RECENT INFORMATION ON TAGGING AND TAG RETURNS FOR TUNAS AND BILLFISHES IN THE ATLANTIC OCEAN

by
F.J. Mather III and J.M. Mason Jr.

SUMMARY

Information on activities and results of Atlantic tuna and billfish tagging programs obtained from a group of tagging correspondents formed by Mather, or from the literature, are presented as an addendum to, and updating of, the "Final report of the working party on tuna and billfish tagging in the Atlantic and adjacent seas" (FAO Panel of Experts for the Facilitation of Tuna Research, La Jolla, California, USA, 8-12 November 1971 (1972) FAO Fish. Rep. (118) Supl. 1:37). That report covered progress in tagging up to October 1971.

The new information (up to 15 November 1972) includes 10,887 taggings and 381 returns, and brings the respective totals to 56,429 and 3,175. These figures show a great increase in the number of taggings, and a significant number of new returns.

The greatest increases were for yellowfin tuna, Thunnus albacares, (3,358 releases and 138 returns) and for albacore, Thunnus alalunga, (1,600 releases and 27 returns). New releases of bluefin tuna, Thunnus thynnus thynnus, totalled 776, and 114 new returns were obtained. More than 259 additional bigeye tuna, Thunnus obesus, were tagged, and the first eight returns from this species resulted. Eight hundred and seventy-three additional blackfin tuna, Thunnus atlanticus, were released, and 11 additional returns have been obtained. Taggings of skipjack tuna, Katsuwonus pelamis, were increased by 741, and 24 returns were obtained.

New taggings and returns for billfishes included, in that order, 554 and 40 for white marlin, Tetrapturus albidus, 112 and 1 for blue marlin, Makaira nigricans, 832 and 6 for sailfish, Istiophorus platypterus, and 6 and 10 for broadbill swordfish, Xiphias gladius. In addition, 1,770 releases and 12 returns for sailfish which were tagged by earlier programs have been included.

In addition to continued and increased tagging of the species of interest to ICCAT, comparisons of tagging techniques and of types of tags, as well as quantitative estimates of tagging mortality and tag shedding rates, are urgently needed to achieve the maximum efficiency in tagging and the most meaningful interpretations of results.

INFORMATION RECENTE CONCERNANT LE MARQUAGE ET LES RECUPERATIONS DE MARQUES DES THONIDES ET XIPHIIDES DANS L'OCEAN ATLANTIQUE

par
F.J. Mather III et J.M. Mason Jr.

RÈSUME

Des renseignements sur le déroulement des programmes de marquage de thonidés et xiphiidés dans l'Atlantique, ainsi que leurs résultats, ont été fournis par le groupe de correspondants pour le marquage fondé par M. Mather, ou rassemblés à partir de travaux publiés, et sont présentés en tant qu'appendice et mise à jour du "Rapport définitif du

groupe de travail sur le marquage de thonidés et xiphiidés dans l'Atlantique et les mers adjacentes" (Groupe d'Experts FAO Chargé de Faciliter la Recherche sur le Thon, La Jolla, California, USA, 8-12 Novembre 1971 (1972) FAO Fish. Rep. (118) Suppl. 1:37). Ce rapport comprenait le déroulement des programmes de marquage jusqu'au mois d'Octobre 1971.

Les nouveaux renseignements (au 15 Novembre 1972) comprennent 10.887 marquages et 381 récupérations, ce qui porte le total à 56.429 et 3.175, respectivement. Ces chiffres indiquent une augmentation importante du nombre de marques posées, ainsi qu'un nombre appréciable de nouvelles récupérations.

L'augmentation la plus importante a été observée en ce qui concerne l'albacore, Thunnus albacares, (3.358 marquages et 138 récupérations) et le germon, Thunnus alalunga, (1.600 marquages et 27 récupérations). Les nouveaux marquages de thon rouge, Thunnus thynnus thynnus, se sont élevés à 776, avec 114 nouvelles récupérations. Plus de 259 thons obèses, Thunnus obesus, ont été marqués, et les huit premières récupérations de cette espèce en ont résulté. Quant au thon à nageoires noires, Thunnus atlanticus, 873 de plus ont été marqués, avec 11 récupérations. Le marquage du listao, Katsuwonus pelamis, a augmenté de 741, avec 24 récupérations.

Les nouveaux marquages et récupérations de xiphiidés s'élèvent à 554 et 40 respectivement pour le makaire blanc, Tetrapturus albidus, 112 et 1 pour le makaire bleu, Makaira nigricans, 832 et 6 pour le voilier, Istiophorus platypterus, et 6 et 10 pour l'espadon, Xiphias gladius. De plus, il a été tenu compte de 1.770 marquages et 12 récupérations de voiliers marqués dans le cadre de programmes antérieurs.

A part le marquage des espèces qui intéressent l'ICCAT et qui doit être poursuivi de façon accrue, il est urgent de procéder à des estimations quantitatives des taux de mortalité due au marquage et de rejet des marques, de façon à effectuer les opérations de marquage les plus rentables possibles et interpréter leurs résultats de la facon la plus satisfaisante.

INFORMACION RECIENTE SOBRE MARCADO Y RECUPERACION DE MARCAS DE TUNIDOS Y MARLIN EN EL OCEANO ATLANTICO

por
F.J. Mather III y J.M. Mason Jr.

RESUMEN

Se presenta una información sobre las actividades y resultados de los programas de marcado de túnidos y marlines del Océano Atlántico obtenidos de un grupo de corresponsales de marcado formado por Mather, o recogidos en trabajos publicados, como addendum y actualización del "Informe final del grupo de trabajo sobre marcado de túnidos y marlines en el Atlántico y mares adyacentes" (Grupo de Expertos FAO para la Facilitación de la Investigación sobre el Atún, La Jolla, California, USA, 8-12 de Noviembre de 1971 (1972) FAO Fish. Rep. (118) Suppl. 1:37). Este informe describe los progresos realizados en marcado hasta Octubre de 1971.

La nueva información (hasta el 15 de Noviembre de 1972) comprende 10.887 marcaciones y 381 recuperaciones, ascendiendo los totales respectivos a 56.429 y 3.175. Estas cifras arrojan un gran aumento en el número de marcaciones, y un número importante de nuevas recuperaciones.

