

Monitoring and Research on Landed Fish at Game Fishing Tournaments in NSW

2008/2009



Report to
The NSW Recreational Fishing Trusts Expenditure Committee

by

Pepperell Research & Consulting Pty Ltd

May 2010



Project background

The gamefish fishery which operates off the New South Wales coast is among the largest of its kind in the world, generating vital economic activity in regional towns and centres along the entire coast. The fishery is well organized and self-regulated, with member clubs affiliated to the parent body, the NSW Game Fishing Association, operating from most of the major ports along the coast. The annual game fishing season runs from October through May, although most activity and organized events occur from January through April. A wide range of gamefish species are caught in the fishery, including black, blue and striped marlin, shortbill spearfish, sailfish, yellowfin, bigeye, longtail, skipjack and mackerel tuna, albacore, dolphin fish (mahi mahi), wahoo and cobia and a range of offshore shark species including mako, blue, tiger, hammerhead and various whaler sharks.

A high percentage of most of these species is now tagged and released. However, the remainder of the catch, representing potentially valuable scientific specimens, are captured and brought back to weigh-stations during tournaments and club activities. In the absence of scientific examination, such specimens are usually eaten for food, but their scientific value is lost. Biological and scientific monitoring of catches is an important part of studying any fishery. Tournaments and organized events provide excellent opportunities to undertake such biological monitoring and research on the landed catch, and in the past, these opportunities have been taken advantage of to varying degrees.

Before the current project was conceived, biological data was collected at NSW Game Fishing Tournaments by Pepperell Research on an ad hoc basis, especially during the largest game fishing event, the annual Interclub tournament at Port Stephens, which has been sampled continuously for over 30 years. During this period, many research projects being undertaken by a wide range of research organizations have been assisted through cooperation with game fishing tournaments in New South Wales. The annual Interclub tournament at Port Stephens in particular has attracted many researchers from around Australia and overseas, especially during the past decade or so. Table 1 lists many of the projects which have been undertaken, illustrating the potential benefits to research and to acquiring knowledge on the biology of game fish which can derive from close cooperation with the fishery.

(Cover photo: A striped marlin being measured during a monitored tournament)

Table 1. Previous and current scientific studies facilitated through NSW game fishing tournaments.

Project	Organization(s)
Global genetics of striped marlin	Virginia Institute of Marine Science (VIMS)
Global genetics of mako sharks	VIMS
Global genetics of black marlin	Pepperell Research/VIMS
Ageing of black marlin*	Pepperell Research & SPC
Biological studies of pelagic sharks	University of NSW/Pepperell Research
Digenic trematode parasites of marlin & sharks*	University of Queensland
Antifouling properties of skin of sharks	Macquarie University
Pit organs in sharks	Sydney University
Biology of slimy mackerel & yellowtail*	NSW Fisheries
Distribution & abundance of dolphin fish	University of NSW/Pepperell Research
Age and growth of dolphin fish*	Sydney University
Distribution & abundance of yellowfin tuna	University of NSW/Pepperell Research
Competition of parasites on marlin skin	Australian Museum/Oxford University
Vision of billfish*	University of Queensland
Vision of sharks*	University of Queensland
Brain structure and function in sharks*	University of Queensland
Attachment mechanisms of external parasites*	Oxford University
Distribution & abundance of black marlin	Sydney University/Pepperell Research
Ongoing monitoring of pelagic sharks*	NSW DPI Fisheries
Ongoing size monitoring and sexing of marlin*	Pepperell Research
Positioning of Satellite tags on blue shark fins*	CSIRO
Parasites in stomachs of marlin and mahi mahi*	University of Queensland
Mercury levels in striped, blue & black marlin*	AMC Tasmania/Pepperell Research
Global genetics of remoras*	VIMS
Global genetics of striped marlin (new study)*	University of Southern California
Studies of nematode parasites in pelagic fishes*	University of Melbourne, Vet Dept.
Testing PSAT tag anchor heads on tiger sharks*	Pepperell Research & NSW DPI
Age, growth & reproduction of striped marlin*	Charles Sturt University
Trematode parasites of pelagic fishes*	University of Adelaide/Museum of SA
Ultrasound testing on large sharks*	NSW DPI
Global genetics of mako sharks (new study)*	National Marine Fisheries Service (US)
Testing PAT tag attachment to tiger sharks*	Pepperell Research & NSW DPI
Genetic discrimination between Atlantic and Pacific billfishes*	Virginia Institute of Marine Science (VIMS)
Global genetics of black marlin*	National Taiwan University
Feeding ecology of mako sharks*	Flinders University, SA

* Studies assisted through current Recreational Trust project

Between 1998 and 2002, many sharks weighed at NSW tournaments were measured and sampled by Dr Ricky Chan of UNSW for his Ph.D (co-supervised by the author). With the successful completion of that work, and the need for ongoing sampling of all fish, it was proposed to the Recreational Fishing Trust that data collection at major tournaments should now continue on a regular basis.

It was proposed that all fish brought to the weigh station of major tournaments would be measured, weighed, and sexed, and biological samples, such as tissue for DNA analysis and hard parts for ageing, would be collected and either supplied for current research projects, or archived for future possible use. It was further proposed to encourage and facilitate research projects on gamefish conducted by other research organizations.

Some initial funding from the small grants program of the Recreational Fishing Trust was obtained in 2001 to coordinate the scientific program for the 2002 Interclub Game Fishing Tournament at Port Stephens. This demonstrated the benefits which can flow from coordinated cooperation between game fishing tournaments and research and monitoring projects and as a result, a more comprehensive program was proposed to cover a broader range of tournaments geographically and through the game fishing season.

In 2002, the Recreational Fishing Trust approved a further proposal to establish a monitoring and sampling program for captured fish at game fishing tournaments during the 2002/2003 season. The establishment of such a program, with its many benefits, was seen by the fishery and the public as an important undertaking. Apart from the cooperation with other research organizations, a rewarding side benefit is the linking with Universities in providing training and research projects for students. With the successful conducting of the project from 2002/2003 to 2007/2008 (see final reports), application was made for continuation of the program for the 2008/2009 game fishing season. The application was successful and this report summarises the activities of the program the 2008/2009 game fishing season.

Aims

The continuing objectives of this project are to organize, coordinate and report on biological research and sampling at major game fishing tournaments in New South Wales. To establish a baseline monitoring program for recording biological data of weighed fish, and to archive biological samples taken from weighed fish

Methods

A range of selected Australian and overseas research institutions were contacted to establish interest in undertaking research during the 2008/2009 game fishing season. Responding scientists supplied information on their prospective research operations and their requirements to conduct their work during tournaments. Necessary arrangements were made regarding equipment delivery, accommodation and other special requirements of researchers. Coordination of all research operations was arranged in consultation with the tournament committees of each tournament.

Persons who assisted as tournament sampling staff this year were Glen Cuthbert, Daniel Nehl, Richard Tilzey and Cameron Baber.

Prior to commencement of the season, standardized sets of equipment for measuring and sampling at tournaments were again distributed to samplers.

