

Comments on AB 1299  
By Richard Parrish April 12, 2011

## PREFACE

My first impression on reading AB 1299 is that the authors seem to be 180 degrees out-of-line with the public's view of sustainable development.

1. There is worldwide agreement that if we are going to achieve a sustainable planet the first world is going to have to increase its consumption of lower trophic level foods and reduce our dependence on higher trophic level sources. AB 1299 will move California in the opposite direction, reducing the take of low trophic level fishes that consume plankton and concentrating California's fisheries on high trophic level predators.
2. The prestigious watch list of the Monterey Bay Aquarium lists California sardine as a 'green' fishery. Why do the authors of AB 1299 disagree with the Aquarium?
3. Fisheries essentially trade a non-renewable resource (petroleum) for a renewable resource (fishes and invertebrates). Fisheries for most high trophic level species have quite low ratios between the food production and fuel consumption; lobster fisheries typically land less than one pound of lobster per pound of fuel, many trawl and tuna fisheries land between 1.5 and 5 pounds of fish per pound of fuel. In contrast the fish: fuel ratio of California fisheries for sardine, anchovy and squid range from about 20 pounds of fish per pound of fuel when fishing is very poor to over 200 pounds of fish per pound of fuel when fishing is very good.

In my opinion AB 1299 cannot be defined as 'green' fishery management.

Before I present my comments concerning the problems and resources required for implementation of AB 1299 I feel that it is necessary to point out that the wording of AB 1299 negates the reason for using complicated ecosystem analyses. Therefore, in my opinion, development of extensive ecosystem information, while important in the long term, is relatively unimportant for the purposes of AB 1299. The reason that ecosystem data and analyses are unnecessary is that the single species component of AB 1299 will prevent ANY significant increase in the landings of ANY planktivorous species or ANY non-planktivorous species that has a bycatch of planktivorous species.

The reasoning for the above statement is based the wording of section 7098 (b) (3).

*7098 (b) (3). The commission shall restrict the development of an emerging fishery, or the significant expansion of an established fishery, where forage species are a significant component of the catch, unless it finds that the available scientific information indicates that the development or expansion of the fishery would be unlikely to have a significant negative impact on the population of the forage species or the ecological services rendered by the forage species in the larger ecosystem.*

Simple single-species population biology clearly shows that any increase in the mortality of a species will result in a reduction in the population of the species. Thus any significant increase

in fishery landings will result in a significant reduction of the population of the species without the need to find “unlikely significant negative impact”. This strongly suggests that there is no reason to do any complicated or expensive ecosystem analyses as the wording of AB 1299 will prevent ANY expansion of fisheries that would result in negative impacts on the populations of planktivorous fishes or invertebrates. Given that simple analyses will prevent the expansion of ANY California fisheries covered by AB 1299, why spend scarce dollars developing the information and analyses necessary for the complicated and expensive ecosystem analyses necessary to estimate ecosystem services?

More involved single-species fishery biology would show that there are a small number of fisheries where specific management measures might prevent a negative impact on the population; for example Dungeness crab. In Dungeness crab the biology of the species and the fishing gear used in the fishery allows the fishery to take only males as it allows captured females to be returned to the ocean with nearly zero mortality. Also size at recruitment to the fishery is set at a size that allows males to reproduce for a year or two before they are allowed to be landed by the fishery. Therefore with Dungeness crab increased landings might not result in significant reductions in the population biomass of the species. In this type of situation the adult population would consist of a much higher percentage of females than would occur without a fishery. Fisheries on species that have highly density-dependent spawner-recruit relationships might also not result in a negative impact on population biomass if the population were at high levels. However, in this case fisheries would have a negative impact if the populations were at low or moderate population levels.

Unfortunately the biology and fishing gear used in the fisheries for planktivorous fishes and invertebrates in the California region do not allow selective exploitation of males and none of these species have been shown to have a spawner-recruit relationship with large density-dependence. In fact, where known, the recruitment of these species is highly dependent on the environment.

Essentially AB 1299 could be used to prevent increases in any California fishery that either targets, or has a significant by-catch of any planktivorous fish or invertebrate. The established fisheries covered by the Coastal Pelagic Species FMP are a good example of how AB 1299 could be used or misused. These species have had observed high variability in reproductive success resulting in fluctuations in populations and landings of factors of one to three orders of magnitude. Managed species have control rules that raise and lower quotas and exploitation rates as the population size goes up and down.

The provisions of AB 1299 are at odds with the present Federal management of sardine, Pacific mackerel, jack mackerel and northern anchovy and State management of Pacific herring and market squid and the bill could be used to freeze California landings of these species at the low levels that occur during periods of unfavorable environmental conditions. The bill would have absolutely no effect on the landings of these species in Mexico, Oregon, Washington and Canada. When favorable conditions occur and populations increase the bill could be used to prevent any increase in the landings in California as any significant increase in landings would result in a significant impact on the species population level. The fisheries in the other areas would realize the increased production from a period of favorable environmental conditions but California would not.

