposium included paper presentations and two panel discussions. The Market Squid symposium offered a rare opportunity to work with experts from around the world to explore management alternatives and to promote future research and effective resource management of market squid (*Loligo opalescens*) in California. The first panel discussion focused on harvest management strategies and was sponsored by the California Seafood Council.<sup>2</sup> The National Oceanic and Atmospheric Administration's (NOAA) Channel Islands National Marine Sanctuary facilitated the second panel discussion, titled: *Multi-Species and Multi Interest Management, An Ecosystem Approach to Squid Harvest in California*. Panel members represented the Center for Marine Conservation, Scripps Institution of Oceanography, marine resource consulting firms, the University of California at Santa Barbara, squid harvesters, seafood marketers, and light boat operators. We are very grateful and indebted to the CalCOFI coordinators and the panel of experts and commend them on pioneering new management approaches to fisheries and ecosystem management.

Herein we have provided the key points of the ecosystem management panel discussion in the form of an executive summary, transcript of the discussion, and the question and answer session. Additional copies are available by sending a request to the Channel Islands National Marine Sanctuary, 113 Harbor Way, Santa Barbara, California 93109, or by visiting the Sanctuary website at <http://www.cinms.nos.noaa.gov/>.

The Channel Islands National Marine Sanctuary is administered by the National Oceanic and Atmospheric Administration and was designated in 1980. The Sanctuary boundaries extend from mean high tide out to six nautical miles surrounding the Islands of San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara and encompass 1,252 nautical miles in area. The Sanctuary is committed to resource conservation, including the protection of ecologically and economically important species and species assemblages and conducting long-term research with an ecosystem approach. The Sanctuary includes both open ocean and nearshore environments that provide habitat to 26 species of marine mammals, over 60 species of seabirds, the state of California's most valuable fish and invertebrate species, and giant kelp forests. In addition to the abundance of natural resources, the Channel Islands National Marine Sanctuary protects historical and cultural resources, which include over 200 documented shipwrecks and numerous Chumash Native American sites and artifacts.

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<sup>1</sup> The 1997 CalCOFI proceedings are available as CalCOFI Reports Volume 39 October 1998 and can be obtained by contacting the CalCOFI Coordinator, University of California, San Diego, Marine Life Research Group, Scripps Institution of Oceanography, 9500 Gilman Dr., La Jolla, CA 92093-0227.

<sup>2</sup> Contact Diane Pleschner with the California Seafood Council regarding the Harvest Management panel discussion.

## BACKGROUND

For over 100 years market squid (*Loligo opalescens*) has been harvested off the California coast from Monterey to San Pedro. The squid fishery has evolved into one of the largest fisheries in volume and economic value in California. In 1996, the squid harvest reached an all time high of over 80,272 metric tons (Vojkovich 1998)<sup>3</sup> that generated millions of dollars of income to the state from domestic and foreign sales. This was a dramatic increase in statewide landings from 55,374 (Vojkovich 1998)<sup>1</sup> tons in 1994. Expanding global markets, especially in China and the Mediterranean, coupled with a decline in squid product from other parts of the world, has fueled the rapid expansion of the California squid fishery.

Fishers from other fisheries, and from other regions, notably Oregon, Washington, and Alaska, have begun to enter the California squid fishery. The rapid expansion in fishing effort and landings has raised numerous concerns from the scientific, fishing, and regulatory communities. At the time of the squid symposium, the squid fishery was considered virtually unregulated, with no permit or entry requirements, no quota on harvest, and no standards to address the safety and conduct of the fleet. The lack of a quota was, and is today, especially troublesome given the lack of knowledge on the squid biomass in California waters.

*Loligo opalescens* ranges from British Columbia to Central Baja California (Recksiek and Frey 1978).<sup>4</sup> Squid reproduction involves spawning within the water column, followed by the deposit of eggs upon the seafloor. The peak of the fishery targets the squid mating and egg laying behavior and occurs during late spring and summer in Monterey and during fall and winter in Southern California. The majority of market squid harvest is centered in the northern Channel Islands region, mainly in the Channel Islands National Marine Sanctuary. In general, the harvest involves luring the animals to the surface with high wattage lamps, encircling them with purse seine nets and pumping and/or using brail nets to remove the squid from the water, finally storing them in a fish hold. On a good net set, tons of squid may be harvested. Squid are minimally processed, mainly in San Pedro, California, frozen and shipped around the world, predominately to markets in the Mediterranean and China.

Squid play a vital role in the California Current ecosystem and serve as a major link in the food chain as both a predator and as prey. For example, squid prey items include planktonic crustacea, mainly euphausiids and copepods, but also fish, cephalopods, gastropods and

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<sup>3</sup> Vojkovich, M. 1998. The California Fishery for Market Squid (*Loligo opalescens*). CalCOFI Reports. 39:55-60.

<sup>4</sup> Recksiek, C.W. and H.W. Frey. 1978. Background of Market Squid Research Program, Basic Life History, and the California Fishery. Pages 7-9. In Recksiek, C.W. and H.W. Frey, ed. Biological, Oceanographic, and Acoustic Aspects of the Market Squid, *Loligo opalescens* Berry. State of California The Resources Agency Department of Fish and Game Fish Bulletin 169.



polychaetes (Karpov and Cailliet 1978).<sup>5</sup> In turn, several species of marine mammals from Risso's dolphins (*Grampus griseus*) to California Sea Lions (*Zalophus californianus*), a host of fish species, including many economically important species like tuna and halibut, and a suite of seabirds all depend upon squid as a key food source.

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<sup>5</sup> Karpov, K.A. and G.M. Cailliet. 1978. Feeding Dynamics of *Loligo opalescens*. Pages 45-65. In Recksiek, C.W. and H.W. Frey, ed. Biological, Oceanographic, and Acoustic Aspects of the Market Squid, *Loligo opalescens* Berry. State of California The Resources Agency Department of Fish and Game Fish Bulletin 169.

## EXECUTIVE SUMMARY

*“[S]quid must play an important role as a vital link between zooplankton and hydrotrophic levels in the pelagic environment” - CDFG Fishery Bulletin (169) 1978*

The Channel Islands National Marine Sanctuary hosted a panel discussion at the October 1997 CalCOFI Conference. This panel discussion focused on ecosystem management implications for the burgeoning market squid fishery with both panel and audience members addressing issues such as: the direct and indirect harvesting effects on squid biomass; the effects of harvest and the role of squid in the broader marine community; the effects of environmental variation on squid population dynamics; the regulatory management issues for an open access; the ramifications of a virtually unregulated fishery; and the sustainability of the fishery from the point of view of both scientists and the fishers themselves. The following executive summary is broken down into subsections that are framed around key points of discussion that were raised by the panel members.

### **Ecosystem Management**

An ecosystem approach to the management of the squid fishery requires that we address the fishery in terms of the role of squid in the ecosystem. The first obvious challenge is to define the ecosystem in which squid are an integral part. By definition, ecosystem management should protect and restore ecological components, functions and structures according to socially defined values and scientific information, in an integrated, holistic manner that does not focus on specific system outputs.<sup>6</sup> This means considering the effects of fishing not only upon the target organism but also upon the food web to which it belongs, allowing for a broad variety of environmental changes within the ecosystem, and regarding the fishing industry in terms of its place within the global market. Ecosystem management also requires local community input and a regional orientation.

### **Potential Impacts of the Squid Fishery**

A key issue raised by the panel and the symposium was the necessity to consider potential fishery impacts upon squid biomass and upon the broader ecosystem. Scientist, regulators, and fishers all agreed that it is imperative to identify a level of harvest that can occur without negatively effecting both squid biomass and the marine ecosystem. Two potential harvest impacts raised during the discussion were: (1) that fishers may harvest squid from an area before they have an opportunity to spawn and (2) that excessively long seine nets may reach the sea floor, disturbing or destroying developing eggs. In order to determine a sustainable harvest level, several panelist recommended more research and monitoring be conducted to further our understanding of squid biomass and population dynamics.

