

COOPERATIVE TAGGING CENTER RELEASE AND RECAPTURE ACTIVITIES FOR BLUEFIN TUNA: 1954-1996

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SUMMARY

A summary of tag release and recapture activities for Atlantic bluefin tuna (*Thunnus thynnus*) from the National Marine Fisheries Service's Cooperative Tagging Center are reviewed for 1954-1996. Release and recapture data are evaluated by year, gear type, and size category (school, medium, and giant size categories). Historical trends for scientific and volunteer release efforts are presented, along with insight into the efficiency of these tagging activities. The majority of bluefin tuna have been tagged and released in the western north Atlantic during the summer months, June through September. Recently, there have been significant shifts in spatial and temporal release patterns, mainly due to a unique recreational fishery which developed off Hatteras, North Carolina, in 1994. The historical recapture percentage for bluefin tuna is 12.7%. More recent recapture percentages over the last decade are between 5-10%. Transatlantic movements are presented by size category. Release and recapture records can generally be grouped into two major gear-related release epochs: 1954 to 1981, when purse seine vessels released mostly school size fish; and 1982-1996, when the recreational rod and reel fishery dominated releases of mainly medium and giant size fish.

RESUME

Le présent document récapitule les activités de marquage et les recaptures de thon rouge (*Thunnus thynnus*) du Cooperative Tagging Center du NMFS de 1954 à 1996. Les données de marquage et de recapture sont évaluées par année, par type d'engin et par catégorie de taille (catégories : juvéniles, poissons de taille moyenne et géants). On indique l'évolution historique du travail des scientifiques et des volontaires, ainsi qu'une appréciation de l'efficacité de ces activités. La plupart des thons rouges ont été marqués et remis à l'eau dans l'Atlantique nord-ouest pendant les mois d'été, juillet à septembre. Il s'est produit récemment des déplacements significatifs des modes spatiaux et temporels du marquage, essentiellement dus à une pêche sportive de caractère unique qui s'est développée en 1994 au large du Cap Hatteras, en Caroline du Nord. Le pourcentage historique de recapture de thon rouge est 12,7 %. Les pourcentages les plus récents de la dernière décennie allaient de 5 à 10 %. Les déplacements transatlantiques sont énumérés par catégorie de taille. On peut en général regrouper les registres de marquage et de recapture selon deux périodes principales associées aux engins : 1954-91, lorsque les senneurs relâchaient surtout des juvéniles ; et 1982-96, lorsque se mirent à prédominer les marquages de poissons de taille moyenne et de géants par la pêche sportive à la canne/moulinet.

RESUMEN

Presenta un resumen de las actividades de marcado y recaptura, en relación con el atún rojo atlántico (*Thunnus thynnus*), del "National Marine Fisheries Service's Cooperative Tagging Center" en el período 1954-1996. Se evalúan los datos de marcado y recaptura por año, tipo de arte y categoría de talla (juvenil, medio y gigante). Se presentan las tendencias históricas de los esfuerzos voluntarios y científicos en materia de marcado, junto con una visión de la eficacia de estas actividades. La mayor parte de los atunes rojos han sido marcados y liberados en el atlántico noroeste durante los meses de junio a finales de septiembre. Recientemente se han producido importantes cambios en los esquemas espacio-temporales, debido sobre todo a una pesquería de recreo de tipo único que se desarrolló en 1994 frente a Hatteras, Carolina del Norte. El porcentaje histórico de recaptura de atún rojo es el 12,7%. Porcentajes más recientes de recaptura, durante la última década, están entre el 5 y el 10%. Los movimientos trasatlánticos se presentan por categoría de talla. Los registros de marcado y recaptura pueden agruparse en dos principales épocas de marcado: 1954 a 1981, cuando los cerqueros marcaron y liberaron sobre todo peces juveniles, y 1982 a 1996, cuando esta actividad estaba dominada por la pesquería de caña y carrete, con peces sobre todo de tamaño medio y gigante.

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INTRODUCTION

The Cooperative Game Fish Tagging Program (CGFTP) was first initiated at Woods Hole Oceanographic Institution (WHOI) in 1954 to study bluefin tuna. In 1973, the program became a combined effort between Woods Hole and the National Marine Fisheries Service (NMFS). The NMFS Southeast Fisheries Science Center (SEFSC) took over sole operation of the program in 1980. In 1992, the CGFTP was re-named the Cooperative Tagging Center (CTC) in order to better reflect the recent expansion of tag release and recapture activities, data requests from other tagging agencies, and domestic and international tagging research needs. The CTC encompasses a variety of functions and responsibilities that center around maintaining and handling a large mark-recapture database for bluefin tuna and other highly migratory species from 1954 to the present.

