

Is there a role for 'uncontrolled' tagging in 'real' fisheries science?

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Abstract

The demand by fishery participants to tag fish has sometimes resulted in the information of large-scale, long-term tagging programmes. The best known examples of these are so-called cooperative tagging programmes through which recreational anglers tag and release fish as part of a broad-scale tagging undertaking. There are many such programmes in operation around the world, some of which have been in operation for many years. Periodic reviews of long-term programmes allow assessment of their progress, utility and application to research goals. The main differences between user-based and scientific tagging operations tend to lie 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 quality data overall since data on all fish released are retained. These differences appear to be intuitively obvious, but may not necessarily be real. Despite their shortcomings, recreationally-based tagging programmes do provide important and useful data which would otherwise be difficult, if not impossible, to obtain.

Introduction

Tagging of fish by fishery participants is popular. It gives the fisher a sense of participation in a scientific activity which will add to knowledge about the target species. The best-known examples of this activity are

so-called cooperative tagging programmes through which recreational anglers tag and release fish as part of a broad-scale undertaking. There are many such programmes around the world, some of which have been in operation for several decades.

The main perceived differences between user-based and scientific tagging operations 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 programmes are always well structured, and usually achieve their goals are obviously not always met. And in practice, how poorly structured are user-based programmes?

This paper focusses on two large-scale, Australian cooperative tagging programmes, the Australian Gamefish Tagging Program, operated by New South Wales Fisheries, and AUSTAG, operated by the Australian National Sportfishing Association in conjunction with the Fisheries Branch of the Queensland Department of Primary Industry.

Brief history of recreational tagging

Tagging of large fish by recreational anglers was made possible by the development of nylon and steel-headed

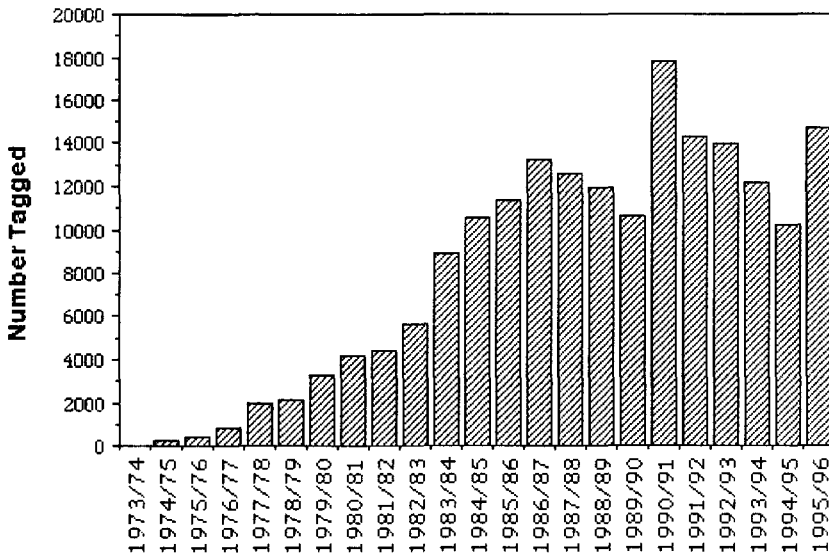


Figure 1. Numbers of fish tagged on the Australian Gamefish Tagging Program.

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 programme 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 programmes, including all of the gamefish tagging programmes operated by the US National Marine Fisheries Service (NMFS), the South African tagging programme, operated by the Oceanographic Research Institute in Durban, Canadian shark tagging programmes operated by Fisheries and Oceans,

Canada, and the Australian Gamefish Tagging Program, operated by NSW Fisheries.

Tagging smaller recreationally important fish, such as bream, flathead, barramundi etc., makes use of tagging equipment used on standard fisheries research programmes. The main tool which has made mass tagging of smaller fish by recreational anglers possible is the 'tagging gun', a modified clothing tag applicator which applies cartridge banks of anchor tags possessing a 'T' shaped head. This method is used by AUSTAG.

In Australia, angler-based tagging programmes are generally confined to these two large, centralised operations. This is in contrast to the US, where numerous tagging programmes have evolved at both governmental and private levels.

Summary results of both Australian programmes are published in annual reports, and are widely distributed to participants and all interested parties. Briefly, the statistics on both programmes may be summarised as follows:

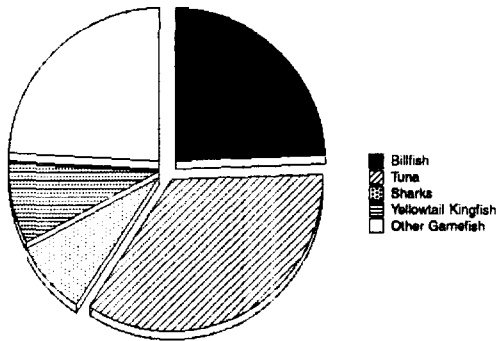


Figure 2. Species composition of Gamefish Tagging Program.

