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THE TUNA-PORPOISE DILEMMA: IS CONFLICT RESOLUTION ATTAINABLE?

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Congress passed the Marine Mammal Protection Act of 1972 to achieve various goals, including a reduction in the taking of marine mammals incident to commercial fishing operations to "levels approaching a zero mortality and serious injury rate."[1] Implementation of the Act has precipitated intense legal and political battles, particularly with regard to porpoise protection, while the performance of the Act to date is believed by many to have fallen short of the legislative goal. The thesis of this paper is that most of the tuna-porpoise controversy as well as the failure to approach a zero porpoise mortality rate can be traced to ineffective and inefficient porpoise protection. By relying on improvements in technology and industry-wide quotas, rather than on an incentive approach, the federal government has failed to achieve maximum porpoise protection at least cost to society.

This presentation examines the origins of the tuna-porpoise controversy—the technologies of tuna harvest and porpoise protection and the manner of tuna exploitation control proscribed by the Act. Then, it turns to the central issue of porpoise protection. The existing regulatory framework is contrasted to porpoise protection under an incentive system. We conclude that the current regulatory system does not meet the efficiency test, that porpoise protection is not afforded at least cost to society. Moreover, we conclude that while the regulatory approach is unlikely to achieve the goal of the Marine Mammal Protection Act without imposing severe economic penalties on the tuna industry, the incentive system should achieve that goal with less disruption and a lower cost to the industry and to society.

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1. Marine Mammal Protection Act of 1972, 16 U.S.C. §1371(a)(2) (Supp. V 1975).

BACKGROUND

The United States tuna fleet fishes along the west coast of the Americas, from Baja California south to Chile, off the west coast of Africa, and in new areas in the Central Pacific and Indian Ocean. The porpoise-related tuna fishing, however, occurs only in the eastern tropical Pacific (ETP) region,[2] one habitat of the yellowfin tuna, *Thunnus albacores.*[3]

The yellowfin tuna is regulated by the Inter-American Tropical Tuna Commission (IATTC),[4] which was created in 1949 by a treaty between Costa Rica and the United States. The IATTC was formed to protect stocks of inshore tuna along the coast of Central American countries, where the tuna-porpoise conflict is now centered. Under the IATTC, overall catch is regulated within the Commission Yellowfin Regulation Area (CYRA)[5] by vessels of all member nations (United States, Canada, Mexico, Nicaragua, Costa Rica, Panama, France, and Japan) on a first-come-fastest-catching basis until the fleet quota is reached and the season closed.[6]

"Open season," which lasts three or four months, begins January first of each year throughout the season. The IATTC monitors the catch through periodic radio reports from the vessels and landing reports collected by IATTC personnel in all member ports. As the annual fleet quota is approached, the open season is closed and vessels are limited to yellowfin catches incidental to other species in the CYRA.[7] Boats in port on the day the season is closed can make one additional trip inside the CYRA without restriction and boats at sea are allowed to fill their holds inside the CYRA. Regulated trips are made within the CYRA after the season is closed.

During the 1960's and early 1970's the purse seine fleet enjoyed large profits, stimulating new entry into the fishery. Because of the short open season, the new boats emphasized design features such as

2. The ETP is bounded on the west by 150°W longitude, on the east by the Americas, on the north by approximately 30°N latitude, and on the south by approximately 20°S latitude.

3. The word "tuna" is applied to several species of related finfish including: Pacific yellowfin, big eye, albacore, shipjack, blackfin, Atlantic yellowfin, bonita, and other tuna-like fish. Yellowfin tuna are labeled "chunk light tuna" in the retail trade.

4. A summary of the IATTC development, its management strategies, and the political, biological, and economic implications of its management strategies is given by J. Joseph, Assessment Studies of Yellowfin Tuna in the Eastern Tropical Pacific (Paper presented at the 31st meeting of the IATTC, March, 1975).

5. The CYRA lies within the boundaries of the eastern tropical Pacific, extending westward from the coast of Baja California to 125°W longitude and southeast to a point off the coast of Northern Chile at 90°W by 20°S latitude.

