

UPDATE ON THE UNITED STATES ATLANTIC BLUEFIN TUNA TAGGING

by

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SUMMARY

The tagging activities of and results from the U.S. Atlantic Bluefin Tuna Program covering the period from November 1, 1976 through September 30, 1977 are discussed. Off the mid-Atlantic coast of the United States, 1,672 small bluefin tuna (*Thunnus thynnus*) were tagged and released by field party personnel aboard purse seine vessels and 203 by anglers aboard recreational fishing vessels. A total of 104 small bluefin were recaptured off the mid-Atlantic coast --94 (25 of which were released again) by purse seine vessels, 6 by Japanese longline vessels, and 4 by recreational fishing vessels. There were 65 additional recaptures of small fish reported for 1976, bringing the total returns to 260 for the reporting period of October 1975 through October 1976.

Two medium-size bluefin were tagged and released by anglers aboard recreational fishing vessels. No returns were reported for bluefin that were tagged as medium size fish.

During 1977, two new types of tags were used for giant bluefin tuna in addition to the standard "H" tag. A total of 11 giants were tagged and released in the Bahamas, and 190 in the Gulf of Maine. A total of 20 tags from giant bluefin were returned (one from the Gulf of Mexico and 19 from the Gulf of Maine). There were two additional recaptures of giant bluefin reported for 1976, which bring the total returns to five for the reporting period of October 1975 through October 1976.

The tagging efforts in 1977 brought the total U.S. (National Marine Fisheries Service - Woods Hole Oceanographic Institution Cooperative Tagging Program) bluefin tuna releases to approximately 18,400 and returns to approximately 3,050 for all types of gear and all areas since 1954.

RESUME

Le présent document fait état des activités de marquage effectuées dans le cadre du programme de marquage de thon rouge des Etats-Unis, entre le 1<sup>er</sup> novembre 1976 et le 30 septembre 1977, ainsi que des résultats obtenus. Au large des côtes atlantiques américaines, à mi-hauteur, 1.672 petits thons rouges (*Thunnus thynnus*) ont été relâchés après marquage par des chercheurs embarqués sur des senneurs, et 203 par des pêcheurs à la ligne à bord de bateaux de plaisance. En tout, 104 petits thons rouges ont été repris dans les eaux à mi-hauteur des côtes atlantiques: 94 d'entre eux (dont 25 furent relâchés de nouveau) par des senneurs, 6 par des palangriers japonais, et 4 par des plaisanciers. En outre, 65 autres recaptures de petit poisson ont été signalées pour 1976. Ceci porte le total des récupérations à 260 pour la période allant d'octobre 1975 à octobre 1976.

Deux thons rouges de taille moyenne ont été relâchés après marquage par des pêcheurs à la ligne à bord de bateaux de plaisance. Aucune récupération de thon rouge d'une taille moyenne lors du marquage n'a été signalée.

En 1977, outre les marques "H" standard, deux nouveaux types de marques ont été employés pour le thon rouge géant. En tout, 11 spécimens géants ont été relâchés après marquage aux Bahamas, et 190 dans le Golfe du Maine. Vingt marques posées sur des poissons géants ont été récupérées (une dans le Golfe du Mexique, et 19 dans le Golfe du Maine). Deux autres recaptures de thon rouge géant signalées pour 1976 donnent un total de 5 retours pour la période d'octobre 1975 à octobre 1976.

Le travail de marquage réalisé en 1977 a porté à environ 18.400 et 3.050, respectivement, le nombre total de marquages et récupérations de thonidés effectués par les Etats-Unis (programme de marquage en collaboration "National Marine Fisheries Service" et "Woods Hole Oceanographic Institution"), tous types d'engins et tous secteurs, depuis 1954.

#### RESUMEN

Trata sobre las actividades de marcado y resultados del "Atlantic Bluefin Tuna Program" realizado por Estados Unidos, cubriendo el periodo desde el 1 de noviembre 1976 hasta el 30 de septiembre 1977. Tuvo lugar en el Atlántico central frente a la costa estadounidense; 1.672 atunes pequeños (Thunnus thynnus) fueron marcados y liberados por personal a bordo de cerqueros, y 203 por pescadores de caña a bordo de barcos deportivos. Un total de 104 ejemplares pequeños fueron recapturados frente a la costa del Atlántico central: 94 por cerqueros (25 fueron liberados de nuevo), 6 por palangreros japoneses y 4 por embarcaciones deportivas. Además se informó la recaptura de 65 peces de pequeña talla en 1976, lo que suma un total de 260 recuperaciones en el periodo octubre 1975-octubre 1976.