Los mayores aumentos correspondieron al rabil, Thunnus albacares, (3.358 marcaciones y 138 recuperaciones) y al albacora, Thunnus alalunga, (1.600 marcaciones y 27 recuperaciones). Las nuevas marcaciones de atún, Thunnus thynnus thynnus, ascendieron a 776 y se obtuvieron 114 nuevas recuperaciones. Se marcaron más de 259 patudos, Thunnus obesus, y se han recuperado las primeras ocho marcas de esta especie. Se marcaron 873 atunes de aleta negra, Thunnus atlanticus, y se han obtenido 11 recuperaciones adicionales. Otros 741 listados, Katsuwonus pelamis, fueron marcados, de los que fueron recuperados 24 marcas.

Las nuevas marcaciones y recuperaciones de marlín se desglosan respectivamente de la siguiente forma: 554 y 40 de aguja blanca, Tetrapturus albidus, 112 y 1 de aguja azul, Makaira nigricans, 832 y 6 de pez vela, Istiophorus platypterus, 6 y 10 de pez espada, Xiphias gladius. Además, se han incluido 1.770 marcaciones y 12 recuperaciones de pez vela que fueron marcados en anteriores programas.

Además de continuar e incrementar el marcado de esta especie de interés para ICCAT, se requiere efectuar urgentemente comparaciones de las diversas técnicas y tipos de marcación, así como estimaciones cuantitativas de los índices de mortalidad por marcado y de desprendimiento de las marcas, a fin de conseguir la máxima eficacia en el marcado y la más exacta interpretación de los resultados.

Summary of recent information on taggings and tag returns for tunas and billfishes in the Atlantic Ocean[1]

by

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INTRODUCTION

At the meetings of the Sub-Committee on Stock Identification under the Standing Committee on Research and Statistics (SCRS) of the International Commission for the Conservation of Atlantic Tunas (ICCAT) in Lisbon, April, 1971, Mr. Mather was asked to form a group of tagging correspondents and obtain up-to-date information on the status of Atlantic tuna and billfish tagging programs for future meetings of ICCAT. This action was taken because the Working Party on Tuna and Billfish Tagging in the Atlantic and Adjacent Seas under the Panel of Experts for the Facilitation of Tuna Research (EPFTR), of which Mr. Mather was the convenor, had been disbanded. The ICCAT meetings at Madrid, November, 1971, confirmed this request. Mr. Mason has participated in compiling this information and preparing this report.

A memorandum requesting information on the status and recent activities of tagging programs was distributed to the respective program directors and other interested parties. The mailing list for this memorandum is shown in the Appendix. Additional information which had not been incorporated in the Final Report of the Working Party on Tuna and Billfish Tagging in the Atlantic and Adjacent Seas (FAO Panel of Experts - 1972) was found in the literature and from other sources.

This additional material has been prepared in the form of an addendum to, and updating of, FAO Panel of Experts - (1972). The tables from that report are reproduced herewith, incorporating the new data which have been compiled and corrections of some minor errors. Some additions to its "General Bibliography on Tuna and Billfish Tagging" are also shown, along with the literature cited in the present report.

SUMMARY OF ATLANTIC TUNA AND BILLFISH TAGGING PROGRAMS

Information is available on the following programs:

Country	Agency	Source of information
Canada	Fisheries Research Board FRB (Ca)	J. S. Beckett
Cuba	Instituto Cubano de Investigaciones Tecnológicas ICIT (Cu)	Suárez Caabro & Duarte Bello (196
	Centro de Investigaciones Pesqueras CIP (Cu)	A. Bosque Abreu
France	Institut Scientifique et Technique des Pêches Maritimes ISTPM (F)	H. Aloncle
	Office de la Recherche Scientifique et Technique d'Outre-Mer ORSTOM (F)	C. Champagnat J. P. Niel
Italy	Centro Sperimentale della Pesca CSP (I)	R. Sara, P. Arena
	Società Informazioni Ricerche Ittiche Oceanografiche SIRIO (I)	G. Giannelli (196 F. Schiavoni
Japan	Far Seas Fisheries Research Laboratory FSFRL (J)	S. Kikawa
	Kanagawa Prefectural Fisheries Experimental Station KPFES (J)	
Norway	Fiskeridirektoratets Havforsknings-institutt FH (N)	J. Hamre
Portugal	Instituto de Biología Maritima IBM (P)	H. Vilela
South Africa	Division of Fisheries DF (SA)	J. H. Stander G. Newman
Spain	Instituto de Investigaciones Pesqueras IIP (SP)	J. Rodríguez-Roda
U.S.A.	Miami Laboratory, Southeast Fishery Center, National Marine Fisheries Service, NOAA, Department of Commerce MILAB (USA)	A. C. Jones
	Narragansett Sport Fisheries Marine Laboratory, Northeast Fishery Center, National Marine Fisheries Service NSFML (USA)	J. Casey C. Stillwell
	Port Aransas Rod and Reel Club (Texas) PARR (USA)	M. H. Weil
	Rosenstiel School of Marine and Atmospheric Research (formerly Marine Laboratory) University of Miami RSMAS (USA)	D. C. Tabb
	Woods Hole Oceanographic Institution WHOI (USA)	F. J. Mather J. M. Mason
U.S.S.R.	Atlantic Research Institute of Marine Fisheries and Oceanography AtlantNIRO (USSR)	V. Chur

The abbreviations shown in this list will be used in referring to the respective programs in the text, tables, and figure captions of this report.

The numbers of fishes tagged and returns obtained by each are listed, by species, in Table 1. This and the following tables include data received up to November 15, 1972.

The available data comprise 56,429 taggings and 3,175 returns in the Atlantic Ocean and the adjacent seas, including 10,887 taggings and 381 returns added since the report (as of October 1, 1971) of FAO Panel of Experts... (1972). The greatest increases in releases were for yellowfin tuna (3,358) and albacore (1,600). Good progress has also been made with bluefin, bigeye and skipjack tunas, white marlin, and sailfish. The greatest numbers of returns were for yellowfin (138) and bluefin (114) tunas, but important progress was made with albacore and white marlin also.