The objectives of this report are to summarize the historical tag release and recapture files of bluefin tuna for the period 1954 through August 1996. An overall synopsis of the mark recapture data by gear type and size category are presented, along with an analysis of trans-atlantic movements and a more detailed examination of the recent bluefin tuna fishery which developed off of Cape Hatteras, North Carolina.

METHODS

Program Operation

An overall description of the CTC tagging program is given in Scott et al. (1990). Individual participants are provided tagging kits upon request which contain tags, tag report cards, stainless steel applicators, and other items which are needed during the tagging event. The type of tags used has changed over the years. The stainless steel dart tag was the primary tag used from 1954 through 1994. Most recently, a medical grade nylon double barb dart was introduced by The Billfish Foundation (TBF) in 1990 and adopted by NMFS in 1995 (National Marine Fisheries Service, 1995). The TBF tag is similar to the latter, though the CTC streamer includes the Japanese characters for the word "reward" in an effort to increase recoveries from Japanese longline vessels. When the fish are tagged, the participant records the event on the tagging report card and mails it to the NMFS Miami Laboratory, where the data and angler information are quality controlled, coded, and entered into the main database. Release data consists of species, date, location, size in length and weight (along with more specific descriptors), and gear type. When the fish is recaptured, the angler calls a toll-free phone number or mails in the information of the recapture (CTC address and number are printed on the streamer). This information is quality controlled, entered as reported into the database, and then coupled with the release information. If there are discrepancies in the release and recapture information (e.g., different species), every effort is made to correct the problem before the information is entered. Both the release and recapture participants receive a reward (tagging hat) and letter summarizing the dates, location of release and recapture, and size specifics of each tag event.

Bluefin Tuna Size Categories

In this paper, bluefin tuna are partitioned into 3 size categories: school, medium and giant. Reported round weight at release or recapture (which can be either measured or estimated) was used as the primary method of determining size category. Where weight was not reported, lower law fork length was used to assign a size group. School size fish are classified as animals 0 to 135 lbs. (61.22 kgs.) or 0 to 56 in. (144 cm.) fork length. Medium fish are between 135 and 311 lbs. (61 to 140.59 kgs.) or 56 to 81 in. (144-206 cm) fork length. Giant fish are considered anything greater than 310 lbs. (140.59 kgs.) or greater than 81 in. (205 cm.) fork length.

Movement

In this paper, movements between point of release and point of recapture are referred to as minimum distance traveled and are not intended to infer route taken. Minimum distance traveled are calculated in

nautical miles using the release and recapture latitude and longitude coordinates. An algorithm developed by Shudde (1984) based on spherical geometry was used to compute minimum straight-line distance between the two coordinates. Since conventional tagging models represent a Eulerian approach to movement, no information is gained on the actual route taken by the fish to the recapture location. Hence, these movements serve only to illustrate the overall location of the fish at recapture relative to the location at release.

Fishing Gear

The types of fishing gear used in release and recapture activities are part of the basic information traditionally recorded in the CTC program. For the purposes of this report, we have characterized gear as purse seine, rod and reel, and other. Other gear include longline, harpoon, hand line, gill net, trawl, and miscellaneous. It should also be noted that release activities involving with purse seine gear were conducted by scientists (i.e. scientific tagging) and mostly involved measured sizes at release. Those release activities associated with rod and reel gear were nearly all ways conducted by volunteer recreational anglers (volunteer tagging) and size at release is most often estimated.