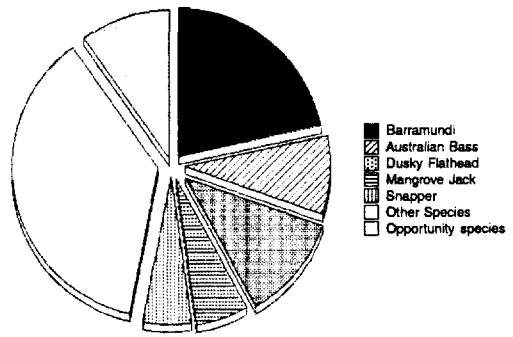


Figure 3. Numbers of fish tagged on the Australian Sportfish Tagging Program. (AUSTAG).

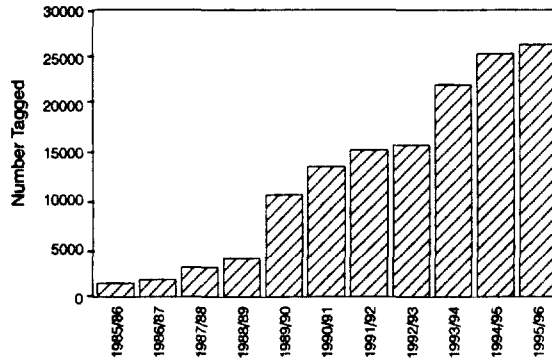


Figure 4. Species composition of Australian Sportfish Tagging Program.

Gamefish Tagging Program

This programme was commenced in 1974, and has operated nationally (and in some overseas countries) ever since. All recognised 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. The growth of the programme 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. The broad species composition for the programme is shown in Figure 2. The results of this programme 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 programme.

Sportfish Tagging Program

The AUSTAG Programme began in 1985, and has grown ever since (Figure 3). Eligible species are generally those termed 'sportfish' by the Australian National Sportfishing Association, the main targeted species for the programme being barramundi, dusky flathead, Australian bass, mangrove jack and snapper (Figure 4). The programme has concentrated on specific scientific studies, such as movement and stock structure of dusky flathead and school mackerel in southeast Queensland, and of snapper in Victoria. AUSTAG operates in all Australian States except New South Wales.

Benefits of recreational tagging

There are two main areas of benefit which derive from recreational tagging programmes. The first is new scientific knowledge, which is discussed below, and

the second area of benefit is that of 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 additional benefits. For example, participating individual anglers, and angler organisations, tend to be very supportive of research programmes in general, and will readily participate and assist in programmes other than tagging. Awareness of tagging programmes, and willingness to assist by anglers, ensures that recaptured tagged fish from any programme are more likely to be reported to the tagging agency.

Recreational tagging programmes are popular with the media, not only angler-oriented, but also mainstream electronic and print outlets. 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.

Scientific gains and uses

Do recreational tagging programmes 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. 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, the basis for the famous charter fishery off Cairns. It is also known that aggregations 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. Tagging has been used to determine such mixing rates of pelagic fishes, notably the tagging programmes on skipjack and yellowfin tunas operated by the Secretariat of the Pacific Community (SPC). Similar information has been derived from tagging of Istiophorid billfish (marlin, sailfish) by recreational anglers. In fact, virtually all of the data on rates and extent of movements have been derived from recreational tagging programmes 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 tag returns by sector will still provide some indication of fishery interaction.

Growth

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 programmes. The AUSTAG Sportfish Tagging Program relies on well-trained taggers who accurately measure all released fish with standardised equipment. Growth data derived from that programme are therefore of good quality (provided, of course, that reliable measurements are made at recapture – a caveat of all tagging programmes). Similarly, smaller gamefish are sometimes accurately measured at release on the Gamefish Tagging Programme, 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, good growth information has been able to be derived. For example, when most fish being released are of similar size, as is the case for juvenile (0+) black marlin which are tagged off Townsville 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 recreational tagging programmes 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 40 years. 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 programmes. As discussed, lack of total quality control does not negate the utility of some forms of data which derive from such programmes. 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 information which 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, it 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 programmes tend to be highly-motivated supporters of ethical and careful fishing practices.

It is expensive

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

Conclusions

Angler-based tagging programmes 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 programmes have been particularly helpful. The value of goodwill generated by such programmes, both within the angling community and the community at large, should not be underestimated.