DISCUSSION OF RESULTS BY SPECIES OF FISH

Bluefin tuna, Thunnus thynnus thynnus

Most of the additional taggings of bluefin tuna (Tables 2-3) were in the western North Atlantic and in the Mediterranean (earlier taggings only recently reported or discovered in the literature).

Few notable migrations were recorded. An exception was one from Palermo, Sicily, in May 1968 to Castellón de la Plana, Spain, in October 1969. The reported weights of this fish were 29-30 kg when released, and 45 kg when recaptured. Four additional recoveries showing local movements in the southern Tyrrhenian Sea were also reported for the CSP (I) program (Arena, 1971).

Two exceptionally long term recoveries from taggings of small bluefin were recorded in the WHOI (USA) program. Both were released from purse seine catches in August 1966, south of Cape Cod, Massachusetts. One was recaptured by longline in August 1972, off the southern tip of the Grand Banks of Newfoundland, and the other by purse seine in September 1972, off Gloucester, Massachusetts. The lengths of these fish were estimated at about 54 cm when released. Both were reportedly 180 cm long when recaptured, but the weights were reported as 120 kg for the first fish and 158 kg for the second.

A double-tagging experiment in the northwestern Atlantic to compare the effectiveness of two types of tags, and to provide estimates of shedding

rates and other parameters, was continued in 1972 by FRB (Ca), WHOI (USA) and MILAB (USA). This experiment had been initiated by the same agencies in 1971 at the request of the Sub-Committee on Stock Identification under SCRS of ICCAT. It consisted of alternately tagging small bluefin, first with two WHOI type H tags, then with two WHOI type D tags, or their Canadian equivalents (Akyüz, 1970). Because of poor fishing, and logistical problems, only 152 fish were tagged in 1972, bringing the total to 732. Seventy-seven pairs of tags and 34 single tags have been returned, indicating a considerable loss of tags. The results of this experiment, which are analyzed in another report, will permit better estimates of population parameters from tagging experiments.

The urgently needed tagging of small bluefin in the Bay of Biscay and elsewhere in the eastern Atlantic and western Mediterranean, strongly recommended by both EPFTR and ICCAT, evidently remains to be accomplished. The recapture of one of the four small bluefin tagged there in 1972 by ISTPM (F) further demonstrates what might be accomplished by an effective program.

Albacore, Thunnus alalunga

The ISTPM (F) program contributed most of the results for albacore (Table 5). Nearly all of their 1,537 releases in 1972 were in the vicinity of the Azores. Most of the returns from these and earlier taggings were near the release localities, but the one longer migration recorded was of great

interest. This fish was released about 300 nautical miles southwest of Lands End, England, in August 1969, and recaptured about 675 nautical miles east of Bermuda in January 1972. This migration tends to support previous hypotheses based on studies of size composition (Mather, 1962) that there is a single population of albacore in the North Atlantic, with the small individuals in the eastern part, and the large ones in the western.

Some progress has also been made in the Mediterranean, where 42 albacore have been marked by SIRIO (I) and CSIP (I) in the Ligurian and Tyrrhenian Seas, respectively. Four of 29 fish released by CSIP (I) near Palermo, Sicily in 1969, were recaptured during that year and in 1970 in nearby localities (Arena, 1971).

Yellowfin tuna, Thunnus albacares

The great increase in taggings and returns for yellowfin tuna (Table 6) was due mainly to the program of ORSTOM (F), in which 3,315 yellowfin were tagged off western Africa in 1972, more than doubling the total number of releases for this species. The total number of returns from yellowfin marked in the eastern Atlantic has reached 145, but no very extensive migrations have been reported. Sustained tagging on this scale will do much to gain the information needed for the management of this important species.

Bigeye tuna, Thunnus obesus

The ORSTOM (F) program off western Africa is also responsible for the real beginning of bigeye tuna tagging. The exact number tagged (Table 1)

is uncertain because some of the bigeye were mixed in with schools of yellowfin when tagged. Eight returns have been obtained. Although no long migrations have been reported, this is a start in obtaining the necessary information for this species.

Skipjack tuna, Katsuwonus pelamis

Numbers of skipjack tuna released (Table 7) have been substantially increased, largely through the efforts of ORSTOM (F) off western Africa. Few returns have been recorded, however, and no long migrations have been reported. This species remains a very difficult one to tag satisfactorily.

White marlin, Tetrapturus albidus

The number of additional releases of this species, 554, is somewhat disappointing,but the number of new returns, 40, is most surprising (Table 9). Nearly all of the releases were by sport fishermen cooperating with WHOI (USA). All of the returns were from releases by cooperating sportsmen. Thirty-five of these were from releases in coastal waters between Cape Hatteras and Cape Cod. Thirty-two of these releases fitted with the cyclical migratory pattern proposed by Mather, Jones and Beardsley (1972) for fish which summer in this area. The other three tagged fish had lagged behind this pattern, or deviated from it, as indicated by recaptures in the Gulf of Mexico in August, off the Carolinas in January, and in oceanic waters south of Nova Scotia in July. Two individuals, released in March and April off southeastern Florida and the Bahamas were recaptured in September east

of Virginia, fitting well with the above pattern. Seventeen recaptures in September-October 1971, in oceanic waters east of the Cape Hatteras-Cape Cod area showed that at the end of summer white marlin move offshore from that area over a wide front, and in various, but mainly easterly, directions. Only two such returns had been obtained in the previous 16 years.

Times at large for tagged white marlin continued to be very long (Table 10). In fact, the record for this species was increased on three occasions, by times at liberty of 58.7, 71.8, and 75.7 months. The two individuals for which the longest periods were recorded were both released off La Guaira, Venezuela, in the summer of 1966, and recaptured in the same locality in the summer and fall of 1972.

Mather, Jones and Beardsley (1972) presented a mortality calculation based on times at liberty for 56 white marlin tagged between Cape Hatteras and Cape Cod in the years 1961-1965, and subsequently recaptured. An indicated mortality rate of 27% per year, with 95% confidence limits of 14% to 39%, was found. Mather, Mason and Clark (in press) show very similar results for a re-calculation with much additional data (90 fish tagged in the same area between 1961 and 1967, and subsequently recaptured). The latter paper will present a more detailed discussion of recent tagging results for white and blue marlins in the Atlantic.