Only the six above species are named as forage species in AB 1299 and it is unclear at this point how many other species will be eventually classified as forage species. The bill states that any planktivorous fish or invertebrate will be classified as a forage species but it does not define how much of a species diet must be plankton before the species is included as a forage species. The vast majority of higher trophic level fishes are planktivorous during their early life history and juvenile stages and then become predators of either nekton or benthos as they mature. Jack mackerel, one of the named forage species in the bill, consumes zooplankton as a juvenile and primarily zooplankton (but including a significant amount of fishes) as an adult. Another named forage species, Pacific mackerel consumes plankton when young and primarily nekton (i.e. fishes and free swimming invertebrates) as an adult. Based on the food habits of these two species a large number of California fishes could be considered to be forage species. Species that have food habits similar to jack mackerel include hake, chilipepper and widow rockfish. Species with food habits similar to Pacific mackerel include yellowtail rockfish and salmon; in fact Pacific mackerel are known to eat young salmon. Species that are clearly planktivores but not normally considered forage species include blue rockfish, ocean sunfish and basking sharks.

Due to the fact that it is presently impossible to determine which species will fit under the definition of forage species as described in AB 1299, it is impossible to determine the full effect or costs that enactment of AB 1299 will entail. An example of this involves two species that traditionally dominated the groundfish landings in Central California, bocaccio and chilipepper rockfishes. These two species share a common habitat centered on the shelf-break. Bocaccio primarily feeds on nekton and chilipepper primarily feed on zooplankton; therefore chilipepper is very likely to be defined as forage species under the wording of AB 1299. Fisheries on each of two species cannot avoid taking the other as they share the same habitat. Over the 1950-1999 period both bocaccio and chilipepper were heavily fished; average catch during this period was 3166 and 2059 MT (respectively) and average exploitation rates were 0.134 and 0.079. The most recent data for the two species (2008 and 2007) show that stringent management regulations have extremely reduced catches (77 and 127 MT) and exploitation rates (0.006 and 0.004). The most recent population estimates show that bocaccio was at 27% (2008) of its unfished biomass and chilipepper was at 71% (2007).

Landings of chilipepper, one of the healthiest groundfish species in California, have been held down by the Rockfish Conservation Area (RCA) and small quotas that are designed to prevent bycatch of the overfished and rebuilding bocaccio population. The RCA, which essentially includes the area between the 30-150 isobaths, prevents trawl, trap and hook and line fisheries over most of the chilipepper's habitat. When the bocaccio population rebuilds to a healthy level (40% of the unfished level) the Council is expected to open Rockfish Conservation Closure for fishing. According to the provisions of AB 1299 it appears that the chilipepper will be classified as forage species and therefore significant increases in the fishery for this species will be prohibited by the State of California. Increases in the fishery for bocaccio will be also stopped by the State of California because chilipepper are a significant bycatch in the bocaccio fishery.

In their presentations to the April 5<sup>th</sup> Committee hearing on AB 1299 in Sacramento the authors of AB 1299 kept repeating that single species management had failed and that we must move to ecosystem based management. These statements are demonstrably untrue and the use of this

line of argument without presentation of any data suggests that the authors of AB 1299 are either unaware of the significant success of single species management in the California Current System or simply activists for belief-based fishery management.

To show the success of single species management I will use the two species mentioned above, bocaccio rockfish (a high trophic level predator) and chilipepper rockfish (a lower trophic level planktivore that consumes some nekton). The information presented is from the most recent single species stock assessments of bocaccio (Status of bocaccio, *Sebastes paucispinus*, in the Conception, Monterey and Eureka INPFC areas for 2009: Field et al 2010) and chilipepper (Status of the Chilipepper rockfish, *Sebastes goodei*, in 2007: Field 2008). Both assessments are available at the web site of the Pacific Fisheries Management Council.

To explain the history of the fishery management for bocaccio and chilipepper rockfish it is necessary to examine the time series of catches, population biomass and exploitation rates (Figure 1). The most recent single species stock assessments have been extended back to 1892 allowing examination of very long time series. Catches of both species were near 200 mt in 1892 and they rose to above 500 mt by 1917. Prior to the end of WW II the fishery was principally a hook and line fishery and the landings of the two species were very similar with chilipepper catches tending to be slightly higher than those for bocaccio. After WW II the California trawl fishery developed quickly with bocaccio landing greatly exceeding those for chilipepper. There were several multiyear decreases in the landings for both species and catches of both species peaked in 1974 (bocaccio: 9001 mt) and chilipepper: 3960 mt). Landings of bocaccio remained well above those for chilipepper until 1993; however a very sharp decline in bocaccio landings started in 1983, landings fell under 1000 mt in 1995 and they fell under 100 mt in 2002. Chilipepper landing exceeded 2000 mt in 1966 and fluctuated around this level until 1997 and then declined sharply to below 300 mt in 2003 when the Rockfish Conservation Area was established.

