LARGE SCALE SPORTFISH TAGGING PROGRAMS: PROS AND CONS

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INTRODUCTION

Tagging of fish by fishery participants, both recreational and commercial, is a popular activity. It gives the fisher a sense of participation in a scientific activity which will add to knowledge about their target species. The best known examples of this activity are so-called cooperative tagging programs through which recreational anglers (and sometimes, commercial operators) tag and release fish as part of a broad scale, long term undertaking. There are many such programs in operation around the world, some of which are very large, and have been in operation for several decades.

The main perceived differences between user-based and scientific tagging operations tend are in the areas of planning and quality control. Scientifically tagged fish may be caught by more 'fish friendly' methods, be more carefully handled and be more accurately measured. It is also likely that scientifically based tagging operations result in better overall data quality due to greater control over all aspects of the study. These differences appear to be intuitively obvious, but may not always be real. The assumptions that scientifically based tagging programs are always well structured, and usually achieve their goals are obviously not always met. And in practice, how poorly structured are user-based programs?

This paper focuses on the Australian Gamefish Tagging Program, operated by NSW Fisheries, and also discusses similar programs in other countries.

BRIEF HISTORY OF RECREATIONAL TAGGING

Tagging of large fish by recreational anglers was made possible by the development of nylon and steel-headed plastic dart tags that could be placed into the dorsal musculature of fish without removing them from the water. The system was developed in the early 1950s by Frank Mather III of the Woods Hole Oceanographic Institute, and tags were made available to anglers on a trial basis in the early 1960s. By 1980, the program had recorded 11,200 white marlin tagged 194 of which had been recaptured, and 21,000 sailfish tagged for 213 recaptures. Perhaps one of the most important findings that Mather had recorded by that time, was the fact that recreational-based tagging was indeed a useful scientific exercise. This was shown by the recapture rate of recreationally tagged bluefin tuna. Mather noted that the overall tag return rate from over 3,200 releases by sport was 20 percent (21.4 to 48.5 percent in the years 1963 - 1972) demonstrating the ability of school tuna to survive being captured on rod and reel, then tagged and released.

The Mather method has since been adopted by many programs, including all of the Gamefish Tagging Programs operated by the US National Marine Fisheries Service (NMIFS), the South African tagging program, operated by the Oceanographic Research Institute (ORI) in Durban, Canadian shark tagging programs operated by Fisheries and Oceans, Canada, and the Australian Gamefish Tagging Program, operated by New State Wales Fisheries.

Summary results of most of the large scale tagging programs are published in annual reports or newsletters, and are widely distributed to participants and all interested parties. A very brief summary of some of the major cooperative tagging programs is shown in Table 1.

Table 1. Summary statistics for major cooperative sportfish tagging programs.

	Main spp Tagged*	No. Fish Tagged 1982-98	No. Recapt 1982-98
Australia (NSW FRI)	BLKM; STM; YFT;SF YTK; MAK; BLU; ALB	94,000	2,100
New Zealand (NIWA)	STM;YTK;MAK	28,000	1,064
South Africa (ORI)	OTH;SH;ALB	139,000	7,200
USA			
NMFS SE Centre	BLU; WHM; BFT; SF	154,400	5,500
NMFS NE Centre	BLU; MAK; TIG; SH	˜98,000	4,500
NMFS SW Centre	STM; BUM; SF	19,000	175

* BLKM=Black marlin; STM=Striped marlin; BLUM=BIue marlin; SF=Sailfish; YFT=Yellowf in tuna; BFT=Bluefin tuna; MAK=Mako shark, BLU=Blue shark; OTH=Other species; SH=Other shark; ALB; WHM=White marlin;

Considering the Australian Gamefish Tagging Program in more detail, briefly, the statistics on the Australian program may be summarised as follows:

Australian Gamefish Tagging Program: This program commenced in 1974, and has operated nationally (and in some overseas countries) ever since. All recognized species of marine gamefish are eligible for tagging, including all billfish and tuna, pelagic sharks and other species such as yellowtail kingfish, dolphin fish, mackerel and wahoo. Table 2 shows the breakdown of species tagged and recaptured since the origin of the program to 1997.

The growth of the program is illustrated in Figure 1, showing that there was a steady increase in numbers of fish tagged until the late 1980s, followed by a slight decline, a peak in 1990/91 and an average of about 12,000 fish tagged per year since.