Sailfish (Istiophorus platypterus)

The data for sailfish (Table 11) have been revised to include the results of the RSMAS (USA) and PARR (USA) programs, along with those of the WHOI (USA) program and new information. Also, the scientific name has been

revised to conform with Morrow and Harbo (1969). The changes bring the total releases to 14,462 and the total returns to 112. Virtually all of these results were accomplished by sport fishermen cooperating in the above programs.

The number of sailfish released since September 1971, 832, is fairly satisfactory, but the number of returns, 6, is somewhat disappointing. Two of the migrations recorded, however, are of considerable interest. One was from the northeastern Yucatan (Mexico) coast, opposite Cozumel Island, in April 1971, to Puerto Santo, on the eastern Caribbean coast of Venezuela in December 1971. The other was from north of the Virgin Islands in January 1972, to off Fort Lauderdale, Florida, in May 1972. Recent tagging results for Atlantic sailfish are discussed in more detail by Mather, Tabb, Mason and Clark (in press).

DISCUSSION AND RECOMMENDATIONS

Bluefin tuna

Urgent needs are as follows:

1. Tagging of young bluefin in the Bay of Biscay and other eastern Atlantic and western Atlantic waters.
2. Extension of tagging to age 0 (less than 2 kg) bluefin on both sides of the Atlantic, and in the Mediterranean.
3. Completion of the northwestern Atlantic double tagging experiment by double tagging at least 500 small bluefin in the 1973 season. Extension of the experiment to the Bay of Biscay if resources permit.
4. Direct studies to determine the survival rate of giant bluefin tagged after capture by hook and line.
5. Development of new means of tagging free swimming giant bluefin and extensive use of these and existing methods, especially in comparison with tagging of fish caught on hook and line.

Yellowfin tuna and albacore

Progress appears to be satisfactory.

Bigeye tuna

Greater volume of tagging appears to be the prime need. Tagging in the surface fisheries seems most promising.

Skipjack tuna

Reduction of tagging mortality is probably the key to success.

Blackfin tuna

The outcome of the Cuban experiments should guide further efforts. Possibly fishing effort is now insufficient to produce adequate returns except in very limited areas.

Broadbill swordfish

Harpoon tagging of free swimming fish should have priority.

White marlin

Present progress seems satisfactory for Cape Hatteras-Cape Cod area. Increased volume of tagging is needed in other areas.

Blue marlin

Studies of tagging mortality are needed. Tagging should be concentrated on small (less than 100 kg) individuals. Volume of tagging should be increased.

Sailfish

Studies of tagging mortality are needed. It is uncertain whether this factor or short life span and low vulnerability to commercial fisheries, are responsible for the low return rate for this species.

Tag type

Completion of the current double-tagging experiment should disclose the relative merits and disadvantages of the WHOI D type (Akyüz, 1970, p. 79), (Floy FT-1, and Inter-American Tropical Tuna Commission) and WHOI H type (Akyüz, 1970, p. 85) tags.

The WHOI M type (Akyüz, 1970, p. 81) has produced considerably higher return rates for white marlin than the other types used by WHOI (USA). It has also been retained by white marlin and small bluefin tuna for considerably longer periods than the other types used by that agency. This tag is very similar to the very successful Lea tag used by FH (N) (Akyüz, 1970, p. 43), and like it, has an explicit multi-lingual message and is very rugged and durable. A seeming disadvantage is a greater tendency to catch in nets than the streamer types. This type of tag would appear to merit further comparative study. Its special advantages would appear to be for fish which are apt to be caught by fishermen of various nationalities, and those which have a potentially long life expectancy when tagged. It would also appear to be more suitable for fish which are not mainly caught by nets.

ACKNOWLEDGEMENTS

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APPENDIX

Distribution of memorandum requesting information on the status and activities of tuna and billfish tagging programs in the Atlantic Ocean and adjacent seas.

Directors of tagging programs:

Aloncle, H. ISTPM (F)
Arena, P. CSP (I)
Carles, C. A. CIP (Cu)
Casey, J.G. NSFML (USA)
Cendrero, O. Laboratorio Oceanográfico, Santander, Spain
Champagnat, C. G. ORSTOM (F) (Dakar, Senegal)
Chur, V. Atlan NIRO (USSR)
Dao, J. C. CNEXO, Brest, France
Hamre, J. FH (N)
Jones, A. C. MILAB (USA)
Kikawa, S. FSFRL (J)
LèGuen, J. C. ORSTOM (F) (Pointe Noire, Congo)
Lima Dias, M. IBM (P)
McMillan, G. American Littoral Society, New Jersey, USA
Pinto-Paiva, M. Laboratorio de Ciencias do Mar, Ceara, Brazil
Poinsard, F. ORSTOM (F) (Abidjan, Ivory Coast)
Rodríguez-Roda, J. IIP (S)
Schiavoni, F. SIRO (I)
Stander, J. H. DF (SA)
Tibbo, S. N. FRB (Ca)
Valdez, V. Centro de Bioceanología e Pescas, Lisbon, Portugal.

Information copies were sent to:

Bayliff, W. Inter-American Tropical Tuna Commission, La Jolla, California
Rodríguez-Martín, O. ICCAT
Rothschild, B. J. National Marine Fisheries Service, NOAA, La Jolla, California
Sahrhage, D. FAO, Rome, Italy

Table 1. Releases (after slash) and returns (before slash) 1954-1972 for Atlantic tunas and billfishes, by species and tagging program (abbreviations are as shown in the summary of Atlantic tagging programs).