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<sup>6</sup> Adapted from “Dilemmas in Moving Toward an Ecosystem-based Approach: Science, Politics and Resource Use in a Sea of Depression”. Abstract to Dr. Michael McGinnis’ panel presentation.

## **Recognizing Environmental Variability**

*“There is large scale environmentally forced variability in these populations that we need to take account of, but we also need to be very careful in the way that we expect this variability to affect populations.” Tom Hayward, oceanographer*

In order to develop an effective management scheme, panelists suggested that the effects of environmental variation and natural perturbation on squid and the ecosystem need to be considered. Only recently have we begun to recognize the variability and long-term changes in the California Current system and the Southern California Bight, changes that ultimately may affect species and their ecosystems. Effective fishery and ecosystem management requires that we broaden our understanding of the squid resource and its response to both harvest and environmental impacts. Historically, we have witnessed huge fluctuations in catch apparently associated with environmental variability, however, it is important to differentiate between variation in harvest yields resulting from changes in the fishing industry and variation in squid biomass due to environmental factors.

For example, during the El Niño Southern Oscillations (ENSO) events, like that of 1997-1998, there was a dramatic decrease in squid catch from a high of nearly 90,000 metric tons in 1996 to almost zero landings in 1997. Squid fishermen, who were fishing during the El Niño of 1982-1983, predicted a dramatic decrease in catch during this latest ENSO event. One panel member noted that during El Niño events, squid probably have a chance to spawn unmolested throughout a year, allowing them an opportunity to recover harvesting. Moreover, the potential for El Niño events to function in the recovery and reproduction of squid was cited as a possible means of maintaining the sustainability of the squid fishing industry.

## **Forging Partnerships Between Researchers, Regulators, and Fishers**

*“Overall the fishers agree that something needs to be done, and I do think that a lot of these guys do want to put their input into the mix. It is just the fear of how much to say or what to say. I think the wall needs to come down, and communication needs to be open.” Tammy Blonden, light boat operator*

Developing partnerships between scientists, fishers, and the regulatory community was suggested by the panel and members of the audience. One benefit may be that researchers and fishers co-develop scientific protocols for collecting data throughout the fishing season. Furthermore, fishers may provide researchers with their knowledge of squid based upon day-to-day observations and years of fishing experience. This sort of traditional knowledge was acknowledged as potentially beneficial in the development of a fishery management plan.

Another mutual benefit of a partnership might aid in finding funding for squid research. By developing research ideas together, fishers and researchers may appeal to a broader funding

community by suggesting projects with goals of gathering scientific data to be used in developing a sustainable fishery.

### **Managing a Sustainable Fishery**

At the time of this conference, there was virtually no regulation in the squid industry: no restrictions in terms of the number of boats allowed to enter the fishery, the type of gear allowed within the fishery, and in Southern and Central California, the periods during which the fishery was open.

The combined effects of the increased number and efficiency of squid fishing boats lead not only to record squid landings, but according to panelists, it also lead to severe and dangerous competition among fishers. It was reportedly difficult to find fishing areas that had not yet been explored or occupied by light boats and seiners. Furthermore, in addition to increasing the range of their fishery, fishers also increased the length of time spent fishing and the conditions in which they were willing to fish, which has the potential to compromise the safety of vessels and crew.

Aside from danger to fishers resulting from the competition for squid, panelists voiced concern that the widespread and consistent harvest on the fishing grounds may infringe upon the ability of the squid to maintain a sustainable population.

### **Harvest Management Strategies**

*“This fishery has come a long way in terms of catchability, marketability, and processing ability.”*  
*Peter Guglielmo, seafood processor*

Throughout the course of the discussion, traditional fishery management was challenged, in part due to the dependence on fishery dependent data and that fishery effort and yield may not be the most accurate way to track trends in population abundance or to set harvest guidelines. The panel suggested a number of harvest management guidelines, including: limiting the entry of new vessels, clearly defining and enforcing harvest parameters, and mandatory safety regulations for fishing and light boats, a quota per season based upon the number of boats permitted within the fishery and the estimated overall biomass of the resource; gear restrictions, including lead line composition to protect the seafloor; limitations in light emission; closing the fishery at certain times, on certain days, or in specific areas. Panel members suggested that such closures could provide organisms within the ecosystem feeding and reproduction opportunity without interruption by fishery activities and also allow fishers themselves the opportunity to rest and to make any necessary equipment repairs. Other suggestion by panelists included setting harvest parameters based on a consensus between scientists and fishermen, and addressing light boats and seiners separately by management guidelines.

## **Conclusion**

The panel and audience agree that the squid fishery is in dire need of some form of regulation in order to maintain a sustainable fishery. At the same time, it was recognized that there exists a paucity of basic biological and ecological information on squid. Before a sustainable, ecosystem-oriented management plan may be implemented, research is necessary to assess both the population dynamics, impacts of the fishery, and squid's role in the marine ecosystem. The Channel Islands National Marine Sanctuary, by editing and publishing this portion of the squid symposium, hopes to foster an ecosystem perspective and approach to managing the squid fishery. For a richer, in depth review of the panel discussion, we invite you to read the panel member and audience comments in their own words.

## PANEL DISCUSSION

### Ed Cassano

I want to start off by welcoming everyone to the second workshop of the symposium. My name is Ed Cassano. I am the manager of the Channel Islands National Marine Sanctuary (CINMS), which is part of the National Oceanic and Atmospheric Administration (NOAA). Before we begin, I would like to express my gratitude and thanks to George and Doyle<sup>7</sup> for facilitating the expansion of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) symposium to include the participation of the Channel Islands National Marine Sanctuary. This conference has been both provocative and informative for me personally, and I suspect for many others based upon the conversations I have heard or participated in over the last couple days. I would also like to recognize the participation of the California Seafood Council and Diane Pleschner. Unfortunately, Diane had to go to Sacramento, so she is not here tonight, but the Seafood Council is going to be partnering with us to publish the proceedings from this workshop and the workshop last night. I would also like to thank Sean Hastings from the Sanctuary office for the great job he has done in assisting me with organizing this panel.

The format of tonight's workshop will be a little different from last night's. I will introduce each panel member, and they will have a maximum of ten minutes to discuss the focus of our panel from their perspective, area of expertise, and interest. Upon the conclusion of these informal presentations, we will open up the dialogue to include what I hope will be a very active participation from the audience. Now I will provide you with a brief synopsis of the Sanctuary program and the history of the squid fishing industry.