RELEASE RECAPTURE ACTIVITIES

Historical Release Activities

There are a total of 33,999 tag-released bluefin tuna records in the CTC database: 19,061 (56%) were caught using purse seine gear, 12,835 (38%) on rod and reel gear, and 2,103 (6%) on other gears types. Figure 1A shows the total number of releases by year and by gear type. Yearly releases are broken down by size group and gear type in Figures 1B, 1C, and 1D for the period 1954 to August, 1996. The majority of these releases took place offshore of the U.S. east coast (29,395). Seasonally, most release activity from 1954-1993 has taken place during the summer months, particularly June, July and August (Figure 2A). However, there has been a recent shift in important spatial and seasonal patterns of releases of bluefin tunas, mainly due to the development of a rod and reel fishery off the north Carolina coast, particularly Cape Hatteras region. For example, historically there are few releases off the Hatteras area (<1%) prior to 1994. In 1994, there were a total of 38 releases off Hatteras (10.6% of all 1994 releases). By 1995, there were 678 releases off Hatteras (43.3% of all 1995 releases) and in 1996 there were, as of August, 1686 releases (91% of overall releases). This change in spatial patterns of tag releases, is accompanied by changes in temporal patterns. Figure 2B demonstrates a bimodal pattern of seasonal release activity within the database, with peak releases now occurring in January, February and March.

Historical Recapture Activities

There have been a total of 4,327 bluefin tuna tags recovered: 3,453 (80%) were caught on purse seine, 602 (14%) on rod and reel, and 6% on other gear types. The total number of recaptures by year partitioned by gear type are illustrated in Figure 3A. Yearly recaptures are partitioned by size group and gear type in Figures 3B, 3C, and 3D. The majority of recaptures took place offshore of the U.S. east coast.

The historical recapture percentage for all releases, which combines all gears and size categories is 12.7%. The highest recapture percentage for a single year of releases was 28.3% for the 1966 tagging year. More specifically, this represents the percentage of fish eventually recaptured anytime after the 1966 release year. The recapture percentage by release year are shown in Figure 4A. The average time at large for a tagged fish is 334 days, with most bluefin tuna at-large less than 3 years (Figure 5). The longest time at-large for a tagged bluefin tuna was 6,556 days (18 years). This fish was released at 40°38'N 72°06'W on Sept. 7, 1968 and recaptured at 42°20'N 70°30' W on Aug. 19, 1985, a straight line distance of 125 nm.

Historical Trends

The average minimum distance traveled by a recaptured bluefin tuna is 169.4 nautical miles. Of the bluefin tunas recaptured, 43% have been retrieved 50 nautical miles or less from the release point, and 63% recaptured 100 nautical miles or less from the release point. There have been several important movements of bluefin tuna in the history of the CTC, including transatlantic and transequatorial movements.

Transatlantic Movements

Fish tagged on one side of the Atlantic and recovered on the other side have occurred almost every year since the tagging program was initiated in 1954, particularly during the last two decades. However, such transatlantic movements are still relatively rare. What constitutes a transatlantic movement is somewhat subjective, depending on which east-west stock delineation is used. For the purposes of this paper, we use the east-west stock coordinates outlined for Atlantic bluefin tuna north of latitude 10° N (Anonymous, 1995), with longitude 45° W being the demarcation between the east and west Atlantic. Below 10° N latitude, the line steps westward to the equator, where the line is positioned at 25° W southward.

There were a total of 79 tag recaptured bluefin tuna in the database that demonstrated transatlantic movements (conforming to the above definition). These movements were from the western to the eastern Atlantic and include: 18 giant, 7 medium, 50 school, and 4 unspecified size bluefin. The specific position coordinates and dates for eastward transatlantic movements are given in table 1A for giant size, 1B for medium size, and 1C for school size bluefin tuna. transatlantic movement patterns for giants, mediums, and school size bluefin tuna are illustrated in Figures 6A-C. At this time, there have been no documented eastern to western transatlantic movements involving bluefin tuna tagged in CTC.

Major Gear Release and Recapture Epochs

Release and recapture records can generally be grouped into two major gear-related release epochs: 1954 to 1981, when most fish were released by purse seine vessels; and 1982-1996, when the recreational rod and reel fishery dominated releases. Figures 1 demonstrate the importance of the purse seine fishery to the total number of releases for the 1954 to 1981 period (Figure 1A), particularly the school size bluefin tuna fishery (figure 1B). This size group and gear type dominates the total releases for this time period. This period contained few releases of the medium size category for any gear type (Figure 1C). The rod and reel fishery, with the exception of 1977-1979, dominated the giant size release group, though total number of releases are small compared to the school size category.

For the second major epoch, 1982-1996, the recreational rod and reel fishery dominates the overall releases (Figure 1A). During the 1994-1996 tagging seasons, there was an unusually high number of medium and giant size fish released by the rod and reel fishery. This was a result of the unusual fishery which developed off the Hatteras, North Carolina coast.