6. Some of the "developing nations" are allowed special allocations during the closed season.

7. Incidental catches of yellowfin may range up to 15 percent of total catch.

large capacity and powerful, high-speed engines in an attempt by the individual owners to capture larger shares of the overall tuna quota. Unknown to the general public at that time was the fact that hundreds of thousands of porpoise were being killed each year as part of the tuna harvest.

TUNA HARVEST AND PORPOISE PROTECTION TECHNOLOGY

In the early years of the tuna industry, a pole and line fishing technique was commonly used by American fishermen. This fishing gear consists of a bamboo pole with a length of line and a feathered barbless hook or a baited hook attached. When bait is thrown into the water, the tuna are hooked while in their feeding frenzy. The long line method is employed primarily by Japanese vessels in tropical and temperate waters today. The long line approach uses lengths of rope secured by a series of buoys, from which a minimum of 1500 baited hooks are attached to individual branch lines, each extending several hundred feet into the water. Because tuna found in the eastern tropical Pacific commonly associate with floating objects and porpoise and because sea birds are often attracted by the same small fish which attract the tuna in these waters, fishermen have long used such associations to locate tuna schools.[8]

Technological innovations in the past twenty years have made it possible for the tuna industry to shift from the labor intensive pole-and-line fishing method to the highly mechanized and more efficient techniques of purse seining. During the 1960's skippers learned that small speedboats could direct the movement of porpoises and that the tuna would continue to follow the porpoise. This discovery allowed purse seiners to deploy nets at will and greatly increased the efficiency of harvest. Unfortunately, porpoise herding also increased the porpoise mortality rate.

The procedure of "setting on porpoise" begins by first locating porpoise and confirming that tuna are below. Through experience, fishermen have learned that a successful set may be accomplished when the porpoise are actually captured or encircled by nets along with the tuna. To achieve this, several speedboats are launched to "corral" the porpoise. A large powered skiff, attached to one end of the three-quarter-mile-long nylon net, is released from the stern of the tuna seiner and the seiner then moves ahead of the porpoise school while deploying the net. Once the seiner and skiff have en-

8. The yellowfin tuna typically swim at depths of about 200 feet and would otherwise be much more difficult to locate.

circled the school, the skiff transfers its end of the net to the seiner. The top of the seine net is fastened to a floating cork line, and the bottom, which extends approximately 350 feet deep, is weighted down by a heavy wire cable. The cable is then winched up causing the net to close much like a string purse, thus giving the process the name "purse seining." The winch then hauls one end of the "pursed" net aboard the boat. When this occurs, the tuna usually accumulate in the deep central pocket of the net near the boat, while the porpoise float in a tight group at the far end of the net near the cork line in the area of least disturbance.

When more than half of the net is aboard and secured, a signal is given for the "backdown" to begin, a procedure designed to release the porpoise from the net. The tuna seiner switches into reverse and the cork line partially dips under the water allowing the porpoise to escape. According to Kenneth Norris, an authority on marine mammals at the University of California at Santa Cruz, at least half of the total porpoise mortality incidental to tuna fishing occurs through drowning after backdown maneuvers have begun.[9] Although the major physical cause of mortality is uncertain, it is recognized that some porpoise drown as a consequence of being entangled in the meshes of the net while others die of shock.

Extreme variation is found in the average porpoise mortality per set. A disproportionately high porpoise mortality occurs on the infrequent sets where the net collapses before the porpoise can escape. The factors which appear to be most closely related to the porpoise kill rate are the gear being used, the skill of the skipper and the degree to which the crew's effort is directed to porpoise protection, environmental conditions such as wind, and the species of porpoise in the set.[10]

Porpoise protection and rescue devices have been developed by the industry and refined through National Marine Fisheries Service (NMFS) gear research. Some devices have become a part of NMFS regulations, as indicated by the 1978 regulations which specify:[11]

> (1) the same gear requirements as in 1977–which include 1¼-inch mesh porpoise safety panels; the use of backdown; the use of hand release procedures; the use of rubber raft, face mask, and snorkel; prohibition of the use of sharp objects for rescuing porpoise; the installation of speedboat bunchlines; proper speed-

9. Los Angeles Times, Jan. 18, 1976, at 1.

10. The importance of the skill and dedication of the crew in protecting the porpoise was emphasized repeatedly in the 1977 hearings on the proposed NMFS regulations, *see* Transcripts at 654-55, 836.