Pescadores de caña a bordo de barcos deportivos, marcaron y liberaron 2 atunes de talla media. No se informó sobre recuperación de ejemplares de esta talla.

En 1977, además de las marcas standard "H", se emplearon dos nuevos tipos para atunes gigantes; 11 ejemplares de esta talla se marcaron y liberaron en las Bahamas y 190 en el Golfo de Maine. Las recuperaciones fueron 20: una del Golfo de Méjico y 19 del Golfo de Maine. Dos recuperaciones de marcas en atunes gigantes en 1976 hacen un total de cinco, para el periodo: octubre 1975 a octubre 1976, ambos inclusive.

Los resultados del programa de marcado efectuado por Estados Unidos en 1977 (National Marine Fisheries Service-Woods Hole Oceanographic Institution Cooperative Tagging Program) son como sigue: 18.400 atunes liberados y 3.050 recuperaciones, aproximadamente, en todas las zonas y con todo tipo de artes, desde 1954.

In this report we update data presented by Mason, [Mather] and Baglin (1977), and describe tagging activities of the U.S. Atlantic Bluefin Tuna Program as conducted by the Southeast Fisheries Center (SEFC) of the National Marine Fisheries Service (NMFS) and its contractee, the Woods Hole Oceanographic Institution (WHOI). We also include preliminary results of a synoptic tagging survey of giant bluefin in the Gulf of Maine conducted jointly by the SEFC and the Northeast Regional Office (NERO) of the NMFS.

#### MATERIALS AND METHODS

Throughout this paper, the tuna are divided into four size categories according to Kivas (MS)<sup>4</sup>. In this paper the size category that fish were assigned to was based on the size of the fish at release. Fish less than 50 cm fork length or less than 3 kg round weight are considered as age 0 tuna. Fish less than 150 cm fork length or less than 66 kg round weight, (ages 0 through 5) are considered small bluefin tuna (school tuna). The age 0 fish are included in the small bluefin category. Fish 150 to 190 cm fork length, 66 to 136 kg round weight, (ages 6, 7, and 8) are considered medium bluefin. Fish greater than 190 cm fork length, 136 kg round weight (ages 9 and older) are considered giants. The mid-Atlantic coast is defined as the area between Cape Hatteras, North Carolina, and Cape Cod, Massachusetts.

Atlantic bluefin tuna were tagged from recreational fishing boats with type "D" and "H" tags (Akyüz, 1970), both by cooperating anglers and by field party personnel working with the Atlantic Bluefin Tuna Program.

Some giant bluefin were tagged in the Bahamas using new "porpoise" tags manufactured by the Floy Tag Company. These tags have a stainless-steel dart similar to the "H" tags, a plastic-coated stainless-steel wire (approximately 57 cm in length and 0.2 cm in diameter), and a yellow plastic streamer approximately 1 cm wide, 0.3 cm thick, and 45 cm long. These tags are referred to as "ST" tags (Figure 1).

In 1977, U.S. regulations required that handgear (rod and reel, handline, harpoon) fishermen tag all released bluefin tuna 136 kg (300 lb) or heavier, with no closed season for tagging and releasing.

U.S. regulations for 1977 set a quota of 800 short tons (726 metric tons) for the open purse seine season and 200 short tons (181 metric tons) for the tagging season. This year, however, the open purse seine small fish quota was exceeded. Consequently, the tagging quota was reduced to 100 short tons (91 metric tons). Field party personnel tagged small fish with "D" and/or "H" tags, and collected fork length data on small fish taken on three purse seine vessels during the tagging quota.

Another U.S. regulation implemented in 1977, set aside 100 giant bluefin tuna from the handgear quota of 2,000 fish for special scientific research. These 100 specimens formed the basis of a cooperative synoptic tagging survey of the bluefin population of the Gulf of Maine begun by the NERO and the SEFC.