The management of California's bocaccio and chilipepper fisheries was similar to those for all rockfish species. Prior to WW II the fishery was primarily a hook and line fishery with almost no regulation. With the development of trawling ecosystem-based management was introduced; closed areas to protect inshore nursery areas of flatfishes (i.e. prohibition of trawling within 3 nautical miles from the mainland) and mesh size restrictions to prevent take of juvenile fishes and to reduce the bycatch of invertebrate species. After enactment of the 200-mile zone in 1976 the Federal Government (through the Pacific Fishery Management Council) became the primary manager of all groundfish species. A large enhancement of existing State monitoring programs was funded and by the late 1980s single species stock assessment methodology was being developed. The results of the first single species assessments suggested that a number of groundfish stocks were being overfished; however, the modeling was newly developed, there was some concern about peer reviewing the models and the PMFC dithered for a period of time. By the early 1990s the models had been accepted and the Council started reducing the allowable take of individual species based partially on the single species methodology. The stocks continued to decline through the mid-1990s. The primary reason for this failure in management was that the primary basis of groundfish management continued to be ecosystem-based management. Instead of using the estimates of population size and productivity from the individual single species stock synthesis models to establish quotas, the Council used the

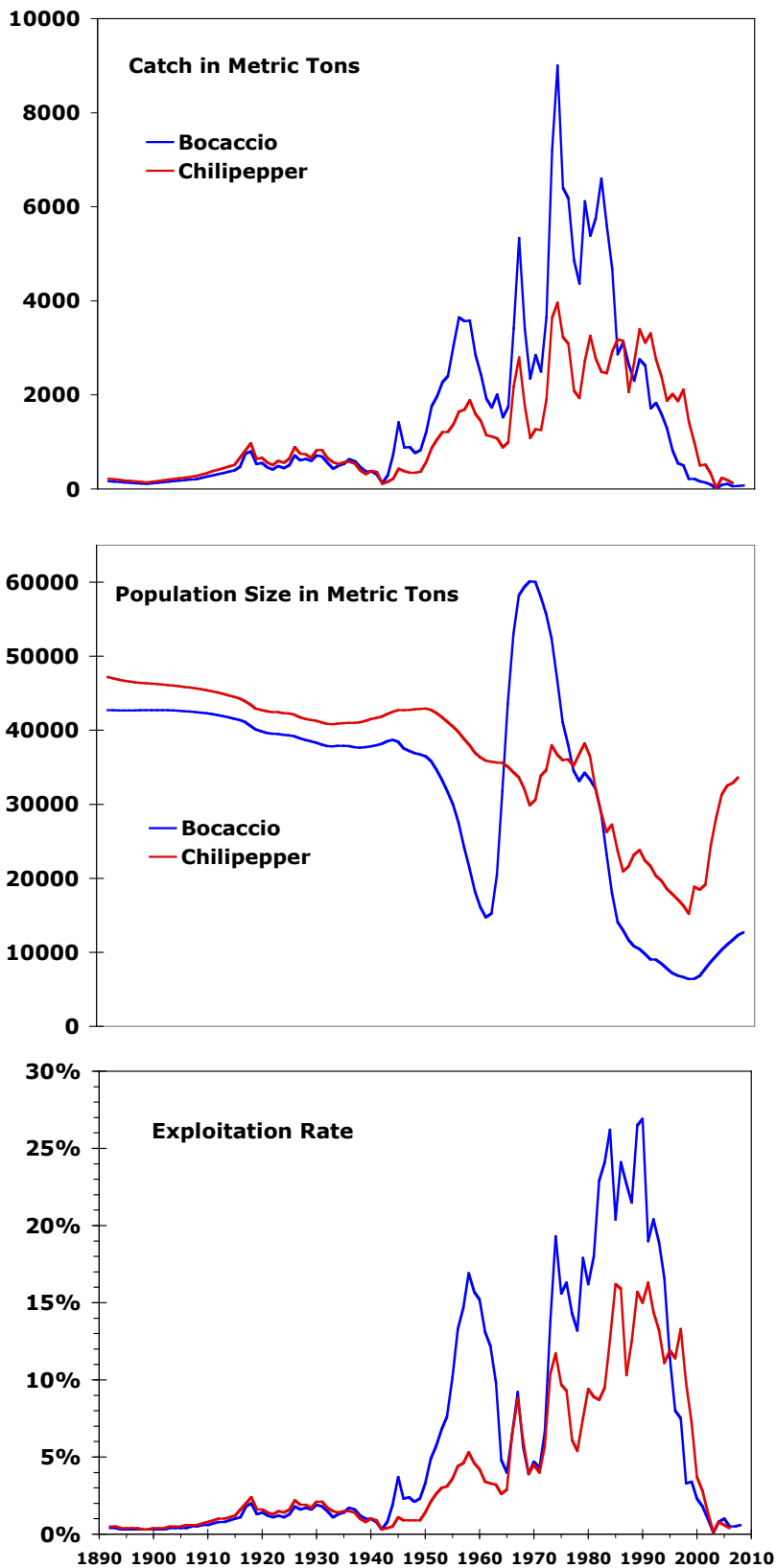


Figure 1. Catches, population sizes and exploitation rates of bocaccio and chilipepper.

assessments of population size and a single ecosystem-based estimate of the productivity all combined groundfish stocks.