TABLE 2.

THE PRINCIPAL SPECIES TAGGED AND RELEASED IN THE GAMEFISH TAGGING PROGRAM (1974-1997)

COMMON NAME	SCIENTIFIC NAME	NUMBER TAGGED	NUMBER RECAPTURE	PERCENT
BILLFISH				
Marlin, Black	*Makaira indica*	26,873	183	0.68
Marlin, Blue	*Makaira nigricans*	1,341	3	0.22
Marlin, Striped	*Tetrapturus audax*	4,017	34	0.85
Sailfish	*Istiophorusplatypterus*	12,134	115	0.95
Spearfish, Shortbill	*Tetrapturus angustirostris*	90	0	0.00
Swordfish, Broadbill	*Xiphias gladius*	46	2	4.35
TUNA				
Albacore	*Thunnus alalunga*	9,786	94	0.96
Bonito, Australian	*Sarda australis*	11,884	205	1.73
Bonito, Watsons Leaping	*Cybiosarda elegans*	1,405	33	2.35
Tuna, Big-eye	*Thunnus obesus*	66	1	1.52
Tuna, Dog Tooth	*Gyinnosarda unicolor*	360	3	0.83
Tuna, Longtail	*Thunnus tonggol*	3,189	45	1.41
Tuna, Mackerel	*Euthynnus affinis*	11,314	40	0.35
Tuna, Skipjack	*Katsuwonus pelamis*	13,485	55	0.41
Tuna, Southern Bluefin	*Thunnus maccoyii*	1,269	52	4.10
Tuna, Yellowfin	*Thunnus albacares*	20,902	502	2.40
SHARKS				
Blue Shark	*Prionace glauca*	1,981	31	1.56
Grey Nurse Shark	*Eugomphodus taurus*	74	4	5.41
Hammerhead Sharks	*Sphyrna spp*	3,402	36	1.06
Mako Shark	*Isurus oxyrinchus*	3,274	58	1.77
Thresher Shark	*Alopias spp*	69	1	1.45
Tiger Shark	*Galeocerdo cuvier*	392	13	3.32
Whaler Sharks	*Carcharinus spp*	5,336	101	1.89
White Shark	*Carcharodon carcharias*	84	7	8.33
SPORTFISH				
Amberjack	*Seriola dumerilii*	874	18	2.06
Australian Salmon	*Arripis trutta*	4,683	339	7.24
Barracouta	*Thyrs lies atun*	1,004	2	0.20
Barracuda	*Sphyraena* barracuda	1,567	2	0.13
Cobia	*Rachycentron canadum*	429	9	2.10
Dolphin Fish	*Co,yphaena hippurus*	12,569	120	0.95
Mackerel, Broadbarred	*Scomberomorus semifasciatus*	64	0	.0.00
Mackerel, Frigate	*Auxis thazard*	1,675	1	0.06
Mackerel, Narrowbarred	*Scomberomorus commerson*	3,451	37	1.07
Mackerel, QLD School	*Scomberomorus*	272	3	1.10
Mackerel, QLD Spotted	*queenslandicus*	869	4	0.46
Mackerel, Shark	*Scomberomorus spp*	564	2	0.35
Queenfish	*Grammatorcynus bicarinatus*	1,741	5	0.29
Rainbow Runner	*Scomberoides spp*	813	16	1.97
Samson Fish	*Elagatis bipinnulatus*	579	35	6.04
Tailor	*Seriola hippos* •.	3,933	120	3.05
Tarpon	*Pomatomus saltatrix*	136	2	1.47
Threadfin Salmon	*Megalops cyprinoides*	73	0	0.00
Trevally, Big Eye	*Polynemus spp*		5	1.16
Trevally, Giant	*Caranx sexfasciatus*		12	0.93
Trevally, Goldspot	*Caranx ignoblis*		11	1.39
Trevally, Silver	*Carangoides fulvogutiatus*		185	2.84
Wahoo	*Pseudocaranx dentex*		4	0.79
Yellowtail Kingfish	*Acanihocybium solandri*		1400	8.00
	Seriola lalandii			

