

The Tuna-Dolphin Controversy in the Eastern Pacific Ocean: Biological, Economic, and Political Impacts

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Since 1959 several million dolphins have been killed in the purse-seine fishery for tunas in the eastern Pacific Ocean. Through combined efforts of the nations whose vessels participate in this fishery, annual dolphin mortality in the fishery was reduced from about 350,000 animals during the 1960s to about 15,000 animals in 1992. In 1993 10 nations implemented an international program to progressively reduce this mortality even further, with a goal of eventually eliminating it. During 1993, the first year of the program, it appears that dolphin mortality will be less than 4000 animals. An alternative program, which would impose a moratorium on fishing for tunas associated with dolphins beginning in 1994, has been proposed. Controversy concerning the practicality and effects of the two programs centers around the morality of fishing for tunas associated with dolphins and the biological, economic, and political impacts of each program.

The fishery for yellowfin tuna, *Thunnus albacares*, in the eastern Pacific Ocean is one of the most important in the world. In recent years this region has been responsible for some 25 percent of world production of yellowfin.

The fishery began shortly after the turn of the century off southern California and Baja California. As demand increased the fishery moved southward and seaward, and by 1940 vessels were fishing in an area that extended from the U.S.-Mexican border to the equator and several hundred miles offshore. During this period nearly all the vessels were U.S.-registered baitboats.

Due to import into the United States of cheap tuna caught by vessels of other nations and the low productivity of the baitboats during the mid-1950s, the U.S. fleet suffered severe economic hardship, and many vessels were retired from the fishery. However, that period also saw the development of synthetic fiber purse-seine nets and a hydraulic power block for retrieving the nets, and in 1957 the first U.S. baitboat was converted to purse-seine fishing.¹ The immediate result was that the vessel's catch rate more than doubled. This success started a wave of conversions, and within a few years nearly all the baitboats in the fleet had been converted to purse seining. Use of the new gear had several other consequences, however, two of which were overexploitation of yellowfin tuna and incidental mortality of dolphins.

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This article focuses primarily on problems related to dolphin mortality in the yellowfin tuna fishery and its biological, economic, and political impacts. It includes a review of measures taken by governments, both individually and collectively, to resolve the problem and concludes with a comparison and evaluation of these measures.

Background

Before the advent of the modern tuna purse-seine vessel commercial fishermen mostly caught tunas in free-swimming schools, a mode of fishing known as *school fishing*, or by fishing near floating objects such as tree trunks under which tunas often congregate, a mode known as *log fishing*. Fishermen had long known that herds of some species of dolphins were often accompanied by schools of large yellowfin tuna, and with the new purse-seine gear they were able to develop a technique that took advantage of this association to increase their efficiency in capturing tuna. In this mode of fishing, known as *dolphin fishing* or *fishing on dolphins*, the net is set around the tunas and the dolphins, then the dolphins are released and the tunas are loaded onto the vessel. Often dolphins die as a result of becoming trapped or entangled in the net, and in the early years of the fishery these incidental mortalities were very high.

It was not until 1968 that data on the magnitude of the problem were collected. In that year a scientist from the National Marine Fisheries Service (NMFS), a branch of the U.S. Department of Commerce, who had accompanied a tuna-fishing trip made by a U.S. purse seiner, reported on the dolphin mortality he observed during that trip.² As a result of these reports, the possibility that high dolphin mortalities were being caused by the fishery became public knowledge.

All this occurred around the time of the controversy regarding harp seals in Canada and international concern about the overexploitation of some populations of great whales. Action by the International Whaling Commission to halt the hunting of whales and efforts to ban the harvesting of seals for furs brought intense public attention and pressure to the issue of marine mammal protection.

The U.S. Marine Mammal Protection Act

The U.S. Congress moved to draft legislation for the protection of marine mammals. Public awareness of the high dolphin mortality in the eastern Pacific tuna fishery, coupled with the fact that vessels of U.S. registry were responsible for almost all fishing for tuna in association with dolphins, was instrumental in the passage of the Marine Mammal Protection Act (MMPA) of 1972.³ This act directs that all marine mammal populations be managed for their "optimum sustainable population,"⁴ defined as "the number of animals which will result in the maximum productivity of the population or the species."⁵ It imposed a moratorium on the taking of marine mammals, but with two exceptions applicable to species or populations that were not endangered: taking for subsistence or traditional purposes by Native Americans, and incidental captures during commercial fishing operations. With respect to the latter, the act states as its aim that "the immediate goal that the incidental kill or incidental serious injury of marine mammals permitted in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality and serious injury rate."⁶ In addition, it provides for a ban on "the importation of commercial fish or products from fish which have been caught with commercial fishing technology which results in the incidental kill or incidental serious injury of ocean mammals in excess of United States standards."⁷

Prior to the passage of the MMPA in October 1972, few data were available on the level of dolphin mortality caused by the yellowfin tuna fishery. From 1959 until the passage of the act information on mortality was available for only 9 out of a total of about 4250 fishing trips.⁸ This limited information was used to calculate a rough estimate of total dolphin mortality due to the fishery. This estimate was very high (Figure 1): The average annual mortality was put at about 350,000 dolphins, or about 5 million dolphins during the 14-year period since the advent of purse seining.

Once the MMPA became law, the NMFS began a program to place observers aboard U.S. vessels during fishing trips for the purpose of gathering data from which accurate estimates of dolphin mortality could be made and on which research could be based to develop methods to reduce the incidental capture of dolphins to the greatest extent possible. Data collected from 1972 to 1976 resulted in estimates of dolphin mortality of about one-third the levels estimated for the period prior to 1972 (Figure 1).

Under the provisions of the MMPA, in October 1974 the U.S. secretary of commerce issued a general permit to the U.S. tuna fleet that allowed the vessels to continue fishing for tunas associated with dolphins. Despite charges brought in the U.S. courts by a number of environmental organizations⁹ that such action was unauthorized, the permit remained in force. In 1976 the permit was amended to limit the permissible mortality caused by the U.S. fleet to 78,000 dolphins. At that time there were 106 U.S. vessels fishing for tunas associated with dolphins. The debate among the government, the tuna industry, and the environmental community continued through the early 1980s, mostly in the courts.¹⁰ It centered on the issue of whether fishing for tunas associated with dolphins should be allowed and, if so, what limits should be set on dolphin mortality.

Dolphin mortality in the fishery declined in response to pressure from environmental groups and the U.S. Congress. From 1976 through the early 1980s it once again declined to about one-third of the 1972–1976 levels.

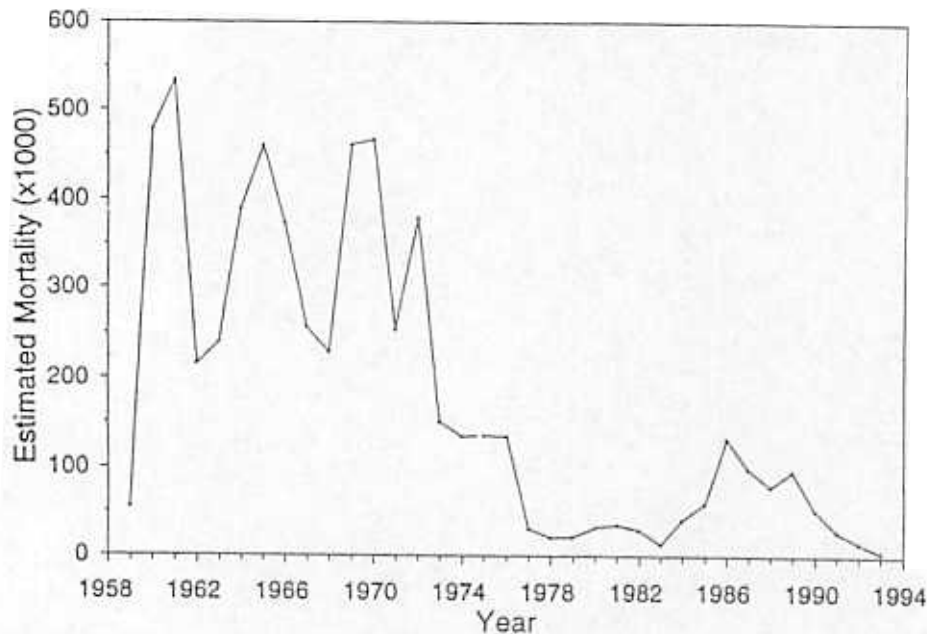


Figure 1. Estimates of the total mortality of dolphins of all species in the purse-seine fishery for tunas in the eastern Pacific Ocean, 1959–1993. The 1993 estimate is preliminary.

In 1981 the MMPA was again amended to allow the continued exploitation of tunas associated with dolphins. In regard to the immediate goal of reducing mortality to levels approaching zero, the amended act stated that "this goal shall be satisfied in the case of the incidental taking of marine mammals in the course of purse seine fishing for yellowfin tuna by a continuation of the application of the best marine mammal safety techniques and equipment that are economically and technologically practicable."¹¹ It established an annual mortality limit of 20,500 dolphins for the U.S. fleet, which then numbered 81 vessels.

Further amendments were made in 1984.¹² The general permit allowing U.S. vessels to fish for tunas associated with dolphins was reauthorized for an indefinite period, and the annual limit of 20,500 dolphins for the U.S. fleet, which at the time consisted of 38 vessels, was reaffirmed with the option of modification at the discretion of the secretary of commerce. For foreign vessels fishing for tunas associated with dolphins "in excess of United States standards,"¹³ the 1984 amendments allowed for the application of import restrictions against the nations under whose flags such vessels operated.

By this time the U.S. fleet, which had previously dominated the fishery, was dwindling. In 1960 U.S. vessels accounted for about 85 percent of the capacity of the international tuna fleet in the eastern Pacific Ocean.¹⁴ By 1984 this had declined to about 35 percent¹⁵ due to the transfer of U.S. vessels to the western Pacific, the sale of U.S. vessels to private interests in Latin American countries, and the construction of new vessels for the growing Latin American fleets. The vessel transfers to the western Pacific resulted from the increased difficulty in obtaining access to the coastal fishing zones of Latin America and the reduced abundance of yellowfin tuna because of heavy exploitation. There was speculation that the transfers were the result of restrictions imposed on U.S. vessels because of the dolphin mortality problem, but a report by Sakagawa suggested that this was probably not the case.¹⁶

Internationalization of the Tuna-Dolphin Problem

In 1973 negotiations began to draft a treaty on the international law of the sea. These negotiations were still under way at the end of the decade, but by then most of the Latin American states with coastlines bordering the Pacific Ocean had extended their jurisdiction over fisheries to 200 miles. Many of these Latin American states also began to expand their tuna fleets and to intensify their tuna fisheries in the eastern Pacific. Since between 50 and 90 percent of the tuna caught in the eastern Pacific was taken in association with dolphins, the levels of dolphin mortality caused by the non-U.S. fleets began to rise, and the problem of dolphin mortality rapidly changed from being a matter of concern only to the United States to one of international concern.

In response to this changing situation, the United States initiated action within the Inter-American Tropical Tuna Commission (IATTC) to establish a program to address the tuna-dolphin problem. The IATTC, an international body created by treaty in 1949¹⁷ to study tunas and tuna-like species of the eastern Pacific and formulate recommendations to the member governments for responsible exploitation of the resource, was the obvious choice for such action since most of the nations involved in the fishery were members and the IATTC was already responsible for gathering data on the fishery. In 1976 the U.S. initiative resulted in the member governments of the IATTC agreeing to address the problem of dolphin mortality in the tuna fishery in the eastern Pacific, with the following objectives: "[1] to maintain a high level of tuna production, and also [2] to maintain [dolphin] stocks at or above levels that assure their survival in perpetuity, [3]

with every reasonable effort being made to avoid needless or senseless killing of [dolphins]."¹⁸ To this end, a program was established whose aims would be to estimate the extent of the mortality caused by the international fleet, assess the impact of this mortality on the populations of dolphins, and investigate ways to reduce dolphin mortality caused by the fishery to the lowest possible levels.