In 1972, Congress passed the National Marine Sanctuary Act along with a suite of environmental bills. The purpose of the Sanctuary Act is to designate and protect areas within the marine environment that meet particular criteria. In addition to its primary function of resource protection, the act requires consideration of sustainable use of the environment by using the tool of ecosystem management. In 1980, the National Oceanic and Atmospheric Administration designated 1,252 square nautical miles of diverse marine habitat around the four northern Channel Islands and Santa Barbara Island as the Channel Islands National Marine Sanctuary. The Sanctuary boundaries extend from mean high tide out to six nautical miles, overlapping jurisdiction with the State of California out to three nautical miles and the Channel Islands National Park out to one nautical mile. The Sanctuary has at its core the mandate to protect the resources found within these boundaries. This includes everything from krill, kelp, whales, and fish species to, of course, squid. Despite its dual function of protecting marine resources while managing sustainable use of the Sanctuary environment, the Channel Islands National Marine Sanctuary does not have the authority to directly regulate control over living

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<sup>7</sup>George Hemingway was the 1997 CalCOFI Coordinator. Doyle Hanan (CA Dept. of Fish and Game) organized the CalCOFI symposium entitled, "Market squid: what we know and what we need to know for effective management?" This symposium was sponsored by the California Department of Fish and Game and was supported by the California Seafood Council and the Channel Islands National Marine Sanctuary.

marine resources that are managed by other agencies. From the beginning, the authors of the Sanctuary Act did not want to duplicate existing law. As many of you are aware, the regulatory management of fish and other marine resources falls within the responsibility of the California Department of Fish and Game and the National Marine Fishery Service. However, the mandate of the Sanctuary Act to protect all resources is not reduced by the multiple jurisdictions at play. The Act requires that the CINMS coordinate and facilitate discussion, education, research and enforcement to protect these resources, using a very elusive concept of ecosystem management.

Last year it became apparent that a growing number of vessels were targeting the squid population. The increasing amount of squid being removed from the system made it clear that we needed to start asking questions about the environmental effects of harvest upon the Sanctuary, in addition to the implications of harvest upon the growing fishery. We wanted to examine these questions and get others to think about this issue in the broader context of ecosystem management, not just from a single species perspective. That is the goal of this workshop.

The CalCOFI symposium and the partnership between the California Department of Fish and Game, Scripps Institution of Oceanography, and the National Marine Fishery Service provide a perfect venue to begin this dialogue. It is my hope that any action we propose will consider the role of squid both as a target for a fishery as well as a component in the ecosystem.

Today, in Southern California we face the dilemma of an unregulated, open access squid fishery, driven by market forces and a squid stock that we know little about, beyond the fact that squid seems to be sensitive to changes in environmental conditions. Tonight, we have asked a panel of experts to give us their perspectives on the subject of our workshop, entitled: *“Multi-species and Multi-interest management, an ecosystem approach to squid harvest in California.”*

**Brock Bernstein**

(Dr. Bernstein is an independent consultant specializing in environmental policy.)

It seems clear to me that the squid fishery, which is not very old, is in need of some sort of management plan. At present, as Ed was saying, the fishery is driven by market forces. There is plenty of evidence from around the world that fisheries driven solely by market forces have a lower chance of being sustainable over the long-term. The market is quite willing to drive things into extinction and then move on to the next resource. So, the question is, what sort of management plan should we develop to manage the fishery? It is kind of complicated by the biology of the critter, whose short life cycle makes it very, very difficult to predict what future catches will be. We should consider this complicated biology when developing a management plan.

We heard some comments yesterday in reference to the Maine Lobster Fishery Management Plan which includes a lot of bottom up, grassroots input from the people actively involved in the fisheries. I think there is a recognition around the world that traditional

knowledge from fishers is really a vital component of any management plan. It also seems that there is a lot of evidence that in the absence of that kind of knowledge, and a good give and take between management agencies and the fishers themselves, the failure rate is pretty high for fishery management plans. However, it is difficult to incorporate traditional knowledge into the management plan of the squid fishery, as we have heard it described here, because there just is not much of it. The fishery at its expanded capacity is less than ten years old, which means that it does not extend back to the last major El Niño in the early 1980's. As a result, there is not a very long history of catches under different oceanographic regimes, nor is there much of a body of knowledge built up among the fishing community about how to react under different circumstances, making both the fishing community and the fishing activity itself less adaptable to different kinds of circumstances. Consequently, there are no accepted norms of behavior or unwritten rules that can tend to structure the behavior of fishers under different scenarios. Unlike the squid fishery, the lobster fishery in Maine has a long history behind it. There is a resident population of fishers in different communities with turfs and territories. They have sort of an accepted body of knowledge, or locally inherited wisdom, that can be passed on from one generation to the next, providing a fairly good basis for their input into management plans. We don't have very much out here in the squid fishery. So, what does that mean for how we can go about developing a management plan for the fishery?

Well, I think that a lot of the information we have heard, yesterday and today, concerning the physical and biological oceanography of the California Current system, indicates that there is a fair amount of change, unpredictability, and uncertainty in the system. That means that any management plan has to incorporate at least two kinds of flexibility, maybe more. The first is that we need to be able to change any kind of regulation or rule as circumstances change. We cannot merely build these regulations or management structures and then assume that they are going to be applicable and appropriate for all time to come. That means that there has to be some type of feedback group for monitoring information, not just about the catches themselves, but about the behavior of the fishers, and the economic structure of the industry. Hence, if indeed the management structure needs to be changed, there is some good information available to do just that.

For the second type of flexibility imperative to management plans, let's go back to some examples of how traditional fisheries and agricultural communities have survived over the long-term and been very sustainable. One of the things we are starting to learn about these communities is that they incorporate a lot of day-to-day, month-to-month, season-to-season flexibility. There are a lot of different strategies available to fishers and farmers that they can use as circumstances change. In contrast, portions of the fisheries management infrastructure system that we have put into place really limit and constrict the number of different strategies available to fishers under different situations. They assume that circumstances will remain the same, and that as circumstances do change, the fishers' ability to adapt to the changed circumstances is limited. So, I think that any management plan that is developed for the squid fishery needs to allow plenty of room for play, in terms of month-to-month, year-to-year, and even season-to-



season strategies among fishers. In order to do that we need to take account of a lot more than just the biology of the California Current system and the economics of the market.

I had an interesting conversation over dinner with Pete.<sup>8</sup> He is basically in a global industry. Factors such as global economics and shipping rates influence his decisions on a very large scale about what to buy, how much to pay for it, and where to send it. It is interesting to me that both the fishing community and the scientific community are interested in things happening on a global scale. The fishers are very aware of where the squid is being caught, what's up, what's down, what has been changing around the world, just as the plots you've seen today show that the scientists are aware of how the physical and biological oceanography is changing around the world. I think that any sort of management plan for the fishery needs to take that sort of large scale dynamic into account, and it needs to incorporate the idea that the fishing community is responding not just to biological changes, but also to economic, political and other sorts of changes. In order for the fishery to be sustainable, we need to take account of the adaptive and selective pressures fishers are under in terms of economics, finances and markets, etc. I believe that this is a great challenge, but in terms of being a multi-discipline problem, it is also quite fascinating and interesting. I think that there is a lot to be learned from lessons in other fisheries around the world, and I am looking forward to seeing how this fishery progresses.

### **Tom Hayward**

(Dr. Hayward is a research oceanographer with the Scripps Institution of Oceanography and Marine Life Research Group. He also manages field work for CalCOFI.)

I would like to say a few words about the nature of environmental changes that may affect squid populations and also about the way that squid populations and changes in them may affect other species. The first issue that I would like to discuss deals with the trends in biomass in the California Current over the last 40 years. One that we talked about a lot today was the effect of El Niños. We could see the declines of squid populations during El Niños, but I also saw an overall rise in squid catch over greater time periods. Thus, the El Niño related declines were just small blips on a long-term trend. In summary, I want to remind everyone that there are long-term changes in the California Current, and El Niño is just one time scale in that process. It is these long-term changes that dominate the variability in the system and that is something that has to be dealt with when considering squid management. We cannot understand the effects on a population of harvesting, or other sources of impact within the sanctuary, without somehow taking account of the large scale natural variability and that population. For example, a decline in zooplankton started in the California Current in the mid-70's. That decline was correlated with a change in the atmospheric forcing, and intensification and a shift in the geographic location of the Aleutian Low. It affected the circulation of the Pacific Ocean on a very large scale. This decline in zooplankton is still continuing in the California Current. We also saw a decline in zooplankton

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<sup>8</sup> A reference to Peter Guglielmo, a commercial fisherman who owns a processing facility in San Pedro. He is also a panel member in this discussion.

occurring in the mid-70's off of Japan and in the Humboldt Current off of Peru and Chile. Hence, that atmospheric forcing impacted zooplankton over a very large area indeed.

