

RESULTS OF THE DOUBLE TAGGING STUDY CONDUCTED IN SHARKS

A. Domingo¹, E. Cortés², R. Forselledo¹, S. Jiménez^{1,3}, F. Mas^{1,3} and P. Miller^{1,3}

SUMMARY

A total of 1,323 shark specimens were double tagged in the period 2012 – 2013, being blue shark (Prionace glauca, BSH) the most represented (95.5%). During 2012 – 2014 recaptures of 15 blue shark and one shortfin mako (Isurus oxyrinchus, SMA) were recorded. Eleven of these sharks had both tags and the remaining five had only one. Nine sharks were at liberty for more than three month, five of which had only one tag (four Stainless steel head dart tags (SSD) and one plastic head intra-muscular tag-small (PIMS)). Comparing recaptures of blue sharks (double or single tagged) as a proxy of tags efficiency, we found a 4.09% of recaptures for SSD (n = 220) and a 0.55% for ICCAT tags (n = 1,818). Although based in few recaptures, this study suggests that SSD would work better than ICCAT tags for shark species.

RÉSUMÉ

Deux marques ont été apposées sur 1.323 spécimens de requins entre 2012 et 2013, principalement (95,5%) sur des spécimens de requin peau bleue (Prionace glauca). Entre 2012 et 2014, on a enregistré la récupération de marques de 15 spécimens de requin peau bleue et d'un spécimen de requin-taupe bleu (Isurus oxyrinchus). Onze de ces requins portaient deux marques et les cinq autres n'en portaient qu'une. Neuf requins ont porté des marques pendant plus de trois mois, cinq ont été recapturés avec une seule marque (quatre marques à dard à tête en acier inoxydable (SSD) et une marque intramusculaire à tête en plastique de petite taille (type PIMS)). En comparant les récupérations de requins peau bleue (porteurs d'une marque ou de deux marques) comme indice approchant de l'efficacité des marques, nous avons trouvé 4,09% de récupérations pour les SSD (n = 220) et 0,55% pour les marques de l'ICCAT (n = 1,818). En dépit du nombre limité de récupérations, la présente étude donne à penser que les marques SSD fourniraient de meilleurs résultats que les marques de l'ICCAT en ce qui concerne les espèces de requins.

RESUMEN

En el periodo 2012-2013 se marcaron en total 1.323 ejemplares de tiburones con dos marcas, siendo la tintorera (Prionace glauca, BSH) la especie más representada (95,5%). Durante 2012-2014 se consignaron 15 recapturas de tintorera y 1 de marrajo dientuso (Isurus oxyrinchus, SMA). Once de estos tiburones tenían dos marcas, y los cinco restantes solo una. Nueve tiburones estuvieron en libertad más de tres meses, cinco fueron recapturados con una sola marca (cuatro marcas dardo de cabeza de acero inoxidable (SSD)) y 1 marca pequeña intramuscular de cabeza de plástico (PIMS). Comparando las recapturas de tintorera (con una o dos marcas) como una aproximación de la eficacia de las marcas, se halló un 4,09% de recapturas para las SSD (n=220) y un 0,55% para las marcas de ICCAT (n=1.818). Aunque hay pocos datos disponibles, parece que las SSD funcionarían mejor que las marcas de ICCAT para las especies de tiburones.

KEYWORDS

Tag efficiency, Recaptures, Sharks, Uruguay

¹ Laboratorio de Recursos Pelágicos, Dirección Nacional de Recursos Acuáticos (DINARA). Constituyente 1497, CP 11200, Montevideo, Uruguay, adomingo@dinara.gub.uy.

² National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, 3500 Delwood Beach Road, Panama City, Florida 32408, USA.

³ Centro de Investigación y Conservación Marina (CICMAR), Uruguay.

1. Introduction

The objectives of tagging programmes are to obtain information about movements, migrations, stock structure, growth and population size, among others. ICCAT has developed an International Cooperative Tagging Program in the Atlantic Ocean and its adjacent seas. A number of member countries are now participating in the program and releasing many tagged sharks, tunas, billfishes and tuna-like fishes.

To make a tagging program successful, it is essential to secure the cooperation of fishermen in recovering these tags. Many of the recovered and returned tags have been accompanied by incomplete data or no data at all; so obviously there is a need for better systems of data collection.

Tagged fish, and particularly the fast swimming species concerned to ICCAT, could lose the tag; therefore, it is important to test the effectiveness of the different type of tags that are being used. In order to address this issue, Uruguay started in 2012 a double tag experiment, using in each fish several combinations of two different types of tags. This double tagging study is still running and here we present the results obtained for the period 2012-2014.