Agency	FRB(Ca)	CIP(Cu) ICIT(Cu)	ISTPM(F) ORSTOM(F) MILAB(USA)	CSIP(I) SIRO(I)	FSFRL(J) KPFES(J)	FH(N)	IBM(P)	DF(SA)	IIP(Sp)	AtlantNIRO (USSR)	WHOI(USA) NSFML(USA) RSMAS(USA) PARR(USA)	Totals
Species												
Thunnus alalunga			70/3890	5/42	0/169			0/15		0/12	0/53	75/4181
Thunnus albacares	3/393		142/5002		0/81			0/8			1/488	146/5972
Thunnus atlanticus		11ǂ/2303									1/534	12ǂ/2837
Thunnus obesus	0/20		8/242--		0/104					0/5	1/119	8/490--
Thunnus thynnus	107/1117		5/34	6/366		32/242	0/74		19/312		2279/11,351	2448/13,496
Katsuwonus pelamis	4/146	12ǂ/744	13/1557							0/82	85/2308	114ǂ/4837
Xiphias gladius	13/213										2/57	15/270
Tetrapturus albidus	0/2				0/3						144/9015	144/9020
Makaira nigricans					0/2						6/784	6/786
Istiophorus albicans											112/14,462	112/14,462
Mixed or unidentified tunas	*3/64							0/14				3/78
All years	130/1955	115ǂ/3047	238/10,725--	11/408	0/359	32/242	0/74	0/37	19/312	0/99	2630/39,171	3175ǂ/56,429--

* 3 T. thynnus returned from 60 mixed T. thynnus and K. pelamis
ǂ 92 returns from T. atlanticus and K. pelamis combined
-- 1971 releases uncertain reported as a few 10's by ORSTOM

Table 2. Releases (after slash) and returns (before slash) for bluefin tuna, Thunnus thynnus, grouped by major tagging localities and seasons. Tagging agencies, methods of capture, and size ranges of fish tagged are also shown. Some releases which do not fit into any of these groups are not listed.

Areas	Norway (west coast)	Portugal (west coast) Bay of Biscay	Spain and Portugal (south coast)	Mediterranean	Cat Cay Bahamas (Straits of Florida)	Cape Hatteras Cape Cod (coastal)	Cape Hatteras Grand Banks (offshore)	New England (southern coastal)	Nova Scotia (Halifax area)	Newfound-land (E.coast)
FAO areas	27	27	27	37	31	21	21	21	21	21
Tagging agencies	FH(N)	IBM(P) ISTPM(F)	IIP(Sp) IBM(P)	SIRO(I) CSIP(I)	WHOI(USA)	FRB(Ca) WHOI(USA) NSFML(USA)	FRB(Ca) WHOI(USA) NSFML(USA)	WHOI(USA) NSFML(USA)	FRB(Ca)	FRB(Ca) WHOI(USA)
Method of capture	Purse seine	Hook & Line (troll)	Trap	hook & line (troll)	hook & line (troll)	purse seine hook & line	longline	hook & line	Trap	hook & line (troll)
Season	Aug-Sep	July-Dec.	May-August	Sept-Nov.	May-June	June-Oct	spring-fall	June-Nov.	July-Sept.	July-Oct.
Lengths-cm	150-250	50-60	70-220	May 25-150	190-260	50-150	70-220	185--	200-260	200-260
Years										
1954	-	-	-	-	0/21	3/169	-	-	-	-
1955	-	-	-	-	0/13	0/215	-	-	-	-
1956	-	-	-	-	0/40	0/58	-	-	-	-
1957	0/5	-	-	-	-	1/34	0/5	-	-	-
1958	5/20	-	-	-	-	0/38	-	-	-	-
1959	10/41	-	-	-	0/25	0/25	1/97	-	-	-
1960	6/64	0/40	9/47	-	2/13	1/15	2/204	-	-	-
1961	9/81	-	5/100	-	2/23	7/150	0/2	-	-	-
1962	2/13	-	3/51	-	1/45	4/77	-	-	-	0/6
1963	-	-	0/24	1/26	1/147	9/29	5/42	-	0/18	0/3
1964	-	-	-	-	0/41	136/482	1/25	-	0/6	0/41
1965	-	-	1/50	0/58	0/54	300/1938	0/37	-	3/52	0/47
1966	-	-	-	-	1/105	1178/3959	0/67	0/2	2/71	0/49
1967	-	-	1/50	4/274	1/82	186/628	0/8	-	7/193	0/6
1968	-	2/38	-	1/8	0/57	115/260	0/4	1/6	-	2/217
1969	-	2/15	-	-	0/50	110/341	-	0/1	1/15	0/195
1970	-	0/1	-	-	1/182	176/459	-	0/4	0/3	1/96
1971	-	-	-	-	0/49	119/622	-	0/10	0/40	0/83
1972	-	1/4	-	-	0/32	8/193	-	1/17	-	0/96
All years	32/242	5/98	19/322	6/366	9/979	2353/9693	9/491	2/40	13/398	3/839
Percent	13.2	5.1	5.9	1.6	0.9	24.3	1.8	5.0	3.3	0.4.

Table 3. Releases and returns for bluefin tuna 50-150 (mostly 50-100 cm long released by FRB(Ca), WHOI(USA) and NSFML(USA) on the continental shelf between Cape Hatteras, N.C., and Cape Ann, Mass., June-Oct., by year of release, months at liberty, and recapture area*. Seven thousand seven hundred and ninety of these fish were released from purse-seine catches, and the remaining 1903 from hook and line (nearly all trolling) catches. Most of the hook and line releases were by cooperating sport fishermen.