11. 42 Fed. Reg. 64,551 (1977).

boat use; use of lights after dark; annual vessel inspection; and vessel operator training;[12]

(2) the supervised installation of the "super-apron" system;
(3) the arrangement of bunchlines to establish towing points;
(4) a minimum of two-man speedboats to be in the water until backdown commences; and
(5) that exactly three bow bunches be pulled.

The marked decline in porpoise mortality during recent years (Table 1) has been attributed in part to the use of improved porpoise protection gear. The 1974 decline stems from a drop in the proportion of sets which were made on porpoise during that year.

TABLE 1

INCIDENTAL PORPOISE MORTALITY ESTIMATES

Year	*U.S. Vessels*	*Non-U.S. Vessels*
1971	310,000	9,000
1972	306,000	42,000
1973	175,000	42,000
1974	99,000	21,000
1975	134,000	47,000
1976	104,000	44,000
1977	24,000	

Source: National Marine Fisheries Service, Environmental Impact Statement 39 (1977).

REGULATION UNDER THE MARINE MAMMAL PROTECTION ACT OF 1972

Although porpoise deaths were not the sole impetus for new Federal regulations regarding the taking of marine mammals, they were a major factor leading Congress to pass the Marine Mammal Protection Act of 1972. This Act was a natural extension of the philosophy already articulated in the Endangered Species Preservation Act of 1966 and the Endangered Species Conservation Act of 1969.[13] Congress delayed the effective date of the Act relative to incidental taking during commercial fishing operations for two years in order to permit industry to make necessary adjustments.[14] The most significant feature of the Marine Mammal Protection Act is the moratorium on the taking and importation of marine mammals, although a number of exceptions to this moratorium were written into the stat-

12. National Marine Fisheries Service, Final Environmental Impact Statement 16 (1977).
13. M. BEAN, THE EVOLUTION OF NATIONAL WILDLIFE LAW 324 (1977).
14. Marine Mammal Protection Act of 1972, 16 U.S.C. §1371(a)(2) (Supp. V 1975).

ute.[15] Of interest to this paper is the exception for the taking of marine mammals "incidental to the course of commercial fishing operations."[16]

Under the Act, in issuing regulations governing the taking of marine mammals, the Secretary of Commerce is to give full consideration to all factors which affect marine mammals, including:[17]

(1) existing and future levels of marine species and stocks;
(2) existing international treaties and agreements;
(3) the marine ecosystem and the related environment;
(4) the conservation and development of fishing resources; and
(5) the economic implications and technological feasibility of implementation.

The Act specifies two goals of marine mammal protection. The first goal is the attainment of the optimum sustainable populations of marine mammals; the second is ". . . 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."[18] Litigation in the tuna-porpoise controversy has focused on the first goal, NMFS and the tuna industry having placed less emphasis on the second goal.[19]

With respect to the first goal, it should be noted that the Act specifies no mathematical definition of optimum sustainable population, describing it only as "the number of animals which will result in the maximum productivity of the population of the species, keeping in mind the optimum carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element."[20] Recently, however, the NMFS proposed a working definition of optimum sustainable population:

> Optimum sustainable population is a population size which falls within a range from that population level of a given species or stock which is the largest supportable within the ecosystem to the popula-

15. The exceptions in §1371 included (1) taking for scientific research, (2) taking by Alaska natives for subsistence, and (3) taking incidental to commercial fishing.

16. Although an exception was granted for taking of marine mammals incidental to commercial fishing operations, the Act specified that the immediate goal was to reduce these takings to a near zero level (*See* Marine Mammal Protection Act of 1976, 16 U.S.C. §1371(a)(2) (Supp. V 1975)).

17. *Id.* §1373(b).

18. *Id.* §1371(a)(2).

19. The NMFS has taken the view that the new regulations for 1978-1980 "meet the goal of the Act to reduce mortality to the lowest possible level," 42 Fed. Reg. 64,550 (1977). For reasons noted later, the authors of this paper do not fully support this view.