The population size and especially the exploitation rates clearly show the transformation away from ecosystem based management and its replacement with single stock management. Note that the exploitation rate of bocaccio, which was one of the first species with peer reviewed stock assessments) started dropping in 1996 when the Council reduced bocaccio quotas. Note that the bocaccio stock had two very abrupt declines in population, the first was followed by a sharp decrease in the species exploitation rates (from over 15% to less than 5% and the population had an extremely fast increase in population to well above any previously recorded. A series of years with very good reproductive success occurred from 1961 to 1967. In 1963 the population had a surplus: the population increased by 29,269 mt even with a catch of 2008 mt. Environmental variation struck again, this time with a large positive affect. Chilepepper exploitation rates did not get as high as those for bocaccio and therefore its population levels did not go as low as bocaccio's. By 2002 restrictive quotas based on the single species stock assessment of bocaccio had reduced the exploitation rate of bocaccio from the highs of above 25% in the late 1980s to 1.4%. At this stage the distinction between single species and ecosystem based management becomes somewhat confused. The exploitation rate of chilepepper was reduced because of the low level of the bocaccio stock and the fact that bycatch in a chilipepper fishery would catch bocaccio. Is this single stock management or ecosystem management? What ever it is called, the exploitation rate of chilipepper in 2002 was only 0.1%. In 2003 the Rockfish Conservation Area (definitely an ecosystem based management measure) was established). The RCA had little effect on catches as exploitation rates were already close to or below 1% and they have remained at this level ever since the RCA was established.

In 1966 when I started work as a marine biologist with the California Department of Fish and Game, catch statistics were the only time series of data available for most species. Over the next 30 years extensive fishery monitoring programs, fishery independent surveys and development of single-species stock assessment methodology progressed to the point that we now have times series of population size and exploitation rates. For many of the most important exploited species we have time series extending 50-100 years into the past.

Before about 1990, fishery management of California Current species was primarily ecosystem-based relying on belief, experience, logic and catch data. The development of single species assessment methodology allowed management to move to single species management focused on time series of population biomass and exploitation rates but still affected by belief, experience, logic and catch statistics. Single-species management has completely turned around the decreasing population trends observed in the groundfish fishery during the mid-1970s to mid-1990s and population levels are now trending markedly upwards (Figure 2).

Enactment of AB 1299 would compel the California representatives on the Pacific Fishery Management Council to cease supporting the single species management that has allowed California Current groundfish stocks to recover.

