YELLOWFIN TUNA, DOLPHINS AND THE EASTERN TROPICAL PACIFIC FISHERY: IS IT SAFE?

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INTRODUCTION

The controversy over tuna fishing and dolphin protection has gained international attention largely as a result of recent debates in the press on the United States' action to embargo yellowfin tuna from suppliers trading in tuna and having weak or no regulations to protect dolphins in the fishing process, and tuna canneries in the United States adopting a policy of processing only tuna caught with dolphin-safe techniques. This controversy has its roots in the eastern tropical Pacific (ETP), which is the region off Central and South America east of about 150° W longitude.

The tuna-dolphin controversy emerged in the 1960s with discovery that U.S. vessels were responsible for large numbers of dolphins killed incidentally to tuna fishing with purse seine nets in the ETP (Sakagawa 1991). This discovery generated intense debate and strong public support in the U.S. for protecting dolphins. Beginning in 1972, the U.S. government responded with a series of laws to protect dolphins and other marine mammals. This encouraged the U.S. tuna industry to develop dolphin-saving techniques and to use methods for preventing needless dolphin mortality in tuna purse seine fishing (Coe, Holts and Butler 1984). Significant reduction in dolphin mortality was realized by the U.S. fleet from these efforts (from 166,600 animals in 1975 to 1,004 animals in 1991). Unfortunately, the positive advances by the U.S. fleet were not matched by the growing non-U.S. fleet. Instead, total incidental mortality (all fleets combined) of dolphins remained high as the non-U.S. fleet expanded their fishing and contributed a greater share to the total incidental mortality. Environmentalists became frustrated with this setback, and resolved to expand the tunadolphin debate to the international arena.

My talk today will not be a review of pluses and minuses of the tuna-dolphin issue in tuna fishing, or a discussion of the legal, moral or ethical arguments of government and private actions to date on this issue. Such a presentation is best done by government administrators and other qualified experts. My purpose today is, instead, to (1) review the dynamics and statistical trends of the ETP fishery, and (2) project those trends to provide a probable scenario of the future fishery.

I begin with first noting that yellowfin tuna, *Thunnus albacares*, is the only tuna species that consistently forms a natural symbiotic relationship with dolphins, mainly of the genus *Stenella*, in the ETP. The relationship is probably related to optimizing foraging strategy (Au and Perryman 1985) and is often referred to as a "bond." This bond is not easily broken. When an aggregation of yellowfin tuna and dolphins is encountered and frightened, the dolphins flee with the yellowfin tuna following directly below and close behind. Purse seine fishermen in the ETP use this bond by encircling the tuna-dolphin complex, because they are aware that capturing the dolphins is the only procedure to insure capture of the tuna as well. Techniques are then used to remove the dolphins alive from the net in order to land the valuable tuna. However, when the techniques are not used properly or diligently, some dolphins die in the net or are badly injured and die eventually after release.

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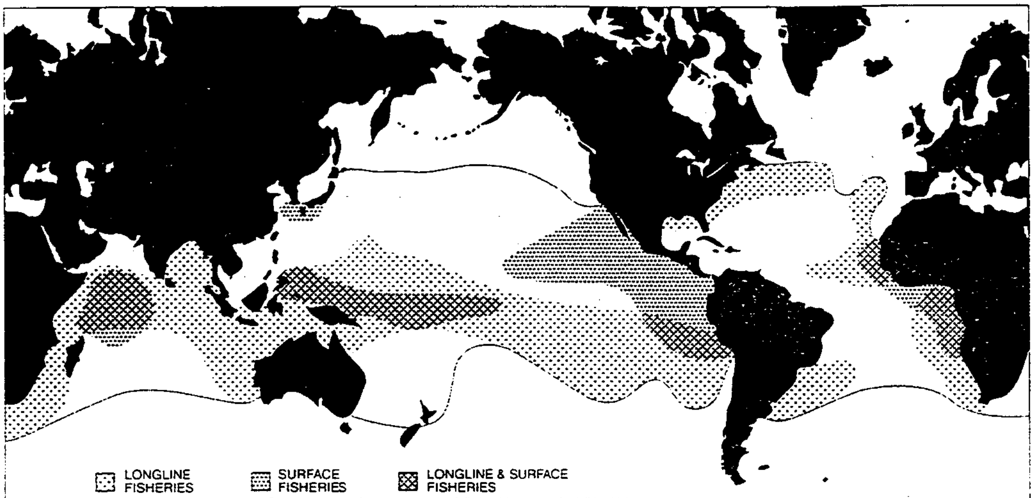
YELLOWFIN TUNA THE TARGET SPECIES