<sup>4</sup>Preliminary models of annual life history cycles of the North Atlantic tuna (*Thunnus thynnus*). ICCAT SCRS (Madrid, 1977).

The 100 fish were reserved for the exclusive use of approximately two dozen fishermen who are participating in the tagging program and are allotted one fish above the daily quota for every five tagged. These fishermen are tagging free-swimming fish with "harpoon" tags and keeping records of observations under the supervision of NMFS personnel and other observers aboard the vessels. After a preliminary study to determine colors that could most readily be seen from both vessels and spotter aircraft, the "harpoon" tags have been color-coded for different areas and time periods. These tags are made of nylon tape (45 cm long and 5 cm wide) with indelible ink legends, and are attached by 15 cm of stainless-steel wire to a conical bronze dart measuring 5 cm long. This dart fits on a 10 cm pike that screws into a threaded harpoon head (Figure 1). They are applied with a standard length harpoon pole (4.3 m) equipped with a rubber stopper and held in place with a rubber band while the harpoon was thrown. Several tags were placed in fast flowing sea water for over 11 weeks with no detectable difficulties in design; however, since these tags were not field tested on tuna, a plastic streamer (either 15 cm or 45 cm long) with a printed legend was attached. Later in this study, four of these tags were placed in tuna held in captivity and observations were made.

The U.S. Federal Government made a pecuniary contribution to the International Commission for the Conservation of Atlantic Tunas (ICCAT) to promote the tagging of eastern Atlantic bluefin, and WHOI personnel participated in the tagging of age 1 fish off the coast of Morocco.

The SEFC has microfilmed all of the WHOI release data from 1954 through 1974 and has approximately 50% of this historical data computerized.

#### RESULTS AND DISCUSSION

##### Small Bluefin Tuna

##### Releases

During the 1977 purse seine tagging season, 1,672 bluefin ages 1 through 4 were measured, tagged with "D" and/or "H" tags, and released off the mid-Atlantic coast of the United States. Of these, 120 were age 1, 1,527 were age 2, 8 were age 3, and 17 were age 4. Therefore, about 91% of the bluefin tagged from purse seine vessels were age 2. Also, 25 previously tagged fish were recaptured and re-released. Of these small fish tagged and released, 501 were double tagged (219 with two "H" tags, 214 with two "D" tags, and 68 with one "D" and one "H" tag).

A total of 203 small bluefin were tagged and released by recreational fishermen off the mid-Atlantic coast mostly within about 20 miles off shore. Of these, 40 were age 0 fish (about 0.5 kg and 30 cm) tagged off Virginia in late September. In the future there should be an increased effort in tagging age 0 fish, especially off the Florida coast in July and August. This effort should allow us to learn whether bluefin spawned in the Gulf of Mexico are actually recruited to the small fish fishery off the mid-Atlantic coast of the United States, to study their growth rates, and to obtain at least an approximate idea of their mortality rates.

As a result of the cooperative effort of scientists from Morocco, Spain, and the United States, 121 age 1 bluefin were tagged off the Moroccan coast near Casablanca. The Moroccan cooperative tagging effort is important in the study of transatlantic movement because it is necessary to define the relationship between eastern and western Atlantic bluefin tuna.