A set of equipment consists of a flexible surveyor's tape measuring in centimetres to at least 6 metres, a stout-bladed knife, knife sharpener, zip-lock

plastic bags of various sizes, waterproof labels, field data sheets, clipboard and pencils, fish identification information and a large cooler. Depending on current projects, other specialized equipment might include phials filled with preserving fluid such as DMSO or 95% ethanol, dissecting tools and so on.

Before each tournament, the Program Manager (Julian Pepperell) contacted the appropriate club officials to ask permission to attend their tournaments and to inform them of the work being conducted. This ensured that competitors and officials were aware of requests for assistance in allowing access to their fish, and ensured cooperation in the logistic operation at the weighstations. With the excellent rapport developed throughout the fishery, cooperation continued to be outstanding in 2009.

As far as possible, all gamefish landed at tournaments which were attended by a field sampler were examined. In many cases, fish examined included some specimens which would not have appeared in official records of an event. These would include disqualified fish, fish not meeting minimum weight requirements and fish not weighed for various reasons. Weights, measurements, sex (by external observation in the case of sharks or by dissection in the case of all other species) and any other secondary observations such as dietary items, parasites and injuries were recorded. Biological samples were obtained for specific research programs as well as for routine archiving, and preserved or frozen as necessary. Researchers from other organizations were facilitated in obtaining their data and samples. This often required coordinated cooperation with weighstation officials.

Where facilities allowed, the activities of scientists conducting research at the tournament were explained and conveyed to the general public during the weigh-ins, who often viewed proceedings in large numbers. Information was also relayed to a wider audience via interested print, radio and television media.

Right: A blue marlin landed at the Interclub tournament at Port Stephens. A large audience gathers to watch proceedings and are informed about fish biology and various research programs by attending scientists.



Results

Tournaments sampled during the season were selected on the basis of their location, timing, likely number of competing vessels and therefore, fishing days, and their history. This year, seven tournaments were selected, covering the main game fishing centres between Port Macquarie and Bermagui. A brief summary of each tournament covered follows, and full results of fish sampled and tagged at all tournaments are presented in Appendix II.

Golden Lure Tournament, Port Macquarie (10-16 January 2009).

This tournament, always held during the second week of January, is the first major tournament of the calendar. Fishing takes place on the second weekend of January plus the following Friday and Saturday, and a midweek Ladies' and Juniors' competition is held as a separate one day event.

The number of boats which registered to fish this tournament was a little up on previous years, with 31 boats (in 2008, only 21 boats actually fished this tournament, which was plagued by bad weather). This year, all five days of this tournament were successfully fished.

The most striking result at this tournament was the appearance of blue marlin in good numbers. A total of 19 were caught, six of which were weighed (94.8 to 190.6kg) and 13 tagged. This tournament often sees large numbers of dolphinfish tagged, but this year, just 21 were tagged by a much larger fleet than fished last year. This was compensated though by the appearance for the second year in succession of adult dolphinfish, with eight weighed ranging from 13.8 to 16kg. Last year this tournament saw 13 yellowfin tuna tagged and none weighed, compared with just 6 tagged and again, none weighed this year.

Right: Large dolphinfish (mahi mahi) were a feature of this year's game fishing season and samples were taken from all landed fish. This one shows the tell-tale wound of a cookie cutter shark on its flank.



As was the case last year, no sharks were landed at this tournament and only three sharks in total, all hammerheads, were tagged. This is not particularly surprising since very few boats actually target sharks at this particular tournament with most sharks caught in the past being taken (and tagged) as a bycatch of trolling baits for small black marlin. For the second year in succession, small black marlin were virtually absent so this method of fishing was undertaken by even fewer boats than normal.

Bill Heyward Memorial Tournament, Botany Bay (24-25 January 2009)

This two day tournament has been an annual event on the game fishing calendar for over 15 years and traditionally attracts a strong fleet of boats from the metropolitan clubs. This year, the tournament attracted 52 boats, ten less than last year. This was a somewhat disappointing tournament for samples, with only five fish weighed on the first day and none on the second. The fish weighed were two large tiger sharks, two mako sharks and a blue marlin. While a total of 93 fish were tagged at this tournament, most were small mahi mahi, skipjack tuna and yellowtail kingfish. Only 13 marlin were tagged this year (all striped marlin), which was well down on previous years. Again, these results illustrate the unpredictable nature of gamefishing and by extension, of being able to predict accessibility of weighed fish for sampling.



A large infestation of parasites on a landed mako shark. These are Callinoid copepods (crustaceans) that are often found on the surface of large, pelagic fish. They are mobile and move around the skin eating mucous and probably blood. The long thin extensions are paired strings of eggs.

Big Fish Bonanza, Lake Macquarie (31 January - 1 February 2009)

This regular tournament is always held during the first weekend of February. The host club, Lake Macquarie Game Fishing Club, tends to specialize on fishing for sharks, so the results of this tournament may give some indication of the availability and sizes of pelagic sharks in the area each year. This year 71 boats fished the tournament compared with 69 the previous year. However, as was the case for the Botany Bay tournament, quite small numbers of fish were weighed (seven fish) compared with 27 in 2008.

These were two blue marlin, two tiger sharks a blue shark, a yellowfin tuna and a mako shark. The number of fish tagged was also down on previous years. A total of 61 fish were tagged this year, which included 43 dolphin fish, but numbers of marlin were low, with only 14 tagged compared with 51 the previous year.

NSW Interclub Tournament, Port Stephens (21 February – 1 March 2009)

This is the largest game fishing tournament in the southern hemisphere, always held over the last weekend of February and the first weekend of March. It is by far the most important event of the NSW game fishing calendar, being the annual competition among all NSW game fishing clubs, nearly always attracting in excess of 200 competing boats. The main tournament is held over two weekends, while during the week, a Ladies' Day and a separate one day tournament are held. This year, all fishing days were covered by the Project personnel.

Right: Dr Nick Otway of NSW DPI examines a landed blue shark with an ultrasound machine. Such trials on landed sharks can demonstrate the utility of this tool in studies on reproduction of living sharks.



All four fishing days of the tournament were fished this year (in 2008, two days were cancelled due to weather), although the number of boats participating this year (175) was considerably less than is usual (thought to be due to the global financial crisis).



Above: A shortbill spearfish weighed at the interclub tournament. The red arrow shows the position of the anus, well forward of the anal fin – a diagnostic (foolproof) feature of spearfishes

A total of 53 fish were weighed and 319 tagged compared with 31 fish weighed and 274 tagged the year before. This year, 21 billfish and 23 sharks were landed compared with 15 billfish and 13 sharks last year (and 7 billfish and 13 sharks the year before). The total numbers of billfish caught (captured plus tagged) were: 20 black marlin (74 in 2008 and 113 in 2007), 26 blue marlin (10 in 2008 and 10 in 2007) and 123 striped marlin (100 in 2008 and 51 in 2007).

Shark captures were unusually dominated this year by blue sharks. A total of 26 were either landed or tagged – much higher numbers than in any previous year sampled. Only 4 tiger sharks were caught this year (all landed) compared with 9 in 2008 and 7 in 2007. Lastly, 11 mako sharks were caught (8 landed and 3 tagged) compared with only 3 in 2008 and 7 in 2007.

The 'other gamefish' category was dominated this year by dolphinfish, with 121 caught (114 of which were tagged). This compared with a total catch of 68 dolphinfish in 2008.