As a first step toward fulfilling these objectives, the member governments moved to establish an observer program similar to that of the NMFS to collect the necessary information on non-U.S. vessels. IATTC observers were to cover trips made by vessels of the international purse-seine fleet at a level that would permit reasonably accurate estimates of the total dolphin mortality to be made. Unfortunately, funds to implement the program did not become available until 1979. As a result, between 1976 and 1979 no trips by non-U.S. vessels were accompanied by observers, though the number of such vessels was increasing.

Beginning in 1979, IATTC observers were assigned to a limited number of trips on non-U.S. vessels. Table 1 shows the number of trips made beginning in 1979 by vessels fishing on dolphins and the number of such trips covered by observers from the IATTC program, as well as the total number of trips observed by all programs. However, it was not until 1986 that all nations with vessels capable of fishing for tunas associated with dolphins in the eastern Pacific were participating on a scale that would make possible the objectives of the IATTC program. Observers were placed aboard one-third of the trips made by vessels of all nations; at this level of coverage, mortality estimates with a higher degree of statistical precision could be calculated.

Another part of the IATTC program involved the development and identification of fishing gear and methods that could prove useful in reducing dolphin mortality, and transfer of this information to the fishing fleets. Some aspects of this program were patterned after the NMFS program initiated for the U.S. fleet some years earlier, and

Table 1
Total Number of Trips Made in the Eastern Pacific Ocean During 1980–1992
by Tuna Purse-Seine Vessels of Carrying Capacity Greater than 400 Short Tons,
Number of Trips Accompanied by Observers from the IATTC
and National Programs, and Combined Sampling Coverage

Year	Total Number of Trips	Trips Sampled by the IATTC	Trips Sampled by National Programs	Combined Sampling Coverage (%)
1980	532	66	45	20.9
1981	447	60	37	21.7
1982	328	48	32	24.4
1983	248	33	0	13.3
1984	331	24	11	10.6
1985	381	47	23	18.4
1986	396	94	20	28.8
1987	473	125	80	43.3
1988	503	159	33	38.2
1989	543	194	73	49.2
1990	539	223	41	49.0
1991	425	237	26	61.9
1992	427	279	140	98.1

both programs worked in close cooperation. Workshops for transferring information to and training key personnel from the tuna industry were held in the home ports of tuna vessels involved in the eastern Pacific fishery, and IATTC personnel carried out routine inspections of fishing gear and nets to ensure that they operated in a way that would minimize dolphin mortality.

The total dolphin mortality in the fishery in 1986, the first year in which all national fleets took part in the program, was estimated by the IATTC staff to be 133,000 dolphins. The estimate for the following year 1987, was 100,000 dolphins. The 1986 estimate was about three times the annual levels estimated for the previous 10 years. There are several likely reasons for this. First, after the very low fishing effort of 1981–1985 caused by anomalous ocean conditions, low apparent abundance of yellowfin tuna, and the transfer of vessels to the western Pacific, the stock of yellowfin grew and the number of large fish that associate with dolphins increased. Second, premium prices were paid for these large yellowfin.¹⁹ Third, a number of vessels that previously had been inactive or had transferred to the western Pacific resumed fishing in the eastern Pacific, increasing fishing effort substantially. Fourth, the 1986 estimate was the first reliable estimate of the mortality caused by non-U.S. vessels.

Embargoes and Boycotts

In 1988 the MMPA was amended once again.²⁰ Public interest in the question of dolphin mortality in the fishery, spurred by a videotape²¹ of dolphin mortality during purse-seining operations aboard a tuna vessel and by the IATTC's estimates of mortality for 1986 and 1987, was greater than ever.

The 1988 amendments banned certain practices used in dolphin fishing, notably sets made after sundown and the use of explosive devices, and mandated 100 percent coverage by observers of trips made by vessels of carrying capacity greater than 400 short tons. (All tonnages in this article are expressed as short tons.)

These amendments, which remain in force, require that tuna-fishing nations satisfy a two-part test to qualify as exporters of yellowfin tuna and yellowfin tuna products to the United States.²² First, the nation must furnish documentary proof that it has a regulatory program governing the taking of marine mammals in the fishery that is comparable to the U.S. program. Second, the average rate of incidental mortality of marine mammals in the fishery caused by that nation's fleet has to be comparable to that of the U.S. fleet; by the end of 1990, and in subsequent years, it cannot exceed 1.25 times the U.S. rate. The amendments also establish maximum mortality levels for eastern spinner and coastal spotted dolphins of 15 and 2 percent, respectively, of the total incidental mortality. The mortality rates are to be monitored by the IATTC observer program or an equivalent international program, with a level of coverage equal to that of the U.S. program during the same period.

Any nation failing to meet these requirements is subjected to a primary embargo, which prohibits the importation of that nation's yellowfin tuna and yellowfin tuna products to the United States. Within 90 days of the imposition of this ban, a further secondary embargo is imposed on yellowfin and yellowfin tuna products from any intermediary nation trading with the nation under embargo and the United States, if the intermediary nation does not ban tuna imports from the embargoed nation within 60 days.²³ All embargoed nations that fail to bring their situation in line with the MMPA's provisions within 6 months are subject to embargoes of all their fish and fish products under the Pelly Amendment of the Fishermen's Protection Act.²⁴ The inclusion of intermediary nations in

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these embargoes considerably increases the number of countries potentially affected by the import rule, from 10 to 12 fishing states to 60 to 65 intermediary nations.²⁵

In testimony presented during congressional hearings on the amendments,²⁶ it was stated that achieving the comparability standard of 1.25 times the U.S. fleet level of mortality over the next few years would most likely prove impossible for the majority of the foreign fleets. This could lead to embargoes on nations which would then develop alternative markets for their tuna products, and efforts by the IATTC program to reduce mortality could possibly be jeopardized. Other testimony contended that dolphin mortality must be reduced at any cost, that foreign fleets must achieve comparability with the U.S. fleet, and that the embargo provisions would serve to ensure this end.

The amendments were passed, and the final rules for their implementation were published on March 30, 1990. Mostly as a result of litigation in the U.S. courts,²⁷ a series of primary and secondary embargoes has been imposed on more than 20 nations since August 1990.²⁸ Embargoes have been imposed and lifted so often that it is sometimes difficult to keep track of a given nation's status.²⁹ However, as of September 1, 1993, there were four nations under primary embargo: Mexico, Panama, and Venezuela because their mortality rates were over 1.25 times the U.S. rate, and Colombia because of less than 100 percent observer coverage of its fleet, though none of its vessels made sets on tunas associated with dolphins. At that time, there were four intermediary nations under secondary embargo.

Throughout the congressional hearings and the surrounding debate, the IATTC program continued to grow. The number of observers covering fishing trips increased, and the program to transfer technology was expanded. Between 1986 and 1990, dolphin mortality due to the fishery fell by 60 percent, from 133,000 to 53,000 animals.

The arguments presented by the environmental community convinced both the U.S. processing industry and the U.S. Congress that dolphin mortality in the fishery should be halted regardless of the consequences for the fishery, the ecosystem of the eastern Pacific, and the nations involved. On April 12, 1990, as a result of threatened boycotts of the products of companies that canned tuna caught in association with dolphins, the largest U.S. tuna-canning company announced that it would no longer purchase tuna from purse-seine vessels fishing in the eastern Pacific unless such tuna was accompanied by a certification from the IATTC or the U.S. Department of Commerce that it was not taken in association with dolphins.³⁰ Within days, the other U.S. canners followed suit. The U.S. Congress passed the Dolphin Protection Consumer Information Act,³¹ which provided for the use of a "dolphin safe"³² label on cans of tuna not caught in association with dolphins.

Impact of the U.S. Embargoes and the U.S. Canners' "Dolphin-Safe" Policy

One result of the U.S. canners' "dolphin-safe" policy was a sudden change in the world trade in tuna. The United States, the most important market for canned tuna in the world, was in effect closed to imports of large yellowfin from the eastern Pacific. Much of this catch was diverted to Europe, the second largest market; the resulting abundance of supply and the lack of competition from U.S. canners led to a precipitous fall in the price paid for the fish in Europe.³³ This, in turn, affected the prices paid in other markets elsewhere in the world.

Another consequence was the almost immediate departure of most of the remaining U.S. vessels from the eastern Pacific. Prior to the U.S. canners' decision, there were about 35 large U.S. vessels fishing for tuna in association with dolphins; of these, 17

transferred to the western Pacific, 11 were sold or became inactive, and 7 remained in the eastern Pacific. The primary reason for this exodus was that vessel operators did not consider it economically feasible to remain in the eastern Pacific unless they could fish for tunas associated with dolphins. Not only is the catch rate for this mode of fishing significantly higher than that of fishing for tunas not associated with dolphins, but the large yellowfin caught mainly in association with dolphins command a significantly higher price than do small yellowfin and skipjack (*Katsuwonus pelamis*) tunas.

The "dolphin-safe" policy was no more successful in putting an end to dolphin fishing than were the U.S. embargoes. The total tonnage of tuna caught in association with dolphins fell slightly, mainly as a result of the departure of the U.S. fleet, but the proportion of the total tonnage caught in this fashion actually rose (Figure 2), and the embargoed fishing nations developed alternative markets for the catch.

In the meantime the IATTC dolphin program continued, and by the end of 1991 dolphin mortality had been reduced by an additional 50 percent relative to the previous year, to about 27,000 animals. This represented an overall reduction of about 80 percent since 1986. Despite this improvement, the U.S. government continued to enforce primary and secondary embargoes against governments that did not comply with the provisions of the MMPA. Certifications of noncompliance for a number of nations (summarized in Table 2) were issued under the Pelly Amendment and have been referred to the president of the United States for action, as called for by the MMPA. Tinoco notes that "the Marine Mammal Protection Act requires that 6 months after a nation has been embargoed, a certification of the importation prohibition be made to the President under the 'Pelly Amendment.' As of this writing, several countries have been certified to the President. No decision on broader embargoes has been made."³⁴ These actions by the

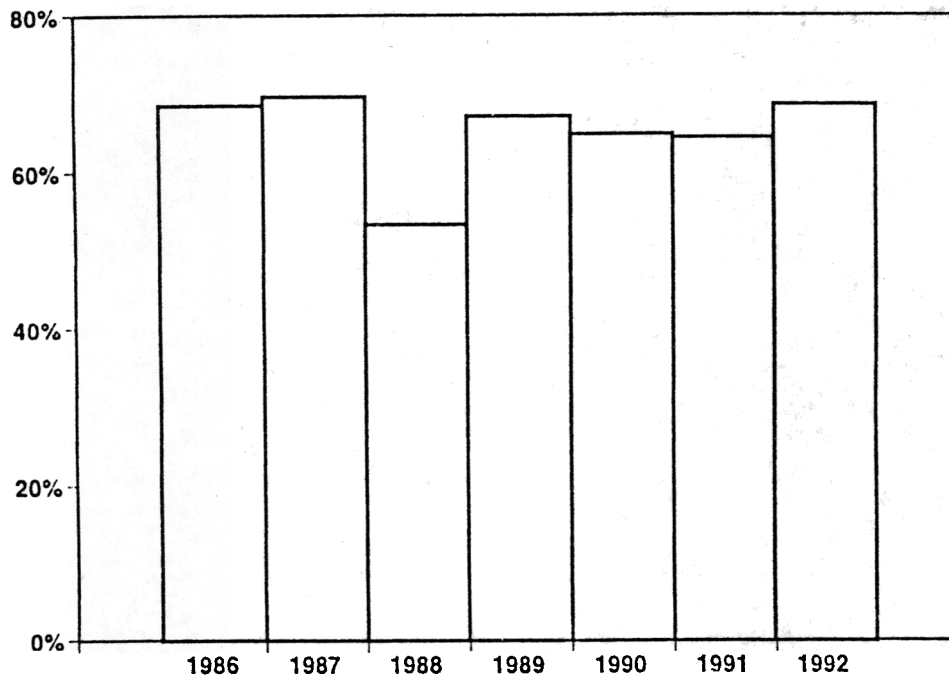


Figure 2. Percentage of the catch of yellowfin tuna from the eastern Pacific Ocean that was captured in association with dolphins, 1986–1992.