The other point I wanted to make, and this is the most important one, is how these long-term changes affect ecosystems. In the previous example, we saw that zooplankton declined as did some of the other species. Some species seemed to show no change at all, while others showed a continual trend of increasing. We have seen examples of this over and over today. Therefore, we should not assume that environmental forcing is going to affect the system in the simple bottom up way that we might imagine. We should not expect to be able to predict atmospheric forcing, change in nutrient input, change in zooplankton, and change in fish and squid. As John<sup>9</sup> was pointing out, if there is a change in the zooplankton or in the squid, it will affect the organisms that depend upon these as a population, such as the seabirds, in simple ways that we might expect. Hence, the lessons are that yes, there is large scale environmentally forced variability in these populations that we need to take account of, but we also need to be very careful in the way that we expect this variability to affect populations.

### **Neil Guglielmo**

(Mr. Guglielmo is a squid fisherman and operator of a squid processing plant in San Pedro, California.)

First of all, I would like to thank CalCOFI for inviting me to this symposium. The information I have to contribute to this symposium is that I have been fishing here for 40 years. I own and operate my own boat. I fish from the Bering Sea to the Baja Mexico shoreline out to 200 miles. Over the years, I have used different types of gear: gillnets, traps, and seines. I have seen many significant changes in the fishery. My grandfather used to use traps made with chicken wire, gillnets of nylon and monofilament, traps constructed of plastic and wire, and seines made with nylon. In the squid fishing industry, with each change the gear has become larger and more efficient. Today, we are even able to fill our hatches with vacuum pumps. In my grandfather's day, fishers fished using kerosene lanterns. In my father's day, they progressed to torchlights and iridescent lights. Today, we work with light boats that use metal highlights, sodium and mercury vapor lights with wattage as high as 100,000 watts. Last year, with the lights I have on my vessel, I was fortunate to accumulate enough squid around my boat to pump them out of the ocean without using a net. This is a rarity.

The squid fishing industry has become so competitive that boats are forced to fish in bad weather, near reefs and other dangerous locations, often tearing their nets and risking their boats and crew's lives. The boats fishing for squid have gone from very few to nearly a hundred and fifty today. In the past, the squid was offloaded at fish markets, packed in ice, and shipped in wooden boxes to fish markets in San Francisco, Los Angeles, Monterey, and other cities in California. The squid was also canned and shipped all over this country and to some countries in Europe. Today, the majority of squid caught is frozen, sold at prime markets in the United

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<sup>9</sup> A reference to Dr. John McGowan of Scripps Institution of Oceanography.

States, Japan, and Europe. Other packs are sold in this country as bait or for longline fishing. Some squid is packed in bulk and shipped to third world countries where it is defrosted and canned. The introduction of China to the world marketplace has opened up a vast market for our fishing fleet. Insatiable demand for this product has caused an increase in its fishing industry. Harbors and loading docks have delays of up to eight to ten hours to offload boats to meet the increase of the world demand for our squid. This increase has also caused markets, at times, to have trouble obtaining ice, which could cause the product to not be as fresh.

Earlier in the history of the squid fishery, it was common to be the only boat fishing in an area. If there were no squid, the light boats would travel to another area in hopes of finding the fish. Sometimes, seiners would go to the area the following night. As I said, today there are in excess of a hundred and fifty boats, and more coming. It is virtually impossible to find a fishing area that hasn't already been looked over or occupied with light boats and seiners. These boats spread out over an eighth of a mile or more and dot the side of an island. If a skipper chooses a wrong spot to anchor, and does not draw any squid, he or she must travel miles before finding another spot to anchor and then try again. The original spot will then be lost to someone else. Many times with the severe weather the protected anchorages are crowded, leaving nowhere for us to anchor. Furthermore, in the past few years the salmon fishery has failed, leaving hundreds of boats from the North with a negative impact on their income and searching for a new fishery to replace that loss. Some of them come south to California: it is a gold rush, of squid! There also have been boats coming from the driftnet-gillnet fishery. There have been boats from Oregon, Washington and the Gulf of Mexico. There has been talk of floating processors in the grounds, causing more lights and congestion to the already crowded areas. At times, tempers have flared. Incidents have occurred between seiners and light boats and I foresee an escalation of tension between these two.

Until recently, squid catch diminished in the first of the year as the markets met their demand, not because there was no squid, just because the orders were filled. The last two years have produced record squid landings. This can be attributed to the fact that there are more boats fishing, more fishing equipment, more processors, and an increased worldwide demand. We have been harvesting areas that haven't been fished before. One concern is that perhaps the squid are being caught before they are able to spawn. It is vital that we research this vigorously to determine if some long lasting effects may occur.

The following statements are based on my knowledge of the squid industry and may not be the consensus. The possibility of a quota per season, gear restrictions, limited entry, and closure of certain days of the week in certain areas should all be considered to protect this industry. Any quota should be based on estimated biomass for the year and number of boats fishing. We must divide that squid pie.

A squid fishing season, if designated, should differ according to location within Central California, Monterey Bay and Southern California. There are several considerations that should be implemented for harvest management within these locations:

1. a determination by fishers and buyers of the period during which time maximum squid yield may be caught and processed with the least amount of effort expended;
2. a designation of a maximum depth and length limit for seine nets to provide protection to squid eggs, which develop on the sea floor;
3. use of leadcore line for seine net weight, not chain, as chain digs deeper into the sea floor;
4. restrictions on the amount of light emitted by each light boat to prevent lights from various vessels from overlapping with each other and scattering the squid (there seems to be an unspoken battle to see who can have the most lights, resulting in the squid seeming to seek shelter in the dark from the boats and the intensity of all the lights);
5. placement of a moratorium on the number of boats permitted to fish off California until a conclusive study regarding the squid industry is completed;
6. establishment of a weekend closure of the squid fishery, meaning an approximate 30% drop in production but providing squid, marine mammals, birds, and fish in the area to reproduce unmolested while allowing truckers, harbor workers, processors, and fishers time to work on repairs, spend time with their families, and rest;
7. the future closure of specific areas, like the Channel Islands, including primary fishing grounds and less productive areas (which are often rocky, windy, and less compatible to fishing), as sanctuaries to encourage the unmolested feeding of mammals and birds and the spawning of squid.

To make the most responsible and educated decision regarding management for the squid fisheries, careful research addressing these issues must be completed. The California Department of Fish and Game collected an estimated \$500,000 tax on squid. We would like to see more of that money spent on squid research.

The final topic that I would like to mention is El Niño. An El Niño is upon us, and we see the effects of the warm water. Squid deliveries are minute, and if this year follows the same pattern of the '82-'83 El Niño, the landings could be minimal to nonexistent. This would be a definite hardship for those in the industry. However, it could be a blessing for the squid, giving them a year of unmolested spawning.

In closing, in discussions this afternoon with Sophie<sup>10</sup>, I've come to the conclusion that this fishery need not to expand, but to concentrate on better quality to insure a better product in the world marketplace. The world is waiting for our squid; let's not disappoint them.

### **Tom Okey**

(At the time of the conference, Mr. Okey was the Pacific Fisheries Project Manager for the Pacific Regional Office of the Center For Marine Conservation.)