A small part of the large fleet fishing the Interclub tournament at Port Stephens in 2009. This is the largest game fishing event in the southern hemisphere and provides a key location for sampling billfish and sharks every year.

Broken Bay Invitational Tournament, Broken Bay (14 – 15 March 2009)

This tournament, hosted annually by the Broken Bay Game Fishing Club in mid to late March, is fished over two weekend days. Last year, striped marlin dominated the catch with 65 caught (compared with just seven the previous year) while this year, 16 striped marlin were caught (14 tagged). Of note was the lack of any yellowfin tuna caught or tagged at this tournament following only three caught last year (although 69 had been tagged the year before at the same tournament).

Fish brought to the weighstation and sampled this year included seven marlin (one black, four blue and two striped), two mako sharks, three large dolphinfish (9 – 17.6kg) and three blue sharks. No tiger sharks were weighed this year. Dolphinfish were again a feature of this tournament with 41 tagged. Finally, and unusually, one albacore was tagged during the tournament, an unusual even off Sydney at this time of the year.

Peter Goadby Memorial Tournament, Sydney (4 – 5 April 2009)

This tournament was only able to be attended by a sampler on one of the two fishing days. Bad weather meant that most of the fleet only fished for a portion of that day, and subsequently, only two fish were sampled. These were a yellowfin tuna and a striped marlin. The only other fish weighed for this event were a blue marlin and five other yellowfin tuna weighing 44 to 67kg.

Canberra Yellowfin Tuna Tournament, Bermagui (17-18 May 2009)

This tournament was again sampled in 2009, having been missed the year previously. The first fishing day was cancelled due to weather, but the next two days were successfully fished.

While just four fish were weighed last year (all yellowfin tuna), this year 28 fish were weighed, of which 17 were able to be measured and sampled (12 yellowfin tuna, three mako sharks and one striped marlin). The weights of the other landed fish were recorded for the project.

Of 50 fish that were tagged, 29 were skipjack tuna and only two were marlin (one black and one striped). Twelve yellowfin tuna were tagged, which was well down on the previous year's 76 tagged. Also largely absent this year were albacore, with just five tagged or captured compared with 32 the year before.

Data Summary

Full details of all fish weighed during tournaments attended by project staff can be found in Appendix II. As many weighed fish were measured and sexed as possible (not all landed fish are available for examination by sampling staff). Anal spines (for ageing) and muscle samples (archived for a variety of potential future projects) have been taken from all billfish weighed. All sharks were identified to species and those examined by Drs Otway and Storrie have been dissected for various studies, including identification of shark species from fins, age and growth, reproductive and dietary studies.

Other activities associated with project

As has been the case in previous years, throughout the season, a number of radio interviews were conducted with the author in which the benefits of the scientific program at tournaments were emphasised. As well, constant liaison with game fishing clubs maintains an excellent working relationship with the fishery.

Scientific Program

A number of scientific projects, both local and international, were again able to be facilitated or assisted through the project in 2008/2009. These included:

Global genetics of mako sharks

Requesting/partner organization(s): US National Marine Fisheries Service (NMFS), La Jolla, California. Shortfin mako sharks (*Isurus oxyrinchus*) occur throughout the tropics and sub tropics of the three major world oceans. An earlier study of their global genetics indicated some population structure, but to refine these results, NMFS is conducting a new study. The Gamefish Tournament Monitoring Program continued to cooperate with this study this year by collecting muscle samples from landed mako sharks at tournaments. This year, a further 16 samples were obtained for this important study.

Age, growth and reproduction of striped marlin

This study, carried out by Keller Kopf, a Ph.D student with Charles Sturt University, (Dr Pepperell, external co-supervisor) entered the analysis and writing up phase. Through the gamefish tournament monitoring project, Mr Kopf has been able to obtain samples from a large number of striped marlin for his study, which is by far the definitive study yet undertaken on age and growth of this important species. The results of this study, apart from being very interesting in their own right, will be fed into stock assessments of striped marlin for the western Pacific region.



Ph.D student Keller Kopf (foreground) records details of samples taken from landed marlin. The opportunity to examine and sample fish from the recreational fishery is vital to this kind of research.

Biological Studies on Pelagic Sharks: NSW DPI scientist Dr Nick Otway again attended the Interclub and other tournaments and point score days throughout the season. This year, Dr Otway was able to examine a further 23 sharks (including 11 blue sharks) and add to his archive of detailed data and biological samples from these species. As noted previously, he has developed a method for measuring large sharks by taking digital images of them with known reference scales while the sharks are being weighed, and later calculating various length measurements. These are particularly useful in situations where it is not possible to measure the sharks in a natural horizontal position.

Dr Megan Ellis of NSW DPI holds a blue shark for photographing. The marked cylinder hanging from the dorsal fin is used as a reference to take detailed measurements in the laboratory.



Ongoing Monitoring and Sampling of Billfish: As in previous years, Principal Investigator, Dr Julian Pepperell of Pepperell Research & Consulting organized and coordinated all of the above research and continued his own ongoing research into billfish biology and determining long term patterns of distribution and abundance of marlin. All marlin brought to the weigh station were weighed, measured, sexed and sampled. Archived tissue samples are regularly requested by overseas researchers for a number of projects, such as those listed above. These samples are taken from not just billfish, but also sharks, tuna and other gamefish. During all weigh-ins attended, information on the scientific work being carried out at the weigh station, including past results of projects, was frequently conveyed to the general public via the tournament public address systems.

Composition of the Monitored Catch

The following sections summarise the species composition of the total catches (weighed and tagged) for all tournaments covered by the project in 2008/2009.

Table 2 Numbers of each species captured and tagged during the tournaments attended for the project.

Species	Pt Macq Capts	Pt Macq Tags	Bot Bay Capts	Bot Bay Tags	Lake Macq Capts	Lake Macq Tags	Pt Steph Capt	Pt Steph Tagged
Albacore								
Amberjack								
Black Marlin	2	8				6	1	19
Blue Marlin	6	13	1		2	1	4	22
Blue Shark				3	1		11	15
Hammerhead		3				1		1
Mahi Mahi	8	21		33		43	7	114
Mako Shark			2	4	1		8	3
Sh'bill spearfish						1	1	14
Skipjack tuna		13		11				15
Spinner shark							1	
Striped Marlin	2	3		13		7	15	108
Tiger Shark			2		2		4	
Whaler shark								1
Wahoo	1	1						2
Yellowfin Tuna	1	6			1	2	2	2
Yellowtail Kingfish		5		29				3
Totals	20	73	5	93	7	61	54	319