A patterns similar to releases (Figure 1A-D) can be observed in the total recaptures by gear type and size category (Figure 3A). Like the releases, the school size fish (figure 3B) dominate the overall number of recaptures. However, unlike the release distribution of gear types for medium and giant size groups, gears other than purse seine and rod and reel play an important role in the retrieval of tags. However, in the last few years, 1994-1996, there is a dominance of recreational rod and reel tag retrievals in all three size categories (Figures 3B-3D). This also relates to the spatial and temporal changes in releases brought about by the Hatteras fishery (Figure 2A-B).

This report is intended to provide a comprehensive summary of the release and recapture data for bluefin tuna in NMFS's Cooperative Tagging Center, 1954-1996. Two major gear related patterns of release and recapture activities are identified from the historical data base. The first epoch occurred from 1954-1981 when most of the tagged fish were released from commercial purse seine vessels. Tag release activities during this period are characterized by scientists conducting the tagging, and mostly involved large numbers of school size tuna with a measured size (length) at release. Conversely, rod and reel gear dominated release activities from 1982-1996. These release activities were characterized by volunteer recreational fishermen conducting the tagging of modest numbers of mainly medium and giant size tuna and for the most part, size at release was estimated, not measured. It is interesting to note that scientific tagging from purse seine vessels resulted in much greater quantities of school fish being released in the early years (1954-1981), compared to the recent rod and reel release effort (1982-1995) by recreational anglers, who targeted mostly medium and giant size fish and released only modest numbers of fish.

Although the historical tag recapture percentage is 12.7%, this figure can be misleading for accessing the potential for current recapture percentages because of the dominance of purse seine tagging activities during the early 1960's - late 1970's. This is evident when examining the historical recapture percentages by release year (Figure 4), which indicates most release years from 1964-1977 had recapture percentages over 15%. Moreover, during this same period, 6 release years had recapture percentages over 20% -- these were years when purse seine tagging activities were highest. After 1982, the recaptures percentages averaged no more than 5-10% and involve only modest numbers of larger fish released or recaptured by rod and reel gear. The end of purse seine tagging activities is related to the change in regulations, which eliminated the purse seine fishery for school tuna. The large numbers of school size tuna that dominate purse seine releases may indicate that a numeric threshold is involved in obtaining a recapture rate of over 10% for Atlantic bluefin tuna. However, numerous other factors may also be involved in the recapture percentage that can be expected and these include: shedding by different style tags used during different periods, shedding of tags or differences in survival due to a disparity between scientific and volunteer tagging techniques, or differences in tag recapture reporting rates. The most important factors influencing the CTC recapture percentage for Atlantic bluefin tuna are presently unclear but likely involve several of the factors listed above. Baglin et al. (1981) evaluated that shedding rates associated with the steel anchor and single barb nylon dart tags on school size bluefin tuna tagged by scientists on purse seine vessels during the late 1970's. They found no statistical difference in shedding rates between tag types but also concluded that shedding rates were unacceptably high for both tag types (>20%).

Historically, the majority (over 90%) of tag recaptured bluefin tuna are caught within 2-3 years after release (Figure 5). However, the record time at-liberty for a bluefin tuna in the CTC is 18 years. Time at liberty does not necessarily appear to be associated with minimum distance traveled. Several historical trends for transatlantic crossings appear to exist by size category (Figure 6A-C). For example, the vast majority of school size tuna making transatlantic crossings moved from the U.S. northeast coast to the Bay of Biscay off Spain. Only 2 out of 48 transatlantic crossings by school bluefin tuna entered the Mediterranean Sea (Figure 6C). Conversely, a higher proportion of transatlantic crossings by medium and giant tuna entered the Mediterranean Sea (Figures 6A-B). In addition, transatlantic crossings by giant tuna in the 1960's through the early 1970's involved movements from the Bahamas to the North Sea. In one case a movement was recorded to the eastern tip of Brazil (Figure 6A). The extension of bluefin tuna distributions into the North Sea and off Brazil were common place during the 1960'-1970's, but were greatly reduced or eliminated as exploitation of Atlantic bluefin increased during the late 1970's through the 1980's. In fact, an intense fishery for bluefin tuna existed off Brazil in the late 1970's but has since disappeared (A. Fonteneau, personal communication). Concurrently, transatlantic crossings by giant tuna during the most recent decade have been restricted to movements from the northeast U.S. coast to the Mediterranean Sea or off the coast of Spain.