20. Marine Mammal Protection Act of 1972, 16 U.S.C. §1362(9) (Supp. V 1975).

> tion level that results in maximum net productivity. Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and growth less losses due to natural mortality.[21]

The lower boundary of the optimum sustainable population, that below which a marine mammal species would be considered depleted and ineligible for taking, is considered to be within a range of 50 to 70 percent of the initial or maximum stock size.[22]

The tuna-porpoise litigation can be traced to a draft report on the impact of purse-seine fishing on porpoise which was published in 1974 by the Southwest Fisheries Center of the NMFS.[23] It estimated that the population level of spotted porpoise could be 30 percent to 80 percent lower than the carrying capacity of the ecosystem, and that this reduction in porpoise stocks could be attributed to purse seining operations. Despite these findings, NMFS issued to the tuna industry a general permit for the incidental taking of an unlimited number of porpoise. On October 4, 1974, the Committee for Humane Legislation brought an action in *Committee for Humane Legislation, Inc. v. Richardson*[24] to have the NMFS regulations declared invalid and to thereby enjoin the NMFS from issuing permits to tuna seine fishermen. At issue was whether the Secretary of Commerce through the NMFS had prepared statements of the estimated porpoise stocks and the impact of the regulations on the stocks.[25]

In August 1975 the American Tunaboat Association applied for a renewal of its porpoise permit. NMFS then proposed a quota of between 50,000 and 100,000 porpoise. Because of objections raised by conservationists, however, the NMFS had agreed in the fall of 1975 to refrain from publishing its 1976 regulations until a conference could be held between representatives of the fishing industry and the conservationists to help reduce the conflicts. At the conference that September, the industry expressed concern over the proposed quota and opposed a mandatory observer on each boat. The conservationists refused to accept the proposed quota and insisted on mandatory observers. In an attempt at compromise, the NMFS pub-

21. 41 Fed. Reg. 55,536 (1976) (amending 50 C.F.R. §216.3).

22. 42 Fed. Reg. 12,016 (1977).

23. *See* NATIONAL MARINE FISHERIES SERVICE, U.S. DEP'T OF COMMERCE, DRAFT REPORT ON PORPOISE MORTALITY INCIDENTAL TO TUNA PURSE-SEINE FISHING FOR FISCAL YEAR 1975 (1974).

24. 540 F.2d 1141 (D.C. Cir. 1976).

25. The litigation is summarized in Nafziger & Armstrong, *The Porpoise-Tuna Controversy: Management of Marine Resources After Committee for Humane Legislation, Inc. v. Richardson*, 7 ENVT'L L. REV. 223 (1977).

lished its 1976 regulations that December, calling for observers on ten percent of the boats and delaying setting of the quota until the 1976 season's take approached 70 percent of the 1975 levels.

On May 11, 1976, the action brought by the Committee for Humane Legislation, Inc. was decided. Judge Richey of the District Court, District of Columbia, ruled that the NMFS regulations and permits were void under the Marine Mammal Protection Act. He ruled that the NMFS had not only failed to determine the optimum sustainable population of each species of porpoise and the effect of the proposed taking on the stocks, but had also failed to specify the number of animals that could be killed. The Court ruled that no permits would be issued until these statutory requirements were met. However, the court order was appealed and a stay granted which allowed the continued taking of porpoise.

In an attempt to meet the statutory requirements of the Act, the NMFS convened a workshop of scientists on July 27-31, 1976, to help the NMFS in estimating the population of various species and stocks of porpoise affected by the yellowfin tuna purse-seining operations. The workshop report provided the basis for new NMFS regulations for the 1977 season. A total U.S. quota of 59,050 was established for twelve species or stocks for which taking would be permitted[26] and setting on five other stocks, including the eastern spinner, would be prohibited. Additionally, the NMFS proposed to have observers on a minimum of 130 vessel trips and to require boats to use small mesh webbing and additional porpoise rescue equipment, such as flood lights and a snorkel-equipped diver on a raft during backdown.[27] In protest, particularly over the prohibition on five species, the industry ceased fishing and returned to port. Subsequently, the fleet was encouraged to return to sea after the regulations were modified to (1) increase the allowable take to 62,429 animals, reflecting a reassessment of the whitebelly spinner population, and (2) permit accidental taking of the prohibited species.