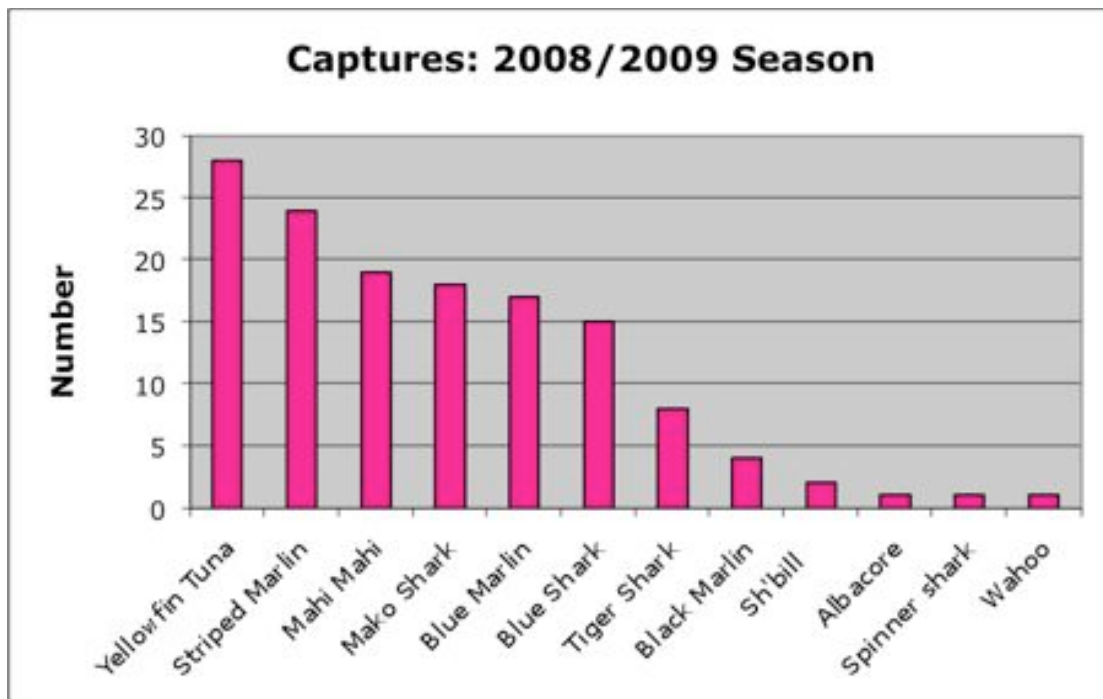
Table 2 (Contd.) Numbers of each species captured and tagged during the tournaments attended for the project.

Species	Br Bay Capt	Br Bay Tagged	Syd Capt	Syd Tagged	Canb Yfin Capt	Canb Yfin Tagged	Total Capt	Total Tagged	Total Catch
Albacore					1	4	1	4	5
Amberjack		1						1	1
Black Marlin	1					1	4	34	38
Blue Marlin	4	2	1	1			17	39	56
Blue Shark	3						15	18	33
Hammerhead								5	5
Mahi Mahi	3	41		21	1	1	18	274	293
Mako Shark	2				5	1	18	8	26
Sh'bill spearfish	1	3					2	18	20
Skipjack tuna		34		6		29		108	108
Spinner shark							1		1
Striped Marlin	2	14	1	10	4	1	24	156	180
Tiger Shark				1			8	1	9
Whaler shark		1		1		1		4	4
Wahoo							1	3	4
Yellowfin Tuna			6	1	18	12	28	23	51
Yellowtail Kingfish		1						38	38
Totals	16	97	8	41	29	50	137	696	833

Considering the combined species composition of all fish caught at all tournaments attended, Figures 1 and 2 indicate that quite different proportions of the main species are tagged and weighed.

The main species weighed at tournaments attended by sampling staff in 2008/2009, by number, was yellowfin tuna followed by striped marlin, mahi mahi, mako sharks and blue marlin. Last year, the main species captured was striped marlin, followed by tiger sharks, mahi mahi and blue marlin. This year, blue sharks were more commonly caught and weighed than tiger sharks.

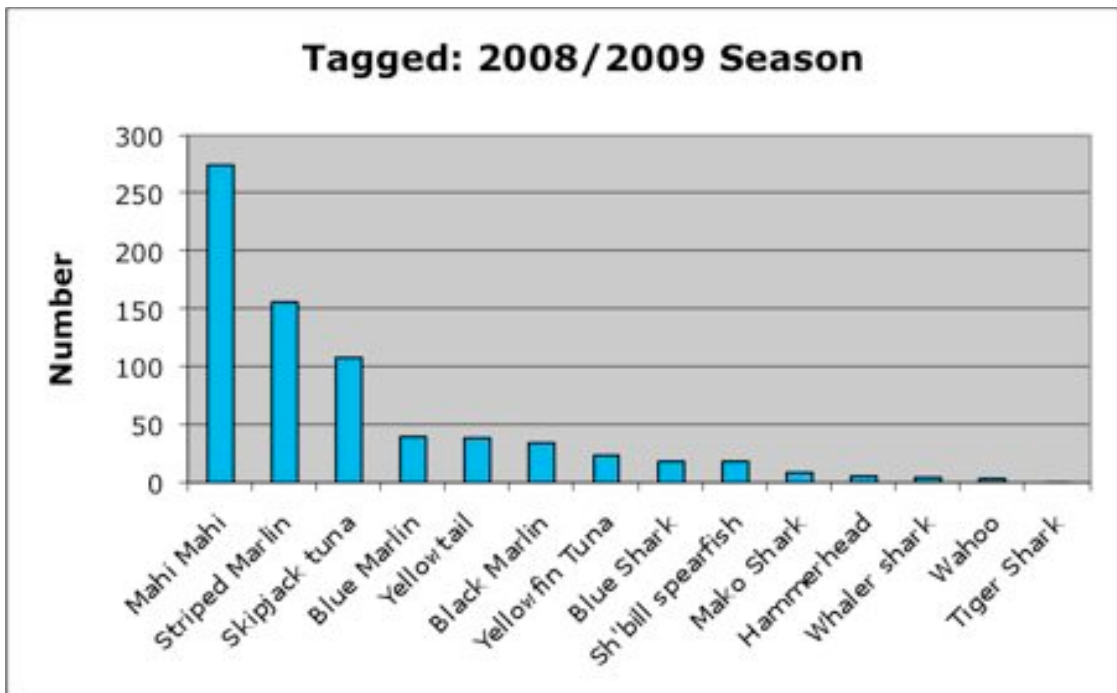
Figure 1. Numbers of all species caught and weighed during the major game fishing tournaments covered by the project in 2008/2009.



Regarding species tagged, Figure 2 indicates that the main species tagged this year was mahi mahi, with 274 released during the attended tournaments. Last year, 307 mahi mahi were tagged, so the numbers this year were again much higher than in 2006/2007 when very few were caught.