Development of the Hatteras Fishery

There has been an unprecedented effort to tag and release bluefin tuna in the past few years by the U.S. Atlantic recreational fishing community off Hatteras, North Carolina. This activity resulted in historical peaks in tag release and recapture efforts for medium and giant fish for 1995 and 1996 (Figure 1C and D, Figure 3C and D). In fact, more medium bluefin tuna have been tagged off Hatteras in 1995 and 1996 than the accumulated total over the previous 42 years of the CTC. In addition, the seasonality of the tag release effort has changed from predominately a summer time activity targeting school fish off New England states prior to 1994, to a winter activity targeting mature fish off Hatteras in 1995-1996 (Figure 2 A and B). The primary reason for the development of this winter fishery is the availability and catchability of large numbers of mature bluefin in this location. Because the fishery for mature bluefin tuna had traditionally been closed during the winter, catch and release and tag and release were the primary options for fishery participants. Also, changes in U.S. fishery regulations now require that a vessel can not fish for Atlantic bluefin tuna after the quota has been reached unless it carries a tagging kit issued by the CTC or other approved tagging program. The development of the unique winter fishery off the coast Hatteras started in 1994 with about 100 bluefin being tagged. However, as widespread knowledge of the fishery grew, increasingly larger numbers of bluefin were tagged and released in the succeeding two years. Education of the fishing community about the importance of resource conservation and encouraging the practice of tag and release fishing also influenced the emergence of this fishery. As a result, the potential for future tag release activities for mature Atlantic bluefin tuna appears optimistic.

Along with the increased tagging effort, tagging techniques used during the last two years of the Hatteras fishery have been refined by tagging participants and NMFS staff in an effort to maximize the chances of survival of tag released fish. Improvements include development of a dual applicator tagging pole to facilitate tag placement in the target area of bluefin tuna when they turn sideways as they come along side the boat (NMFS 1995). In addition, use of circle hooks are being used to minimize hook damage and special techniques to remove these hooks prior to release have also contributed to efforts to maximize survival of tag released fish.

In addition to increasing conventional tagging opportunities due to the emergence of the Hatteras fishery, the availability of large numbers of mature fish increased research opportunities for more sophisticated tagging, such as use of acoustic and archival tagging techniques. For example, a pilot study that was recently completed off Hatteras in March, 1996, resulted archival tags being successfully implanted into the body cavity of ten medium and giant Atlantic bluefin tuna (NOAA 1996). These are the first Atlantic bluefin tuna to be equipped with archival tags and the research effort was conducted by a team of scientists from the National Marine Fisheries Service, Stanford University's Hopkins Marine Station, and Monterey Bay Aquarium Tuna Research and Conservation Center. The research team had to overcome the significant obstacle of handling very large bluefin tuna on the high seas, as medium and giant tuna were successfully brought aboard fishing vessels and a short surgical procedure was used to implant the tags into the body cavity of these fishes.

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Table 1A. Transatlantic recovery data for west to east for giant size bluefin tuna. RelDate is the release date; RelLat is the release latitude; RelLon is the release longitude; RecDate is the recapture date; RecLat is the recapture latitude; RecLon is the recapture longitude East-west stock coordinates are defined as longitude 45° W from 10° N latitude northward. South of 10° N latitude, the line steps westward to the equator, where the line is positioned at 25° W southward.