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<sup>10</sup> Dr. Sophie Des Clers is affiliated with Imperial College, London, U.K. Dr. Des Clers presented, "The Falkland Islands Patagonian squid (*Loligo gahi*) trawling fishery: Management, assessment and data requirements," at the symposium and published: Hatfield, E. and S. Des Clers. 1998. Fisheries Management and Research for *Loligo gahi* in the Falkland Islands. CalCOFI Reports. 39:81-91.

I actually tried to get on a squid seiner before I came and sat on this panel tonight, but unfortunately I was not able to. I have worked on a salmon seiner in Alaska though and it looks pretty similar, except for the pumps and the lights.

As the Pacific Fisheries project manager of the Center for Marine Conservation (a national, non-governmental, non-profit organization that focuses on protecting marine ecosystems), I advocate paradigm shifts at the federal and state levels in fisheries and national resource management. This includes, in general, shifting the burden of proof of ecosystem affects from the public or the trustees, to users of the resource, thus advocating a precautionary approach to fisheries utilization. Over the last year, I have been working on shifting to a habitat-based approach, with Essential Fish Habitat provisions. But primarily, in general, I have been working on shifting to an ecosystem based management. I have suggested this to all three Pacific Fisheries Management Councils: the Pacific, the North Pacific, and the Western Pacific. With regards to squid, I have come across them at the state level in some of the bills that have been passed. Moreover, the Center for Marine Conservation took part in putting forward some of the bills in the legislative flotilla that you've been hearing about. So, my connection to squid has been conversational and on paper over the last year, but I have other connections with squid, as we all do.

My background is in marine disturbance ecology, particularly at the heads of submarine canyons and nearshore heads of submarine canyons, more specifically in the head of Monterey Submarine Canyon. As I explored these wonderful places, I had the opportunity to observe both squid and squid egg cases over the years, as I was actively in the water doing the studies. I would like to share with you one encounter in particular.

In late January of 1990, I was on my way back from the Gulf of California looking at some canyon heads there, and of course I had to stop in at Scripps. I jumped into the head of La Jolla Submarine Canyon. My partner and I found ourselves in the middle of an amazing squid run. It seemed as if the whole food web was there, and in fact we did observe different zones within the canyon. The access of the canyon was so full of squid that instead of resembling a busy airport, it was more like a squid orgy. You could have pumped the squid out of the head of the canyon there. There were lots of seabirds, pinnipeds, like California sea lions (large ones at the surface with, I am sure, full stomachs), and blue sharks. This definitely helped to mold my perspective of squid. Squid are an integral part of the food web, not just a single species that we should manage in that way.

Being a student of submarine canyons and a student of Monterey Bay, at that time I had already read a couple of the papers in Fishery Bulletin 169,<sup>11</sup> which has been mentioned over the last couple of days. In this bulletin the authors stated, “One of the impetuses for this study is

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<sup>11</sup> Recksiek, C.W. and Herbert W. Frey (Ed.). 1978. Biological, Oceanographic, and Acoustic Aspects of the Market Squid, *Loligo opalescens* Berry. California Dept. of Fish and Game Fish Bulletins (169). 1978.

that squid are perceived to be one of the last underutilized resources.” I was going to take exception to that because ecologically you could argue that they are not underutilized, but I will not. They also stated that, “It is necessary to determine the impact of an increased squid harvest among the other living marine resources by investigating what *Loligo opalescens* consumes, with what it competes, and to what extent other species are dependent upon this species as a food source.” They then concluded that, “Market squid, the northern anchovy and rock fish constitute the major prey species for many marine mammals, fishes and birds in Monterey Bay, and since squid are a major food source for many other marine predators, squid must play an important role as a vital link between zooplankton and hydrotrophic levels in the pelagic environment.”

The take home message that I would like to deliver is that if we are going to develop a regimen of management for squid, we need to recognize the interactions that squid have with other components of the ecosystem. Any decisions that we make about the harvest of squid have to take into account the impacts on those other components of the ecosystem.

### **Tammy Blonden**

(Ms. Blonden is a light boat captain in the California squid fishing industry.)

In the past, all seiners were fully loaded on the grounds after a shorter time period. The light boats would turn off their lights, and they and the seiners would go up in the coves. Now the number of seiners has increased so much that the fishery effort has become an all-night process. Therefore, the fishing grounds are not left alone. What’s more, in the past the lights were sufficient at 16 to 20,000 watts. However, as Neil said, there are now some light boats that have increased to 100,000 watts, meaning larger generators, and in turn more pollution. At the present time boats are waiting on the grounds as of nightfall. They are waiting for squid to show, forced by making money or by market demand. Another factor that is problematic in today’s industry is that fishers are sometimes also forced to work in harsh conditions. We work during small craft advisories and we have even worked in gale-force winds. This can only lead to loss of life and property.

Something else that I have noted that has not been discussed among this conference is that the Santa Barbara Harbor has become another place for unloading squid. Squid fishers have an agreement with the harbor that at certain times they may come in to unload, so that the harbor is not merely unloading squid. They have other operations so that the trucks are not sitting there and pumps are not sitting out on the docks.

Permits are a crucial matter in this fishery. Some people were discussing the control of light boat permits by seiners. In the future, I say that seiners should have no control over the light boats. They are separate entities, separate boats, separate businesses. However, vessels that are allowed to work on the fishing grounds should be approved by the Coast Guard.

Sophie<sup>12</sup> mentioned that in the Falkland Islands they were approved for safety and got a certificate, then they got their license to fish. I think that should be enforced here. I know that in the past vessels have been out there with no radar, no lifesaving devices, and no anchor. It is not a good situation when you work in such thick fog that sometimes boats cannot see one another at even an eighth of a mile apart. Mandatory safety inspections and Coast Guard approval to obtain permits may prevent such dangerous situations.

Now I will address days off and weekend closures. I think these are good ideas, at least for some light boats. Some feel that we should be able to work all week, but I think that closures will allow the grounds to be left alone. In addition, closures allow the fishers to have a break, as we do stay out there sometimes for weeks, even months at a time. In fact, I sometimes move to the Islands where we are fishing. The Monterey closure is a good example of how this idea can work. Not only is it a weekend closure, but it is a daytime closure too. The lights do not come on until midnight. So during the day the fishing grounds are left alone, which makes good sense.

As far as more boats coming into the fishery, it is not the origin of the new vessels that I am concerned about, it is the number of vessels. With an El Niño year staring us in the face, now is the time for a moratorium more than ever. If the research and the data show that the biomass can support a larger fleet, then we can issue more permits down the road. Furthermore, the Department of Fish and Game should monitor the unloading process because there has been talk of problems ranging from use of falsified tickets so that fishing boats will qualify for permits in the coming years, right down to talk of paying off fishers and truck drivers. Now, this is hearsay, but it is also a scary thought.

Concerning gear restrictions, as Neil said, these should be a factor in protecting the spawning grounds. In addition, chains should not be used for seine net weight and shallower nets should be used for some things. Some of these guys set in shallower grounds and when you have a 30-40 fathom net and you try to set in 15-20 fathoms your net is definitely touching the bottom. If there are eggs resting on the sea floor, these shallow nets definitely create a hazard.

On the Sher and Papan Bills<sup>13</sup> that were presented in Sacramento, there was a lot of talk about permit issuance on the basis of significant investment as opposed to time and years of

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<sup>12</sup> A reference to Dr. Sophie Des Clers (see footnote 10).

<sup>13</sup> California State Assembly Bill No. 1204 was introduced in 1997 by Assembly Member Louis Papan to require that owners of commercial squid fishing vessels and light boats obtain commercial market squid vessel permits issued by the Department of Fish and Game by April 1, 1999.