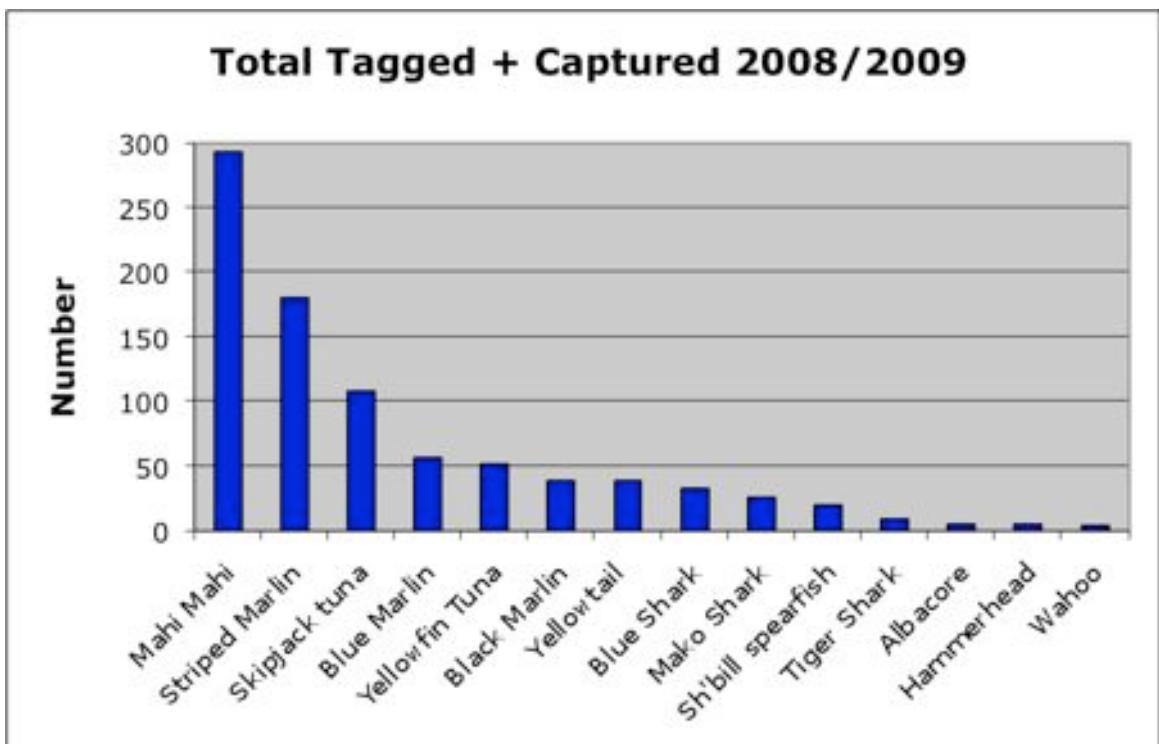
Regarding marlin, striped marlin topped for the third year running with 156 tagged (compared with 262 tagged last year and 126 the year before) followed by blue marlin (39 tagged) and black marlin (34 tagged). The number of black marlin was well down on the previous two years (92 last year and 131 the year before). As for all recent years, this continues a trend, begun in the early 1990s, of striped marlin becoming the dominant marlin species in the New South Wales gamefish fishery in all years except those when a strong year class of juvenile black marlin appears (as happened in 2004/2005). For at least three decades prior to the early 1990s, striped marlin were relatively rare in the game fishing catch of marlin, which had been completely dominated by black marlin. The shift to striped marlin has been a phenomenon which is due partly to improved targeting techniques, but also, almost certainly to increased regional abundance of the species.

Figure 2. Numbers of all species tagged and released during the major game fishing tournaments covered by the project in 2008/2009.



Combining tagged and captured fish, Figure 3 shows the species composition of the total catch for all tournaments combined.

Figure 3. Numbers of each species caught (captured plus tagged and released) during all tournaments attended in 2008/2009



Because of the dominance of tag and release at tournaments, the figure above largely reflects the numbers of fish tagged, although in some cases, such as tiger sharks and mako sharks, and this year, yellowfin tuna, the ratio of tagged to captured numbers is relatively low (see Figure 8). Figure 3 indicates that as is often the case, mahi mahi represented the highest overall catch this year, with 293 tagged and captured (combined). The second highest overall captures were striped marlin (180) with yellowfin tuna being well down this year with just 51 caught in total at all attended tournaments, 30 of those at just one event (the Canberra tournament in May).

Overall shark captures and taggings totalled 77 – slightly down on last year (88), but more than the year before. Surprisingly, this year, the main shark species caught was the blue shark, with 33 caught, followed by makos (26 this year compared with 28 the year before). Tiger shark captures were well down this year with only 9 caught (tagged plus captured) compared with 28 the year before.

Comparing absolute and relative catches over the duration of tournament monitoring, Figures 4a and 4b continue to show that the species composition has varied considerably among fishing seasons. In 2002/2003, mahi mahi and yellowfin tuna were the most numerous species caught while black, blue and striped marlin were proportionally less abundant than in 2003/2004, in relative terms. In 2004/2005, black marlin became the most numerous species, entirely due to an influx of one year old fish travelling down the coast – a phenomenon which occurs perhaps twice per decade. In the 2005/2006 season, mahi mahi again dominated numerically, while black marlin catches subsided, but were still higher than the first two years. In 2007/2008, mahi mahi was again the most numerous component of the catch with striped marlin the next most abundant, in fact, more abundant than in any other year so far sampled. This year (2008/2009), mahi mahi was again the dominant species by number, with striped marlin again the next most common. Black marlin catches were the lowest since sampling began, as were yellowfin tuna. Blue marlin catches were up on all previous years, albeit, slightly.

Regarding sharks, mako shark catches were 'average' while tiger shark catches were the lowest of the series. Few whaler sharks were caught but as mentioned, blue shark catches continued an upward trend.

Catches of skipjack tuna (all tagged) were by far the highest in this time series while albacore catches were well down on the previous two years.

Figure 4a. Numbers of the main species caught (captured plus tagged and released) during all tournaments attended 2002/2003 through 2008/2009