2. Material and methods

The tagging program was carried out by scientific observers of the National Observer Program on board the Uruguayan Tuna Fleet (PNOFA), also on board Japanese-flagged vessels that operated in Uruguayan waters either under an experimental fishing license or by leasing, and on board DINARA's Research Vessel. All monitored trips operated in the southwestern Atlantic, in Uruguayan EEZ and adjacent international waters.

The methodology followed was opportunistic, tagging as much specimens as possible. In order to test the effectiveness of conventional tags, we used four different types of tags; three provided by ICCAT Tagging Program and developed for a wide range of great pelagic fishes, and one from the Cooperative Shark Tagging Program of the NOAA's National Marine Fisheries Service, used specifically for shark species. The types of tags used were: Plastic Tipped Dart Tags (PDAT, **Figure 1A**); Plastic Head Intra-muscular Tags (small head, PIMS) (**Figure 1B**); Plastic Head Intra-muscular Tags (large head, PIMA) (**Figure 1B**), provided by ICCAT and Stainless Steel Head Dart Tags (SSD, **Figure 1C**) provided by NOAA. The election of the combination of tags used depended on the amount of tags available of each type. For this reason we used in almost every specimen (99.3%) a PDAT tag combined with one of the other types available.

As an approach to compare tags efficiency, we used the number of reported recaptures of tagged (double or single) blue sharks (the most tagged species; see Results and Discussion) with SSD tags against ICCAT tags (PDAT, PIMS and PIMA).

3. Results and discussion

A total of 1,323 specimens were double tagged in the period 2012 – 2013, being blue shark (*Prionace glauca*, BSH) the most represented (95.5%). **Table 1** presents the number of specimens tagged by species and the combination of tags used. **Figure 2** shows a double tagged blue shark before release, and **Figure 3** a map of all the release and recapture locations of double tagged specimens.

During 2012 – 2014 recaptures of 15 blue shark and one shortfin mako (*Isurus oxyrinchus*, SMA) were recorded. Six of the recaptures were recorded in Uruguayan vessels; the other 10 were reported either to ICCAT or NOAA by other countries, mainly Brazil. Time at liberty for all the recaptures was from one to 563 days. A summary of the release and recapture information for the specimens is presented in **Table 2**.

Eleven sharks had both tags and five had only one. These latter cases comprise one individual double tagged with PDAT and PIMS, where the PIMS was recovered, and four sharks double tagged with PDAT and SSD, where the SSD was recovered. Nine sharks were at liberty for more than 3 month, five of which were recaptured with only one tag (four SSD and one PIMS). The shortest time at liberty correspond to one blue shark recaptured one day after its release by another fishing vessel operating near the releasing location. Additionally, a tagged blue shark was found two days after released inside the stomach of another blue shark captured by the same fishing vessel (**Figure 4**).

A total of 220 blue sharks were tagged (double or single) with SSD, and 1,818 (double or single) with ICCAT tags in the period 2012-2013. The number of reported recaptures in the period 2012 – 2014 was nine for the SSD (4.09%) and 10 for ICCAT tags (0.55%).

Although there are only few data available, considering the double tags recaptures and the total BSH recaptures it appears that SSD would work better than ICCAT tags, and of this PIMS would work better than PDAT for shark species. However, only one recapture with NOAA and ICCAT tags was reported to both organizations. This raises the question whether recapture reports of only one tag were complete, as the reporter might have informed only to one organization, failing to specify that the specimen had two tags.

Table 1. Number of double tagged sharks by combination of type of tags. (Plastic Tipped Dart Tags (PDAT); Plastic Head Intra-muscular Tags (small head, PIMS); Plastic Head Intra-muscular Tags (large head, PIMA); Stainless Steel Head Dart Tags (SSD)).

NUMBER OF DOUBLE TAGS BY COMBINATION						
SPECIES	PDAT - PIMS	PDAT - PIMA	PDAT - SSD	PIMS - SSD	PIMS - PIMA	TOTAL
<i>Prionace glauca</i>	884	162	208	8	1	1263
<i>Lamna nasus</i>	40	4	0	0	0	44
<i>Isurus oxyrinchus</i>	13	2	1	0	0	16
TOTAL	937	168	209	8	1	1323

Table 2. Release and recapture information. The number of days at liberty equal or greater than 90 days are highlighted. When the exact recapture date was not available, days at liberty were estimate as the minimum. Recaptures with only one of the two tags are highlighted.