State Senate Bill No. 364, Chapter 785, Statutes 1997 (Sher and Karnette) became an effective law on January 1, 1998. This bill succeeded in requiring permits obtained from CA Dept. of Fish and Game for the owners of commercial squid fishing boats and light boats. Until April 1, 2001 the landing taxes gained from commercial sales of squid are to be used for the purposes of the bill including developing a Squid Fishery Advisory Committee to establish recommendations for conservation and management. This bill also limits fishery activities in the region North of Point Conception between noon on Sunday and noon on Friday.

experience that one has been fishing. If investment amount is given priority, the boat owners are the ones to benefit whereas crew members, operators or other people who want to be able to work in this fishery, cannot. Permits would just be going to the vessels or the vessel owners. Some of us who are fishers are throwing pebbles or stones at Fish and Game. I know, we all know, that they are just managing what laws have been passed. So, it is up to the politicians to create or change the laws, which you know means that we speak out or the public speaks out, which means acquiring knowledge, which means having conferences like these.

**David Ainley**

(Dr. Ainley is an ecologist at H.T. Harvey and Associates.)

I think it is a real challenge to try to do well with this fishery because squid are important in the food web. I have seen fisheries come and go, mostly go in California. Fortunately, however, we have seen recovery from a few early California fisheries. For example, we had the “over-fishing” of fur seals and sea otters in the early 1700’s, both of which are very high on the food web and have recovered from that time period. Note that as we move upward through trophic levels the food web seems more and more strange and complex. We have had other upper-trophic-level creatures showing no recovery from fish stock collapse in spite of what seems to be abundant resources in the form of sardines, but they're just not going according to the book. So, I think that this fishery is a challenge, and I hope that we learn from the 200 years of experience with the usual trial and error in fishery management.

People talk about ecosystem management. Well that sounds pretty good, but there is no precedent for ecosystem management. There have been attempts, and these were landmark bits of fishery management. I admit I was a part of this in the case of the Southern Ocean and of the setting up of the ecosystem management program. What tends to happen is that you sit back and somebody says, for example, that penguins are not producing as many chicks anymore. So, then you talk to some fishers who have traveled some 10,000 miles to Antarctica with a 250 foot vessel, and tell them that they cannot fish anymore because the penguins are not doing very well. So, this presents an amazing challenge. There is a so-called ecosystem management scheme all set up and waiting for some penguin to not do very well and then see what happens. We have that challenge before us here. We know that these squid are a key element in the California food web as much as krill are in the Antarctic. The thing about the Antarctic is that the ecosystem monitoring scheme was propelled by the fact that society has deemed that it is important for whales to recover. With the case of the squid, we don't have any cuddly creatures to drive what we're hoping to do. So, that is another aspect of the challenge that is before us. I can only say that the things that people have said here are definitely right on. I look forward to seeing the outcome.

**Peter Guglielmo**

(Mr. Guglielmo is a squid fisherman and operator of a squid processing plant in San Pedro, California with his brother Neil Guglielmo, also on this panel.)



My brother Neil and I represent one of the 14 processors of California squid. Two years ago there were only about ten of us. As his brother, I agree with most of Neil's concerns, but the reality is that over the last three years California squid catches have been record breaking and last year was one of the largest. Note that there has been a lot more effort and there have been a lot more vessels, coming down into this fishery. In addition, the domestic market is growing in popularity. There is more and more squid in the restaurants because we're using the name Calimari and it seems to be a little more of a catchy name than squid.

Originally, the majority of our sales were in Europe until there was an abundance of squid caught in the Falkland Islands and Argentina. The abundance of Argentine *Loligo patagonia*, which is similar to *L. opalescens* but a little bigger in size and with a little thicker meat, resulted in the crash of the European market for *Loligo opalescens* over the last two years. What's more, with the abundance of Argentine squid, the European market said that they had enough squid in cold storage to last them for four years. What actually happened was that they decided to dump the squid at a much lower price and in a year and a half they had cleaned out their cold storage. As we have a 20% import duty, we were still out of the European market, which was our primary spot for selling the smaller packs of squid, a one-pounder, three-pounder or five-pounder. So, what we had to do was get back into the marketing aspect of it and find a new home.

The loss of the European market forced us to look elsewhere and as it turns out, opened up the market in China and increased the market in Japan. Plus, Korea will now be able to import frozen squid, whereas in the past they could not. In addition, this year we have gone to New Zealand and Australia. We have been able to harvest and process a greater amount of squid due not only to this increasing, world-wide demand, but also due to the fact that where in Europe they take small packs of squid, markets in Asia are taking a much larger pack, for example 20 pounds or 10 kilos.

This fishery has come a long way in terms of catchability, marketability, and processing ability. Basically, squid come onboard alive and then are received at the ports immediately when the boats arrive into port, no matter what time of day it is. Then we proceed to chill them in small bins with salt water and ice and then transport them by refrigerated trucks to our processing area. So, all-in-all we've done a great job as far as quality on the market for the *Loligo opalescens* and the boats have done a great job. The concern is that more and more boats are coming down to a viable fishery and the majority are coming because of failing fisheries elsewhere. There is certainly not too much we can do about that. The boats that are already in this fishery are facing several problems. There are many boats that can now go out with a crew of three men; whereas some of these San Pedro boats are 50-60 years old and have a crew of nine or ten men. It is quite difficult for these crews to make a living because the processing end of marketing has shifted toward not allowing the boats to fill up their hatches 100% nor to have cold water to kill the fish. Moreover, as the demand for market squid grows so does the price. In turn, the price to the fishers increases as well. Yet the fishers, this year on a record breaking

catch, saw that the price of squid being paid to the boats was kept at a constant level from day one. In fact, the price to fishers was \$250.00 per ton and stayed so all year long.

In conclusion, I would say that hopefully the reoccurrence of the El Niños will be part of a safeguard for the recovery and reproduction of squid to make it a substantial and ongoing fishery.

### **Mike McGinnis**

(Dr. McGinnis is the acting Director of the Ocean and Coastal Policy Center at the University of California at Santa Barbara.)

Well, let me start off with a question: what happens when you see your reflection in the eye of a squid or snowy plover or pinniped or a neighbor? The answer you provide is one key to understanding the dilemma we face in ecosystem management. The answers we have are diverse. Some of them may be scientific in orientation. Let me provide you with a more philosophical answer to the question. Ecosystem management, first and foremost, combines ecological thinking with living in a particular place. Secondly, ecosystem managers face fundamental problems. The first one is economic globalization. I think we need to be honest about the threats of globalization on ecosystem management and planning. A couple of months ago on the back of the New York Times there was a full-page ad that asked, "Can you see the 12 million dollar market?" Above that question was the old state of the world emblem, Pangea, where the continents are joined together. Ecosystem management requires a local orientation, a community-based orientation.

Today, 17 federal resource agencies, the Executive Office of the White House, and several other agencies are proposing the development of some ecosystem-based approach. Yet, ecosystem management is more than a government initiative. It is a community-based initiative. Up here in the San Bernardinios, ecological thinking requires openness to the black bear. Becoming truly intimate with the black bear so that honey dribbles down your fur as you catch the bus to work. Along the coast of the Santa Ynez watershed, where I'm from, my human voice was shaped by my place-based identification, the sea breeze, and the sycamore leaves. My sense of civilized time gained definition by contrast with the timeless yet seasonal environment. Ecological thinking and living, the cornerstones to ecosystem-based management, require that human beings face and deal with pressing conflicts.

I want to focus on a few conflicts endemic to ecological thinking and living: we face a fundamental border or boundary redefinition conflict. This border conflict is a major obstacle to the development and implementation of ecosystem management. Let me define it in terms of scale. We face three scale mismatches. First, there is a spatial mismatch. We have bureaucratic, political, and economic jurisdictions that we all live by in modern society. We also have ecosystem-based spatial scales that are hard to draw, hard to define, and hard to identify with. Second, we have a functional mismatch. We have a division of labor, and a bureaucratic form of organization, which is very hierarchical. Ecological systems function in terms of relationships.