Table 2
Summary of the Countries Certified for Noncompliance

Country Certified	Date of U.S. President's Decision
Mexico ^a	October 21, 1991
Venezuela, Vanuatu ^b	January 10, 1992
Costa Rica, France, Italy, Japan, Panama ^c	January 10, 1992
Costa Rica, France, Italy ^d	March 3, 1992

Source: I. Tinoco, "The Tuna-Dolphin Conflict: An Evaluation of the Marine Mammal Protection Act Embargoes" (Master's thesis, University of Washington, Seattle, 1993), 70. Master's thesis copyrighted by author. Table reprinted with permission.

^aU.S., President, *Public Papers of the Presidents of the United States*, Letter to Congressional Leaders on the Determination Not To Prohibit Fish Imports From Certain Countries (27 Weekly Comp. Pres. Doc. 1479, October 21, 1991) (Lexis Search).

^bU.S., President, *Public Papers of the Presidents of the United States*, Letter to Congressional Leaders on the Determination Not To Prohibit Fish Imports From Certain Countries (28 Weekly Comp. Pres. Doc. 71, January 10, 1992) (Lexis Search).

^cU.S., President, *Public Papers of the Presidents of the United States*, Letter to Congressional Leaders on the Determination Not To Prohibit Fish Imports From Certain Countries (27 Weekly Comp. Pres. Doc. 1479, October 21, 1991) (Lexis Search).

^dU.S., President, *Public Papers of the Presidents of the United States*, Letter to Congressional Leaders on the Determination Not To Prohibit Fish Imports From Certain Countries (28 Weekly Comp. Pres. Doc. 392, March 3, 1992) (Lexis Search).

United States resulted in both Panama and Ecuador prohibiting their vessels from fishing for tunas in association with dolphins. In 1993 Panama lifted this ban, however, and Ecuador has announced that it intends to do the same.³⁵

A Turn to GATT

In a challenge to the legality of the embargoes imposed by the U.S. government, in January 1991 Mexico requested that a Dispute Settlement Panel be convened by the Council of the General Agreement on Trade and Tariffs (GATT). Mexico contended that

- (a) the Marine Mammal Protection Act is contrary to Articles III, XI, and XIII of the General Agreement;
- (b) the Dolphin Protection Consumer Information Act is incompatible with Article IX (marks of origin) of the General Agreement;
- (c) this is a *prima facie* case of nullification or impairment under Article XXIII of the General Agreement; and
- (d) neither Act is justified under the GATT.³⁶

Mexico sought to have the panel declare the embargoes to be both in violation of GATT agreements concerning restrictions of trade and discriminatory, and to call on the signatory nations of the GATT to request that the United States change its import regulations to make them consistent with the GATT. Several other nations supported Mexico's stand before the panel, arguing that the MMPA was disruptive to trade and protectionist in nature. On September 3, 1991, the panel published its decision in favor of Mexico, declaring that U.S. import restrictions against Mexico were inconsistent with the provisions of the GATT.³⁷

The panel's decision aroused considerable concern in the United States. Environmental organizations and members of Congress expressed concern over the effect of the decision on negotiations then taking place within the GATT concerning environmental issues and the ability of nations to take unilateral action to protect the environment.³⁸ A letter sent to President Bush by 63 U.S. senators urged that the adoption of the panel's report be blocked and that the president seek multinational agreements to achieve the objectives of the MMPA.³⁹ The letter also implied that the senators' support for the North American Free Trade Agreement (NAFTA) might be linked to a resolution of the dolphin mortality problem. The reaction in the House of Representatives was similar.

As of September 1993, Mexico had not sought a vote from the GATT Council on the panel's decision.⁴⁰ In the meantime, President Salinas de Gortari announced a 10-point program to protect dolphins, which included expanded coverage of Mexican vessels by observers, funds for research into means of reducing mortality, and strict and severe penalties for violating Mexican legislation for the protection of dolphins.⁴¹ However, this initiative met with a negative reaction from many of the U.S. environmental organizations active in the matter.⁴²

The U.S. administration attempted to defuse the controversy by proposing a moratorium on dolphin fishing for a period of 5 years, beginning on March 1, 1994.⁴³ The moratorium formed part of a bill under whose provisions any nation subjected to embargo under the MMPA would have the embargo lifted immediately upon communicating formally to the United States its intention to implement such a moratorium. During the congressional hearings regarding this bill, much opposition was expressed;⁴⁴ environmentalists opposed it because the moratorium would last only 5 years and would not go into effect until March 1994, and the fishing industry was against it because it considered it to be too restrictive. The bill appeared to have little chance of passing.

In the meantime the member governments of the IATTC, at meetings held in Costa Rica in September 1990, agreed in principle to achieve a significant reduction in incidental dolphin mortality in the short term and to reduce it to insignificant levels approaching zero and, if possible, eliminate it altogether in the longer term.⁴⁵ However, the IATTC was faced with a conservation dilemma. Prohibiting dolphin fishing would eliminate the incidental mortality of dolphins but would probably result in adverse long-term consequences for yellowfin tunas and possibly harm the ecosystem of the eastern Pacific as a whole. Changing from fishing in international waters for the large, sexually mature yellowfin usually found associated with dolphins to fishing on logs and schools for predominantly smaller, sexually immature yellowfin and skipjack tunas closer to shore would, at current levels of effort, lead to overexploitation of the resource and also give rise to political problems over access to areas under national jurisdiction.

With this in mind the states bordering the eastern Pacific and other states with fleets operating in the region, working through the IATTC, continued the efforts initiated in Costa Rica to find a way to achieve the objectives of reducing, and perhaps eliminating, the mortality of dolphins in the fishery without incurring heavy ecological costs to the yellowfin population or the ecosystem of which they both form a part.

Current Events

The International Dolphin Conservation Program

The international efforts toward a solution to this dilemma resulted in an agreement reached in April 1992 by 10 nations involved in the fishery, whose objectives are

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(1) progressively reducing dolphin mortality in the [eastern Pacific Ocean] fishery to levels approaching zero through the setting of annual limits and (2), with a goal of eliminating dolphin mortality in this fishery, seeking ecologically sound means of capturing large yellowfin tunas not in association with dolphins while maintaining the populations of yellowfin tuna in the [eastern Pacific Ocean] at a level which will permit maximum sustained catches year after year.⁴⁶

To achieve these objectives, a schedule of progressively decreasing annual limits on dolphin mortality was implemented, and a research program was approved. This program is intended to find methods to improve the effectiveness of current purse-seine technology in reducing dolphin mortality and to seek alternative means of catching large yellowfin tunas which do not involve encircling dolphins.

The mortality reduction program would limit mortality to less than 5,000 animals by 1999, in accordance with the following schedule, the left column representing the year and the right column representing the limit:

1993	19,500
1994	15,500
1995	12,000
1996	9,000
1997	7,500
1998	6,500
1999	<5,000

It was agreed that the overall limit for each year would be divided among vessels that intended to fish for tunas associated with dolphins and that met certain requirements regarding fishing equipment and procedures and crew training. These vessels could apply for individual dolphin mortality limits (DMLs); DMLs would be calculated by dividing the annual limit for all vessels by the number of vessels requesting DMLs. With this system, those vessels that kept within their individual DMLs could fish for tunas associated with dolphins all year, but those that did not would have to abandon this mode of fishing for the rest of the year when they reached their DMLs. Thus, each vessel would be competing not against other vessels for a share of a quota, but rather against its own ability to reduce dolphin mortality, and careful operators would not be hurt by careless ones. Compliance with the limits would be verified by observers who would accompany every trip made by vessels of carrying capacity greater than 400 tons.

Many of the provisions of the agreement establish precedents in the management of multinational fisheries. Two examples of this are the allocation of limits to individual vessels of different nations by an international organization, and the composition and function of the International Review Panel established to monitor compliance with the provisions of the agreement. The International Review Panel is composed of representatives of governments, the fishing industry, and environmental organizations. It reviews the observers' records of each vessel's fishing activities. Infractions of the agreement are reported to the vessel's flag state, which is requested to notify the panel of any measures taken against the vessel. The panel is also responsible for recommending to governments standardized sanctions for specific infractions, as well as multinational diplomatic, political, or economic measures that can be taken against nations that violate the terms of the agreement, whether those nations are party to the agreement or not.

The agreement also provides for the establishment of a Scientific Advisory Board of

technical experts to assist the IATTC in matters regarding research to modify current purse-seine technology aimed at reducing dolphin mortality and seeking alternative means of capturing large yellowfin tuna.

This international program is not only unique in attempting to resolve a multispecies conservation problem and in establishing a series of technical, enforcement, and research mechanisms to accomplish this objective, but it is also consistent with the objectives of the MMPA regarding international cooperation, which mandate that

The Secretary, through the Secretary of State, shall . . . (2) initiate . . . (B) discussions with foreign governments whose vessels harvest yellowfin tuna with purse seines in the eastern tropical Pacific Ocean, for the purpose of concluding, through the Inter-American Tropical Tuna Commission or such other bilateral or multilateral institutions as may be appropriate, international arrangements for the conservation of marine mammals taken incidentally in the course of harvesting such tuna, which should include provisions for (i) cooperative research into alternative methods of locating and catching yellowfin tuna which do not involve the taking of marine mammals, (ii) cooperative research on the status of affected marine mammal population stocks, (iii) reliable monitoring of the number, rate, and species of marine mammals taken by vessels of harvesting nations, (iv) limitations on incidental take levels based upon the best scientific information available, and (v) the use of the best marine mammal safety techniques and equipment that are economically and technologically practicable to reduce the incidental kill and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate.⁴⁷

In accordance with these provisions, the U.S. representatives at the meeting in April 1992 worked diligently and effectively with the other governments to reach the final agreement establishing the International Dolphin Conservation Program.

After this agreement was reached the moratorium bill, which earlier had been rejected, was reintroduced in the House of Representatives, supported by several environmental organizations that had previously opposed it. This time, the House passed the bill.

In the Senate, the Committee on Commerce, Science, and Transportation was presented with a choice between the two different approaches to the issue of dolphin mortality in the fishery: "(1) a global moratorium on the practice of harvesting tuna with purse seine nets deployed on dolphins, and (2) the IATTC program to progressively reduce dolphin mortality in the eastern Pacific fishery."⁴⁸ In a hearing held before this committee on July 23, 1992, a number of interested parties presented testimony.⁴⁹ The U.S. tuna industry supported the IATTC's international program; a number of environmental groups supported the moratorium. The U.S. administration supported the moratorium and indicated that the governments of Mexico and Venezuela, the nations with the largest fleets in the fishery, also had agreed to support it. However, these governments issued statements denying this.⁵⁰ After intense debate within Congress, in the last hours of the 1992 congressional session, the Senate passed the moratorium bill, which became the International Dolphin Conservation Act of 1992.⁵¹

The International Dolphin Conservation Act of 1992

As noted above, the International Dolphin Conservation Act calls for a 5-year moratorium on encircling dolphins with purse-seine nets, beginning on March 1, 1994. How-

ever, the moratorium will not go into effect unless at least one other major tuna-fishing country (defined as having an active purse-seine, tuna-fishing fleet of 20 or more vessels) agrees to comply with it. The act also states that any nation now embargoed under the MMPA will have that embargo lifted if it commits to the moratorium. If that nation fails to convert that commitment to an agreement by March 1, 1994, all its yellowfin tuna and yellowfin tuna products will be embargoed and all its fish products banned, but only up to 40 percent of the aggregate value of all such products.⁵²

Regardless of whether the moratorium enters into effect, there are certain provisions that will apply:

- (1) Observers will be required on all vessels in all areas of the world in which it is determined that there is a regular and significant association between marine mammals and tunas.
- (2) The encirclement of eastern spinner and coastal spotted dolphins will be banned.
- (3) U.S. citizens will be forbidden to sell, purchase, transport, or ship to the United States tuna caught in association with dolphins.