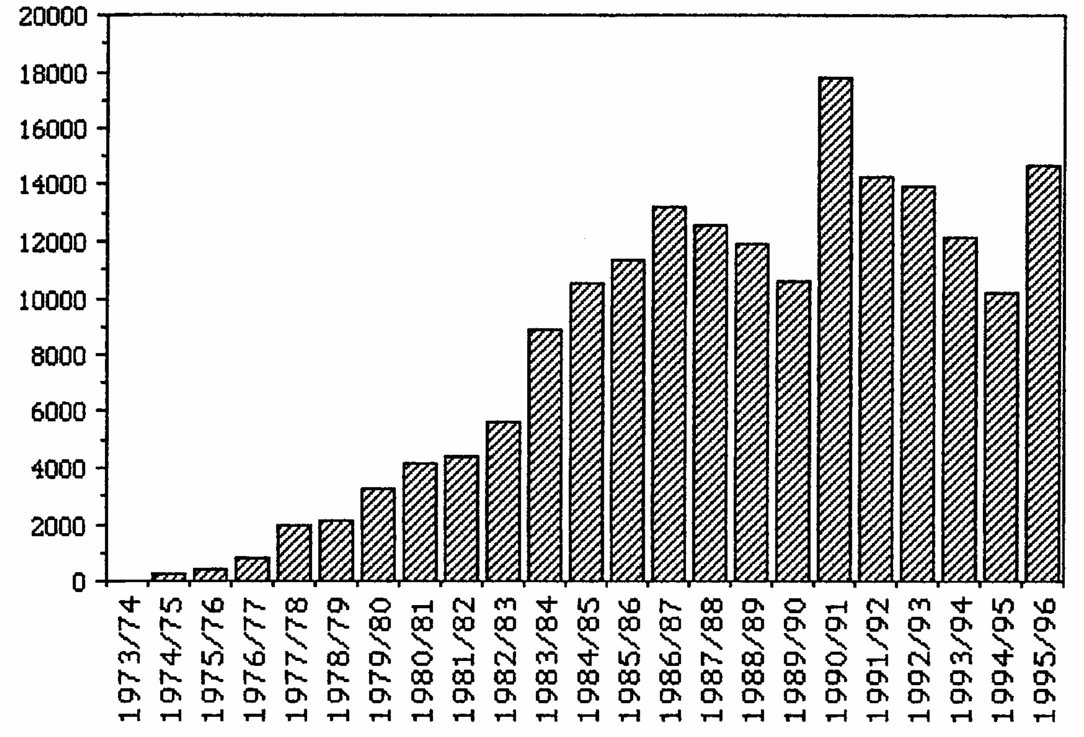

Figure1. Numbers of marine gamefish tagged by recreational anglers since the origin of the Australian tagging program.

Overall species composition, by groups, for the program is shown in Figure 2.