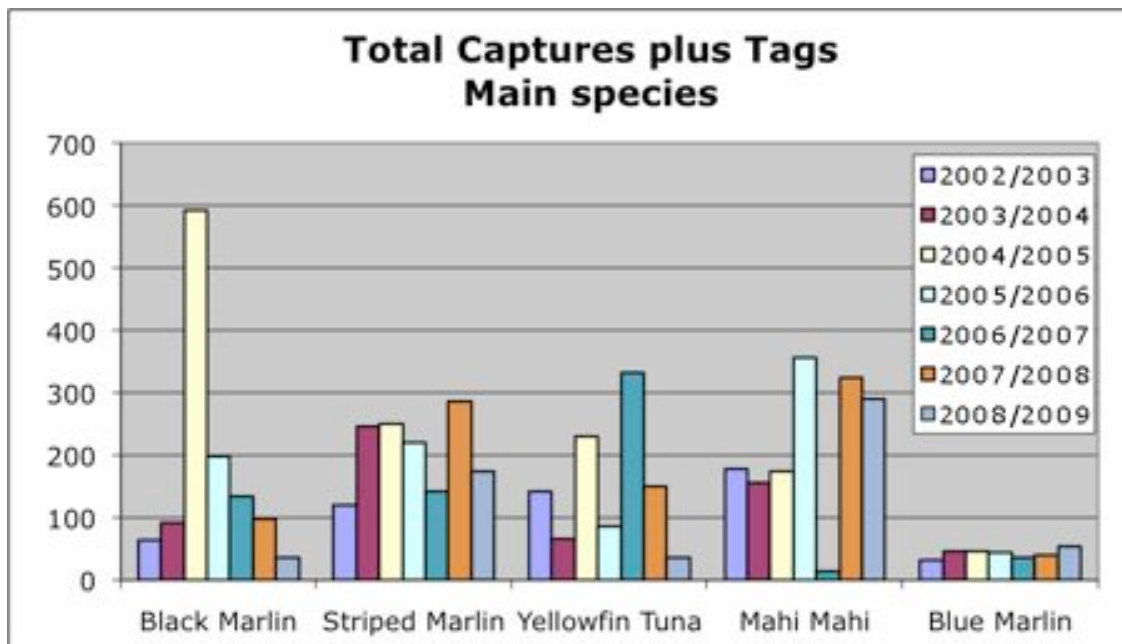
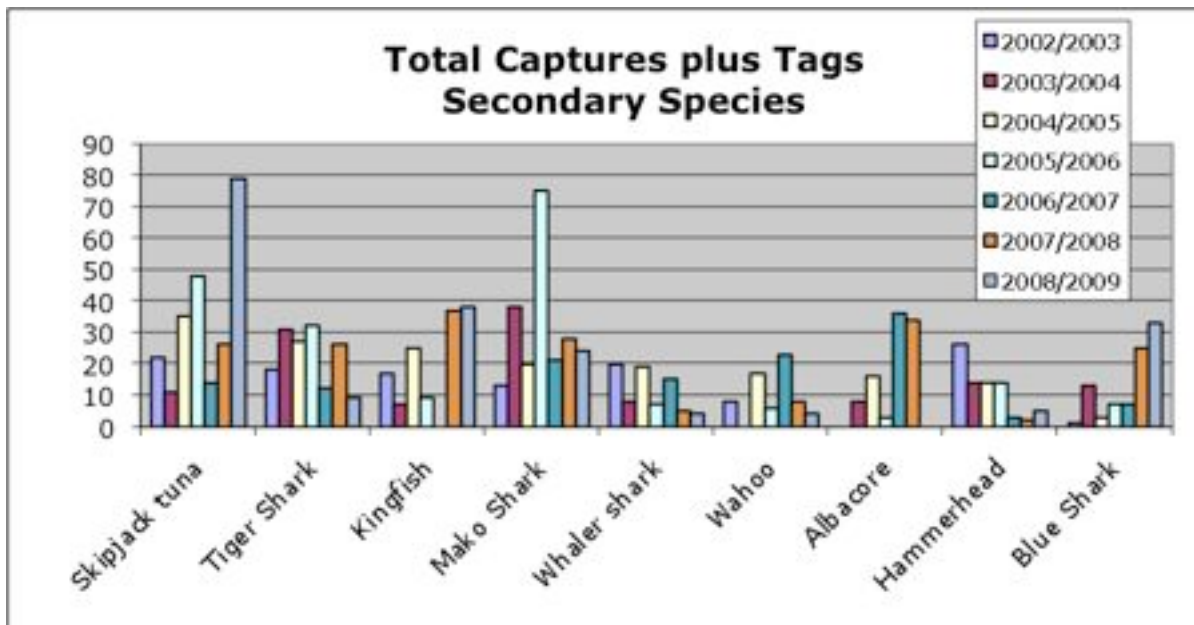
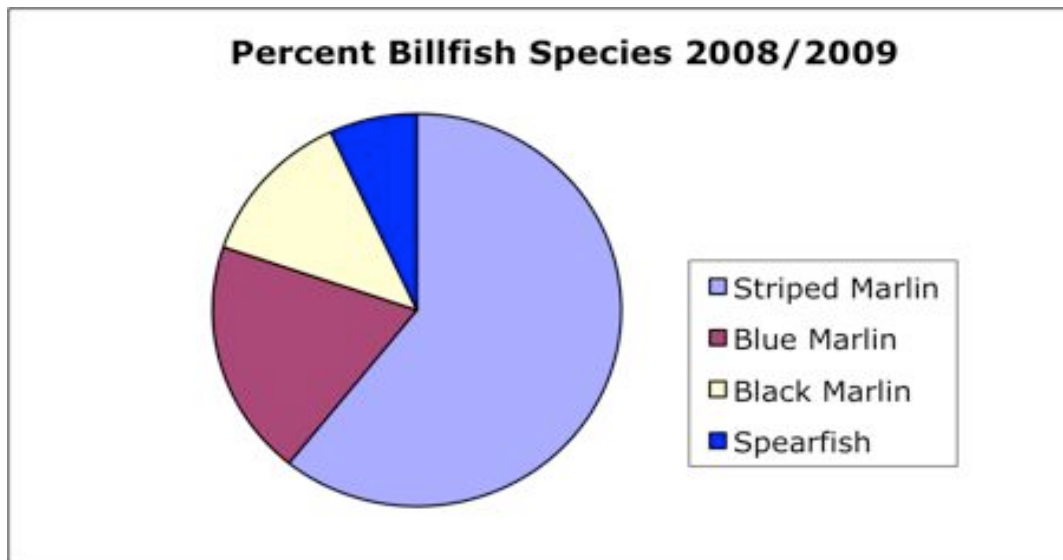


Figure 4b. Numbers of secondary species caught (captured plus tagged and released) during all tournaments attended 2002/2003 through 2006/2007



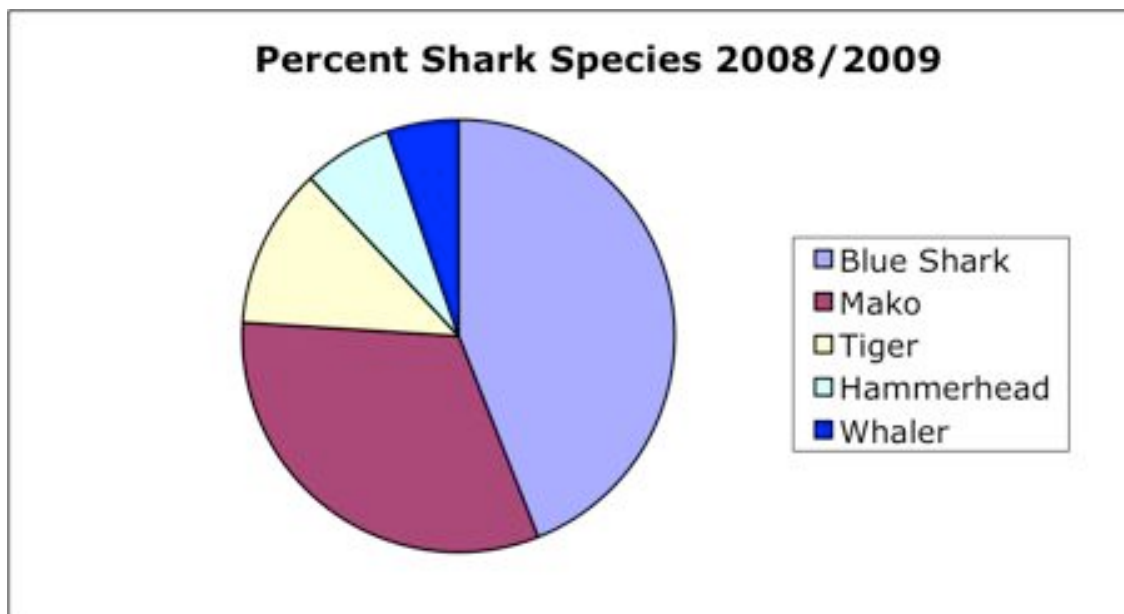
Considering now the ratio of marlin species recorded during the season, Figure 5 shows that striped marlin was again by far the dominant species,, constituting constituted 60.8% of the marlin catch, compared with 67% and 45.4% in the two previous years. Blue marlin constituted nearly 20% of all billfish caught, which was much great than the previous two years (9.6% and 11.7%). Black marlin represented just 12.8% of all billfish which was an all time low (23% last year, and 43% the year before). Interestingly, 20 shortbill spearfish were recorded at attended tournaments representing 7% of the billfish catch, more than in any previous year sampled.