Yellowfin tuna is found over a wide range in the Pacific Ocean from off Japan to New Zealand in the west and from off the U.S. to Chile in the east (Figure 1). Fishing for this species is conducted throughout this range with various fishing gears, but only selected tropical regions of the range appear to be suitable for large-scale surface fishing with purse seine gear. One of those regions is the ETP.

FIGURE 1 **Global geographic ranges and fishing areas for yellowfin tuna.**

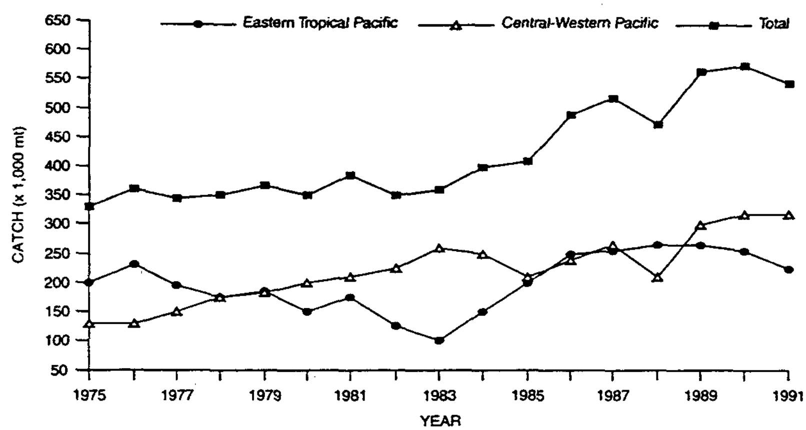


In the ETP, the purse seine fishery targets yellowfin tuna, which is landed mainly for the canned tuna market. The catch is currently (1990-91) at a high level — 210,000 to 280,000 t per year (Figure 2) — and the stock is in good condition. In the late 1970s, this was not the case. The stock was being overfished and was on a decline after peaking in the early 1970s. The stock was unable to sustain profitable catch rates and catches for U.S. vessels, so vessels began leaving the region for the western Pacific. The exodus was initially a few vessels each year until 1983 when a substantial number switched from the ETP to the western Pacific. Since then, the U.S. tropical tuna purse seine fleet has shrunk to less than 10 vessels in the ETP, with about 45 vessels operating in the western Pacific (Sakagawa 1991). Simultaneously during the exodus, new vessels were being added to the non-U.S. component of the ETP fleet and operated successfully through government support. The net result was a small decline in the total number (all fleets) of large purse seiners in the ETP fishery — about 24% decline in number of large purse seiners between 1976 (170 vessels) and 1990 (130 vessels).

The large exodus in 1983 is particularly significant because it occurred during the period of the strongest El Niño phenomenon of the century. The phenomenon modified ocean currents and affected the global climate. The phenomenon also significantly affected the catch of yellowfin tuna in the entire Pacific Ocean (Figure 2). Before 1983, the total Pacific catch of yellowfin tuna was relatively stable at about 350,000 t annually.

During the 1982-83 El Niño availability of yellowfin tuna in the ETP was significantly reduced, and in the western Pacific, significantly increased. The catch in the ETP plummeted and increased in the western Pacific. Since then catches recovered and increased to new records in the ETP and continued to increase in the western Pacific. For the entire Pacific, the current catch is approximately 600,000 t per annum.