So, we have a functional mismatch. If we are ever going to develop an ecosystem-based approach, the question is how do you stop being functionaries of bureaucratic centralized forms of order and become functionaries of an ecological community? The third mismatch is a temporal mismatch. Modern human history is based primarily on the over exploitation of resources. I think a lot of the graphs that have been put up for us show the over exploitation of natural resources. Natural history or geological time is much longer than our economic, political, or business cycles. So, if we are going to develop ecosystem-based approaches we are going to have to try to reconcile these scale mismatches.

Let me propose one potential resolution. I have been studying watershed-based restoration and ecosystem-based management in the American West. I have been focusing on issues that deal with salmon in particular. One emerging development in the American West is the framework agreement.<sup>14</sup> In the absence of government regulation this agreement can provide a step in the development of a partnership to deal with biodiversity needs and to integrate human culture with an ecosystem. A classic example is the number of framework agreements in California to attempt to restore habitat, restore water quality and bring back a salmon run. The key to these framework agreements is based on the development of a partnership and on relearning lost social and community values. One thing for people here to consider is the framework agreement which involves multiple stakeholders who hold multiple values. That is what I propose.

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<sup>14</sup> A framework agreement is an informal, voluntary agreement that is often non-binding. These agreements may serve as memorandums of understanding between governmental and non-governmental organizations working towards solving common problems.

## QUESTIONS & ANSWER SESSION

**Ed Cassano:** At this time I would like to open it up to questions. This is going to be very informal. Those of you with questions please identify yourselves.

**Loren Haury**<sup>15</sup>: There has been a lot of talk about the complex ecosystem relationships of the squids to all of these other organisms, but I have not heard any discussion of any bycatch problem or any act of the fishery directly upon any of the other organisms.

**Ed Cassano:** Neil, maybe you can comment on that. Do you deal with bycatch issues out there?

**Neil Guglielmo:** At times we encounter a mix of sardines and pacific mackerel in our catches. Other than that we catch a few barracuda and a few bat rays, very few.

**Loren Haury:** You don't catch predators like pinnipeds or seabirds? Things that are not allowed to be taken.

**Neil Guglielmo:** Yeah, well some of the birds will come in the net. Some of the sea lions will jump in and out of the net. At times we have to lower the floats that hold the fish in the waterline so the seals will go over the top. There are times when we are setting the nets that dolphins will come into the nets, but for some reason they seem to go under the first line while we are pursing the net. Occasionally, you may have a whale come into the net and if they do get into the net we are forced to let one end of the net go so they can swim out. It is much easier to do that than to try to work around these animals. It is much easier to let the end of the net go and then try another set.

**Larry Jacobson**<sup>16</sup>: I am curious about how the relationships between the processors and the boats evolve and how you choose the boat you buy from. Do you choose on the basis of the refrigeration or the quality of the product? Do you choose on the basis of a long-standing business relationship?

**Peter Guglielmo:** Basically, we are more selective of the vessels that fish for us because our particular company chooses not to purchase squid from any non-refrigerated vessel. Over the years our company has built up its processing capabilities to be able to know what kinds of boats are out there. Sometimes boats are looking to switch from one company to another, but all in all, the boats we have fishing for us have been doing so for many years now. As far as a relationship goes, I do not think there is a problem at all. Our guys seem to be happy. We do not take too many boats to hamper the ability of how much they can bring on board. We do not allow them to fill the hatch up a 100%, as I said earlier, because we do try to maintain the

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<sup>15</sup> Loren Haury is affiliated with the Scripps Institution of Oceanography.

<sup>16</sup> Larry Jacobsen is affiliated with the National Marine Fisheries Service, Southwest Fisheries Division.

quality. Overall, we tend to go with refrigerated vessels. There are a number of boats out there that are not refrigerated. Some companies choose to take these, but most do not.

**Larry Jacobson:** Do you have trouble finding vessels to buy squid from?

**Peter Guglielmo:** No, a lot of guys come to us.

**Karen Garrison:** My name is Karen Garrison. I am with the Natural Resources Defense Council. I guess I mainly want to express my appreciation to you, Neil, Peter, and Tammy for coming here and making very concrete suggestions. My biggest fear is that we will not act on any of them. I think it is really critical that we do, and I think support from folks like you is going to make the biggest difference. I agree with a lot of your suggestions that we need to seriously consider closed areas, day closures, and all kinds of gear restrictions that you mentioned earlier. We definitely need effort limits, whether that is practical this year or not. My question is, how much support do you think there is, or can you help muster, in the processing community for the kinds of suggestions you've made?

**Peter Guglielmo:** Well, it is pretty difficult to have the boats that want to come and join this fishery and then basically tell them that they are not allowed to put food on their tables for their families. Although we know that we cannot buy from too many vessels that it impacts the viability for the vessels, we also have to be able to stay in business. I think the market is pretty much going to dictate how many boats can actually participate in this fishery based on the amount of processors, and how much they can process each day. You cannot take everybody's catch. The one thing that I emphasize is to have a market as we have now. To create a market all over the world you have to do it on quality. You have to watch whom you are working with and how much they can bring in, and if you want to expand then naturally you have to take on more boats. We have to realize one thing when we talk about closures. Other than last year, which I have to agree was a much tougher weather environment to fish in, in previous years we had incredibly nice weather. We are going to get back to where the weather gets bad one of these days and that is going to be a main factor of how many days we can fish per week. I remember myself as a fisherman. I used to fish in San Francisco in January. When I was over there the weather would be so bad these guys were only getting out two or three days in the month of January. We didn't go out because it was so cold, but we didn't miss a thing. That was bad weather. We have been quite fortunate in the past few years where we go out almost every day, but you cannot count on that forever.

**Tammy Blonden:** Regarding your question of support concerning the light boat operators, before I came here I went and called and I asked around the different light boat operators whom I have worked with, what their opinions are, what their outlooks are, what they have seen in the past. A lot of them had negative reactions to speaking out. They felt that you are closing our fishery, or I should not say this or I should not say that, but overall I do feel that the majority do agree that we need to do something. More and more boats seem to be going, everybody seems to be going, towards this fishery. A lot of urchin divers are turning their boats into light boats as are

a lot of different vessels that are having slow seasons, or they are doing both. I noticed last year that a lot of sport-fishing vessels were actually light boats. I understand if that is what they need to do, well then okay. As Pete said we all need to support our families. Overall, the fishers agree that something needs to be done, and I do think that a lot of these guys do want to put their input into the mix, it is just the fear of how much to say or what to say. I think the wall needs to come down and communication needs to be open.

**Neil Guglielmo:** I would like to say that I believe the purse seine fishers will support closures as far as weekends. As far as closures of certain areas of the island we may have some opposition from some of them. I still feel the weekend closure is the best way because some of the known spawning grounds and the unknown spawning grounds will have a chance this way to have some sort of reproduction on them. If we choose specific areas to close as spawning areas the areas we choose to close that year may not actually be spawning areas. So, we would be closing an area that is not even productive. I still believe 100% that we need to close the fishery to new entrance immediately and then after research, if we find out that the squid is in sufficient amounts, we can open up to whatever the biologists feel is necessary. As I said, I think we are going to find out later on that these 90,000 ton years are nowhere near what is going to be the mainstay of the fishery. We need to concentrate on quality in the marketplace more so than just taking the fish out of the ocean. We can make money with quality, with less fish and have an even production record. Then we would have a better idea within the marketplace as to what we can produce out of California.