Releases			Returns								
		Recapture	Number by months at liberty								
Year	Number	area	0-5.9	6.0-17.9	18.0-29.9	30.0-41.9	42.0-53.9	54.0-65.9	66.0-77.9	Totals	Percent
1954	169	1	1	0	0	0	0	0	0	1	0.6
		2	0	0	0	0	0	2	0	2	1.2
1955	215	-	0	0	0	0	0	0	0	0	0
1956	58	-	0	0	0	0	0	0	0	0	0
1957	34	1	0	0	1	0	0	0	0	1	2.9
1958	38	-	0	0	0	0	0	0	0	0	0
1959	25	-	0	0	0	0	0	0	0	0	0
1960	15	1	0	0	1	0	0	0	0	1	6.7
1961	150	1	0	2	3	2	0	0	0	7	4.7
1962	77	1	0	4	0	0	0	0	0	4	5.2
1963	29	1	7	2	0	0	0	0	0	9	31.0
1964	483	1	100	36	0	0	0	0	0	136	28.2
1965	1938	1	182	60	37	0	1	0	0	280	14.4
		2	0	14	5	1	0	0	0	20	1.0
1966	3959	1	529	569	50	8	4	0	2	1162	29.4
		2	0	12	3	0	1	0	0	16	0.4
1967	628	1	97	59	15	13	0	-	-	184	29.3
		2	0	1	1	0	0	-	-	2	0.3
1968	260	1	88	19	8	0	-	-	-	115	44.2
1969	341	1	12	85	12	1	-	-	-	110	32.3
1970	459	1	50	118	8	-	-	-	-	176	38.3
1971	622	1	38	81	-	-	-	-	-	119	19.1
1972	193	1	8	-	-	-	-	-	-	8	4.1
All years	9693	1	1112	1035	135	24	5	0	2	2313	23.9
" "		2	0	27	9	1	1	2	0	40	0.4
" "		Totals	1112	1062	144	25	6	2	2	2353	24.3
		Percent	11.5	11.2	1.5	0.3	0.1	0.1	0.1	24.3	

*Recapture areas: 1. Release area; 2. Bay of Biscay

Table 5 . Releases (after slash) and returns (before slash) for albacore, Thunnus alalunga. grouped by major tagging localities and seasons. Tagging agencies, methods of capture, and sizes of fish tagged are also shown.

Area	Mediterranean	Northeast Atlantic	Entire Atlantic	Southeast Atlantic	Northwest Atlantic		
FAO Area	37	27		47	21, 31		
Tagging Agencies	CSIP(I) SIRO(I)	ISTPM(F)	FSFRL(J) KPFES(J)	AtlantNIRO (USSR) DF (SA)	WHOI(USA)	Totals	Percent
Methods of capture	Hook & line (troll)	Hook & Line (troll)	Longline		Longline		
Season	Sept-Nov May	July-Sept					
Lengths cm.		50-80			60-110		
Years							
1957	-	-	-		0/1	0/1	0
1958	-	-	-		-	-	-
1959	-	-	-		-	-	-
1960	-	3/400	-		0/14	3/414	0.7
1961	-	-	-		0/3	0/3	0
1962	-	-	-		-	-	-
1963	0/6	-	-		0/12	0/18	0
1964	-	-	-		0/20	0/20	0
1965	-	-	0/44		0/1	0/45	0
1966	-	-	0/9		0/2	0/11	0
1967	0/6	-	-		-	0/6	0
1968	-	18 /471	0/97		-	18 /568	3.2
1969	5/30	12/315	0/4		-	17/349	3.8
1970	-	12/524	0/15	0/12	-	12/551	2.2
1971	-	21/643	-	0/15	-	21/658	3.2
1972	-	4/1537	-	-	-	4/1537	.3
All years	5/42	70/3890	0/169	0/27	0/53	75/4181	1.8
Percent	11.9	1.8	0	0	0	1.8	-

Table 6. Releases (after slash) and returns (before slash) for yellowfin tuna, Thunnus albacares, grouped by major tagging localities and seasons. Tagging agencies, methods of capture, and size ranges of fish tagged are also shown.

Area	Gulf of Guinea	Entire Atlantic	Northwest Atlantic	Southeast Atlantic	Totals	Per-Cent
FAO areas	34, 47		21, 31	47		
Tagging agencies	FRB(Ca) ORSTOM(F)* MILAB(USA)	FSFRL(J) KPFES(J)	FRB(Ca) WHOI(USA)	DF(SA)		
Method of capture	Purse seine	Longline	Longline (some hook & line)			
Season	June-May		Mar.-Oct.	June + Nov.		
Lengths-cm	30-80		60-150			
Years						
1956			0/105		0/105	0
1957		0/28	0/1		0/29	0
1958						
1959						
1960			0/50		0/50	0
1961			0/18		0/18	0
1962			0/3		0/3	0
1963			0/29		0/29	0
1964			0/104		0/104	0
1965		0/14	0/17		0/31	0
1966		0/16	1/25		1/41	2.4
1967	3/378		0/48		3/426	0.7
1968		0/10	0/26		0/36	0
1969		0/4	0/11		0/15	0
1970	0/30	0/5	0/12		0/47	0
1971	16/1657	0/4	0/36	0/8	16/1705	0.9
1972	126/3315		0/18		126/3333	3.8
All years	145/5380	0/81	1/503	0/8	146/5972	2.4
Percent	2.7	0	0.2	0	2.4	

*Method of capture and length of fish were not reported for ORSTOM(F) (1970) tagging.

Table 7. Releases (after slash) and returns (before slash) for skipjack tuna, Katsuwonus pelamis, grouped by major tagging localities and seasons. Tagging agencies, methods of capture, and sizes of fish tagged are also shown.

Area	Northeast Atlantic	Cape Verde	Gulf of Guinea	Western Cuba	Northwestern Atlantic		Totals	Per Cent
FAO Area	27	34	34, 47	31	21	21,31		
Tagging Agencies	ISTPM(F)	Atlant NIRO (USSR)	FRB(Ca) ORSTOM(F)* MILAB(USA)	ICIT(Cu) CIP(Cu)	FRB(Ca) WHOI(USA)	WHOI(USA)		
Methods of Capture	Hook & line (troll)		Purse seine* Live bait	Live bait	Purse seine	Hook & line (troll)		
Season	Aug.-Sept.		June-Aug. November	April-Oct.	July-Sept.			
Length, cm.	40-45		40-80					
Years								
1959				†/541		0/1	†/542	?
1960						0/1	0/1	0
1961						0/10	0/10	0
1962						0/27	0/27	0
1963						0/12	0/12	0
1964					74/761	1/40	75/801	9.4
1965					5/445 ⊕	0/29	5/474 ⊕	1.1
1966					7/783	1/21	8/804	1.0
1967			1/37			0/26	1/63	1.
1968	0/35					0/26	0/61	0
1969	0/6	0/82				0/56	0/144	0
1970			0/220			0/103	0/323	0
1971			5/794	12/203	0/4	0/41	17/1042	1.6
1972	0/13		8/489			0/31	8/533	1.5
All years	0/54	0/82	14/1540	12+/744	86/1993	2/424	114+/4837	2.4+
Percent	0	0	0.9	1.6+	4.3	0.5	2.4+	

*Method of capture and sizes of fish were not reported for ORSTOM(F) (Nov. 1970) taggings.