### Returns

A total of 104 small bluefin were recaptured between November 1, 1976 and September 30, 1977 (81 single-tag recaptures, of which 5 had previously shed a tag, and 23 double-tag recaptures). Of these 104 fish, 94 were caught by purse seine vessels, 6 by Japanese longline vessels, and 4 by recreational fishing vessels. Eighty of the 94 fish caught by purse seine vessels off the mid-Atlantic coast had been tagged and released aboard purse seiners (7 during 1974, 47 during 1976, and 26 during 1977) in the same general area in which they were recaptured. The data, however, does suggest a northward movement during the summer. Fourteen of the purse seine caught fish had been released by recreational fishermen along the eastern coast between Cape Hatteras and Cape Cod (1 during 1974, 3 during 1975, 5 during 1976, and 5 during 1977). They were all recaptured in the southern part of this area by purse seine vessels. Also, evidence is available from 1977 purse seine catches which corroborates findings during past years that fish caught, tagged, and released rejoin other nearby schools within a short time. Several fish were recaptured during the same day that they were released. In fact, one fish was recaptured twice during the same day. Of the 104 small bluefin, four that were originally released aboard U.S. purse seine vessels off Virginia were recaptured by recreational fishermen in the same general area. Six of the 104 bluefin that were released during July and August of 1974 and 1976 were recaptured by Japanese longliners during December 1976 and January 1977. They had been tagged aboard U.S. purse seine vessels fishing approximately 10 to 35 miles off the mid-Atlantic coast of the United States between 36° to 40° N latitude, and 70° to 75° W longitude. These fish provide additional information on the wintering grounds of small bluefin, and together with the six similar previous returns noted in Mason, [Mather], and Baglin (1977) and Mason (1975), indicate that the area approximately 150 to 250 miles off the northeast coast of the United States between 38° to 40° N latitude and 64° to 72° W longitude (Figure 2) may be a significant wintering ground for small bluefin.

Of the 104 recent recaptures of small bluefin, 33 had been released in 1977, 58 in 1976, 3 in 1975, and 10 in 1974 (Table 1). All the fish were recaptured in the western Atlantic. Therefore, there were no reported transatlantic migrations of small fish during 1977. In fact, there have been no such migrations recorded since the 1970 recovery of two tags in fish taken off the northeastern U.S. Coast.

A fish tagged from a purse seine vessel during August 1974, measuring 86 cm, was recaptured as a medium fish (160 cm) during January 1977 by Japanese longliners in the same general area off the northeast coast of the United States as the small fish that were recaptured by the longline vessels (Figure 2). This may indicate that medium bluefin, which are practically absent now from the U.S. fishery, may be concentrated farther offshore where only Japanese longline vessels are fishing, especially during the cold months.

Sixty-five additional recaptures of small bluefin in 1976 are reported here bringing the total to 260 for the reporting period of October 1975 through October 1976. Most of the fish were ages 1 to 3 and were recaptured aboard purse seine vessels fishing off the mid-Atlantic coast of the United States during 1976. One of these recaptures was released at age 0 weighing about 1.4 kg (3 lb) in October 1973 by an angler off New Jersey. This fish was recaptured by a Canadian purse seine vessel fishing off New Jersey during August 1976 (no size data reported), and is the fifth reported return of a fish tagged at age 0 in the western Atlantic. As previously mentioned, since very few of this age group have been tagged and recaptured, valuable migratory information could be obtained by increasing tagging efforts on these fish.

There was also a late report of a bluefin released by a purse seine vessel approximately 40 miles southeast of Block Island, Rhode Island, during August 1966 at age 1 and about 56 cm fork length. It was recaptured as a giant by a Japanese longliner in the Gulf of Mexico during April 1976 (Figure 2). It was reported at 218 cm fork length. This fish sets a new time at large record for Atlantic bluefin tuna of almost 10 years (3,545 days), thus providing us with valuable growth information.

The recent regulations for purse seine vessels which set a total seasonal quota of 1,000 short tons (907 metric tons) for small bluefin tuna may have an effect on our tag returns. The decrease in the return rate (1.7%) for fish released and recaptured in 1977 (Table 2), when compared to same season rates for earlier years (Mason, [Mather] and Baglin, 1977), may be the result of greatly reduced fishing time (<8 days for any boat) and tagging only at the end of the season. When the return rates from earlier years are examined, however, some suggestions emerge. The percent of 1977 returns from 1976 releases is also low (2.4%), and may show that an increase of the western Atlantic small fish population is occurring due to U.S. regulations. The fish released in 1976 had an equal chance of being re-taken throughout the 1977 season, and the return rate is still low when allowance is made for years of larger catches. The 1977 return rate for 1975 releases is also low (1%), and most of the returns are fish from the 1973 year class which is believed to be the dominant one in our present purse seine fishery, and our data continue to support this assumption. The significant 1977 return rate for 1974 releases (0.6%) supports this since all but one of these fish is a member of that year class. In addition, since the 1973 year class made up the predominant portion of this year's catch, fewer fish were taken per ton than in most years when the average age of the fish taken was between ages 2 and 3 (unpublished Woods Hole Oceanographic Institution data). This would also make a reduction in return rates more likely.