Tag #	RelDate	RelLat	RelLong	RecDate	RecLat	RecLong	Distance (nm)
H072483	8/22/78	40° 46 N	71° 28 W	4/15/86	39° 40 N	3° 28 E	3322
H071676	6/22/80	36° 28 N	75° 40 W	5/20/86	38° 7 N	7° 57 W	3159
H020290	5/9/72	25° 30 N	79° 18 W	8/27/73	59° 58 N	5° 2 E	3920
H020284	6/8/73	25° 30 N	79° 25 W	9/12/74	59° 52 N	5° 0 E	3924
M008189	3/26/66	30° 0 N	60° 0 W	7/30/79	36° 25 N	6° 0 W	2703
CK000967	6/15/62	25° 30 N	79° 20 W	8/4/62	60° 40 N	4° 34 E	3901
R004549	8/21/86	41° 0 N	71° 0 W	6/6/92	39° 30 N	0° 30 E	3179
H074780	6/13/81	36° 12 N	75° 14 W	5/16/86	36° 0 N	5° 35 E	3790
R119071	9/29/90	41° 0 N	71° 0 W	6/2/95	38° 40 N	1° 48 E	3255
R185010	9/8/91	40° 0 N	65° 50 W	7/3/96	37° 36 N	0° 59 W	2967
H071704	6/22/80	36° 28 N	75° 40 W	5/30/89	35° 5 N	14° 0 E	4188
E000466	6/8/60	25° 30 N	79° 18 W	9/3/62	68° 38 N	14° 0 E	4053
E000446	6/4/60	25° 30 N	79° 18 W	8/6/62	60° 50 N	4° 20 E	3892
D058558	8/22/78	41° 0 N	71° 22 W	9/17/89	45° 40 N	42° 5 W	1301
D002385	6/1/61	25° 30 N	79° 18 W	9/28/61	61° 10 N	4° 30 E	3894
C009603	5/23/63	25° 27 N	79° 33 W	3/3/65	8° 31 S	32° 21 W	3729
B020548	5/24/67	25° 30 N	79° 16 W	8/14/67	59° 50 N	5° 0 E	3919
B019371	6/8/69	25° 30 N	79° 20 W	8/24/76	61° 28 N	4° 27 E	3891

Table 1B. Transatlantic recovery data for west to east for medium size bluefin tuna.

Tag #	RelDate	RelLat	RelLong	RecDate	RecLat	RecLong	Distance (nm)
G000054	7/27/54	41° 0 N	70° 50 W	8/16/59	43° 55 N	3° 25 W	2904
D012604	7/8/76	38° 50 N	74° 20 W	8/20/79	44° 15 N	2° 45 W	3128
H006960	7/23/66	39° 25 N	73° 36 W	8/18/70	44° 46 N	2° 38 W	3075
R340249	3/6/95	35° 7 N	75° 58 W	6/13/96	38° 54 N	1° 26 E	3600
R320382	10/3/95	41° 10 N	69° 23 W	6/1/96	39° 30 N	3° 0 E	3211
R269815	9/5/91	40° 50 N	71° 50 W	7/7/95	43° 58 N	4° 36 W	2900
R210436	10/8/90	40° 0 N	71° 0 W	6/2/95	39° 39 N	1° 58.6 E	3261

Table 1C. Transatlantic recovery data for west to east for school size bluefin tuna.

Tag #	RelDate	RelLat	RelLong	RecDate	RecLat	RecLong	Distance (nm)
D007650	7/21/65	39° 12 N	74° 3 W	7/22/66	43° 31 N	2° 18 W	3139
R211343	10/1/91	40° 34.4 N	71° 37.41 W	8/2/92	43° 48 N	2° 27 W	2990
H007204	7/21/66	39° 52 N	73° 34 W	6/20/67	43° 32 N	2° 42 W	3084
D057367	8/22/78	40° 51 N	71° 10 W	8/28/79	44° 30 N	2° 30 W	2946
D055434	7/2/77	37° 20 N	75° 15 W	8/15/79	44° 20 N	2° 50 W	3207
D009511	7/23/66	39° 25 N	73° 36 W	6/29/67	43° 45 N	2° 5 W	3119
D008802	8/14/65	40° 24 N	73° 41 W	9/14/66	43° 27 N	1° 48 W	3111

Table 1C (continued). Transatlantic recovery data for west to east for school size bluefin tuna.