†As of October 30, 1960, 92 returns had been obtained from these releases and 1458 others of blackfin tuna, combined.

⊕Includes 30 of 60 mixed bluefin tuna and skipjack tuna.

Table 8. Releases (after slash) and returns (before slash) for broadbill swordfish Xiphias gladius, grouped by major tagging localities and seasons. Tagging agencies, methods of capture, and sizes of fish tagged are also shown.

Area	Northwest atlantic	Northwest atlantic	Totals	Per Cent
FAO Area	21	21		
Tagging Agencies	FRB(Ca) NSFML(USA) WHOI(USA)	FRB(Ca) WHOI(USA)		
Methods of Capture	Longline	Free swimming		
Season	Apr.-Nov.	July-August		
Length, cm.	90-260	150-250		
Years				
1961	0/3		0/3	0
1962	0/1		0/1	0
1963	0/1		0/1	0
1964	1/34		1/34	2.9
1965	1/28		1/28	3.6
1966	1/26	0/2	1/28	3.6
1967	0/20		0/20	0
1968	0/7	5/20	5/27	18.5
1969	1/28		1/28	3.6
1970	0/44	6/41	6/85	7.1
1971	0/9		0/9	0
1972	0/6		0/6	0
All years	4/207	11/63	15/270	5.6
Percent	1.9	17.5	5.6	

Table 9. Releases (after slash) and returns (before slash) for white marlin, Tetrapturus albidus, grouped by major tagging localities. Nearly all were caught on rod and reel (trolling) and tagged by sportfishermen cooperating with WHOI (USA).

YEARS	AREA									TOTALS
	Hatteras to Chesapeake	Chesapeake to Barnegat	Barnegat to Cape Cod	Oceanic North Atlantic	S.E.Florida and W. Bahamas	West Indies and Vicinity	Gulf of Mexico	Venezuela and Vicinity	Cozumel and Yucatan	
1954			0/4							0/4
1955		1/116				0/8	0/21			1/145
1956		1/402				0/3	0/8			1/413
1957	0/3	0/140	0/1	0/1						0/145
1958	0/1	0/39	0/1							0/41
1959		0/190	0/10					0/2		0/202
1960		0/96	0/2		0/4	0/1	0/4	0/4		0/111
1961	0/2	2/187	0/10		0/13	0/9	0/11	0/30		2/262
1962	0/30	4/294	0/18		0/41		0/4			4/387
1963	0/75	4/533	0/4	0/3	0/35		0/10			4/660
1964	4/182	8/258	0/1	0/5	1/67		0/13			13/526
1965	0/15	6/258	0/5		0/67	0/5	0/10	2/25		8/385
1966	1/36	9/172	1/64	0/6	1/54	0/4	0/23	4/149		16/508
1967	0/37	6/234	0/6		0/88	0/7	1/46	0/103		7/521
1968	2/100	15/569	1/32		1/95	0/16	0/56	0/16		19/884
1969	8/360	12/829	0/27		2/86	0/18	2/35	2/46		26/1401
1970	12/320	8/463	1/55		2/49	0/15	0/24	0/17	0/4	23/947
1971	2/247	11/559	0/17		1/57	0/20	0/18	0/95	0/4	14/1017
1972	0/167	0/164	0/14		0/36	0/10	0/62	0/21	0/1	0/475
Unknown	2/2	4/4					1/1			7/7
TOTALS	31/1577	91/5507	3/271	0/15	8/692	0/116	4/346	8/508	0/9	145/9041

Table 10. Releases for white marlin, Tetrapturus albidus, in the western North Atlantic by years, and returns from these by months at liberty.

Releases Year	Releases Number	Months at large						Totals
		0-5.9	6.0-17.9	18.0-29.9	30.0-41.9	42.0-59.9	60.0-77.9	
1954	4							0
5	145					1		1
6	413		1					1
7	145							0
8	41							0
9	202							0
1960	111							0
1	262				2			2
2	387		1	1	1	1		4
3	660	1	2	1	0	0		4
4	526	3	5	4	0	1		13
5	385	2	4	1	1	0		8
6	508	4	2	4	1	3	2	16
7	521	0	2	2	1	2	-	7
8	884	1	10	4	4	-	-	19
9	1401	6	11	7	2	-	-	26
1970	947	4	15	3	-	-	-	22
1	1017	8	6	-	-	-	-	14
2	449	0	-	-	-	-	-	0
Totals	9015*	29	59	27	12	8	2	144*