### Medium Bluefin Tuna

#### Releases

One medium bluefin, estimated to be 114 kg (250 lb), was tagged and released off Block Island, Rhode Island, during August 1977. Another medium bluefin, estimated to be 95 kg (210 lb), was released off Block Island, Rhode Island, during September 1977.

## Returns

No returns were reported for bluefin tuna tagged as medium-size fish.

As is true of age 0 fish, there is little information available for medium bluefin; therefore, increased effort should be made to tag a sufficient number of fish of this size.

## Giant Bluefin Tuna

### Releases

During the period from November 1, 1976 to September 30, 1977, five giant bluefin were released in the Bahamas with "H" tags and six with "ST" porpoise tags. This brings the total releases from the Bahamas to 1,105 since 1954 (Table 1). Additionally, 33 giant bluefin were tagged with "R" tags and released by handgear fishermen off the northeast coast of the United States, and 157 giants were tagged in the Gulf of Maine, using "harpoon" tags (Table 1). Due in part to U.S. regulations that set aside 100 giant fish to be used for scientific purposes, and in part to the cooperation of harpoon fishermen, more giant bluefin than ever before have been tagged this year in the Gulf of Maine. This year's tagging exceeds the combined total of 117 fish from 1966 through 1976.

We were interested in what effect the new "harpoon" tags might have on tuna, so in early September, we placed four of these tags in giant bluefin tuna held in captivity in the pens in St. Margarets Bay, Nova Scotia. While observing these fish, obvious signs of abrasions were noted. A large, rectangular white patch developed on the skin under the streamer, probably caused by the fluttering motion observed in the plastic tape used in these streamers. When the fish were slaughtered in early November two of the tags were missing.

### Returns

A total of four giant bluefin tagged with "H" tags were recaptured in 1977, three of which were released and again recaptured in the Gulf of Maine. One of these three fish, recaptured during July 1977, had been tagged in August 1975 while free-swimming. The other two, captured by rod and reel, were released in August 1974 and October 1975, and recaptured by handline and rod and reel in July and August 1977. The other giant bluefin released in June 1975 by a U.S. recreational fisherman in the Bimini-Cat Cay area of the Bahamas, was recaptured in April 1977 by Japanese longliners in the Gulf of Mexico (Figure 2).

A total of 16 giant bluefin tagged this year with "harpoon" tags during June, July, and September, were recaptured during July, August, and September in the Gulf of Maine (8 by handline, 3 by harpoon, 4 by purse seine, and 1 by rod and reel). These returns indicate that once the giant fish reach their summer destination to feed, they remain there until fall. Over 30 separate sightings of streamer harpoon tagged fish have been reported by fishing boats and aircraft. The sighting of the tags which are color-coded for time and geographic area eliminates the need for each tagged fish to be recaptured to derive useful information. More valuable information should be obtained from these tagged fish after they leave their summer feeding grounds.

There was an additional giant return reported here for 1976 (Figure 2). This brings the total to five for the reporting period of October 1975 through October 1976. This fish was estimated to weigh 181 kg (400 lb), when released in the Bimini-Cat Cay area of the Bahamas by a recreational fisherman during May 1971. It was recaptured by a Japanese longliner in the Gulf of Mexico during March 1976. This fish was reported to weigh 250 kg (550 lb) and was at liberty for 1,772 days.

For the first time, therefore, in 1976 and 1977, giants tagged in the Bahamas have been recaptured in the Gulf of Mexico. These fish may have been tagged on their migratory route to the northern feeding grounds and later recaptured at the spawning grounds in the Gulf of Mexico. This brings the total returns for the Bahamas since 1954 to 17 (9 migrating to Norway, 4 to northeastern North America, 2 to South America, and 2 fish to the Gulf of Mexico). In the past two years, there have been fewer fish tagged off the Bahamas in comparison to other years (Table 1). Increased tagging effort is needed in this area to better determine the migratory routes taken by fish passing through the Bahamas.

As has been discussed, increased tagging efforts are needed in several areas to obtain necessary data needed to manage the fishery.