FIGURE 2 **Total catch of yellowfin tuna from eastern and western regions of the Pacific Ocean, 1977-91.**

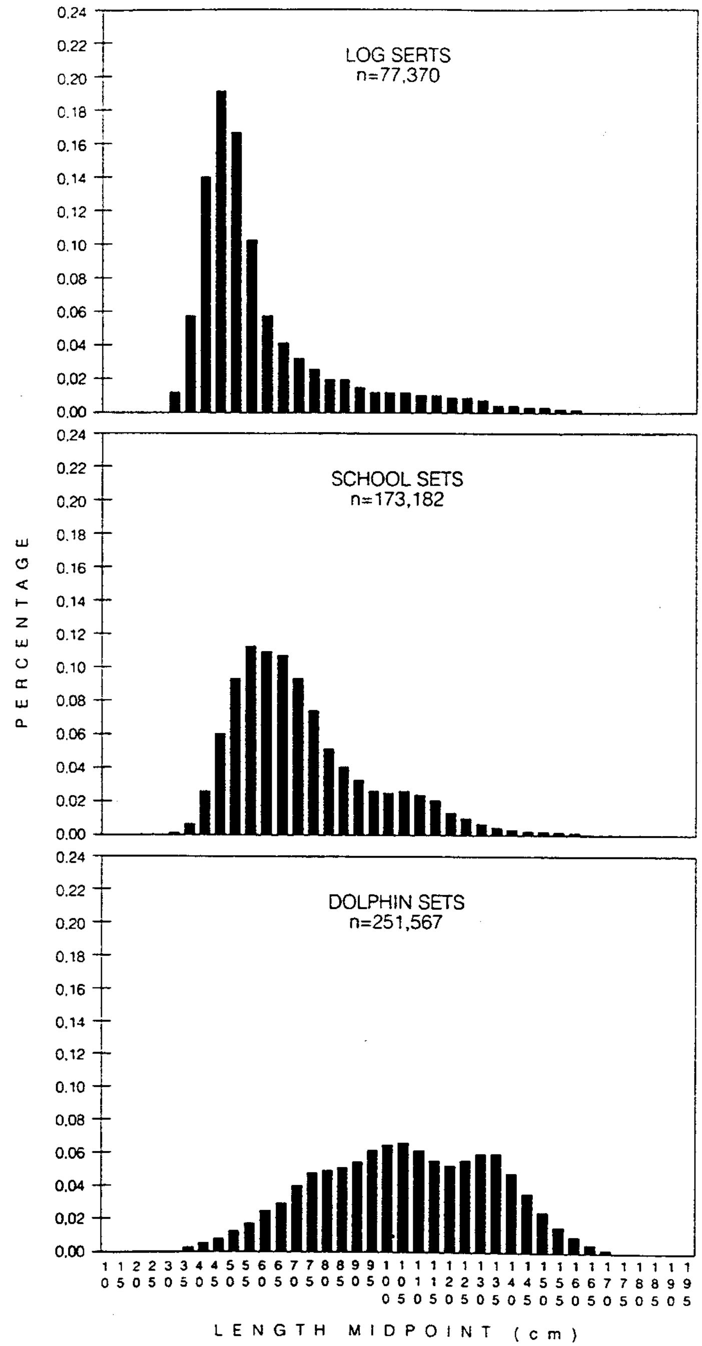


Some researchers believe that the 1982-83 El Niño event created a permanent shift in the environmental regime that allowed for increased production and subsequent high yield of yellowfin tuna in the Pacific Ocean. The hypothesis is that the change brought about improved survival of young and increased the abundance of yellowfin tuna available to the fishery — about 30% higher than levels during the early 1970s and 110% higher than levels during the overfishing years of the late 1970s in the ETP (IATTC 1991). Other researchers hypothesize that if a regime change has occurred and abundance has increased as a result, that this is only a temporary situation and the regime will soon revert to the original pre-1982-83 El Nino state. With this hypothesis, yellowfin tuna abundance will return to lower levels. If so, then the current yield of 600,000 t annually appears to be unsustainable and the sustainable yield might be closer to the 350,000 t level recorded before the 1982-83 El Niño event. No one knows which one of these hypotheses is correct and researchers continue to work on this matter.