RELEASE							RECAPTURE					
TAGS	DATE	LAT	LON	SPECIES	FL	SEX	DATE	DAYS AT LIBERTY	LAT	LON	FL	TAGS
SEC007242 (PDAT) BYP052329 (PIMS)	1/2/2012	-45.18	-51.83	BSH	100	1	21/6/2012	140	-35.50	-47.08	160	PIMS
BYP025389 (PDAT) BYP072730 (PIMA)	25/8/2013	-35.67	-52.47	BSH	136	1	26/8/2013	1	-35.29	-52.10	---	BOTH
SEC007539 (PDAT) BYP052148 (PIMS)	20/7/2012	-36.72	-53.03	BSH	125	2	23/6/2013	330	-36.53	-50.98	148	BOTH
SEC007202 (PDAT) BYP052340 (PIMS)	6/2/2012	-45.47	-51.02	BSH	93	1	8/2/2012	2	-45.37	-50.35	---	BOTH
SEC007110 (PDAT) BYP052611 (PIMS)	16/7/2012	-36.87	-54.00	BSH	157	2	29/8/2012	45	-34.42	-51.76	165	BOTH
BYP019752 (PDAT) 354469 (SSD)	2/6/2013	-37.32	-53.02	BSH	149	1	11/11/2013	162	-33.48	-50.42	200 (TL)	SSD
BYP019443 (PDAT) 354484 (SSD)	13/6/2013	-35.28	-51.98	BSH	161	1	---/9/2013	90	-28.60	-46.25	---	BOTH
BYP019410 (PDAT) 354494 (SSD)	13/6/2013	-35.28	-51.98	BSH	145	1	27/6/2013	14	-37.46	-52.59	145	BOTH
BYP058232 (PIMS) 354508 (SSD)	26/8/2013	-35.43	-52.25	BSH	183	2	14/9/2013	19	-31.55	-49.17	---	BOTH
BYP019483 (PDAT) 354552 (SSD)	8/6/2013	-35.79	-52.24	BSH	167	1	12/11/2014	522	-20.35	-30.13	---	SSD
BYP019554 (PDAT) 354558 (SSD)	6/6/2013	-36.23	-52.64	BSH	160	1	2014	180	-28.83	-47.85	---	SSD
BYP019743 (PDAT) 354606 (SSD)	2/6/2013	-37.32	-53.02	BSH	155	1	7/4/2014	305	-34.65	-51.73	225 (TL)	BOTH
SEC007491 (PDAT) BYP52575 (PIMS)	12/6/2012	-37.13	-50.87	BSH	126	2	4/6/2013	360	-37.63	-52.95	154	BOTH
BYP019438 (PDAT) 354499 (SSD)	13/6/2013	-35.28	-51.98	BSH	146	1	25/6/2013	12	-37.53	-52.71	150	BOTH
BYP019482 (PDAT) 354572 (SSD)	8/6/2013	-35.79	-52.24	BSH	147	1	23/12/2014	563	4.85	18.60	190	SSD
BYP19619 (PDAT) BYP58470 (PIMS)	7/6/2013	-36.83	-52.59	SMA	147	1	---/6/2013	10	---	---	148 (TL)	BOTH