**Johann Augustyn**<sup>17</sup>: I think you can find that it can be very useful and productive to form some kind of partnership between the fisheries and the researchers, including in terms of funding. We've got a very interesting system in that respect in that during the closed season, is there really any time when you can do good ecological/biological work on the shelf? At all other times the shelf is always being hit by the fishery. Consequentially, it is essential that scientists work with the fishers. Moreover, we have our own funding, but we also have projects that we cannot afford to do. So, we apply to a fund for projects to be done and we get consensus from the fishers as to what they would like to do as well. So, all along this has been a partnership that is beneficial for science. It is been beneficial for the fishery. When it comes to setting an effort level or a catch level I do not think it should be a level that is set purely by science. One should look at the risk associated with each catch level and you know the fishers should be a part of that decision and what level they should be able to risk, if that helps.

**Neil Guglielmo:** I agree. I think the fishers and the biologists should get together for a common goal. I stand here and say that my vessel will be available to Fish and Game if they need it for

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<sup>17</sup> Dr. Augustyn is a researcher from the Sea Fisheries Research Institute, Cape Town, South Africa. The research that he presented at the symposium focused on the fisheries biology, stock assessment and management of *Loligo vulgaris reynaudii* (Chokka squid) in South Africa. In addition, he published: Augustyn, J.C. and B.A. Roel. 1998. Fisheries Biology, Stock Assessment, and Management of the Chokka Squid (*Loligo vulgaris reynaudii*) in South African Waters: An Overview. CalCOFI Reports. 39:71-80.

any kind of research. There has been a reluctance among some of the fishers to help biologists. They fear their doors may be closed against them, but that is usually because they are uneducated about the fact that the common goal is for the good of the resource.

**Brock Bernstein:** I think that is a good idea. If you think about the amount of time the fishers are out on the grounds, they really are the best educated naturalists around. There needs to be a way to take advantage of that. We need to find that way. That is first hand knowledge that needs to be used and there are barriers on both sides. You mentioned one, on the other hand I think that scientists often times think that fishers don't often know a good scientific method, and don't gather good data with good protocols, but I think it is fairly easy to establish decent protocols so that this first hand information could be gathered by the fishers on a routine basis and could be a part of the research data base. I think there is a lot of opportunity for that.

**Tammy Blonden:** Some of the light boat operators gathered together this summer and were talking about trying to combine information about fishing and what they saw to try to give to scientists and to help. I have always been open to giving information because I have no problem working with anyone.

**Paul Smith**<sup>18</sup>: I was wondering if in all the time you spend going from place to place on the search, whether you have ever seen any concentrations of squid in areas that you suspect are feeding grounds for the squid as opposed to reproductive grounds?

**Neil Guglielmo:** Either at fishing grounds or during off-loading this has occurred to us, yes. We found that off the west ends of Santa Cruz and Santa Rosa, and also at the east end of Santa Cruz. We also found that many times on the shelf of the submarine canyon outside Port Hueneme, more than two or three miles out. Many times we have seen the fish and then later on the fish would come up onto the flats, out of the canyons and we would be able to take some of this fish. As far as determining if there are squid there, we believe they are.

**Ed Cassano:** If there are no more questions I would like to thank all of our panel members for coming. I would like to extend our thanks to CalCOFI for holding the conference and allowing the Sanctuary to broaden the scope of the Squid Symposium. We look forward to future symposiums and dialogue on critical marine issues.

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<sup>18</sup> Paul Smith is affiliated with the National Marine Fisheries Service in La Jolla, CA.

## BIOGRAPHIES

### **Ainley, David, Ph.D.**

David Ainley received his Ph.D. at Johns Hopkins University in ecology. He is an ecologist at H.T. Harvey and Associates, working on trophic relationships among marine birds. He has published several papers indicating the ecological importance of market squids to seabirds in the California Current. Dr. Ainley is currently conducting research on penguins in Antarctica under a National Science Foundation grant as well as work on seabirds in the California Current, Hawaii and Alaska.

### **Bernstein, Brock, Ph.D.**

Brock Bernstein received his Ph.D. from Scripps Institution of Oceanography in 1977 in biological oceanography. He is currently an independent consultant specializing in environmental policy.

### **Blonden, Tammy**

Tammy Blonden has been a light boat captain in the squid fishery since 1994. Prior to that she worked for the Channel Islands National Park fish habitat in kelp forest monitoring. Tammy is very active in representing the fishing community on a variety of issues.

### **Cassano, Edward R., LCDR**

LCDR Edward Cassano received a B.S. in marine biology from South Hampton College and holds a Master of Marine Affairs Degree from the University of Washington School of Marine Affairs. As Manager of the National Oceanic and Atmospheric Administration's Channel Islands National Marine Sanctuary, Lieutenant Commander (LCDR) Edward Cassano has led efforts to broaden the role of the National Marine Sanctuary Program in the Southern California region, increase protection and education of sensitive resources and improve research capabilities. LCDR Cassano has been a commissioned officer with the NOAA Corps since 1986 and has conducted marine mammal, fisheries and oceanographic research. He serves on several marine management boards, including the Advisory Council to the Monterey Bay National Marine Sanctuary and the Mineral Management Service High Energy Seismic Survey Team.

### **Guglielmo, Neil**

Neil Guglielmo has been fishing squid in California for 40 years. He has also been active in most other California fisheries, including sardines, mackerel, and halibut.

### **Guglielmo, Peter**

Peter Guglielmo has been a commercial fisherman for 30 years. He and his brother Neil have operated a processing facility in San Pedro for the last ten years. They process squid, sardines, mackerel, and anchovy.



**Hastings, Sean**

Sean Hastings holds a Master of Marine Affairs Degree with a concentration in coastal zone management from the School of Marine Affairs at the University of Washington, and a Bachelor of Arts degree in environmental studies through the University of California at Santa Cruz. Sean joined the CINMS in 1997. In 1998, Sean was nominated as a Presidential Management Intern and has been brought on as a policy program specialist working on CINMS policy issues related to offshore oil exploration and development, fishery management, and research in the Santa Barbara Channel.

**Hayward, Tom, Ph.D.**

Tom Hayward received his Ph.D. in oceanography from Scripps Institution of Oceanography. He is now a research oceanographer with the Scripps Institution of Oceanography and Marine Life Research Group. In addition, Tom manages field work for CalCOFI and is currently working on the physical structure in plankton distribution of the California Current.

**MacWilliams, Sarah**

Sarah MacWilliams received a B.A. in environmental, population and organismic biology, as well as in cultural anthropology, from the University of Colorado at Boulder in 1997. Her studies have focused upon marine invertebrates. She is currently an intern at the Channel Islands National Marine Sanctuary where she assists with fieldwork aboard the research vessel *Ballena* and edits volumes such as this one. Sarah plans to attend graduate school in marine science or fisheries management.

**McGinnis, Michael Vincent, Ph.D.**

Dr. McGinnis is Acting Director of the Ocean and Coastal Policy Center at the University of California, Santa Barbara. Since 1992, he has received grants from the U.S. National Science Foundation to study regional environmental policy making (1991-1993) and the place of values and science in ecosystem and watershed-based restoration in the American West (1994-1999). He is editor of *Bioregionalism* (New York and London: Routledge, 1998), and author of several essays on ethics, politics, science, policy, and bioregional thinking. He is completing books entitled *Rewilding Imagination: The Politics of Restoring Art, Nature and the City*; *Making the Watershed Connection*; and *Endangered Watersheds*.

**Okey, Tom**

Tom Okey has a Masters of Marine Science from Moss Landing Marine Lab. He is the Pacific Fisheries Project Manager for the Pacific Regional office of the Center for Marine Conservation. Tom has conducted research from Alaska to the South Pacific.