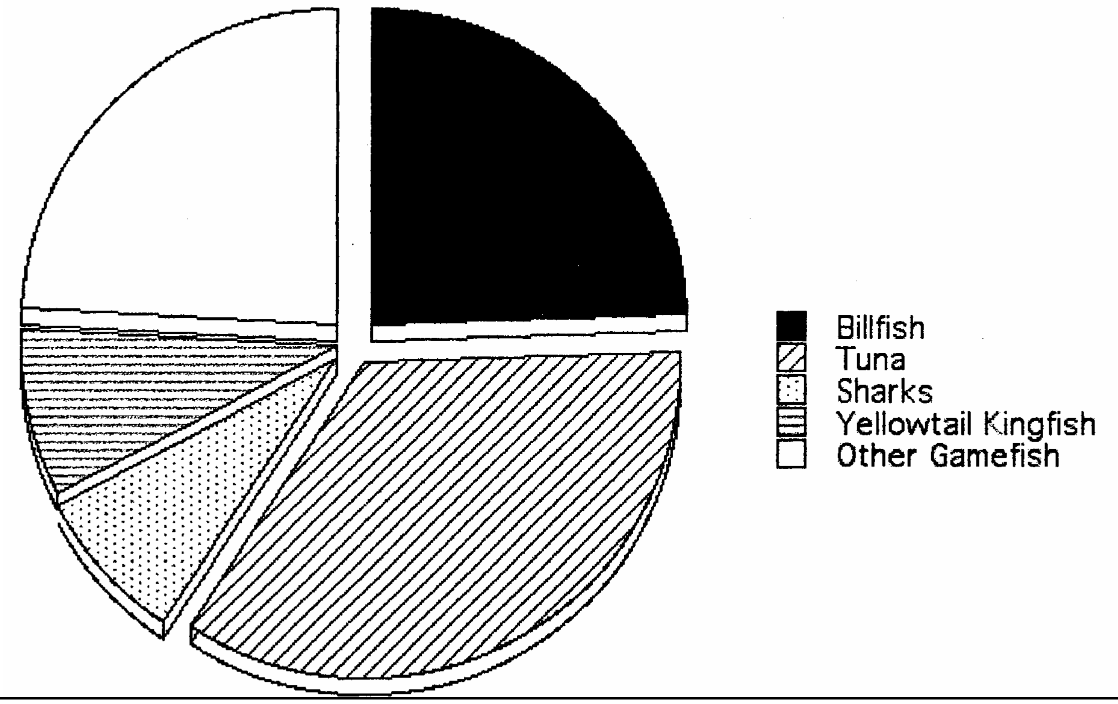

Figure 2. Species group composition of marine gamefish tagged on the Australian gamefish tagging program.

The results of this program have been used widely for many purposes, including stock delineation, movement rates, variation in year class strength and growth studies. Many published papers have resulted from, or have used data from this and the other large scale tagging programs.

BENEFITS OF RECREATIONAL TAGGING

There are two main areas of benefit which derive from recreational (sportfishing) tagging programs. The first is new scientific knowledge, which is discussed below, and the second is that of improved angler and community perception and attitudes. If anglers feel that they are contributing to a worthwhile endeavour, they will be more likely to develop, and promote ethical attitudes towards fishing, and the fish they target. This leads to a strong conservation ethic in participating anglers which has a range of benefits. For example, participating individual anglers, and angler organizations, tend to be very supportive of research programs in general, and will readily participate and assist in not only tagging and recapturing fish, but also in programs other than tagging. Awareness of tagging programs, and willingness to assist by anglers, also ensures that recaptured tagged fish from any program are more likely to be reported to the tagging agency.

Recreational tagging programs are popular with the media, not only angler-oriented, but also mainstream electronic and print outlets. News of the more ‘spectacular’ tag recaptures (long distance, long time-at-liberty) capture the public imagination, leading to support for research in general. Public awareness and education may also demonstrate conservation aspects of recreational fishing which would not otherwise be known by the general public.

SCIENTIFIC GAINS AND USES

Do recreational tagging programs achieve scientifically useful or meaningful results? It is clear from an inspection of the uses to which recreational tagging data have been put that the answer to this question is in the affirmative. The main uses of such data are:

Stock delineation: One of the important issues in fisheries management is the determination of the extent, or boundaries of stocks which may exist within the range of an exploited species. (includes rates and extents of movements). For the large, pelagic species such as tuna, billfish and sharks, which have trans-oceanic ranges, and are often fished by many nations, delineation of stocks is a critical question. Genetic studies of such species have often (but not always) proven to be inconclusive in determining stock structure. Tagging is then the only tool available for giving some indications of stock structure.

Because billfish and tuna have extensive trans-oceanic ranges, and because tagged individuals of some species of tuna and billfish sometimes show long distance movements, billfish and tuna are often called “Highly Migratory Species”, a term which has international legal connotations. However, it is also known that some species of billfish and tuna are much less ‘migratory’ than others, and that many of them aggregate seasonally in localised areas. A good example of this is the annual aggregation of adult black marlin off the Great Barrier Reef, Australia, the basis for the famous charter fishery off Cairns, Australia. It is also known that aggregations of many species may be separated by great distances. Therefore, the rate of exchange of individual fish between such aggregations is a Critical factor in assessing the effects of fishing on a given aggregation. This rate of exchange of individual billfish and tuna throughout their ranges is often termed a “Mixing Rate”, and can be likened to the viscosity of a fluid. If a fluid is highly viscous, like molasses, then mixing will be very slow. Similarly, if the mixing rate of a given species of tuna or billfish is very slow, then it may take a long time to recover from depletion of the stock in a localised part of its range, even though this depletion may be of a temporary nature. Large-scale ‘commercial’ tagging has been used to determine such mixing rates of pelagic fishes, notably tagging programs on skipjack and yellowfin tunas operated by various international agencies in all three major oceans. Similar information has been derived from tagging of Istiophorid bullish (marlin, sailfish) by recreational anglers. In fact, virtually all of the data on rates and extent of movements of the Istiophorid billfishes have been derived from recreational tagging programs operating in the US and Australia.