Figure 5. Catch composition of all marlin caught (weighed and tagged) during monitored tournaments in 2008/2009.



Considering shark captures, Figure 6 shows the species composition of all sharks caught during monitored tournaments.

Figure 6. Catch composition of all sharks caught (weighed and tagged) during monitored tournaments.

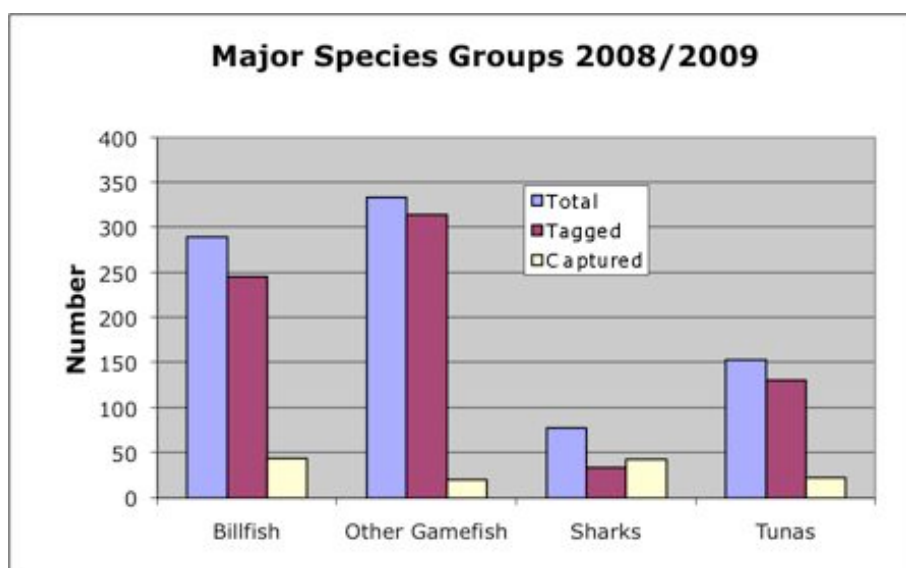


This shows that this year, for the first time, blue sharks dominated the shark catch with 44% of all captures and taggings (blue sharks constituted 29% of the catch last year. Mako sharks were next with 32% of the catch compared with 32.5% last year and 41% the year before. Last year, tiger sharks represented 30% of the catch and 23.5% the year before, but this year, only 12% of the catch. Hammerhead and whaler sharks made up the remaining catch, representing just 6.7% and 5.3% of the total shark catch respectively.

Most hammerhead and whaler sharks are caught while trolling baits intended for marlin, while tiger and mako sharks are mostly caught while drifting with dead baits intended for sharks. Because many more boats troll for marlin than drift for sharks, this means that higher numbers of hammerhead and whaler sharks in the catch almost certainly indicate a higher absolute abundance of these in the area at that time (which occurred in 2002/2003). Without a measure of targeted effort for tiger sharks, it is difficult to interpret fluctuating numbers of this species in the catch. Monitoring the catch through this program is an excellent way of keeping track of such changes in availability and possibly abundance of this and other species.

Another way to consider species composition of the catch is to combine species groups and compare proportional representation. Figure 7 shows that combined billfish catch (dominated by striped marlin) represented the the second highest species group caught by gamefish anglers during the season after 'other gamefish' – a category that consists primarily of mahi mahi. Billfish catches as a group numbered 290, well down on the 434 recorded last year, but still representing a reasonably good season for this prize target group of fishes. Tuna catches were again down on last year, with yellowfin tuna being few and far between, except for a small show of large tuna at Sydney and another spate off Bemagui in May.

Figure 7. Numbers of fish caught at all tournaments, combined as species groups.

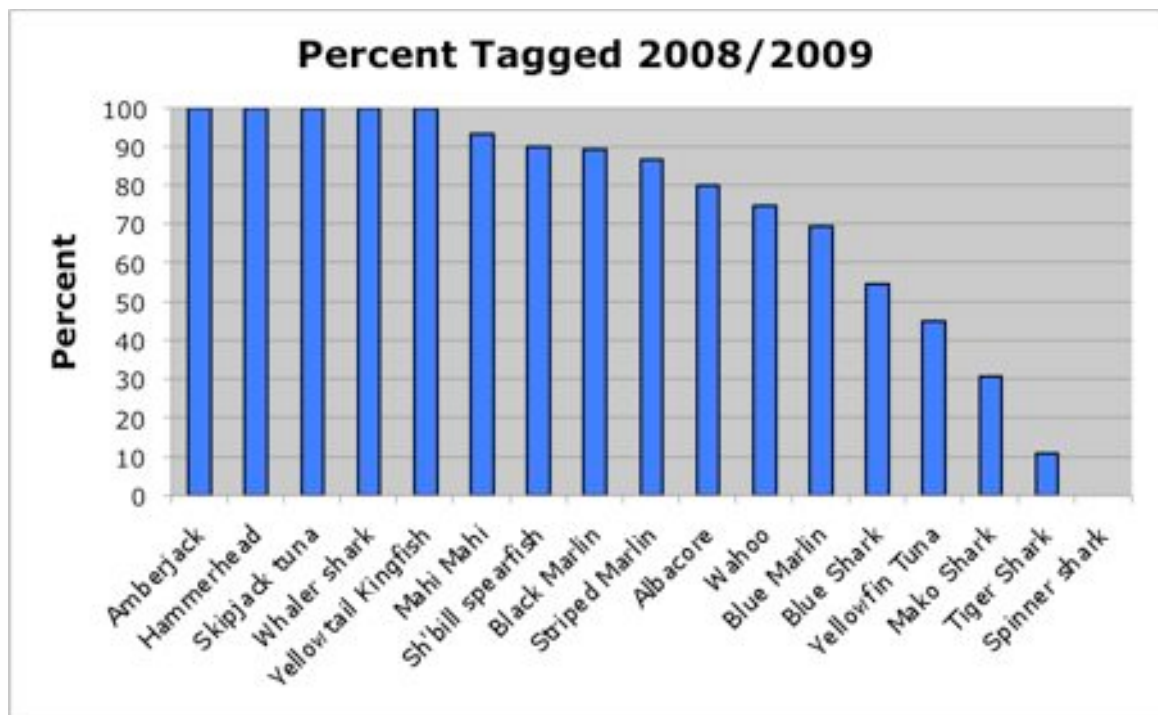


As is always the case, only relatively small proportions of billfish, tunas and other gamefish were captured and weighed compared with the numbers tagged and released (Figure 8).