DOLPHINS: INCIDENTAL SPECIES TAKEN IN THE FISHERY

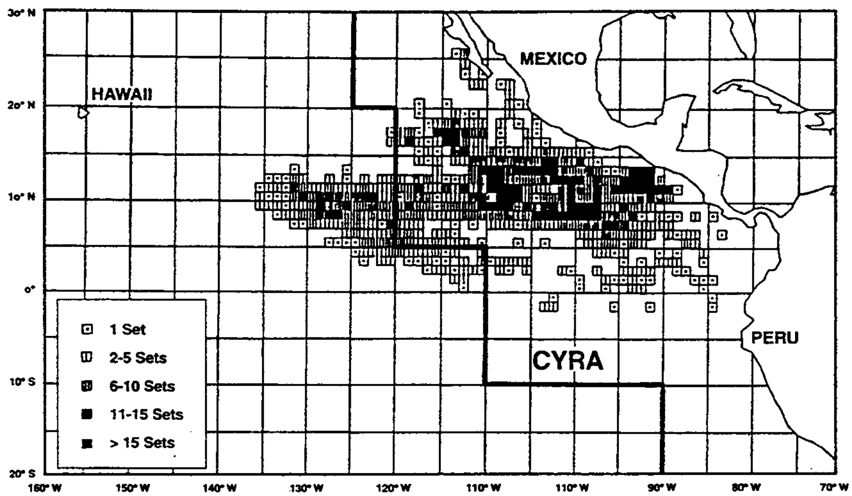
In the ETP tuna fishery, virtually the entire catch of yellowfin tuna is made with purse seine gear and the major portion is caught with dolphins. On the average, for every 3 t of yellowfin tuna caught in the ETP purse seine fishery, 2 t are caught with dolphin-associated schools and 1 t with flotsam-associated or on free-swimming schools. Yellowfin tuna caught in dolphin-associated schools are generally large fish, but sizes caught vary and overlap those for other school types (Figure 3). Fishermen prefer the

FIGURE 3 **Average (1974-90) length-frequency distribution of yellowfin tuna by school or set type from the eastern tropical Pacific. (From: Hall, Lennert and Arenas 1992)**



large yellowfin tuna because they are worth more than smaller yellowfin tuna (e.g., exvessel US$860/t for about 20 kg fish versus US$735/t for 3 kg fish in March 1992). Also, catch rates for dolphin-associated schools, which yield the large yellowfin tuna, tend to be high, although in some years, flotsam-associated schools produce the highest catch rates (Greenblatt 1979).

FIGURE 4 **Location and number of sets made on tuna-dolphin schools by U.S. purse-seiners in the eastern tropical Pacific Ocean in 1987, and the boundary of the Inter-American Tropical Tuna Commission's yellowfin tuna regulatory area (CYRA). (From: Sakagawa 1991)**