If the moratorium is enacted both the mortality limit set by the MMPA for the U.S. fleet, currently 20,500 dolphins, and the exemption granted by the MMPA authorizing such vessels to fish, will be revoked. If the moratorium is not enacted the exemption will not be revoked until December 31, 1999, but the limit will be reduced.

Trends during 1992–1993

The controversy over dolphin mortality in the fishery for tunas in the eastern Pacific has had a significant impact on the fishery itself, the levels of dolphin mortality it generates, the distribution of fleets among regions and nations, the development of markets, the price of the raw material, and relationships among nations. Although problems related to this issue have been developing over the past 20 years, it is only recently that they have become so severe.

Dolphin Mortality. The reduction in dolphin mortality in the fishery that began in 1986 has continued to the present. Mortality in 1992 was about one-half the 1991 level, 15,539 dolphins as against 27,292 (Figure 1). The mortality per set, a measure of the success of the fleet in reducing mortality, fell by slightly more, from 2.9 dolphins per set in 1991 to 1.5 in 1992 (Figure 3).

On January 1, 1993, the International Dolphin Conservation Program established by the multinational agreement was implemented. An overall mortality limit of 19,500 dolphins was set for the international fleet in 1993; thus, each one of the 106 vessels that applied for individual dolphin mortality limits was assigned a limit of 183 animals. So far in 1993 the mortality per set is about one-third of the 1992 level, and if this is maintained the total mortality generated by the fishery in 1993 will be less than 4000 animals. The fleet has performed much better than expected, and at the current rate the objective that the program established for 1999 will be reached during the first year.

Because of the faster-than-expected decline in mortality during 1993, the governments involved agreed to revise downward the schedule of DMLs.⁵³ A decision on how much the annual limits should be reduced was postponed until a special intergovernmental meeting to be convened prior to December 15, 1993,⁵⁴ but it was agreed that the DML for an individual vessel in any given year could not be higher than that vessel's DML for the previous year. This was an important decision, since if the number of vessels

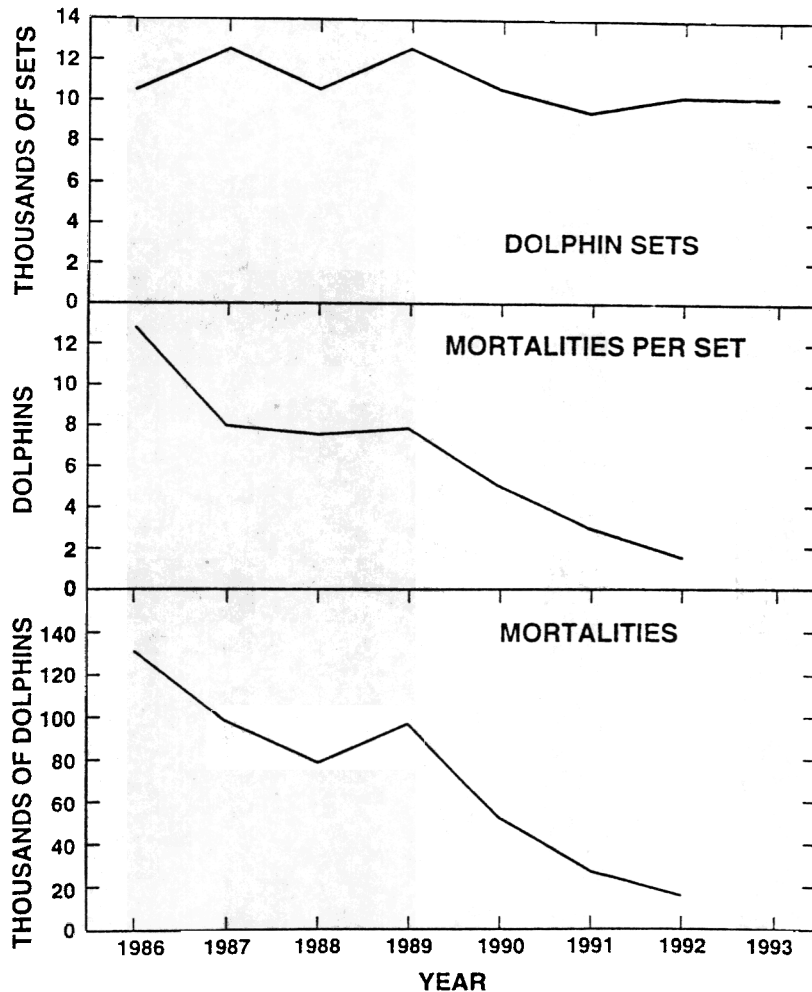


Figure 3. Total mortality, average mortality per set (MPS), and total number of sets on dolphins in the purse-seine fishery for tunas in the eastern Pacific Ocean, 1986–1993. The 1993 estimates are preliminary.

assigned a DML decreases, the overall dolphin mortality would decrease proportionately.

The Fishery. After a decline in the production of tuna from the eastern Pacific during the early 1980s and a sharp reduction during 1982–1985 in the mortality of yellowfin tuna due to fishing, the abundance of the yellowfin stock in the eastern Pacific Ocean grew and the catches increased substantially.⁵⁵ Much of the increased catch of yellowfin since 1985 consisted of fish taken in association with dolphins, and, as mentioned above, this led to an increase in dolphin mortality. The resulting attempt by the United States to eliminate mortality by means of trade embargoes and the U.S. canners' "dolphin-safe" policy failed to resolve the problem, but it had several other direct and indirect effects.

The U.S. fleet was effectively excluded from the fishery. The number of large U.S. purse seiners operating in the eastern Pacific declined from 101 vessels in 1980 to 39 in

Tuna-Dolphin Controversy in the Pacific

1986, and it shrank even more after the adoption of the "dolphin-safe" policy and the U.S. legislative restrictions. As of mid-1993, only 8 such vessels are still fishing in the eastern Pacific. However, during that same period the non-U.S. fleet increased substantially, from 63 vessels in 1980 to 70 in 1986 and 89 in 1993.

The catches of yellowfin tuna made by the international fleet rose to over 300,000 tons in 1986 and remained above that level until 1991. In 1991 and 1992 the total catch fell to about 260,000 tons as a result of decreased fishing effort due to the departure of the U.S. fleet from the fishery.

Neither the embargoes nor the "dolphin-safe" policy had the expected effect on dolphin fishing; in fact, the smaller number of boats remaining in the eastern Pacific concentrated more of their effort on dolphin fishing. The number of sets on dolphins in 1992 remained about the same as in 1986, but the mortality declined by about 90 percent (Figure 3). The proportion of the total catch of yellowfin taken in association with dolphins also remained nearly the same, about 65 to 70 percent (Figure 2).

So far in 1993 the catch of yellowfin is accumulating at about the same rate as it did during 1991 and 1992. However, there appears to be a slight decline in the proportion of the catch and the fishing effort made on tunas associated with dolphins. Whether this change is real or just an artifact of the sampling process is difficult to determine, but the adoption of a "dolphin-safe" policy by Italian and Spanish canners has reduced to some degree the market for yellowfin tuna taken in association with dolphins.⁵⁶

Loss of the U.S. market has been a matter of concern for the coastal states of Latin America since they began to develop their own tuna fleets. Historically, most of the tuna caught in the eastern Pacific has been sold in the United States, and the newly expanded Latin American fleets depended on this market. However, the embargoes imposed under the MMPA are by no means the first time foreign producers have been excluded from the U.S. market for tuna. In accordance with the Fishery Conservation and Management Act of 1976,⁵⁷ which reflected the then U.S. policy of not claiming or recognizing national jurisdiction over tunas within their own or another nation's 200-mile exclusive economic zone (EEZ), embargoes had been imposed on nations that seized U.S. vessels fishing for tunas within their EEZs.⁵⁸ These embargoes led the other fishing nations to develop alternative markets for their tuna products, to ensure that their fleets could continue to operate and expand.

As a result of the 1988 amendments to the MMPA, the number of embargoes imposed by the United States increased. In response, the Latin American states involved in the fishery increased their internal consumption of tuna and expanded their alternative external markets. The resulting changes in the distribution and consumption of tuna from the eastern Pacific were profound. Whereas in 1975 the United States consumed about 85 percent of the yellowfin tuna from the eastern Pacific, by the end of 1992 this figure was less than 10 percent. During the same period, Mexico's internal consumption rose from about 20,000 to about 100,000 tons, and in the other fishing nations of the region the rate of increase was similar. These unprecedented increases in the internal markets explain why the proportion of tuna taken in association with dolphins has remained constant. Most of the increase is accounted for by canned tuna, but the amount of frozen tuna consumed has also been increasing rapidly. This is particularly true of Venezuela, where consumption of noncanned tuna products has risen from an insignificant amount in the mid-1980s to about 25,000 tons currently.⁵⁹ The governments of these nations are encouraging this development, since tuna in this form is a nutritious and relatively inexpensive source of animal protein, and these internal markets are expected to continue growing.

The Status of Tuna and Dolphin Stocks

The tuna fishery in the eastern Pacific harvests several species of tuna using a variety of fishing gear. Most of the catch consists of yellowfin and skipjack tunas and is taken by purse-seine vessels. In terms of catch, the next most important gear is longlines that capture mostly bigeye tuna, *Thunnus obesus*. The two fisheries have different objectives: The purse-seine fishery supplies the canned fish market and is interested in the volume of the catch; the longline fishery supplies fresh fish for the sashimi market and concentrates more on the quality of the fish. Longlining is not efficient enough to supply the market for canned fish, and the quality of the fish caught with purse seines is not high enough for the sashimi market.

The yellowfin stock that supports the tuna fishery in the eastern Pacific is virtually independent of the stocks of yellowfin in the central and western Pacific, whereas the skipjack stock is part of a larger population that extends beyond the eastern Pacific. From 1986 to 1992 the annual catch of these two species by the purse-seine fleet was about 350,000 to 425,000 tons, about three-quarters of it yellowfin.

According to studies made by the IATTC staff, the yellowfin stock is capable of sustaining annual catches of about 320,000 tons at optimum levels of fishing effort, providing the age structure of the population does not change.⁶⁰ With current levels of fishing effort, the catch is below this level; abundance and catch rates remain high, and the population is not overfished.

The abundance of skipjack tuna in the eastern Pacific is variable, but the stock also appears to be in good condition. During years when skipjack migrate into the region in greater than usual numbers, catches could increase substantially; in years of low migration, catches would be correspondingly lower. Overall, the stocks of yellowfin and skipjack in the eastern Pacific are at high levels of abundance and are not considered to be fully exploited.

Several species of dolphins are captured during tuna-fishing operations in the eastern Pacific, but of these only three are frequently found associated with tunas and consequently suffer the greatest mortality in the fishery. These three species are, in order of their importance in the fishery, the spotted dolphin (*Stenella attenuata*), the spinner dolphin (*Stenella longirostris*), and the common dolphin (*Delphinus delphis*). In order to assess the impact of the incidental mortality of these three species since the advent of modern purse seining, estimates of their abundance have been made. These estimates are based on data collected by research vessels and by observers aboard fishing vessels. Between 1986 and 1990 the NMFS conducted five research vessel cruises to assess dolphin abundance. The resulting estimates are shown in Table 3. The total population of the three species is estimated to be about 6.8 million animals, and that for all species involved in the fishery is about 9.6 million.