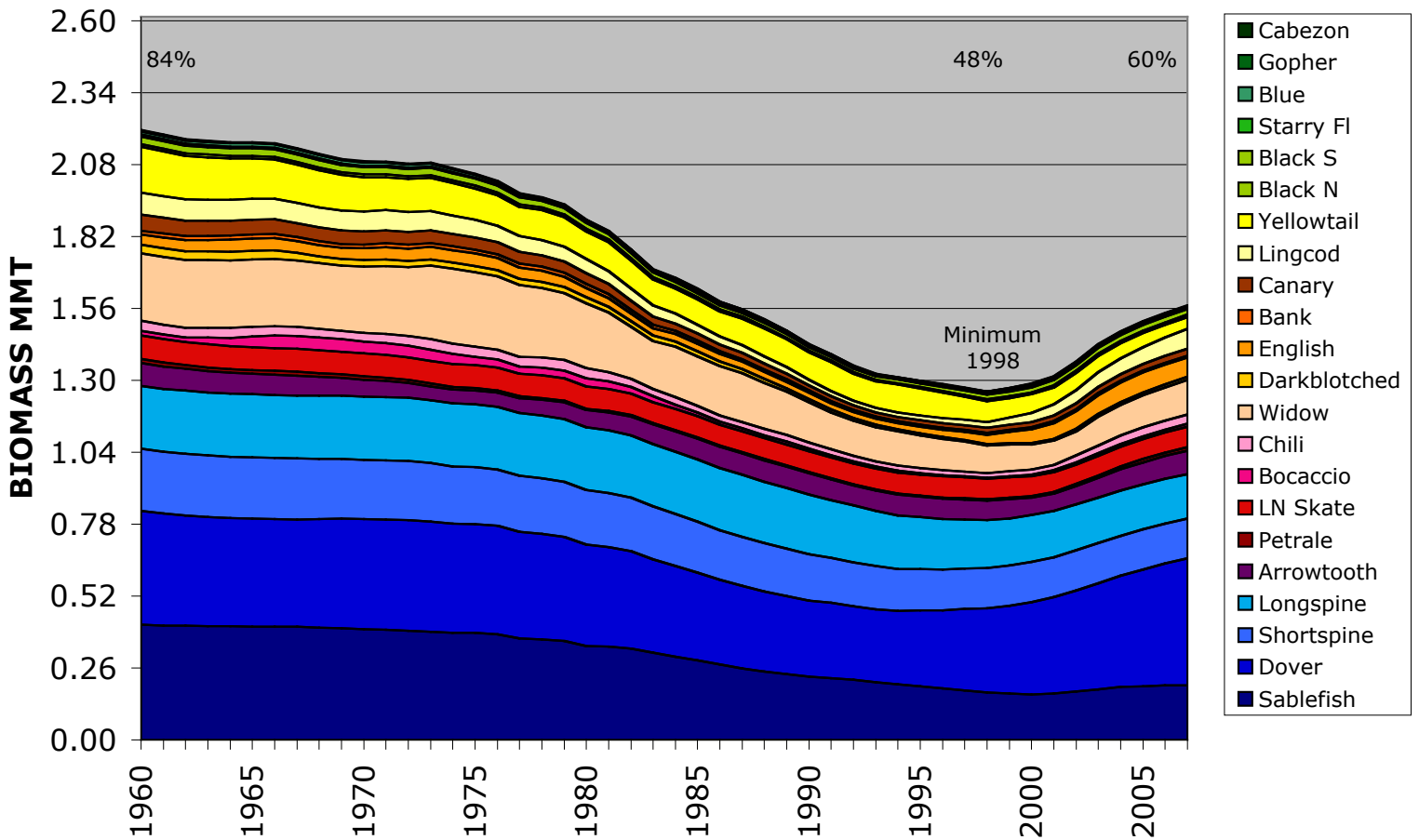


Figure 2. Accumulated biomass level of 22 species of groundfish. Data extracted from stock assessments available from the Pacific Fishery Management Council web site in 2009.

The authors of AB 1299 who presented the “for” presentations at the Water Parks & Wildlife Committee hearing Sacramento brought up the point that the present sardine management regulations have been “debunked” and also said that recent landings of sardine were 22% of the biomass estimate, whereas the management formula has a maximum exploitation rate much less than this. They did not expand and explain what actually happened, and this is probably technically excusable given the fact that hearing testimony is limited to two three minute presentations “for” and the same for “against”. However, the authors misled the Committee by not informing them that the ecosystem-based part of the management plan is what was ‘debunked’. Fishery management is a very complicated process and even with my very brief exposure to the State legislature process it is clear that this forum is a very poor place to do fishery management.

It is time to set the record straight and as I am the person who developed and presented the present sardine fishery management I am probably the best one to do this. The present sardine control rule that is used to establish the annual quota for sardine has four factors. Three of these are based on single species management (i.e. cutoff, fraction and maximum catch) and one is ecosystem-based management (changing the fraction based on sea surface temperature).

The cutoff determines the population size where the fishery is closed to fishing (150,000 mt for sardine). The fraction determines the exploitation rate and it is multiplied to the total biomass minus the cutoff to establish the annual quota (for sardine the fraction is 0.15 in warm water cycles, i.e. 3-year mean sea surface temperature above 17.2 degrees Celsius. Below 17.2 degrees, the exploitation rate declines to 0.05 when the 3-year mean temperature reaches 16.7 degrees Celsius).

The exploitation rate with a biomass of 150,000 mt is 0.0%, and a biomass of 300,000 mt would have an exploitation rate of 7.5%, a biomass of 1 million tons would have 12.75%. This allows the proportion of the population that is harvested to be low at low population sizes and it then increases as the population increases. The third single species factor in the sardine control rule is the maximum catch (200,000 mt). Due to the maximum catch factor the exploitation rate at a biomass of 3 million mt (very close to the estimated average unfished biomass) is only 7.0%. Sardine is the only finfish species on the west coast that has a maximum catch. Although very few people are aware of this, the maximum catch is one of the most important pieces in the management plan, considerably more important for maintaining a high average sardine population than the cutoff. The maximum catch is also a major factor in preventing large economic losses due to excessive buildup of the fishing fleet and processing capacity during the short periods when the biomass of sardine goes to very high levels. This is because the maximum catch reduces the exploitation at high biomass levels, allowing the sardine population to expand to well above 5 million tons for short periods of time. It also allows the high biomass level to be exploited over a period of years rather than quickly reducing the population with high exploitation rates. Based on evidence from sediment studies carried out in the anaerobic basins off Southern California, the sardine population (and other major coastal pelagic species, and also hake) had numerous multimillion mt population fluctuations before the Europeans arrived in California. Although the principal reason for establishing a cutoff is to maintain a high population level, it also has economic benefits, and also part of our reasoning in having a maximum catch was ecosystem-based management. The 'normal' pattern for coastal pelagic species in the California, Peru, Benguela, and Oyashio/Kuroshio currents is for extremely large population fluctuations with a quasi-period of about 60 years. Therefore a management strategy that maintains the 'normal' pattern was thought to have some value (i.e. belief-based, ecosystem-based management)

As mentioned above, the factor resulting in the 'debunked' comment by the authors of AB 1299 is the ecosystem-based piece in the control rule. This brings up the following question. If the authors of the bill believe that ecosystem-based management is so superior to single species management for forage species why didn't they point out this clear contradiction to their belief that ecosystem-based management is superior to single species management?