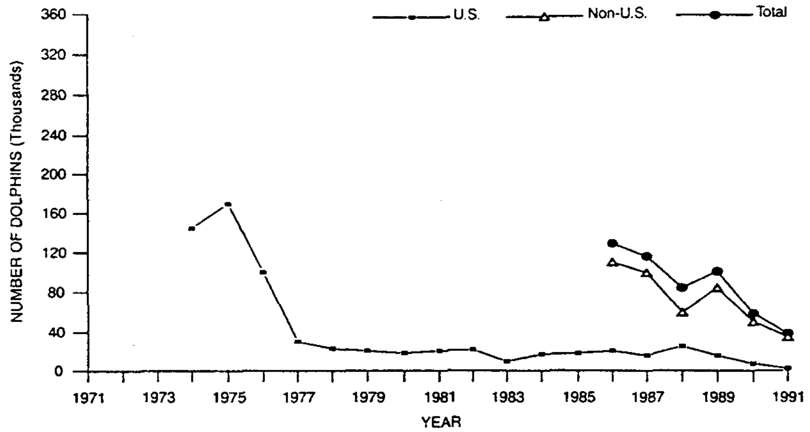


Four species of dolphins (spotted dolphin, *S. attenuata*; spinner dolphin, *S. longirostris*; striped dolphin, *S. coeruleoalba*; and common dolphin, *Delphinus delphis*) consisting of 9 currently recognized stocks are principally involved in the fishery. Each species-stock has its unique geographic range (Perrin, et al. 1975), but all have ranges that fall largely in the ETP purse seine fishing area (Figure 4). By far the most important species-stock is the northern spotted dolphin.

In the 1960s and early 1970s when dolphin-saving techniques were not fully known and used, 170,000 to 500,000 dolphins were killed by the fishery each year (Figure 5). With development and wide-use of dolphin-saving gear and procedures by the U.S. fleet, the incidental kill was reduced significantly in the late 1970s and maintained at a low level for this fleet (Sakagawa 1991). The non-U.S. part of the fishery, on the other hand, increased in size and was less effective in saving dolphins; consequently, total dolphin mortality for the fishery remained high (about 100,000 animals per year) until at least 1987. Since then, wider use of dolphin-saving gear and procedures by the non-U.S. fleet has been implemented and the total incidental kill has begun to decrease. The total in 1991 was 27,000 dolphins. A further reduction is anticipated in 1992 (M. Hall, IATTC, pers. communication).

Dolphin populations have been affected adversely by the ETP purse seine fishery and are currently at lower levels than existed before the purse seine fishery expanded. The

FIGURE 5 **Estimated number of dolphins killed by U.S. and non-U.S. purse-seine vessels participating in the eastern tropical Pacific tuna fishery. Although sampling by observers began in 1971 for the U.S.fleet and in 1983 for the non-U.S. fleet, coverage was not adequate until 1974 and**



greatest reductions in the populations occurred in the 1960s and early 1970s (Smith 1983). Available data indicate population declines of as much as 50% between 1970 and 1980 (IATTC 1992). Since about 1980, the populations have remained stable with no clear trend. Recovery to higher levels that existed before 1980 is not expected to be rapid, despite significant reductions in incidental mortality, because the animals have a low birth rate and significant reductions in incidental mortality have occurred only recently. For 1986-90, the population of northern offshore spotted dolphin was estimated to average 1.5 million animals (Wade and Gerrodette 1992).

THE FUTURE FISHERY

What is the outlook for the ETP fishery? Predicting the future of the ETP fishery would be largely speculative given uncertainties with government actions/reactions to possible international dolphin regulations and uncertainties in economic forces affecting the tuna industry. However, actions to date have produced trends that will probably continue into the near future and dominate events despite the uncertainties. Assuming that the trends will continue, I propose two probable scenarios for the future ETP fishery.

The first scenario builds on the following current trends: yellowfin tuna abundance in the ETP will continue to be at record high levels; dolphin-saving technology will be more widely and diligently used by all purse seine fleets in the ETP; dolphin-safe labeling of canned tuna will continue to gain support; and the global catch of tropical tunas will continue to increase. Assuming these trends continue, the ETP fishery will operate for the near-term at a status quo of high yellowfin tuna production, but with increased cost for assuring that incidental dolphin mortality is reduced to levels approaching zero mortality. With time, however, yellowfin tuna production will decline as fishing on dolphin-associated schools taper off in response to consumer preference for dolphin-safe tuna products.