The IATTC staff has collected data on sightings and sizes of dolphin herds since 1975, although the most reliable and complete information is available for the years subsequent to 1985. This information, collected by observers aboard commercial tuna vessels fishing in the eastern Pacific, forms the basis for estimating trends in the abundance of the dolphin stocks. Several analyses of the data have been produced, most recently one by Anganuzzi and Buckland.⁶¹ They show all of the major stocks to be stable or increasing during the past several years.

In its report on the tuna-dolphin fishery, the National Research Council stated: "In summary, both the NMFS and the IATTC studies demonstrate that none of the indicators of stock size shows any statistically significant trend in the last 5 years. . . .

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Table 3

Estimates of the Average Abundance of Dolphins in the Eastern Pacific Ocean,
1986–1990, the Incidental Mortality During 1992, and the Percentage
of the Estimated Abundance Represented by the 1992 Incidental Mortality

Species and Stock	Abundance	Incidental Mortality	Percentage
Spotted dolphin			
Northeastern	738,100	4,657	0.63
Western/Southern	299,300	1,874	0.14
Spinner dolphin			
Eastern	632,700	2,794	0.44
Whitebelly	202,100	2,044	0.20
Common dolphin			
Northern	477,000	1,773	0.37
Central	415,600	1,815	0.44
Southern	2,211,500	64	0.003
Other dolphins	2,729,100	518	0.02
All	9,523,400	15,539	0.16

Sources: The sources of all estimates of absolute abundance of eastern Pacific dolphins, with the exception of the central Pacific common dolphin, are P. R. Wade and T. Gerodette, "Estimates of Cetacean Abundance in the Eastern Tropical Pacific," Document SC/44/O 18 (Presented at the Scientific Committee Meeting of the International Whaling Commission, June 1992); and T. Gerodette, "Preliminary Results of a 1992 Cetacean Survey off the Pacific Coast of Central America," Document SC/44/SM 6 (Presented at the Scientific Committee Meeting of the International Whaling Commission, May 1993).

[S]ince 1983 all indicators of stock size have been stable, and some appear to have been increasing."⁶²

Discussion and Conclusions

The problem of dolphin mortality caused by the tuna fishery of the eastern Pacific has inspired one of the most heated, emotional, and public debates over fisheries since the controversy over whales and fur seals in the 1970s and 1980s. It has strained relations among otherwise friendly countries, altered fishing patterns and the flow of trade among nations, and polarized positions among special interest groups. All parties involved (the public and private sectors, industrial and government groups, environmentalists, and fishermen) apparently agree that complete elimination of dolphin mortality caused by the fishery is a desirable goal, but opinions are divided as to whether this is possible and, if so, at what cost.

These differences of opinion stem largely from unresolved questions about the nature and behavior of the tunas themselves: the reasons and mechanisms for their association with dolphins, their behavior in early life before they associate with dolphins, and the relationships and interactions of both tunas and dolphins with the rest of their ecosystem. All these factors have a direct bearing on how tuna are exploited commercially and on the ways in which this exploitation can be altered to eliminate dolphin mortality in the fishery. Many proposals have been put forward for dealing with this problem. The

two most generally favored are a complete and immediate moratorium on fishing on dolphins, and the systematic reduction of dolphin mortality to insignificant levels approaching zero, as outlined above. Pursuing either of these two approaches poses problems. On the one hand, if a moratorium is put into effect immediately as called for by U.S. law, this will create a conservation problem for tuna and a bycatch problem for other species; fishing success will decline, but dolphin mortality should be almost completely eliminated. On the other hand, if the systematic reduction approach is followed, dolphin mortality will continue perhaps for a long time, but the effect of this mortality on dolphin stocks would be biologically insignificant; tuna production would remain high, and the balance of species within the area would be maintained.

The following discussion will treat these observations in more detail and attempt to quantify them and put them into perspective.

The Moratorium

The Effect on Tuna Production. If fishing on dolphins is prohibited, and no other technique is developed for capturing large yellowfin tuna, the fishing effort will be directed toward school and log fishing, as defined at the beginning of this article. In these modes of fishing, the catch tends to consist mostly of smaller fish (Figure 4). Yellowfin tunas caught by school and log fishing are normally still growing rapidly, are sexually immature, and weigh on average about 10 pounds, as opposed to 45 pounds for yellowfin taken in association with dolphins. Thus, if all the effort were concentrated on log and

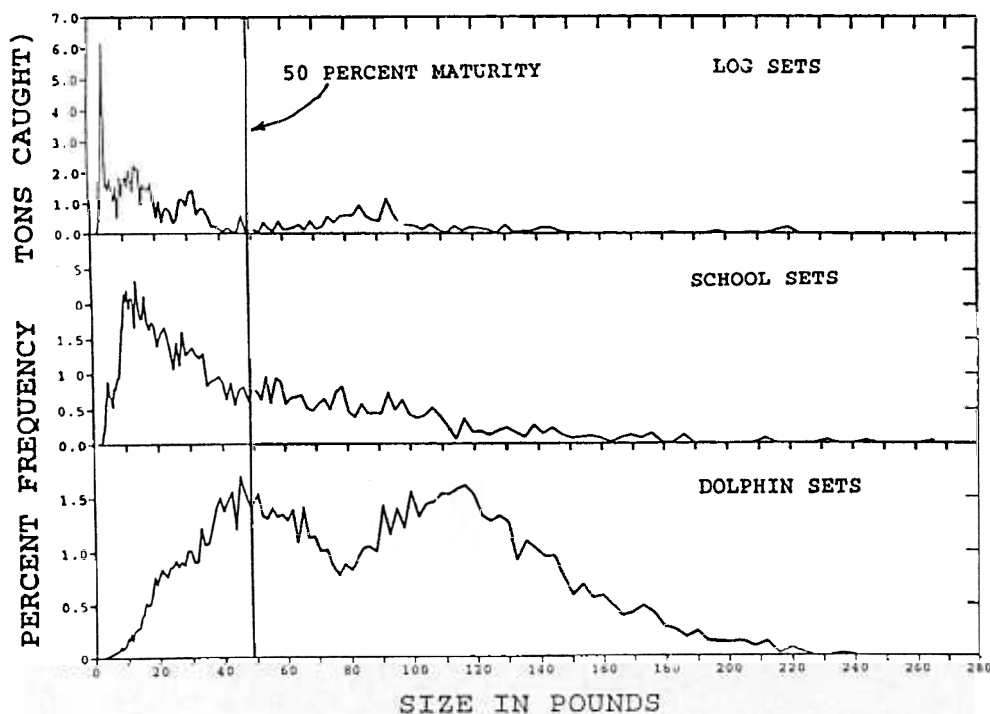


Figure 4. Average size-frequency distributions of yellowfin tuna caught in log, school, and dolphin sets, based on data from 1990–1992. The vertical bar represents the average size of the fish at first sexual maturity.

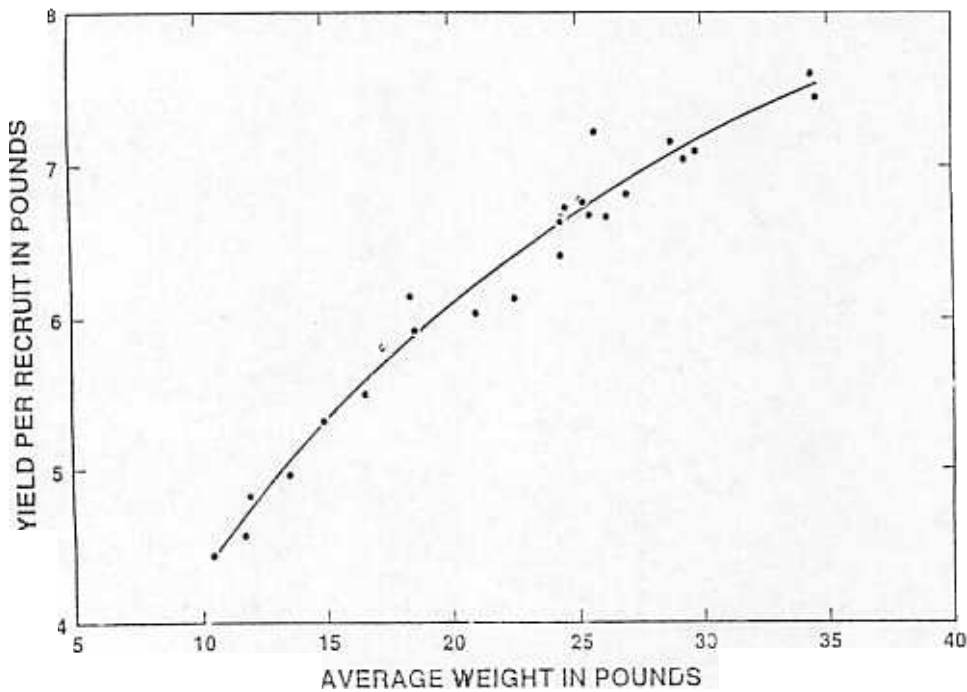


Figure 5. Relationship between yield per recruit and average weight at capture for yellowfin tuna in the eastern Pacific Ocean, 1968–1992.

school fishing, the result would be a sudden drop in the average size of fish in the catch and a concomitant decrease in the overall production of yellowfin.

After hatching, an annual generation of fish (known as a *cohort*) increases in weight due to the growth of individual fish (known as *recruits*) but decreases in numbers due to mortality. Eventually the rate of growth slows, and when the cohort reaches a point where growth and mortality balance out, its biomass (or weight) is at a maximum. In the absence of fishing, yellowfin tuna reach that point when the fish in a cohort weigh about 65 pounds each. If that were the average size of fish in the catch when that cohort was harvested, the yield per recruit, and thus the total catch, would be maximized. Before that point, there are more fish but they are individually smaller, whereas afterward they are larger but there are fewer of them. In the fishery of the eastern Pacific most of the catch of yellowfin consists of fish near the optimum size, mainly because it is near that size that they are found associated with dolphins. Smaller yellowfin and other tunas do not generally associate with dolphins but are found mostly associated with floating objects or in free-swimming schools.

A measure of the degree to which the yield per recruit would decrease as a result of a change in the average size of the yellowfin caught can be derived from Figure 5, which illustrates the relationship between these two factors. In recent years, the average weight of all yellowfin caught in the eastern Pacific has been about 25 to 30 pounds; if fishing on dolphins were prohibited, this would drop to about 10 pounds. Figure 5 shows that this would mean a decrease of about 30 percent in the yield per recruit, from about 6.5 pounds to about 4.5 pounds; if recruitment did not change, the total catch of yellowfin would thus also drop by about 30 percent. However, because the average size of

yellowfin caught varies in different areas of the fishery and because the members of the stock do not mix completely over short periods of their life, a further reduction in catch would occur, which would appear to be the result of reduced recruitment but would, in fact, be due to this size-specific distribution of the fish. School and log fishing takes place mostly within national EEZs, while most dolphin fishing occurs beyond that limit.⁶³ During the 1983–1991 time period, when fishing was directed mostly at dolphin-associated yellowfin, the average annual recruitment was about 98 million fish. If fishing for tunas associated with dolphins is eliminated, there probably would be a substantial reduction in the area in which fishing takes place. During the 1976–1982 time period, when a considerably greater portion of the fishing effort was directed at fish associated with floating objects and fish in free-swimming schools, the recruitment averaged 73 million fish.⁶⁴ Accordingly, if fishing is confined to the inshore area, the catch probably would be reduced additionally due to reduction in recruitment to the area in which fishing takes place.

The net effect of restricting the fishery to log and school fishing would be a reduction of between 30 and 60 percent in the catch of yellowfin, from recent levels of 300,000 tons to between 120,000 and 200,000 tons. Since the fishery is directed at skipjack as well as yellowfin, and the skipjack stock is generally capable of sustaining higher catches, increased catches of this species would, up to a point, make up for the reduction in yellowfin catch. Given the variability of the abundance of skipjack in the eastern Pacific, however, it is difficult to predict the extent to which skipjack could replace yellowfin. Nevertheless, the reduced catches would lead to economic difficulty for many whose livelihoods depend on the fishery, especially since the reduced catches would also be worth less in absolute terms, because smaller fish command a lower price.