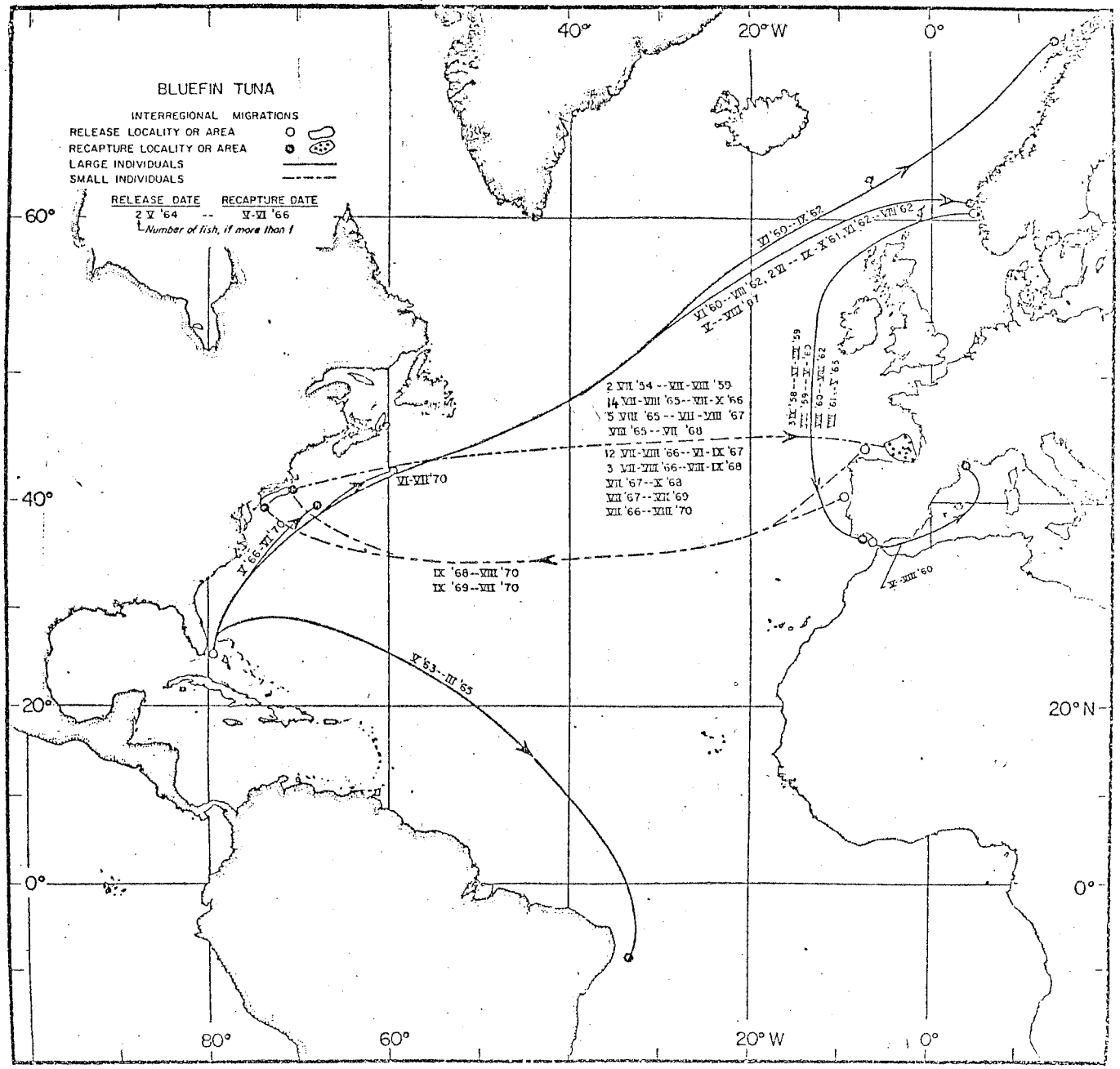
*Totals include 7 releases and returns not shown in breakdown by years because release data is not known.

Table 11. Releases (after slash) and returns (before slash) for sailfish, Istiophorus platypterus, grouped by major tagging localities. Nearly all were caught on rod and reel (trolling) and tagged by sportfishermen cooperating with WHOI (USA).

Program	Hatteras-Delaware WHOI	NE Florida WHOI	SE Florida WHOI	SE Florida RSMAS	Bahamas WHOI	Gulf of Mexico Fla. & La. WHOI	Gulf of Mexico Texas WHOI	Gulf of Mexico Texas PARR	Haiti & Virgin Is.* WHOI	Caribbean SE WHOI	Caribbean NW WHOI	Totals
Year												
1950				1/78								1/78
1951				1/112								1/112
1952				2/102								2/102
1953				1/140								1/140
1954			0/27	0/299				0/76				0/402
1955			1/15	0/201		0/1		1/44				2/261
1956				1/167				0/34				1/201
1957			0/17	2/142			0/7	0/13				2/179
1958			2/7	0/17			0/21	0/36				2/81
1959			0/72			0/1	0/33	1/49		0/7		1/162
1960	0/2		5/746		0/4	0/3	0/22	0/196	0/5	0/44	0/1	5/1023
1961	0/1	0/1	5/949		0/9	0/5	0/182	1/64	1/3	0/7		7/1221
1962	0/2	0/4	10/1141		0/32	0/3	0/93	0/3	0/9			10/1287
1963	0/4		9/1000		0/45	0/1	0/102				0/10	9/1162
1964	0/2		6/925		0/73	0/9	0/60		0/5		0/6	6/1080
1965	0/1	0/3	7/928		1/34		0/95		1/17	0/15		9/1093
1966	0/2	0/1	9/565		0/57	0/4	0/152		1/150	7/186	0/22	17/1139
1967	0/1	0/2	6/385		1/34	2/52	0/188		3/67	0/53	0/46	13/828
1968			6/420		2/43	1/220	1/54		0/20	0/3	0/15	10/775
1969	1/15		3/339		0/71	1/24	0/154		0/53	0/60	0/47	5/763
1970	0/28	0/2	1/254		0/38	0/71	0/73		0/47	0/32	0/76	1/621
1971	0/22	0/2	1/449		0/39	0/35	1/76		0/75	0/31	1/351	3/1080
1972+	0/5		1/259		0/48	0/21	0/50		1/96	0/13	0/178	2/670
Unknown				1/1		1/1						2/2
Totals	1/85	1/15	72/8498	9/1259	4/527	5/451	2/1362	3/515	7/547	7/451	1/752	112/14,462

*Haiti-1960-1962, Virgin Islands 1964-1967.

+Through Oct.


BLUEFIN TUNA
INTERREGIONAL MIGRATIONS
RELEASE LOCALITY OR AREA
RECAPTURE LOCALITY OR AREA
LARGE INDIVIDUALS
SMALL INDIVIDUALS
RELEASE DATE
RECAPTURE DATE
2 V '64 -- V-VI '66
Number of fish, if more than 1
40°
20° W
0°
60°
40°
20°
0°
20° N
80°
60°
20° W
0°
VI '60--IX '62
VI '60--VII '62, 2 VI -- IX '61, VI '62--VII '62
X--XII '67
2 VII '54 --VII-VIII '55
14 VII-VIII '65--VII-X '66
5 VIII '65 -- VII-VIII '67
VIII '65 -- VII '69
12 VII-VIII '66--VI-IX '67
3 VII-VIII '66--VIII-IX '68
VII '67--X '68
VII '67--XII '69
VII '66--VIII '70
VI-VII '70
X '66-VI '70
IX '68--VIII '70
IX '69--VII '70
V '63-III '65
X-XII '60