So how was the sardine management plan 'debunked'? The sardine management assessment model was developed in 1998-9. A peer-reviewed paper describing a statistical relationship between sea temperatures measured at Scripps Pier and sardine recruitment success was published in CalCOFI reports (Jacobson and MacCall 1995). This work reported a weak/moderate relationship between sea surface temperature and reproductive success with colder sea surface temperature favoring increased reproductive success. The Jacobson and MacCall model was included in the sardine management assessments developed for the fishery management plan. A recent paper in the Canadian Journal of Fisheries and Aquatic Sciences

(McClatchie et al 2010) reexamined the relationship between sea surface temperature and sardine reproductive success, adding 17 years to the original time series, and found that the relationship described by Jacobson and MacCall was no longer statistically valid. McClatchie et al. did point out that the 17 years of additional data did not include any years with cold temperatures. It is also noteworthy to point out that neither of the two studies included data from the extended coldwater period (1964-1976) when Scripps Pier temperatures reached the coldest on record, the sardine population was too small to be measured and no increase in population was observed.

Nevertheless the McClatchie et al paper does raise serious concerns about the validity of the ecosystem-based component of the sardine management control rule, The authors state “Our results show that one of the fundamental relationships (the temperature-recruit relationship) underpinning the stock-recruit-environmental relationship does not fit the more recent data. The other fundamental relationship underpinning the original model (the stock recruitment relationship remains valid when tested with the more recent data.”

In other words the single species component of relationship remains valid even if the ecosystem component does not. This is quite a different story than that implied by the authors of the bill in their testimony to the Committee.

In my opinion, the authors of AB 1299 also misled the Committee when it was stated that sardine management was resulting in a 22% exploitation rate when the management model called for much less and it was then implied that ecosystem-based management would be the solution of this problem. So why is the exploitation rate so high? The reason is that the Pacific Fishery Management Council has no management authority over the fisheries in either Canada or Mexico and it cannot accurately predict the landings of sardine outside of US Waters. Neither single species or ecosystem-based management could solve this allocation problem; the only real solution is International Management.

#### IMPLEMENTATION OF AB 1299

Given the present wording of AB 1299, it appears that the intent of the bill is to ensure that there will be no significant increases in ANY California fishery for planktivorous fishes and invertebrates or ANY California fishery that has a significant bycatch of planktivorous species. Given the wording in the final bill and the material presented in the above preface, it is clear that single species population dynamics are all that is required to achieve the intent of the bill, notwithstanding the bill’s stated intent to achieve ecosystem-based management. Therefore, the much more complicated and expensive tasks that will be required to determine the effects of increased landings on ecological services are unnecessary and redundant.

I cannot predict the funding that the Department will receive to implement AB 1299 so I have tried to compartmentalize the costs into individual tasks, some of which allow estimation of the funding that will be required to implement the provisions of the bill.

The work that needs to be done to implement AB 1299 is primarily described in section 7098 (b) (1):

“ 7098 (b) (1) Commencing January 1, 2012, management decisions of, and regulations promulgated by, the department and commission, including, but not limited to, new fishery management plans and amendments to existing fishery management plans that significantly affect an existing or emerging fishery for forage species, or a fishery in which forage species are a significant component of bycatch, shall be consistent with the policy described in subdivision (a). In determining consistency with subdivision (a), and in implementing subdivision (d) of Section 7080, the department shall review the best readily available scientific information to do all of the following.

(A) Identify the major predators, determine the relative contribution of the forage species to the diets of those predators, and evaluate the effects of management actions on those predators.

(B) Identify the other forage species that serve as similar prey in the forage pool of the California Current Ecosystem and evaluate their stock status.

(C) Evaluate the long-term effects of alternative harvest strategies on available indicators of ecosystem structure and function.

(D) Consider the effectiveness of existing fishing regulations to provide adequate forage for the populations of major predators.

(E) Consider current population levels of major predators of those forage species.

(F) Consider ecological and ocean conditions, including the dynamics of decadal or long-term oceanic cycles, that affect the populations of forage species.

(G) Ensure sufficient availability of live and dead bait to support the needs of California commercial and recreational fisheries.”

Based on my reading of AB 1299, the Department is primarily tasked with carrying out a literature search of a very broad range of biological, ecological and oceanographic topics. I assume that the output from this literature search will include a large annotated bibliography, and the evaluations mentioned in sections A-B above.

Very little is said about using the information that is developed or described in the bill, and it is clear that the bill does not require the Department to carry out any of the evaluations or considerations mentioned in sections A-G for any specific species; it only requires that present knowledge be reviewed and evaluated. In addition the Department does not appear to be funded under AB 1299 to actually carry out any of the very complicated and expensive evaluations, analyses or modeling that AB 1299 says are needed for the management of California fisheries.

Instead of providing the funding to actually carry out the principal mandates of AB 1299, it appears that the bill is designed to pass on the costs of the provisions of the bill to any decisions and regulations happening after January 1, 2012. In other words AB 1299 will provide a literature search and it will be up to future legislation or to future Department or Commission initiatives to actually pay for the very extensive and expensive monitoring and assessment work that would be triggered by an increasing fishery for forage species as defined under AB 1299. It is possible that the fishers involved in the fishery under future consideration would be expected to supply the funding and it is possible that the work could be funded by grants from several sources (if the current prohibition on outside grants is removed).