The key to this scenario is increased consumer support for dolphin protection and continued high production of tropical tunas in fishing areas outside the ETP where there is no serious tuna-dolphin problem. Production of primarily skipjack tuna, *Katsuwonus pelamis*, but also yellowfin tuna as well, from areas other than the ETP has been increasing in recent years. This has lessened the dependence of major processors on ETP production for raw material and has weakened the role of ETP production to set international raw material prices. For example, yellowfin tuna caught in the ETP was once the mainstay for the large U.S. canned tuna market and was the leader in setting global raw tuna prices. In 1990 less than 10,000 t of ETP yellowfin tuna entered the U.S. market (about 690,000 t (Peckham 1992)) and raw material prices were largely set by production in other fisheries, e.g. western Pacific Ocean and Indian Ocean. Currently, the catch of yellowfin tuna associated with dolphins from the ETP make up only about 10% of the total world supply of raw material for the "light meat" canning market. Consequently, the price to consumers of a can of "dolphin-safe" tuna has been competitive to a can of "not dolphin-safe" tuna and skipjack tuna has become the major ingredient for the light meat pack.

As consumer awareness of the tuna-dolphin issue increases and product prices remain competitive, preference for dolphin-safe canned tuna will grow. More processors will join the movement to reduce or discontinue canning of ETP yellowfin tuna caught in association with dolphins in order to maintain market share. With time, fewer markets will be available for producers of ETP yellowfin tuna caught in association with dolphins. Fishing on dolphin-associated schools will decline and incidental dolphin mortality will likewise decrease to very low levels.

The second scenario builds on the recent movement to outlaw completely purse seine fishing on tuna-dolphin schools in the ETP and on conditions listed for scenario 1, i.e., yellowfin tuna abundance in the ETP remaining at high level, dolphin-safe canned tuna gaining in popularity, and global catch of tropical tunas increasing. This scenario predicts an immediate dislocation of vessels in the ETP fishery and a resulting decrease of the ETP yellowfin tuna catch. The experience of the U.S. fleet can serve as an example. In 1990, processors in the U.S. adopted a policy of not buying or selling tuna caught in association with dolphins. Because the majority of the U.S. fleet depended solely on the U.S. processors, many were unable to market their catch or find an alternative to remain in the fishery. Consequently, there was a large dislocation of vessels and significant reduction in the catch.

In the ETP, there are no readily available alternatives to fishing on tuna-dolphin schools that equal the high catch rate (IATTC 1992) and high value of the catch. Furthermore, the availability of non-dolphin associated schools, i.e. flotsam-associated and free-swimming, is largely centered within the jurisdiction of the ETP coastal nations (Joseph and Greenough 1979). The nations do not have a uniform policy to allow all vessels easy and at-reasonable-cost access to their jurisdiction. Consequently, many of the vessels in the current fishery cannot gain full access to the areas of non-dolphin associated schools and will have little choice except to stop fishing or move completely out of the fishery, if tuna-dolphin fishing is prohibited. The catch of yellowfin tuna will hence decline. The IATTC (1992) estimates that the catch will decline to about 150,000 t Yield per recruit will likewise decline to about 2.0 kg, as a result of increased small fish being caught (Figure 3). The high recruitment of recent years (1988-90 average of 95 million age 1 fish) to the fishery, however, is more than adequate to sustain a catch of 150,000 t annually, at low yield per recruit, and to maintain a healthy population.

For each of these scenarios, the effect on the populations, both yellowfin tuna and dolphins is favorable. The populations will be under less fishing pressure, subjected to less incidental kills or catch, and will be under less of a threat of depletion owing to fishing.

The serious impacts, however, will be on the fishery. The fishery for yellowfin tuna will shrink and be smaller over the long term with scenario 1 and almost immediately with scenario 2. Efforts to develop alternative fishing strategies for purse seine vessels, e.g. artificial drifting devices to attract fish and new fish locating devices (IATTC 1992), have started in earnest only recently and will take time to prove their profitability as a substitute. They will most likely not be ready in sufficient time to mitigate the impact. Consequently, the key issues emerging from these scenarios are not ones of the ETP resource, but challenges in dealing with the dislocation of a large segment of the ETP fleet and with the shortfall of about 100,000 t per year of yellowfin tuna to the global processing sector. How these issues are handled will affect not only the ETP fishery, but tropical tuna fisheries and stocks in other parts of the world as well. It is crucial, therefore, that the challenges be addressed with global considerations as well as ETP considerations.

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