An additional concern in this respect is the fact that the small fish caught in school and log fishing are sexually immature. Yellowfin tuna are very fecund, releasing millions of eggs each time they spawn, but they do not start spawning until they are about 1½ years old, when they weigh about 15 pounds. By age 2½ (49 pounds), 50 percent of them are sexually mature; by the time they reach 3 years of age (85 pounds), they are almost all sexually mature.⁶⁵ If the fleet were restricted to school and log fishing, the yellowfin caught would be on average below the age of first sexual maturity. Concern has been expressed that this would endanger the recruitment of yellowfin to the fishery by reducing the spawning biomass. However, it has not been shown, for the levels of population abundance observed in the fishery, that there is any measurable relation between the size of the spawning stock and recruitment, so it is not possible to say that recruitment will be affected or, if it is, to what extent.

Problems of Bycatch. Dolphins are not the only species caught incidentally in the purse-seine fishery for tunas: Many other marine species are also caught regularly. The IATTC has for some time been interested in the extent of these bycatches, and for the past two years the observers of the IATTC program have been collecting detailed information on the subject. Although the data collected to date allow only tentative conclusions, it is clear that many other species are taken along with the target species of marketable tuna. The study also shows that much of the bycatch is made up of yellowfin tuna that are of no commercial value because they are too small.

Of the three modes of fishing used by purse seiners, the bycatch is lowest for dolphin fishing and highest for log fishing. For illustrative purposes, estimates of the numbers of the various species of fish and other marine animals which would be taken by 10,000 sets made on free-swimming schools, log-associated schools, and dolphin-

associated schools, provided the fishery had no effect on their abundance, are shown in Table 4. These estimates were obtained by multiplying the average catches per set by 10,000. It should be recognized, however, that the populations of some of these fish and other animals might become reduced due to fishing, in which case the catches would be less than the estimates in Table 4.

It is clear that the greatest bycatch, in terms of both number of species and numbers of individual fish, is taken in log sets. For some unknown reason, floating objects adrift in the ocean attract large numbers of marine species, which tend to stay around these objects and form relatively persistent aggregations or communities.⁶⁶ A purse-seine set made around such an object to capture the commercially valuable tuna will also result in the capture of most other members of the aggregation. By the time the net is retrieved and the tuna loaded aboard, nearly all of the other animals caught in the net are dead, and they are discarded. Most of the fish discarded are tuna weighing less than two pounds. It has been estimated from the observer data analyzed so far that about 25 percent, by weight, of the fish caught in log sets are discarded dead because they are of little or no commercial value.⁶⁷

If fishing on dolphins is prohibited, then the fleet will concentrate its effort on school and log fishing, resulting in a large bycatch of the species listed in Table 4, and possibly others. The exact size of the bycatch would depend on how the effort was allocated between these two modes of fishing, but it is likely that most of it would be directed toward log fishing for two reasons: Catch rates for log fishing are higher than those for school fishing, and vessels can easily deploy artificial "logs" in the ocean. It is difficult to know what the effect of such a large bycatch might be. In the case of sharks and billfishes, it might be possible to measure the effect of this mortality on the populations and the current commercial and recreational fisheries that target them. Discards of

Table 4
Estimates of the Bycatch of Species that Would Be Caught and Discarded
in 10,000 Sets of the Net in the Three Modes of Fishing Used
in the Purse-Seine Fishery for Tunas in the Eastern Pacific Ocean,
Assuming No Fishery-Dependent Effect on Abundance

Species	School Fishing	Log Fishing	Dolphin Fishing
Dolphins	8	25	5,000
Small tunas	2,430,000	130,080,000	70,000
Mahi mahi	2,100	513,870	100
Sharks	12,220	139,580	—
Wahoo	530	118,660	—
Rainbow runner	270	30,050	—
Other small fish	1,010	12,680	3
Billfish	1,440	6,540	520
Yellowtail	—	2,980	—
Other large fish	—	200	30
Sea turtles	580	1,020	100
Triggerfish		50	

Source: M. Hall, "An Ecological View of the Tuna-Dolphin Problem" (unpublished manuscript, Inter-American Tropical Tuna Commission, La Jolla, CA, 1993).

small yellowfin tuna could amount to tens of millions of fish, and in their case the effect on recruitment to the exploitable population could be quantified and would probably be significant. For the other species, particularly the small tuna-like fishes that provide food for other animals in the ecosystem, such as large pelagic predators and dolphins, the effect is presently not quantifiable. However, the complex trophic dynamics of the ocean ecosystem suggest that the ecological impact could be significant.⁶⁸

Fishing Success. As stated above, many U.S. boatowners maintained that their reason for leaving the eastern Pacific after the U.S. canners adopted their "dolphin-safe" policy was that catch rates would be too low to be profitable unless their vessels could fish on dolphins. To examine this contention, catch rates were calculated for vessels that fish exclusively "dolphin-safe" and compared to those of vessels that fished on dolphins. The comparison is based on all trips made during 1991 and 1992 in the eastern Pacific by vessels of carrying capacity greater than 400 tons. The results are shown in Table 5.

These data demonstrate that vessels that fish on dolphins have a catch rate about 55 percent higher than those that do not. The difference is much greater when comparing gross earnings. Large yellowfin of the size taken in association with dolphins currently sell for about \$907 per ton, while small yellowfin and skipjack of the size generally taken by the other modes of fishing sell for about \$727 per ton. By applying these prices to the catch rates in Table 5, it can be seen that the gross earnings of vessels fishing on dolphins during 1991 and 1992 were 88 percent greater than those of vessels that fished "dolphin-safe."

The International Dolphin Conservation Program

The International Dolphin Conservation Program (IDCP) was, as mentioned above, the result of an international agreement among 10 nations. The aim of the program is to reduce dolphin mortality to levels approaching zero and to develop alternative means of catching large yellowfin tuna that do not involve encircling dolphins. The agreement stipulates, however, that such methods shall be ecologically sound and shall maintain the population of yellowfin tuna in the eastern Pacific at levels of abundance that can sustain maximum levels of production. These provisos made supporting the concept of an immediate moratorium impossible, since the parties to the agreement recognized that such a moratorium could create problems for the conservation of yellowfin tuna and possibly

Table 5
Catch Per Day's Fishing, in Short Tons, of Yellowfin and Skipjack Tunas,
by Vessels that Fish for Tunas Associated with Dolphins
(on Dolphins) and Those that Fish Exclusively for Tunas
Not Associated with Dolphins ("Dolphin-Safe")

Species	1991		1992		1991 + 1992	
	"Dolphin-Safe"	On Dolphins	"Dolphin-Safe"	On Dolphins	"Dolphin-Safe"	On Dolphins
Yellowfin	5.5	17.4	5.0	17.5	5.2	17.4
Skipjack	6.3	2.4	9.3	3.1	7.8	2.8
Total	11.8	19.8	14.3	20.6	13.0	20.2

have an adverse effect on the ecosystem to which the tunas and the dolphins belong. They were also concerned about the severe economic dislocation that might result.

Although these arguments were sufficient for the parties to the agreement, many environmental groups strongly opposed the IDCP because it permitted continued dolphin mortality. Several of these organizations have made it clear that they consider unacceptable not only any dolphin mortality in the fishery, but also their pursuit and encirclement, even if none are killed.⁶⁹

A Continuing Dolphin Mortality. The IDCP permits dolphin mortality in the fishery through 1999, for which year a target mortality of fewer than 5000 dolphins has been set. However, as noted above, it appears that this target will be reached in 1993, the first year of the program.

Even though the agreement seeks to find alternative methods for catching large yellowfin tuna that do not involve encircling dolphins, it does not seem that a method that is as efficient at capturing large yellowfin tuna as the current method will be developed in the near future, and probably not by the end of this century. A modest amount of effort has been devoted to finding such an alternative over the last two decades,⁷⁰ but without success. Additional studies and investigations are currently being carried out, mostly by the IATTC and NMFS, although recently the Secretaría de Pesca of Mexico has initiated several projects along these lines.⁷¹ Most of this research is concentrated on the development of fish-aggregating devices (FADs), which are, in essence, artificial logs of various designs that may eventually prove useful for attracting large yellowfin tuna if deployed in areas where large tunas are currently most often caught in association with logs. The other avenue of research being explored is the nature of the bond between yellowfin tuna and dolphins. If this bond can be understood, then it may be possible to use this information to break the bond before the tuna are captured in the net. Progress to date on both these lines of research has been slow. In a recent review of efforts to develop alternative gear, the National Research Council reported that it was clear that "no methods of catching tuna without killing dolphins—currently available or capable of rapid development—are as efficient as current methods of catching large yellowfin tuna in the [eastern Pacific]."⁷²

It therefore seems very probable that, failing a moratorium, dolphin mortality in the tuna fishery in the eastern Pacific will continue. However, if this mortality remains at current levels it will be insignificant from a biological point of view.⁷³ Table 3 shows the 1992 mortality for each of the major stocks of dolphins involved in the fishery as a percentage of the estimated total population size. It can be seen that, in almost all cases, the mortality caused by the fishery is less than one-half of one percent of the total population. In 1993 these values are expected to decline to about one-third of the 1992 levels.

The annual net rate of recruitment to the dolphin populations is estimated to be between 2 and 6 percent. Even the lowest estimate of 2 percent far exceeds the mortality caused by the fishery for all of the stocks shown, and all the populations of dolphins shown in Table 3 should be increasing in abundance; none is threatened or endangered. In fact, the report of the National Research Council quoted above also stated that "a complete ban on dolphin fishing or the purchase of tuna caught on dolphins is not required to ensure the survival and even the increase of dolphin populations."⁷⁴

Fishing Success. Because the IDCP has been in effect less than a year, it is difficult to determine what effect the extra efforts by fishermen to protect dolphins and to stay

within their individual dolphin mortality limit will have on fishing success. The increased caution and more effective procedures used by fishermen to ensure that all dolphins are removed from the net alive and uninjured require additional time before the tuna can be removed from the net, the net retrieved, and the boat resumes searching. This reduces search time by up to about one hour per day and will undoubtedly have an effect on catch rates and the comparisons shown in Table 5.

Outlook for the Future

Dolphin mortality has been occurring in the tuna fishery of the eastern Pacific Ocean since purse-seine fishing began in the late 1950s, and the total number of dolphins killed runs into millions. This has naturally caused widespread concern, and even outrage. However, as a result of this concern and of action by the fishermen, the mortality of dolphins in the fishery is now very low and poses no threat to the survival of the dolphin populations. Nevertheless, there is still great interest in further reducing and eventually eliminating this mortality. This interest stems largely from the special relationship that has existed between humans and dolphins since ancient times. Dolphins figure prominently in the art and literature of many early civilizations and cultures, particularly the ancient Greeks and Romans. Dolphins "playing" in the surf or riding the bow wave of ships are a sight familiar to many. In the Western world, particularly the United States, many people are familiar with dolphins through television and marine parks, and their harassment and exploitation are regarded as unconscionable. However, in many other parts of the world, dolphins and other marine mammals are regarded in the same way as other living marine resources and are harvested and sold for food. Most of the national tuna fleets in the eastern Pacific look on dolphins as a component of the ecosystem in which tuna are found and consider it reasonable to use them as a means for harvesting the tuna resource. Their attitude is that dolphins should be managed like other resources and that, while mortality caused by the fishery should be reduced to the lowest possible levels, dolphins should not be accorded a special status that goes beyond rational management. They contend that the complete protection of dolphins should not be pursued regardless of the cost to other members of the ecosystem and the economic and other consequences for those whose livelihood depends on the tuna fishery.