The estimated porpoise take of 24,143 during 1977 fell short of the quota for a variety of reasons. One factor was the fact that when the fishermen returned to sea after ending their protest, they found

26. The initial NMFS proposal was for a quota of 29,920. The industry recommended 96,100, the Environmental Defense Fund and the Marine Mammal Commission 53,120 and 50,158, respectively. The Administrative Law Judge had recommended 96,100. The final decision of the NMFS Director was 59,050.

27. 42 Fed. Reg. 12,010-12,020 (1977). The proposals were first published in 41 Fed. Reg. 45,015 (1976). Hearings were conducted in San Diego, Nov. 22-26, and in Washington, D.C., during November and December. The proposed regulations were accepted with only minor modification by Administrative Law Judge Frank W. Vanderheyden.

tuna in locations which did not have many porpoise.[28] Also credited for much of the improvement were the increased care demonstrated by the fishermen and the deployment of porpoise-saving technology.[29]

The NMFS recently issued final regulations covering 1978, 1979, and 1980.[30] Individual species and stock quotas totaling 51,945, 41,610, and 31,150, respectively, were established for each of the three years and three major gear regulations were set for 1978.

First, use of the super-apron was required on all vessels greater than 400 tons carrying capacity and built after 1960.[31] A super-apron system reportedly will require more time in releasing porpoise but proportionately less time for the overall set when one considers the time otherwise spent untangling and disposing of porpoise from the net in the brailing portion of the fishing operation. The cost of the apron was estimated at $3000 per boat;[32] installation may take a day or less, and a trial set, also required under the regulations, may require an additional day. If a boat would not otherwise be fishing on those two days, the cost to the boat is limited to the equipment expense plus the cost of testing. If a boat would otherwise fish, the financial cost is the net daily profit, unless the effect of outfitting all the vessels is to extend the season. The second provision requires that vessels employ porpoise-release procedures, specifically backdown and the use of speedboats to hold open the net at the cork line during backdown. The third provision prohibits intentional sets on the eastern spinner porpoise due to the findings that the stock is depleted.

The tuna industry opposed the regulations, contending that if reduced quotas were met or exceeded for any particular species, harvest opportunities would be restricted and costs per unit catch would increase.[33] According to industry testimony, the prohibition against sets on schools containing eastern spinners restricts fishermen and further increases the costs per unit catch. The tuna industry sought a quota of between 78,000 and 81,000 animals for 1978, and flexible quotas for the years following. The industry claimed that the NMFS regulations were based on insufficient evidence of technological feasibility and that, because the porpoise stocks are healthy, regulation would be unnecessary and unwarranted.

28. Washington Post, January 7, 1977, at 4.
29. Final Decision by Administrative Law Judge, Frank W. Vanderheyden, at 40.
30. 42 Fed. Reg. 64,548 (1977).
31. 42 Fed. Reg. 64,551 (1977).
32. Brief for NMFS.
33. Brief for tuna industry.

EVALUATION OF THE NMFS REGULATORY APPROACH

The contention of the Administrator of the National Oceanic and Atmospheric Administration, of which the NMFS is an element, is that the regulations which have been proposed for the 1978, 1979, and 1980 seasons meet the goal of the Act to reduce porpoise mortality to the lowest possible levels.[34] We argue here that such is not the case, that lower porpoise mortality is technologically feasible, and moreover, that it could be achieved for, at most, a modest increase in cost to society.

Just as the various tuna commissions have opted for annual quotas on the catch as the principal regulatory device to protect the long-run productivity of the tuna fisheries, so also the NMFS has opted for quotas on individual species to protect the porpoise stocks. In addition, NMFS has opted to dictate the choice of gear and porpoise rescue devices which must be used. Both policy choices have serious limitations.