### LITERATURE CITED

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- Mason, J.M., Jr.; [F.J. Mather, III]\* and R.E. Baglin, Jr. 1977. Results of United States Cooperative Tagging of Atlantic Bluefin Tuna, October 1975 through October 1976. International Commission for the Conservation of Atlantic Tunas. Collective Volume of Scientific Papers 6(18): 259-264. \*Mather's name was omitted in error from table of contents and one of the title pages.

Table 2. Releases of small bluefin tuna off the mid-Atlantic coast of the United States by years, and returns in percent of releases by region of recapture, and by time at large.

Releases		Returns							Total	Bay of Biscay Months at large 11.0-60.0
		Mid-Atlantic Coast								
		Months at large								
Year	Number	0-5.9	6.0-17.9	18.0-29.9	30.0-41.9	42.0-53.9	66.0-77.9			
1954	169	0.6	0	0	0	0	0	0.6	1.2	
1955	215	0	0	0	0	0	0	0	0	
1956	58	0	0	0	0	0	0	0	0	
1957	34	0	2.9	0	0	0	0	2.9	0	
1958	38	0	0	0	0	0	0	0	0	
1959	25	0	0	0	0	0	0	0	0	
1960	15	0	0	6.7	0	0	0	6.7	0	
1961	150	0	1.3	2.0	1.3	0	0	4.7	0	
1962	77	0	5.2	0	0	0	0	5.2	0	
1963	29	24.1	6.9	0	0	0	0	31.0	0	
1964	465	21.3	6.9	0	0	0	0	28.2	0	
1965	1,672	9.8	2.9	1.9	0	0	0	14.5	1.1	
1966	3,959	13.4	14.4	1.3	0.2	0.1	<0.1	29.4	0.4	
1967	628	15.4	9.4	2.4	2.1	0	0	29.3	0.3	
1968	260	33.8	7.3	3.1	0	0	0	44.2	0	
1969	336	3.6	24.4	3.6	0.6	0.3	0	32.4	0	
1970	458	10.9	25.8	2.0	1.5	0.2	0	40.4	0	
1971	342	3.2	17.3	2.6	0	0	0	23.1	0	
1972	193	4.7	27.5	2.6	0	0	0	34.7	0	
1973	351	12.0	5.4	2.0	0.3	0	0	19.7	0	
1974	1,713	4.2	7.2	2.4	0.6	0	0	14.4	0	
1975	309	7.1	7.1	1.0	0	0	0	15.2	0	
1976	2,379	5.5	2.4	0	0	0	0	7.9	0	
1977	1,900	1.7	0	0	0	0	0	1.7	0	

Table 1. Releases and returns of small and giant bluefin tuna by year and area.

Year	Small Bluefin		Giant Bluefin		New England Number of Returns to Date
	Mid-Atlantic Coast of U.S. Number of Releases	Number of Returns to Date	Bahamas Number of Releases to Date	Number of Releases to Date	
1954	169	3	21	0	0
1955	215	0	14	0	0
1956	58	0	41	0	0
1957	34	1	0	0	0
1958	38	0	0	0	0
1959	25	0	25	0	0
1960	15	1	13	2	2
1961	150	7	34	2	2
1962	77	4	45	1	1
1963	29	9	147	1	1
1964	465	131	41	0	0
1965	1,672	261	55	0	0
1966	3,959	1,180	105	2	2
1967	628	186	82	1	1
1968	260	115	57	0	0
1969	336	109	50	2	2
1970	458	185	182	1	1
1971	342	79	49	2	2
1972	193	67	32	1	1
1973	351	70	47	2	2
1974	1,713	256	31	0	0
1975	309	52	18	1	1
1976	2,379	237	5	0	0
1977	1,900	33	11	0	0
Totals	15,775	2,986	1,105	17	36