Given the general agreement that reducing and eventually eliminating dolphin mortality in the fishery is a desirable objective, the problem is to determine just how quickly and in what way this objective can be achieved, preferably without causing any further economic disruption and political confrontation.

The approach adopted by nearly all the nations bordering the eastern Pacific and other nations involved in the fishery is to work cooperatively to reduce dolphin mortality gradually to insignificant levels and ultimately eliminate it, but not at the expense of a viable tuna industry. The United States, however, has chosen a different approach; its aim is likewise to eliminate dolphin mortality, but without taking other considerations into account.

It does not appear that the differences between the two approaches will be easily or quickly reconciled, and the debate and confrontation are likely to continue. The Latin American fishing states rejected the moratorium proposed by the United States, contending that the most rational and appropriate way to resolve the problem of dolphin mortality was through international cooperation rather than unilateral action. These nations point to the fact that a number of agreements and conventions call for international cooperation in the management of marine resources, such as tunas and marine mammals,

that occur in the high seas beyond national jurisdiction and whose migrations carry them across national boundaries.⁷⁵ Furthermore, they note that the MMPA calls on the U.S. secretary of state to initiate discussions, through the IATTC or other international institutions, to limit dolphin mortality to insignificant levels approaching zero through the use of the best techniques and methods available.⁷⁶ This is precisely what the IDCP does.

During a recent Intergovernmental Meeting on the Conservation of Tunas and Dolphins in the Eastern Pacific, the governments of Colombia, Costa Rica, Mexico, Panama, Vanuatu, and Venezuela—the primary tuna-fishing nations in the eastern Pacific—issued a joint declaration urging the government of the United States to take into consideration the achievements and the success of the IDCP and to urge the U.S. Congress to lift the U.S. embargoes imposed under the MMPA.⁷⁷ However, as of this writing, there is no indication that Congress has any intention of rescinding or changing the comparability requirements established by the 1988 Amendments to the MMPA.⁷⁸

The International Dolphin Conservation Act of 1992 clearly expresses Congress's new intent for eliminating dolphin mortality in the fishery. However, close examination of a recent bill to amend the MMPA which is being considered by Congress⁷⁹ reveals that the intentions of U.S. policy regarding the bycatch of marine mammals are unclear and somewhat contradictory. The proposed legislation would permit the incidental mortality of marine mammals to continue, even when the species involved is classified as endangered. The pertinent section of the bill states:

The Secretary shall allow the incidental, but not the intentional, lethal taking by citizens of the United States while engaging in commercial fishing operations of small numbers of marine mammals listed as endangered species under the Endangered Species Act of 1973 if the Secretary determines, after notice and opportunity for public comment, that the total of such taking will not exceed the potential [biological removal level] established for that marine mammal stock or species under section 118(c).⁸⁰

This bill includes the objective that “the incidental kill or serious injury of marine mammals permitted in the course of commercial fishing operations be reduced to insignificant levels approaching zero,”⁸¹ a goal it shares with both the MMPA and the IDCP.

It would appear at first sight that the objectives of this proposed legislation and the IDCP are the same. However, whether they are really equivalent will depend on the definitions of “intentional” and “incidental” lethal taking. It has been argued that the taking of marine mammals is intentional in the purse-seine fishery for tunas in the eastern Pacific but incidental in the case of other forms of fishing gear, such as trawls, gill nets, and longlines. The distinction is based on the assertion that in the former case the fishermen are deliberately setting their nets around the dolphins in order to catch the tuna associated with them, whereas in the latter case dolphins are not a specific target, although they are often captured.⁸² However, this distinction ignores the fact that in both cases the true objective of the operation is to catch fish, and neither purse seiners nor other fishing vessels have any interest in or derive any benefit from killing marine mammals, although in both cases a quantifiable probability exists that a certain number of dolphins will be killed. From the point of view of the impact on dolphins, the argument that one form of mortality is “intentional” and the other is “incidental” is irrelevant.

Representatives of a number of different governments,⁸³ have noted that U.S. policy regarding the conservation of marine mammals sets a double standard. On the one hand, the United States applies restrictive laws to a resource that is beyond its jurisdiction

while at the same time permitting the harvest of marine mammals taken incidentally in fisheries operating within its own EEZ.⁸⁴

It appears that unless the United States and the other nations involved can agree on a system for resolving the problem of dolphin mortality in the fishery, the current controversy and the resulting economic problems and political confrontation will continue and intensify. If this occurs, there is a danger that some nations now participating in the international program, through which they have contributed to reducing dolphin mortality in the fishery to biologically insignificant levels, may question the desirability of continuing in the program. If that were to occur, dolphin mortality would almost certainly increase, but without an international observer program there would be no way of monitoring it.⁸⁵

We are living in an ever more crowded world, and ever-growing demands are being placed on its natural resources. The living resources of the open ocean live in an environment foreign to humans and are difficult to monitor and control; they pay no heed to man-made boundaries and pass unhindered from national to international waters, all of which makes their management contentious and difficult. Customary international law is clear in its requirement that nations work together through appropriate regional bodies to conserve and manage these common resources, reflecting the fact that it is only through such mechanisms that we can ensure that our stewardship of the resources is exercised responsibly and rationally. Failure to do so will ultimately lead only to further difficulties and hardship for all involved, not least the tunas and the dolphins.

Notes

1. See R. L. McNeely, "The Purse Seine Revolution in Tuna Fishing," *Pacific Fisherman* 59, no. 7 (1961): 27-58.

2. See W. F. Perrin, "The Porpoise and the Tuna," *Sea Frontiers* 14, no. 3 (1968): 166-174; and W. F. Perrin, "Using Porpoise to Catch Tuna," *World Fishing* 18, no. 6 (1969): 42-45.

3. Marine Mammal Protection Act of 1972, Pub. L. No. 92-522, 86 Stat. 1027 (codified as amended at 16 U.S.C. §§ 1361-1407 (1988 & Supp. IV 1992)).

4. 16 U.S.C. § 1361(6).

5. 16 U.S.C. § 1362(8).

6. 16 U.S.C. § 1371(a)(2).

7. 16 U.S.C. § 1371(a)(2).

8. See T. D. Smith and N. C. H. Lo, *Some Data on Dolphin Mortality in the Eastern Tropical Pacific Tuna Purse Seine Fishery Prior to 1970*, NOAA Technical Memorandum NMFS SWFC 34 (Washington, DC: U.S. Dept. of Commerce, National Marine Fisheries Service, 1983); and N. C. H. Lo and T. D. Smith, "Incidental Mortality of Dolphins in the Eastern Tropical Pacific, 1959-72," *Fishery Bulletin* 84, no. 1 (1986): 27-34.

9. A. Felando, "Harmony between Tuna Fishing and the Environment of the Eastern Pacific Ocean" (Manuscript submitted to the World Conference of Tuna Fishing Countries, Tokyo, Japan, December 3-6, 1991, sponsored by the Japan Fisheries Association, Tokyo, Japan).

10. A number of lawsuits were initiated that dealt with this issue: *Comm. for Humane Legislation, Inc. v. Richardson*, 414 F. Supp. 297 (D.D.C.), *affirmed*, 540 F.2d 1141 (D.C. Cir. 1976); *American Tunaboat Ass'n v. Baldrige*, 738 F.2d 1013 (9th Cir. 1984); and *Balelo v. Klutznick*, 519 F. Supp. 573 (S.D. Cal. 1981), *rev'd*, 724 F.2d 753 (9th Cir.), *cert. denied*, 467 U.S. 1252 (1984). Department of Commerce administrative law judge hearings held on this issue include the following: In the Matter of Proposed Regulations to Govern the Taking of Marine Mammals Incidental to Commercial Fishing Operations for the Year 1977, Docket No. MMPAH No. 2-1976 (hearings held November-December 1976) (decided by Judge Frank W. Vanderheyden on January 17, 1977); In the Matter of Proposed Regulations to Govern the Taking of Marine

Mammals Incidental to Commercial Fishing Operations for the Years 1978 through 1980, Docket No. MMPAH No. 1-1977 (hearings held August–September 1977) (decided by Judge Frank W. Vanderheyden on November 3, 1977); and In the Matter of Proposed Regulations to Govern the Taking of Marine Mammals Incidental to Commercial Fishing Operations, Docket No. MMPAH 1980-1 (hearings held March–June 1980) (decided by Judge Hugh J. Dolan on July 18, 1980).

11. 16 U.S.C. § 1371(a)(2) (as amended by Act to Improve the Operation of the Marine Mammal Protection Act of 1972, and for Other Purposes, Pub. L. No. 97-58, § 2(1)(A), 95 Stat. 979, 979 (1981)).

12. Act to Authorize Appropriations to Carry Out the Marine Mammal Protection Act of 1972, for Fiscal Years 1985 through 1988, and for Other Purposes, Pub. L. No. 98-364, 98 Stat. 440 (1984).

13. 16 U.S.C. § 1371(a)(2).

14. See Inter-American Tropical Tuna Commission, *Annual Report for the Year 1960* (La Jolla, CA, 1961).

15. See Inter-American Tropical Tuna Commission, *Annual Report 1984* (La Jolla, CA, 1985).

16. See G. T. Sakagawa, "Are U. S. Regulations on Tuna-Dolphin Fishing Driving U.S. Seiners to Foreign-Flag Registry?" *North American Journal of Fisheries Management* 11, no. 3 (1991): 241–252.

17. Convention for the Establishment of an Inter-American Tropical Tuna Commission, May 31, 1949, U.S.-Costa Rica, 1 U.S.T. 231, 80 U.N.T.S. 3.

18. See "Summary Minutes of the 33rd Meeting of the Inter-American Tropical Tuna Commission, Managua, Nicaragua, October 11–14, 1976" (IATTC, La Jolla, CA, 1976), 9.

19. During 1986–1987 the price paid to fishermen for tunas larger than 20 pounds, the size captured in association with dolphins, was about \$790 per short ton. The price paid for tunas of less than 7.5 pounds, the size most commonly taken in non-dolphin schools, was about \$625 per short ton (American Tuna Sales Association, San Diego, CA).

20. Marine Mammal Protection Act Amendments of 1988, Pub. L. No. 100-711, 102 Stat. 4755.

21. The videotape in question was taken by a member of the staff of the Earth Island Institute aboard a Panamanian-flag vessel, the *Maria Luisa*, and was shown on all major U.S. television networks and at a hearing of the U.S. House of Representatives Committee on Merchant Marine and Fisheries, September 8, 1988.

22. 16 U.S.C. § 1371(a)(2)(B).

23. 16 U.S.C. § 1371(a)(2)(C).

24. 16 U.S.C. § 1371(a)(2)(D).

25. See I. Tinoco, "The Tuna-Dolphin Conflict: An Evaluation of the Marine Mammal Protection Act Embargoes" (Master's thesis, University of Washington, Seattle, 1993).

26. U.S. Congress, House Committee on Merchant Marine and Fisheries, Subcommittee on Fisheries and Wildlife Conservation and the Environment, *Marine Mammal Protection Act Reauthorizations—Pt. 2: Hearing*, 100th Cong., 2d sess., 1988, Serial 88.

27. *Earth Island Institute v. Mosbacher*, 746 F. Supp. 964 (N.D. Cal. 1990).

28. Letter from Dr. William W. Fox, Jr., National Marine Fisheries Service, U.S. Dept. of Commerce, to Mr. Bill Broward, Director, Office of Trade Operations, Customs Service, U.S. Dept. of the Treasury, Washington, DC, January 30, 1992.

29. See Tinoco, *supra* note 25.

30. See D. B. Pleschner, "The Story Behind Dolphin-Safe Tuna," *Pacific Fishing* 11, no. 8 (1990): 48–55.

31. The Dolphin Protection Consumer Information Act was included as part of the Fishery Conservation Amendments of 1990, Pub. L. No. 101-627, § 901, 104 Stat. 4436, 4465–4467 (codified as amended at 16 U.S.C. § 1385 (Supp. IV 1992)).