The deficiencies of the quota approach are well known and will not be repeated in detail here. Among other shortcomings, it encourages each fisherman to capture as large a share of the quota as is possible before it is filled, so that the harvest of fish is accelerated. Additionally, as has been amply documented by others, the effect of relying on the tuna quota as the primary mangement tool has been to induce excessive investment in the industry.[35] To capture as large a share of the IATTC quota as is possible, many fishermen have selected large, high-speed vessels and other costly gear to minimize travel time and accelerate the harvest of fish. From the viewpoint of industry efficiency, these outlays for engines, large boats, and time-saving gear are unwarranted, but to the individuals involved, the investments are perceived as one means of obtaining a larger share of the overall quota.[36]

Furthermore, by not controlling the entry of new fishermen, the IATTC permitted excessive growth in fleet size in response to the profits which were being earned in the late 1960's and early 1970's. It has been estimated that the present fleet is at least twice the size necessary for the harvest of the maximum sustained yield of tuna in the eastern tropical Pacific.[37] Using current fishing practices, the

34. 42 Fed. Reg. 64,550 (1977).

35. S. Saila & V. Norton, Tuna: Status, Trends, and Alternative Management Arrangements (RFF/PISFA Paper 6, 1974); V. Flagg, *Optimal Output and Economic Rent of the Eastern Tropical Pacific Tuna Fishery: An Empirical Analysis*, 36 AM. J. ECON. & SOC. 19 (1977).

36. Recent estimates are that vessels of 800 to 1,200 tons are most efficient but that new additions to the fleet will be in the 2,000 ton range.

37. Flagg, *supra* note 35, at 29.

U.S. fleet is capable of harvesting the entire annual quota in the CYRA in approximately three months.

The effects of the porpoise quota on the economics of tuna fishing are similar. During that part of the year before the tuna quota for the IATTC area is reached, individual fishermen are pressured by the need to catch as large a share of the commission quota as is possible. Porpoise are a free good; there is no penalty for killing a porpoise until the individual species quotas are reached.[38] The high historic levels of porpoise mortality suggest that, at least in the past, porpoise protection was not consistent with maximizing the tuna catch for individual fishermen. Recent evidence from experimental cruises is that best porpoise protection practice should not increase the time per set and may actually save some time. Nonetheless, with porpoise in effect a free input to the process of catching tuna, the incentive to protect the porpoise is weak at best.

Once the porpoise quota has been filled, the industry faces an entirely new structure of incentives. Fines up to $20,000 can be assessed for intentional porpoise kills. In contrast to the situation before the porpoise quota has been filled, where porpoise are viewed as a free good to the individual fisherman, once the quota is filled the porpoise must be treated as a very expensive input to the process of harvesting tuna.

Although experience under a filled porpoise quota is limited to a few weeks in 1976, there is evidence that porpoise mortality can be reduced sharply from the typical experiences during unfilled quotas. In contrast to the average industry performance during the 1970's of approximately one porpoise kill per ton of tuna caught, recent efforts using best techniques indicates that the rate of porpoise kill may be held to less than one per hundred tons caught.[39] If fishermen could be induced to adopt best techniques, the porpoise kill could, according to these recent experiences, be held to a maximum of a few thousand animals per year.

In addition to industry-wide quotas on the individual porpoise species, the NMFS has mandated the use of several forms of porpoise protective gear. Without on-board observers on all trips, gear requirements are unlikely to be fully effective because the gear may not be used in its intended manner; the fishermen still profit from rapid harvest under the industry-wide tuna and porpoise quotas and would

38. Without an observer on board every vessel, it will be difficult to detect that the porpoise quotas are being met or exceeded.

39. Experiments during 1976 and 1977 with improved gear and techniques on the seiner, Elizabeth C.J., resulted in an average porpoise mortality of one for every eleven sets of the net. The kill rate per ton of tuna harvested was .004. *See supra* note 12, part 2, at 35.

be likely to use the gear in its intended manner only to the extent it lowers cost or accelerates the rate of tuna capture. Furthermore, the fishermen have no incentive to develop yet more effective devices for porpoise protection.