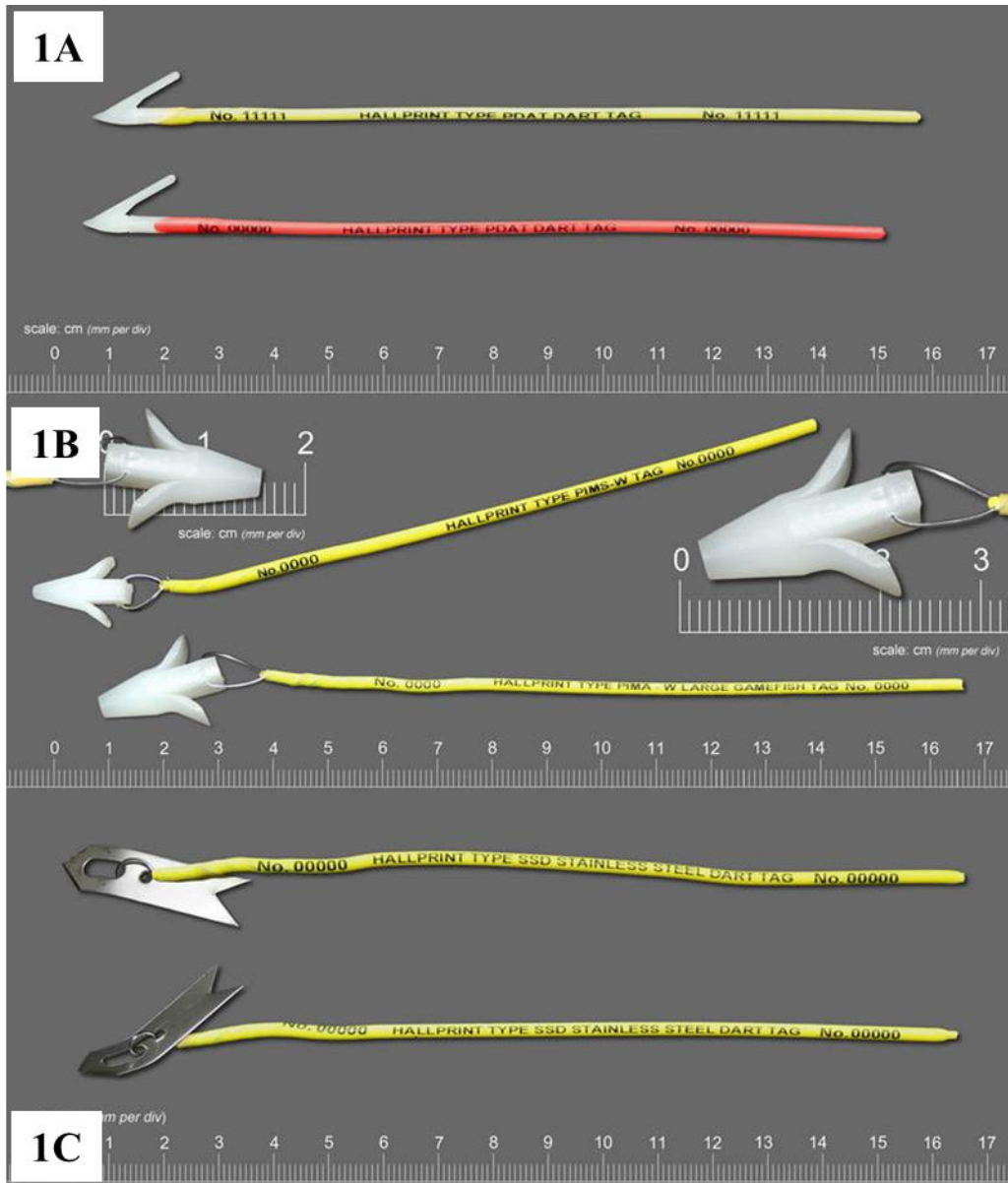


Figure 1. Types of tags used in the double tagging study conducted by Uruguay. Illustrative images of tags taken from Hallprint Fish Tags (www.hallprint.com). A. Plastic Tipped Dart Tags (PDAT). B. Above: Plastic Head Intra-muscular Tags (small head, PIMS); below: Plastic Head Intra-muscular Tags (large head, PIMA). C. Stainless Steel Head Dart Tags (SSD).



Figure 2. Double tagged blue shark with PDAT and PIMS tags before release.

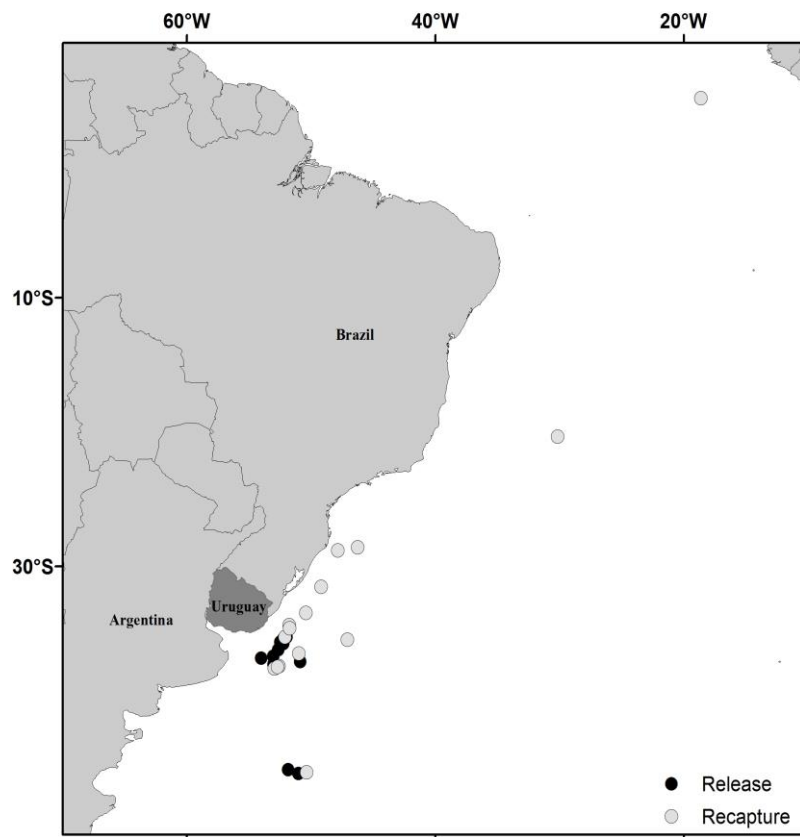


Figure 3. Release and recapture locations for 15 double tagged blue sharks.



Figure 4. Tagged blue shark found two days after its release by the same vessel in another blue shark stomach.