The expected situation resulting from the application of the mandates described in AB 1299 is that if landings of a forage species increased over a period of time, or if there was an increase in landings in a fishery that has a significant bycatch of a forage species, then anyone could bring this to the attention of the Commission and someone would have to come up with the funding that would be necessary to develop the very complicated and expensive analyses that will be necessary to meet the provisions of AB 1299. Under 7098(b)(3) the Commission would be required to curtail the fisheries unless and until findings proved “no significant impact”, which is virtually impossible to prove scientifically for concepts as broad and undefined as “ecosystem services”. With regards to ecosystem services is there a definition for these services in the Fish and Game Code?

#### COSTS OF IMPLEMENTATION OF AB 1299.

The principal task assigned to the Department is to carry out a very extensive literature review. In my opinion the task is very open ended and it will be difficult to determine how much is enough. Therefore the review should be broken into several parts each of which would require personnel with educational and experience in the particular discipline being addressed.

Estimation of the costs of implementation of AB 1299 is dependent upon the geographical area covered by the analyses used for implementation. Therefore, an early decision should be made concerning the area to be described with funding provided for AB 1299. Should the work center on California State Waters, State and Federal Waters off California, the U.S portion of the California Current or the entire California Current System including some Canadian and Mexican Waters?

The material presented in the preface suggests that the first and most important thing that needs to be done to implement AB 1299 is to develop information on the food habits of marine fishes, invertebrates, mammals and birds. The first goal of this work would be to simply separate marine animals into planktivores and predators (i.e. the species protected by the bill and the species not protected by the bill). This information could then be used to design a food web for the California Current Ecosystem. I note that several such food webs and even generalized ecosystem models have already been developed for the California Current System or portions of it. A comprehensive ecosystem-based management policy simply cannot be addressed if only California State Waters are considered. Currently a comprehensive, and expensive, California Current ecosystem analysis is being developed through the Pacific Fishery Management Council. However, this type of analysis cannot be used to assess the many unnamed species with small populations and small fisheries that would fall under the definition of forage species in AB 1299 (i.e. fishes and invertebrates whose diets include some undefined proportion of plankton). Assessment of these species would require monitoring programs and analyses that are presently unfunded.

#### **A. Food Habits of California marine vertebrates and invertebrates.**

The principal work necessary for this sub-task is a literature review designed to identify the food habits of marine fishes, invertebrates, birds and mammals. The purpose of this work is to identify species as either lower trophic level plankton consumers or higher trophic level

predators so that it can be determined which species qualify as forage species. This task would also identify the importance of forage species in the diets of predatory species. Obviously staff will be needed with expertise in marine fishes, invertebrates, birds and mammals. This task seems relatively straightforward; however, nearly all-marine fishes are planktivores in their larval and juvenile stages and the adults of many fishes have a diet composed of a mixture of zooplankton and nekton (fishes and squids). AB 1299 provides no guidelines regarding how this enters into the determination of what species are planktivores. The six named forage species includes the northern anchovy, a species that is almost exclusively a planktivore for its entire life history. It also includes Pacific mackerel, a species that consumes zooplankton as larvae and juveniles; however, adult Pacific mackerel commonly feed on nekton (fishes and squids) and they would normally be considered as one of the major predators in the California Current. Obviously the authors of AB 1299 had other things on their mind rather than the proper use of biological terms when they wrote the bill. The issues of which life history stages are used to determine if a species is defined as a planktivore and the proportion of plankton in the diet that defines a species as a planktivore need careful consideration by the Department as the authors of AB 1299 provide little guidance for these primary issues.

In developing cost estimates, rather than listing dollar amounts I have instead described my assessment of the number of staff months necessary to complete individual areas of the review. I note that I have not included any overhead cost assessments and if this work were contracted out, for example to university personnel, overhead costs would add 50-100% to the total cost.

I recommend that a preliminary review of food habits be made before the work is expanded into a general literature review. I suggest that this assessment focus on two areas: First material in "California's Living Marine Resources: A Status Report" and it should include a number of general books on fishes and invertebrates (i.e. Milton Love's book "Probably more than you want to know about the fishes of the Pacific Coast"). Second a review of the information on FISHBASE (<http://www.fishbase.org>). The results of this quick review would show the general patterns and provide a good basis to expand the work into more a more detailed review. I note that information from the above general sources will not be sufficient to determine the percentages of plankton and nekton in the diet of many species.

Personnel requirements: 2 months of mid-level staff.

Review of CDF&G peer reviewed publications; internal CDF&G and NMFS report series, and CalCOFI publications for food habits of exploited fishes and invertebrates.

Personnel requirements: 2 months of lower level staff.

Review of peer reviewed journals, internal reports, thesis results from California educational institutions and internet searches for information on the food habits of exploited and unexploited marine fishes, invertebrates, birds and marine mammals.

Personnel requirements: This is a rather open-ended task, low and high cost options range from about 10 to 24 months and include a mix of lower level, mid-level and senior staff.

Compilation of results and preparation of reports for planktivorous species.  
 Personnel requirements: 4 months of lower level and mid-level staff.

Compilation of results and preparation of reports for predators.  
 Personnel requirements: 4 months of lower level and mid-level staff.

SUBTOTAL COST: 22-34 months of lower level to senior staff.