32. "Dolphin Safe" is defined in the act as a product made from tuna harvested by a fishing vessel that the secretary of commerce has determined incapable of deploying its purse-seine

nets on dolphin, whose owner or manager has a written statement executed by an official of the U.S. Department of Commerce or the Inter-American Tropical Tuna Commission which confirms that there was an approved observer aboard the vessel during the entire trip in question, and whose net was not intentionally deployed on or around dolphins. 16 U.S.C. § 1385(d)(2).

33. As reported in *FAO Globefish Highlights*, no. 2 (June 15, 1992): 11, the price paid for frozen yellowfin tuna in the round, C and F, Italy, was approximately \$1800 per short ton in March 1990, but by May 1990 it had dropped to about \$1200 per short ton. After that it continued to decline, and one year later was about \$950 per short ton.

34. See Tinoco, *supra* note 25, p. 70.

35. The government of Panama, in a letter to the Inter-American Tropical Tuna Commission dated September 18, 1992, requested Dolphin Mortality Limits for three of its vessels to fish for tunas in association with dolphins in the eastern Pacific Ocean during 1993. The government of Ecuador submitted a similar letter, dated May 4, 1993, requesting Dolphin Mortality Limits for seven of its vessels.

36. "United States—Restrictions on Imports of Tuna, Request for the Establishment of a Panel under Article XXIII-2 by Mexico" (Memorandum from the Council of GATT, January 25, 1991).

37. A number of interesting technical articles have been published on the Mexican initiative and the Panel's ruling. See E. Christensen and S. Gaffin, "GATT Sets Its Net on Environmental Regulation: The GATT Panel Ruling on Mexican Yellowfin Tuna Imports and the Need for Reform of the International Trading System," *Inter-American Law Review* 32 (1993): 570–612; J. H. Jackson, "World Trade Rules and Environmental Policies: Congruence or Conflict?" *Washington and Lee Law Review* 49 (1992): 1227–1278; D. J. Ross, "Making GATT Dolphin-Safe: Trade and the Environment," *Duke Journal of Comparative and International Law* 22 (1992): 346–366; and Tinoco, *supra* note 25.

38. See C. Van Note, "Free Trade Dooms Dolphins and the Environment," *Mainstream* 23 (Winter 1993): 11–12.

39. Letter from the U.S. Senate Committee on Commerce, Science, and Transportation to U.S. President George Bush, October 3, 1991.

40. In mid-1992 the European Economic Community requested that a Dispute Settlement Panel be seated by the Council of GATT to determine whether the intermediary nation embargoes under the Marine Mammal Protection Act were contrary to GATT agreements. "Panelists Being Selected for Second GATT Round on Tuna," *International Trade Register*, September 2, 1992, 1552–1553.

41. See "Balance de los Diez Puntos del Código de Ensenada," *La Jornada Ecológica* 2, no. 10 (1992): 7.

42. See J. Darling, "Tuna Turnabout, Mexico Announces a Dolphin Protection Plan," *Los Angeles Times*, September 25, 1991.

43. Letter from Representative Gerry E. Studds, Chairman, Subcommittee on Fisheries and Wildlife Conservation and the Environment, U.S. House of Representatives, to Dr. James Joseph, Director, Inter-American Tropical Tuna Commission, March 9, 1992.

44. U.S. Congress, House Committee on Merchant Marine and Fisheries, Subcommittee on Fisheries and Wildlife Conservation and the Environment, *Review of the Administration's Proposal to Promote Dolphin Protection: Hearing*, 102d Cong., 2d sess., 1992, Serial 72.

45. See "Summary Minutes of the 48th Meeting of the Inter-American Tropical Tuna Commission, San Jose, Costa Rica, September 17–20, 1990" (IATTC, La Jolla, CA, 1990), Appendix 6.

46. See "Summary Minutes of the 50th Meeting of the Inter-American Tropical Tuna Commission, La Jolla, Calif., June 16–18, 1992" (IATTC, La Jolla, CA, 1992), Appendix 10.

47. 16 U.S.C. § 1378(a), (a)(2).

48. Letter from Senator Ernest F. Hollings, Chairman, U.S. Senate Committee on Commerce, Science, and Transportation, to Dr. James Joseph, Director, Inter-American Tropical Tuna Commission, July 15, 1992.

49. U.S. Congress, Senate Committee on Commerce, Science, and Transportation, *Marine Mammal Protection Legislation: Hearing*, 102d Cong., 2d sess., 1992, Serial 1036.

50. Letter from Ministerio de Agricultura y Cría, Republic of Venezuela, to James A. Baker, III, U.S. Secretary of State, July 22, 1992; Communiqué of the Secretaría de Relaciones Exteriores de México, "México en Favor de una Defensa Real y Eficaz de los Delfines" (Tlotelolco, Mexico, October 31, 1992).

51. Pub. L. No. 102-523, 106 Stat. 3425 (codified in scattered sections of 16 U.S.C. (Supp. IV 1992)).

52. The figure of 40 percent had been chosen to conform to a commitment to Mexico that, in the event of an embargo against Mexico because of the dolphin issue, Mexican shrimp exports to the United States would not be affected. Anonymous source in the United States government, interview with author, Washington, DC, July 23, 1992.

53. See "Minutes of the Intergovernmental Meeting on the Conservation of Tuna and Dolphins in the Eastern Pacific Ocean, Port Vila, Vanuatu, June 9–10, 1993" (IATTC, La Jolla, CA, 1993), Appendix IX.

54. A meeting for this purpose has been set for October 26–27, 1993, at the headquarters of the Inter-American Tropical Tuna Commission in La Jolla, California.

55. See Inter-American Tropical Tuna Commission, *Annual Report 1991* (La Jolla, CA, 1992).

56. Greenpeace International has questioned the effectiveness of the dolphin-safe policy, noting that only in the eastern Pacific Ocean are all tuna vessels with carrying capacities greater than 400 short tons required to carry observers. See *Dolphins Aren't the Only Sacrifice* (Amsterdam, The Netherlands: Greenpeace International, 1993).

57. Pub. L. No. 94-265, 90 Stat. 331 (codified as amended at 16 U.S.C. §§ 1801–1882).

58. 16 U.S.C. § 1825(a)-(b).

59. C. Giménez, Director of the Asociación Venezolana de Armadores Atuneros, Cumaná, Venezuela, interview with author, Mexico City, July 28, 1993.

60. See Inter-American Tropical Tuna Commission, *supra* note 55; and "Background Paper 2, 51st Meeting of the Inter-American Tropical Tuna Commission, Port Vila, Vanuatu, June 8–10, 1993" (IATTC, La Jolla, CA, 1993).

61. See A. A. Anganuzzi and S. T. Buckland, "Relative Abundance of Dolphins Associated with Tuna in the Eastern Pacific Ocean: Analysis of 1992 Data," Document SC/45/SM 7 (Presented at the Scientific Committee Meeting of the International Whaling Commission, May 1993).

62. See National Research Council, Committee on Reducing Porpoise Mortality from Tuna Fishing, *Dolphins and the Tuna Industry* (Washington, DC: National Academy Press, 1992), 66.

63. This would drive most of the fishing effort to waters inside the Exclusive Economic Zones of the coastal states, which would exacerbate the political problems over the issue of access.

64. See Inter-American Tropical Tuna Commission, *Annual Report 1991*, 64.

65. See Inter-American Tropical Tuna Commission, *Quarterly Report*, April–June 1993 (La Jolla, CA: IATTC, 1993), 26–28.

66. M. Hall, M. García, C. Lennert, and P. Arenas, "The Association of Tunas with Floating Objects and Dolphins in the Eastern Pacific Ocean. III. Characteristics of Floating Objects and Their Attractiveness for Tunas" (Manuscript submitted to the International Workshop on Fishing for Tunas Associated with Floating Objects, La Jolla, California, February 11–14, 1992, sponsored by Bumble Bee Seafoods, San Diego, CA, and organized by the Inter-American Tropical Tuna Commission, La Jolla, CA).

67. M. Hall, "An Ecological View of the Tuna-Dolphin Problem" (Unpublished manuscript, Inter-American Tropical Tuna Commission, La Jolla, CA, 1993).

68. See K. Sherman, "Stress, Mitigation, and Sustainability of Biomass Yield in Large Marine Ecosystems," *Bulletin of the Sea Fisheries Institute*, no. 3 (1992): 43–59.

69. The International Dolphin Conservation Act of 1992, in fact, prohibits the encirclement of dolphins. 16 U.S.C. § 1412(a).

70. There have been several workshops since the mid-1970s to discuss the development of fishing gear and technology to eliminate dolphin mortality due to fishing. The most recent meeting was that of the Scientific Advisory Board of the Inter-American Tropical Tuna Commission, which met in San Diego, California, on April 14–15, 1993. At all of these meetings, it has been concluded that it is unlikely that means of capturing large yellowfin tuna in the eastern Pacific Ocean not associated with dolphins can be developed in the near future which are as efficient as current technology that captures large yellowfin tuna associated with dolphins.

71. See "Minutes of the Organizational Meeting of the IATTC Scientific Advisory Board, San Diego, Calif., April 14–15, 1993" (Inter-American Tropical Tuna Commission, La Jolla, CA).

72. See National Research Council, *supra* note 62, p. 3.

73. See Symposium on Mortality of Cetaceans in Passive Fishing Nets and Traps, International Whaling Commission, La Jolla, California, October 20–21, 1990.

74. See National Research Council, *supra* note 62, p. 71.

75. See *The Law of the Sea: Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index* (New York: United Nations, 1983); and United Nations Conference on Environment and Development, *Agenda 21: Programme of Action for Sustainable Development* (New York: UN Dept. of Public Information, 1993).

76. See "Summary Minutes of the 50th Meeting of the Inter-American Tropical Tuna Commission," *supra* note 46, Appendix 10.

77. See "Minutes of the Intergovernmental Meeting on the Conservation of Tuna and Dolphins in the Eastern Pacific Ocean," *supra* note 53, Appendix X.

78. It is of interest to note that after April 1, 1994, there will probably be no U.S. vessels fishing for dolphin-associated tunas in the eastern Pacific Ocean. Therefore, the 1.25 comparability figure will become moot.

79. H.R. 2760, 103d Cong., 1st sess. (1993).

80. *Ibid.* § 3.

81. *Ibid.* § 6(1).

82. See B. Warren, "Fishermen and Environmentalists Work Together to Protect Mammals," *National Fisherman* 74, no. 3 (1993): 14–15, 50; and E. C. Fullerton, Regional Director, Southwest Region, U.S. National Marine Fisheries Service, statement in *Report of the Third and Final Meeting to Review Progress in Reducing Dolphin Mortality in the ETP Purse Seine Fishery for Tunas*, Administrative Report (Washington DC: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 1992), 32–33.

83. Dr. G. González Cabral, Subsecretario de Recursos Pesqueros, Ministerio de Industrias, Comercio, Integración y Pesca, Ecuador, statement at the Conferencia Interamericana sobre Pesca Responsable, Mexico City, Mexico, July 28–29, 1993; and F. Charat, "Mexico: No Threat to Dolphins," *Journal of Commerce*, November 5, 1991.

84. H.R. 2760, 103d Cong., 1st sess. (1993), § 6, will provide for the establishment of a biological removal level which will allow the incidental lethal take of marine mammals which occur in waters under the jurisdiction of the United States. Guidelines for computing these levels have been proposed by the National Marine Fisheries Service, U.S. Department of Commerce, in a report entitled *Proposed Regime to Govern Interactions between Marine Mammals and Commercial Fishing Operations* (Silver Spring, Md.: National Marine Fisheries Service, 1992).

85. See R. Carpenter, Commissioner of Maritime Affairs, Vanuatu, statement in *Report of the Third and Final Meeting to Review Progress in Reducing Dolphin Mortality*, *supra* note 82, pp. 53–55.