ALTERNATIVE REGULATORY APPROACHES

The principal deficiency of present NMFS regulations governing the taking of porpoise is that they induce desired behavior on the part of the tuna industry only to the extent that porpoise protection increases the efficiency of the tuna harvest. When the porpoise are, in effect, a free good, there is at best only a weak incentive for fishermen to use the best porpoise-saving techniques. When the porpoise quota has been reached, penalties for capturing an additional porpoise probably outweigh the expected value of any further tuna catch. But, if the fishermen could be induced to recognize the value of porpoise throughout the season, the occasional problem of indiscriminant porpoise slaughter early in the season, as well as that of an effective ban on fishing on porpoise once the quota has been reached, could largely be eliminated.

At least three methods exist for insuring that fishermen would continue to seek methods for reducing their porpoise kills and not treat porpoise as a free good. The first and simplest conceptually would be to place a price on each porpoise which is killed, the price to be fixed through either governmental regulation or at an auction of marketable (exchangeable) porpoise permits.[40] This system would reward those who have invested in porpoise-saving technologies and would offer a continuing incentive to each skipper to practice the best techniques.

A second procedure for achieving desired porpoise protection and efficient tuna harvest would be to grant individual porpoise quotas to each fisherman or each boat. With an individual quota, an incentive exists to treat the porpoise as having a value. Should an individual porpoise quota be filled before the season is over, no more fishing from that boat using porpoise as locators would be allowed for the rest of that season. One desirable modification of this approach

40. On May 5, 1977, Representative Murphy proposed, in H.R. 6970 amending the Marine Mammal Protection Act, to incorporate many of the economic incentives present in a system of marketable vessel porpoise quotas. In order to provide continuing incentives to individual skippers to practice porpoise protection: (1) the Secretary of Commerce could refuse to issue permits to fish on porpoise to those skippers who exceeded the industry-wide porpoise kill factor per trip by more than 100 percent, (2) fees would be charged for the permits but incentive payments would be made to the skippers whose kill factor is less than 50 percent of the industry average, and (3) an additional fee of $32 per porpoise would be assessed for each porpoise killed in excess of the industry average per trip.

would be to allow transfer of the porpoise quota among boats or fishermen. In this way, the careful fisherman, using the best techniques, would be able to sell his unused quotas to the less careful or less skilled members of the industry.

A third approach is to eliminate the economic institutions that encourage porpoise taking. Porpoise may be protected to some extent by marketable, individual boat tuna quotas. The incentive to minimize the time per set would be reduced, allowing more time to be devoted to porpoise protection. This solution is particularly attractive because it would gradually eliminate overcapitalization created by open access to the tuna fishery. This regulatory option could be combined with boat porpoise quotas or porpoise kill fees.

The final environmental impact statement (EIS) issued by the NMFS covering the proposed 1978, 1979, and 1980 porpoise quotas reviewed the idea of using individual porpoise quotas both to fishermen and to vessels as alternatives to the overall industry-wide quota. The EIS noted that individual quotas would require the promulgation of new regulations under Section 104 of the Act and that certain legal and funding problems would have to be worked out.[41] One of the critical problems in allocating individual quotas is the wide variation in technology and skill which is represented in the vessels and skippers. Issues of fairness must also be addressed; to penalize poor performance when it is subject to the individual's control may be desirable, but to force a vessel or skipper to cease fishing because of a streak of isolated and uncontrollable high kills would not seem equitable.[42]

The EIS notes that many of the problems inherent in granting individual quotas are eliminated when marketable porpoise quotas are auctioned to interested vessel owners. The advantage to such an auction is that good performance would be rewarded directly and poor performance would be penalized directly through the amount which must be spent to purchase the needed share of the industry quota. Furthermore, the NMFS would not be placed in the uncomfortable position of deciding how large a share of the quota should go to each vessel or skipper. Rather, the market process would fix these allocations.

A problem with any porpoise protection scheme which relies on estimates of individual porpoise kills is that an observer is required

41. *Supra* note 12, at 50 & 53.