## **B. Evaluate the stock status of California Fishes and Invertebrates**

Review and compile single species stock assessments prepared for the management of West Coast and California Fishes and Invertebrates.  
 Personnel requirements: 4 months of mid-level and senior level staff

Preparation of reports for stock assessments of exploited species.  
 Personnel requirements: 2 months of mid-level and senior level staff.

Review of peer-reviewed literature, soft publications and time series of landings for California commercial and recreational fisheries, and compile low-resolution information on stock status.  
 Personnel requirements: 3 months of lower level and mid-level staff.  
 Review of published and unpublished reports to determine the stock status of unexploited fishes and invertebrates of California.  
 Personnel requirements: 2 months of lower-level and mid-level staff.

Preparation of Reports on unexploited species.  
 Personnel requirements: 2 month of mid-level staff.

SUBTOTAL COST: 13 months of lower level to senior level staff.

## **C. Identify and describe the species composition of California fisheries.**

The purpose of this work is to identify the fisheries for predatory species that have significant take of forage species. This task requires a literature search, examination of pink tickets to determine landed bycatch from the many California fisheries and examination of the species composition of unpublished CF&G and NMFS fishery monitoring programs. It will also require a considerable amount of effort to compile and write up the results. The task will provide very useful information.

SUBTOTAL COST: 18 months of lower level to mid-level staff.

## **D. Evaluate the long-term effects of alternative harvest strategies on available indicators of ecosystem structure and function.**

- **Consider the effectiveness of existing fishing regulations to provide adequate forage for the populations of major predators.**
- \* **Consider current population levels of major predators of those forage species.**

- \* **Consider ecological and ocean conditions, including the dynamics of decadal or long-term oceanic cycles, that affect the populations of forage species.**
- \* **Ensure sufficient availability of live and dead bait to support the needs of California commercial and recreational fisheries.**
- \* **Evaluate the effects of management actions on major predators.**

A literature search on item D is an imposing task. The write up for this report would require a multi-authored effort including experienced senior level personnel from at least 6 disciplines:

1. Physical oceanography (wind and thermohaline driven currents).
2. Chemical oceanography (including ocean acidification).
3. Biological oceanography (phytoplankton/primary production/satellite oceanography).
4. Biological oceanography (zooplankton)
5. Fishery biology (stock assessment and management simulation modeling).
6. Ecosystem assessment (modeling and management simulation modeling).

The Department does not have the personnel required to carry out this work; neither does any fisheries agency that I am aware of. The work would have to be contracted out and it would be a very expensive contract.

I recommend that the Department refuse to take on this task.

## SUMMARY

Clearly AB 1299 is a major unfunded mandate that will make it very difficult for the Department, the Commission and many fisheries to operate in the future. It appears that the unfunded costs of AB 1299 will have to come from some unidentified source. Given the history of California's fisheries, it must be expected that many species will have large environmentally induced population fluctuations that will interact with existing fisheries to produce further changes. Therefore it should be expected that there will be numerous cases where the provisions of AB 1299 trigger a management response requiring very expensive analyses, modeling and management activity. Costs for individual species would be similar to those for the development of a single species fishery management plan (probably a minimum of one million dollars per species. If multiple species were involved the costs would depend on the number of species and the minimum cost per species might be less than 1 million dollars. The costs of some of these analyses will exceed the value of the landings of the affected fishery. This suggests that there will be many occurrences similar to the single example I describe below.

Several years ago the Legislature closed all State Waters to trawling. In the 50 years prior to this closure trawling was not allowed within 3 nautical miles from shore. At the time very few people, apparently including the Department staff in Sacramento that reviewed the proposed legislation, knew that Monterey Bay State Waters extends offshore to a point about 12 nautical miles west of Moss Landing. Consequently a significant segment of the traditional trawl grounds were lost. Currently there is a research project being developed to determine if an increase in trawling for California halibut in the northern side of Monterey Bay would be sustainable. The project is being designed by a stakeholder group for a portion of the area

outside of 3 nautical miles from shore. The research project is not yet finalized; however, the preferred preliminary project appears to have a total cost of about \$1.3 million. This effort is to reestablish a traditional fishery in a small geographical area that was trawled for California halibut for more than 50 years. Experimental trawl hauls made in the study area by the Department show that bycatch included a number of planktivorous species including market squid, Pacific herring, ocean sunfish, Pacific butterfish, chilipepper rockfish, and several other fishes that might be considered planktivorous species. I note that the project would not meet the requirements for any of the provisions listed in section 7098 (i.e. A-G).

If the project is funded, carried out and if it is found that trawling is sustainable in the project area it would be expected that the Commission would re-open the area to trawling. If this were to happen anyone could go to the Commission and rightly protest that the expansion of the fishery would not meet the provisions of AB 1299 because it would result in an increase in the catch of planktivorous species.

AB 1299's loosely worded provisions, failure to identify the species that the bill refers to and lack of funding to carry out poorly designed mandates suggests that it will provide enormous problems for the Department of Fish and Game, the Fish and Game Commission and individuals that rely on California's fishery resources for employment and food.