Tag #	RelDate	RelLat	RelLong	RecDate	RecLat	RecLong	Distance (nm)
D008602	8/14/65	40° 24 N	73° 41 W	8/23/66	43° 25 N	2° 30 W	3084
D008487	8/14/65	40° 24 N	73° 41 W	8/3/66	44° 15 N	2° 30 W	3065
D008478	8/14/65	40° 24 N	73° 41 W	7/7/68	43° 55 N	2° 45 W	3062
D008343	8/4/65	40° 0 N	73° 31 W	8/9/67	45° 10 N	4° 0 W	2991
R210682	9/2/91	40° 50 N	71° 38 W	7/31/93	44° 38 N	2° 33 W	2960
D007446	7/7/67	39° 35 N	73° 38 W	7/3/69	43° 58 N	2° 48 W	3081
D006750	8/5/65	40° 24 N	73° 34 W	7/8/66	43° 20 N	2° 15 W	3092
D006665	8/4/65	40° 1 N	73° 17 W	10/23/66	43° 45 N	2° 30 W	3071
D006647	8/4/65	40° 1 N	73° 17 W	8/6/66	44° 20 N	4° 10 W	2991
D006453	8/21/66	40° 48 N	71° 40 W	8/1/67	43° 56 N	2° 47 W	2969
D006431	8/4/65	40° 1 N	73° 17 W	8/25/66	44° 50 N	4° 40 W	2961
R272065	10/26/91	40° 0 N	73° 20 W	7/12/93	44° 25 N	2° 45 W	3267
R272751	9/5/92	40° 40.5 N	70° 55 W	5/10/94	41° 7 N	1° 15 E	3172
C027431	8/21/65	40° 55 N	70° 32 W	8/17/67	43° 56 N	2° 12 W	2949
R277935	9/7/92	40° 40 N	71° 1 W	9/17/93	43° 55 N	2° 20 W	2965
D008384	8/14/65	40° 24 N	73° 41 W	8/23/66	43° 25 N	2° 30 W	3084
H007655	7/22/66	39° 43 N	73° 16 W	8/10/68	43° 24 N	2° 30 W	3087
M000445	8/21/65	41° 0 N	71° 30 W	8/14/67	43° 38 N	2° 6 W	2991
M001163	8/21/65	41° 0 N	71° 30 W	7/12/67	44° 1 N	2° 58 W	2947
M001166	8/28/66	40° 0 N	70° 0 W	8/2/67	44° 10 N	2° 20 W	2937
M002475	8/14/66	40° 41 N	71° 2 W	8/6/68	43° 26 N	2° 29 W	2970
H071014	7/13/79	38° 28 N	74° 19 W	7/6/80	44° 12 N	3° 20 W	3116
H070790	8/22/78	41° 0 N	71° 22 W	7/27/80	43° 50 N	2° 50 W	2952
H070554	7/2/77	37° 28 N	75° 12 W	7/15/78	43° 50 N	3° 3 W	3176
H029600	8/3/78	41° 0 N	71° 0 W	8/1/80	43° 50 N	3° 20 W	2917
M005295	8/21/65	41° 0 N	71° 30 W	8/10/66	45° 20 N	2° 25 W	2940
M005299	8/21/65	41° 0 N	71° 30 W	7/4/67	43° 47 N	3° 25 W	2934
D058448	7/14/77	38° 4 N	74° 47 W	7/22/79	44° 53 N	2° 52 W	3152
H007690	7/22/66	39° 43 N	73° 16 W	7/4/67	43° 22 N	2° 25 W	3091
H074168	7/3/77	37° 7 N	75° 28 W	7/28/78	44° 15 N	3° 47 W	3185
M013723	7/6/67	39° 35 N	73° 39 W	10/5/68	46° 20 N	2° 11 W	3057
R125103	9/15/91	40° 34.5 N	71° 10 W	7/8/93	44° 35 N	2° 44 W	2943
B019139	8/28/65	41° 0 N	71° 30 W	8/2/66	45° 0 N	2° 0 W	2964
H006603	7/25/66	40° 21 N	73° 22 W	7/12/67	44° 0 N	3° 0 W	3040
H006508	7/24/66	40° 19 N	73° 32 W	7/11/67	43° 35 N	1° 45 W	3106
H006181	7/23/66	39° 36 N	73° 35 W	7/12/67	44° 10 N	2° 55 W	3069
R128245	9/12/90	40° 50 N	71° 40 W	7/28/93	44° 45 N	2° 30 W	2961
H000470	7/23/66	39° 26 N	73° 36 W	7/14/67	43° 35 N	1° 45 W	3135
H000401	8/4/66	40° 42 N	70° 58 W	8/22/67	43° 58 N	3° 46 W	2903
H000396	8/6/66	40° 36 N	71° 19 W	9/1/68	43° 21 N	2° 23 W	2989
R178532	9/30/90	40° 0 N	70° 3 W	8/23/93	44° 15 N	2° 37 W	2926
R208465	3/20/94	34° 30 N	76° 30 W	6/8/96	37° 30 N	14° 0 E	4211
H010029	8/21/66	40° 55 N	71° 47 W	8/1/67	43° 30 N	1° 58 W	3012