42. These points have also been made by Franklin Alverson, a spokesman for the tuna industry, in *Hearings on H.R. 6970 Before the Subcomm. on Fisheries and Wildlife Conservation and the Environment of the Comm. on Merchant Marine and Fisheries*, 94th Cong., 2d Sess. 345-48 (1977).

aboard each boat. The regulations for 1978 through 1980 will place observers on a minimum of 130 trips annually (out of some 400-plus trips by the industry). The NMFS has estimated that it would cost from four to five million dollars to monitor all of the trips made by the U.S. fleet each year ($30,000-$40,000 per vessel, per year). The observers, like other federal inspectors and wardens, would be subject to threats or bribes and may need some special training. The potential problem of threats, while it must not be overlooked, in theory should be manageable if the price per porpoise is low. In fact, however, the problem of threats may provide the ultimate constraint in reducing the overall industry quota of marketable permits.

Inasmuch as the Marine Mammal Protection Act specifies the *immediate* goal of reducing porpoise kills to levels approaching zero, statutory responsibility would appear to obligate the Secretary of Commerce to request Congressional appropriations for the sums required for observers on each vessel if these expenditures would reduce porpoise kills significantly. We believe that marketable porpoise quotas, offered annually at auction, would achieve the intent of the Act, that such marketable quotas would provide a powerful incentive to reduce dramatically the kill levels relative to those specified in the new regulations, and that the ensuing economic cost of porpoise protection imposed upon industry and consumers should not rise substantially.[43]

One of the potential problems which could adversely affect any program for porpoise protection is that vessels would transfer to other nations of registry to escape U.S. restrictions. Two distinct issues must be kept in focus. First, does vessel transfer pose an immediate threat to the success of existing porpoise protection efforts? Second, would individual vessel quotas, as outlined in the paper, provide a greater inducement for change of registry than exists at present? We believe that in both cases the answer is no.

The actual rate of transfer of purse seiners in 1975 through 1977 was very low. One converted purse seiner was transferred in 1975 and another in 1976; two new purse seiners were transferred in 1976. Recently, the Maritime Administration granted permission for thirteen additional transfers. The low rate of transfer may be explained in part by U.S. import restrictions on tuna which is taken in a manner which does not conform to U.S. laws and regulations governing the protection of marine mammals. Another important factor in-

43. The principal societal cost of porpoise protection with a system of marketable porpoise quotas is for the observers needed to monitor each trip. The potential savings to the industry lie in the flexibility to choose the method of protection which is cost effective for the individual skipper or vessel.

hibiting transfers to escape U.S. marine mammal protection is the requirement of the Maritime Administration that any foreign purchaser must agree to conform to present and future U.S. laws and regulations governing the protection of marine mammals.

CONCLUSION

The NMFS regulatory approach of sharply decreasing annual porpoise quotas and the use of mandated gear has evolved from the interaction of several forces. First, the Service has a very limited budget to allocate to all forms of marine mammal protection and an intensive program of porpoise protection and management would require the use of funds currently devoted to other marine mammal protection programs. Second, the tuna industry strongly resists the suggestion of intensive governmental involvement in marine mammal protection and argues that a technological solution will significantly reduce porpoise kills. Third, the environmental interests have applied continuing pressure to have lower kill limits imposed each year.

This strategy by NMFS should accomplish the objective of reducing porpoise mortality, but it may do it at a high cost to the industry and society and not achieve the legislative goal of near-zero kills. Only if porpoise protection results in a significant time savings per set will fishermen have a strong incentive to avoid porpoise mortality. Otherwise, it is likely that the annual industry-wide quotas will be filled each year and that the industry will continue to point to the declining quota as a root cause of the financial plight of the industry.

By not permitting fishermen to choose their own most cost effective form of porpoise protection, the NMFS discourages innovation. By relying on an industry-wide quota, the NMFS decreases efficiency in that porpoise are a free good for part of the year and very expensive for the remainder of the year. Rather than relying on a single technique for porpoise protection, the individual skippers must develop different strategies for the two periods.

If society is truly interested in achieving maximum porpoise protection with minimum disruption to the tuna industry, we highly commend the use of marketable porpoise quotas, offered at auction each year. Such a system would give flexibility to the industry in the protection technique used, would offer incentives to each fisherman to minimize kills, and would apply this incentive uniformly throughout the fishing season.