Interaction and Sector Allocation: Reporting of recaptured fish by different sectors of a fishery is often a good indicator of interaction between sectors. Recreationally tagged tuna have been reported by both commercial and recreational fishers, while tagged billfish have been reported by recreational, artisanal and commercial fisheries using a range of gear types, including trolling, longline and purse seine. If tags are returned by all fishery sectors, either in total, or in proportion to the relative catches of each, then return rates will provide a measure of proportional catch of each sector. Of course, in practice, this is virtually never the case, but nevertheless, with careful interpretation, tag returns by sector will still provide some indication of fishery interaction.

Growth rates: Even though it is often argued that, because of unreliability of initial release measurements or estimates, recreationally based tagging data are of no use in determining growth rates, important information on growth rates can be derived from recreational programs. For example, many of the smaller gamefish, such as juvenile yellowfin tuna, trevallies and dolphin fish, are often accurately measured at release on the Gamefish Tagging Program, although it is more common to estimate the size of tagged fish. For larger fish which are tagged while still in the water, the weight of the fish is estimated, and while such estimates are prone to error, under some circumstances, useful growth information has been able to be derived. For example, when most fish being released at the same time and place are similar sizes, as is the case for juvenile (0+) black marlin which are tagged off northeast Australia each year, estimates of size at release have very narrow ranges. If any of these fish is recaptured years later, and if an accurate measurement of weight or length is obtained, then good long term growth estimates may be obtained. This has indeed been the case for a number of species, including black marlin, albacore, yellowfin and southern bluefin tuna.

Survival: The condition of fish at release is usually recorded for recreationally tagged fish. Many cases have been recorded of fish with apparently serious injuries at release being recaptured in healthy condition much later, demonstrating, at least for some individual fish, recovery and healing after hooking injuries.

Catch information: One of the little realised benefits of recreationally tagging programs is the information derived from release data. Catches of recreational fisheries are rarely monitored due to cost and logistic constraints, and while records of released fish usually do not include effort data, they nevertheless may form a long-term record of the availability of fish through time and space.

Examples of this would include examination of tagging data bases to reveal changes in species composition of sharks, tuna and billfish off the New South Wales coast over the last 25 years. Of course, such changes need to be considered in relation to changes in targeting practices, but can be indicative of real changes in availability.

Criticisms of Recreational Tagging

As mentioned above, recreational tagging is sometimes criticised on a number of grounds. The main criticisms of recreational tagging might be summarised as follows, together with brief comments:

It is unscientific. The apparent lack of quality control over recreational tagging operations is sometimes cited as a reason for non acceptance of results from such programs. As discussed, lack of total quality control does not negate the utility of some forms of data which derive from such programs. Also, it is possible to direct and train participants in tagging projects to achieve excellent data quality.

It causes unacceptable mortality. In some cases, tagging may lead to additional mortality of fish. This argument has always seemed redundant. A tagged fish has a far greater chance of survival than a landed fish, and in any case, any slight increase in mortality caused by the physical act of tagging would be more than compensated by the potential information which the tagging could provide.

It may damage sensitive populations of fish. This argument suggests that availability of tags may encourage fishing where, in the absence of tag and release, that fishing would not take place. This would appear to be a purely hypothetical objection, since anglers will still seek out fishing opportunities, and if they wish, still catch and release fish with or without tags. Anglers who take part in tagging programs tend to be highly motivated supporters of ethical and careful fishing practices.

It is expensive: Co-operative tagging programs often cost a lot to run, but is value for money achieved? The decision on cost-benefits of any program rests with the managers of those programs. In determining costs and benefits of recreational tagging programs, all benefits must be considered. Reviews of the utility of the data generated by such programs should be regularly undertaken, and goals and targets modified accordingly. The social benefits of such programs should not be under estimated. Finally, the popularity of these programs readily allows opportunities for external, private-sector based sponsorship.

CONCLUSIONS

Angler-based tagging programs can and do produce very useful information which would otherwise not be possible, or be prohibitively expensive, to achieve. Stock delineation and determination of movement and mixing rates are two areas in which recreational tagging programs have been particularly helpful. The value of good will generated by such programs, both within the angling community and the community at large, should not be underestimated.