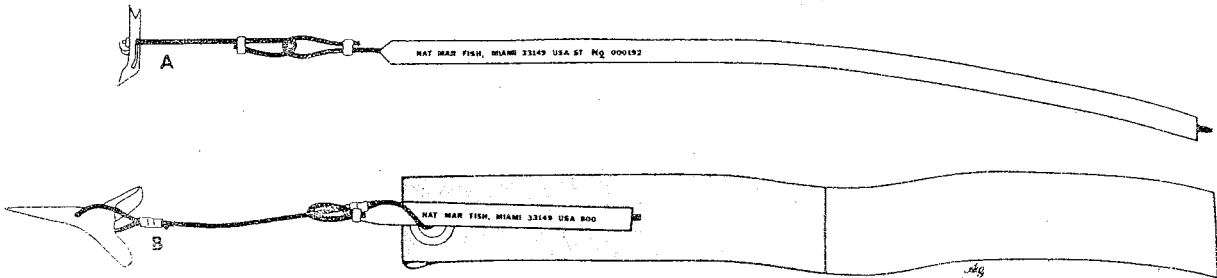


Figure 1. A. "SI" porpoise tag used during the spring of 1977 to tag giant bluefin in the Bahamas.  
 B. "Harpoon" tag used during the summer of 1977 to tag giant bluefin in the Gulf of Maine.

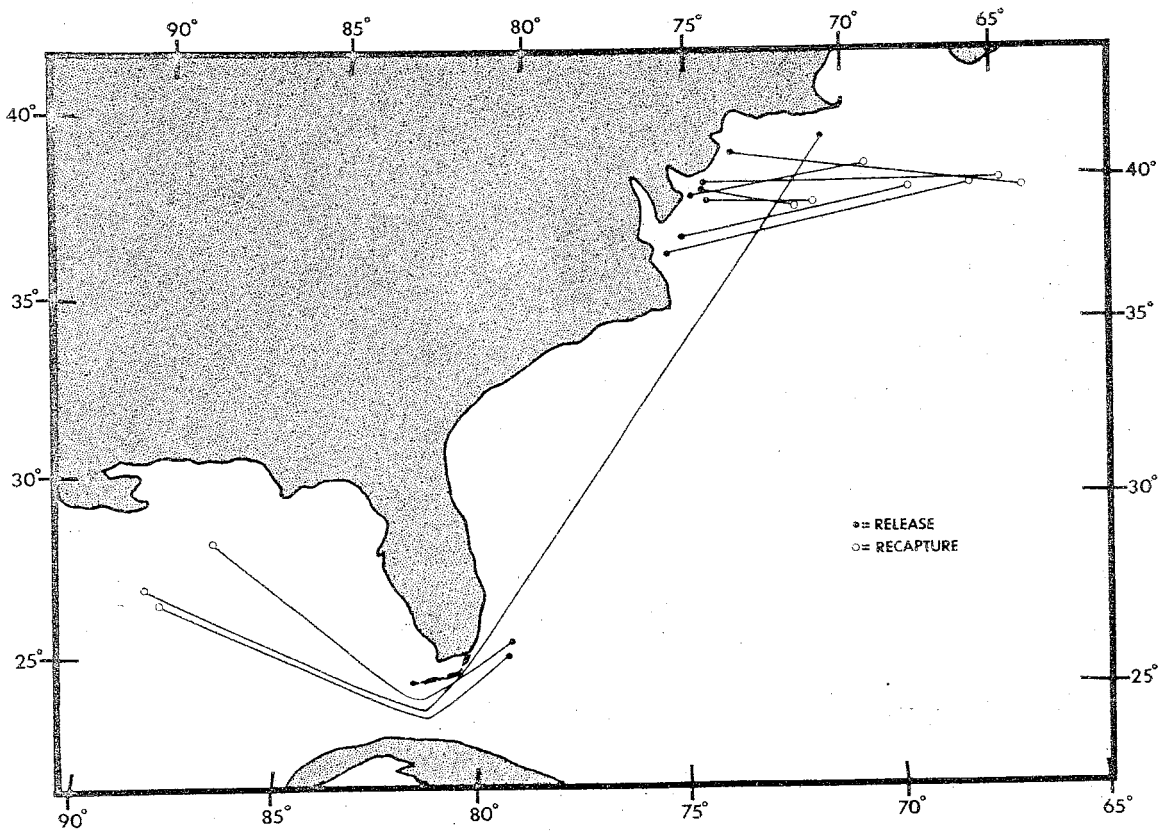


Figure 2: Recent tag returns from Japanese longline vessels. Lines connecting approximate release and recapture localities represent shortest water routes. Modified Gnomonic projection.