This again indicates that at least 80% of most species were tagged and released in 2006/2007. And again, the main exceptions were blue marlin (69.6% tagged – virtually identical to last year’s 70.7% tagged and up on the last year (56.8% tagged). The percentage of yellowfin tuna tagged (40.7%) was well down on previous years but this was largely because most of the catch was large fish (40kg plus), with very few school sized fish being available. The mako shark tag to capture ratio varies considerably from year to year. This year, 29.6% were tagged; much lower than last year (67.9% tagged) but consistent with the year before (28.6% tagged). Again, this is indicative of the ratio of large to smaller fish available in a given season.

Species which continue to be tagged in high proportions include hammerhead sharks, skipjack tuna, mahi mahi, spearfish and black and striped marlin. Percentages of marlin released, with the last three year’s figures in brackets, were: black marlin, 89.2% (92.9%, 97%), and striped marlin, 88.6% (91.6%, 88.1%, 92.7%). The percentage of blue marlin tagged continues to be lower than the other two species, but was about 70% for the second consecutive year. This is primarily due to the fact that blue marlin found off NSW tend to be much larger than either blacks or stripes, and therefore, there is some incentive to bring larger fish to the scales in some tournaments. Nevertheless, the proportion of *large* blue marlin tagged is still high.

Figure 8. Proportion of each species tagged during attended tournaments.



Discussion

Some biological sampling has been undertaken at game fishing tournaments in New South Wales to varying degrees for over 25 years. The author first collected data on juvenile black marlin landed at the Port Stephens Interclub tournament in 1977 (Pepperell 1990) and CSIRO scientists regularly monitored catches of sharks from central NSW game fishing events in the late 1970s and early 1980s (Stevens 1984). As noted, many Australian and overseas research projects have benefited over the years through cooperation from game fishing tournaments (see Table 1) and routine monitoring of catches at tournaments is often a core research function in overseas organizations (see, for example, Stillwell and Kohler 1982).

Regular monitoring of catch and effort of game fishing tournaments in New South Wales did not commence until 1993 (Pepperell and Henry 1997) but since then, very detailed catch/effort data has been carefully collected every year (Murphy et al 2002). More recently, studies on the biology of large sharks, in particular, mako and tiger sharks, could not have been undertaken without the provision of free access to specimens brought to weigh stations during game fishing tournaments over a four year period (Chan 2001). Despite this history, biological research and monitoring at game fishing events in New South Wales had not been methodically undertaken in a planned fashion until the commencement of this project. Until then, research was undertaken when and where possible, and no long term data sets on weighed fish were officially maintained (although these kinds of data on marlin have been archived for many years by the author).

Now that the project has been underway for a number of years, some indicators of consistency, or variability in catches can be examined. Apart from the vagaries of the availability of fish in the region of a given port when a tournament is held, weather plays a role in the number of days able to be fished in that event. In previous years, days lost due to bad weather have been quite significant. In 2003 for example, one entire weekend of the Port Stephens Interclub tournament was cancelled due to weather, while in 2004, one of the three fishing days of that event was also cancelled. In 2005, the Port Stephens Interclub tournament was fished on all four days, but other tournaments were badly affected by weather. The 2006/2007 season also saw a number of fishing days cancelled, notably, at Botany Bay and again, at Broken Bay.

In order to gain a feel for variability of fish availability at the same time and place over four years, Table 3 compares the numbers of fish captured and tagged during the 2004 to 2009 Interclub tournaments at Port Stephens.

Table 3. Numbers of fish by species captured and tagged during the NSW Interclub Tournaments of 2004 to 2009. Note that in 2004, one full day was cancelled and in 2008, two full fishing days were cancelled due to weather.

Species	2004	2004	2004	2005	2005	2005	2006	2006	2006	2007	2007	2007	2008	2008	2008	2009	2009	2009
	Capt	Tag	Total	Capt	Tag	Total	Capt	Tag	Total	Capt	Tag	Total	Capt	Tag	Total	Capt	Tag	Total
Black Marlin	7	58	65	6	557	563	9	141	150	2	111	113	5	69	74	1	19	20
Blue Marlin	5	17	22	1	12	13	6	20	26	2	8	10	3	7	10	4	22	26
Blue Shark	0	1	1	1	0	1	1	2	3	1	1	2	0	2	2	11	15	26
Hammerhead	1	2	3	1	9	10	1	7	8	0	1	1	0	2	2	0	1	1
Mahi mahi	3	27	30	6	15	21	1	206	207	0	2	2	3	65	68	7	114	121
Mako	7	5	12	6	1	7	7	4	11	7	3	10	2	1	3	8	3	11
Spearfish	0	3	3	0	0	0	1	4	5	0	1	1	0	0	0	1	14	15
Skipjack Tuna	0	0	0	0	6	6	1	20	21	0	6	6	0	8	8	0	15	15
Striped Marlin	9	140	149	10	139	149	11	159	170	3	48	51	7	93	100	15	108	123
Tiger Shark	1	1	2	9	1	10	12	5	17	5	2	7	8	1	9	4	0	4
Wahoo	0	0	0	0	10	10	0	0	0	1	13	14	0	0	0	0	2	2
Whaler Shark	2	5	7	0	18	18	0	2	2	2	5	7	1	2	3	1	1	2
White Shark	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y'fin Tuna	5	10	15	1	21	22	5	31	36	1	65	66	2	11	13	2	2	4
Y'tail Kingfish	0	2	2	0	0	0	0	0	0	0	0	0	0	13	15	0	3	3
Total	40	272	312	41	789	830	55	601	656	24	266	290	31	274	305	54	319	373

Considering some key species, these data indicate that the availability of gamefish, at least to the coastal game fishing fleet, fluctuates quite markedly from year to year. For example, black marlin numbers were quite low in 2004 (and 2003, not shown) but 2005 saw a record 'run' of juvenile fish appear. With this year class not then appearing since, numbers of black marlin caught during the Interclub tournament has declined consistently, to this year with only 20 in total being caught, 19 of which were tagged. (This was a disappointment to one of the research projects we are helping with – a study of the genetics of black marlin being conducted by Professor Chi-Lu Sun of the National University of Taiwan. Anglers are now being asked to try and collect fin clips from released black marlin). In contrast, striped marlin numbers have been reasonably consistent over the years, as have blue marlin.

Two species that appeared in 2009 in greater numbers than in previous years were blue sharks and shortbill spearfish.

Another species of importance is the tiger shark. This species was caught in much lower numbers during the first two years of this series compared with longer term averages (Chan 2001). The numbers caught in 2005 and 2006 increased to more 'average' levels, especially when all tournaments are taken into account but in 2007, 2008 and 2009 catches were relatively poor. It is important to realize, as noted in last year's report, that there has been a likely decline in fishing effort aimed at tiger sharks, but catch trends of this icon species warrant a more in depth examination of all potential factors than is possible to undertake in this report. It is again highly recommended that the NSW DPI catch/effort monitoring program be analysed with respect to targeted catch rates of all species of sharks during the past 10 years.

Lastly, in the report of this project for 2005/2006, some concern was directed towards yellowfin tuna numbers in the catch. In 2006, numbers caught at other tournaments, including the Interclub, where over 220 boats fishing for four days, were very low. In 2007, numbers were the best for five years, (even though only one weighable fish was caught) but in 2008, numbers were very low again (13 tagged and no fish weighed) and in the last year, 2009, the lowest in this series of data.

Conclusions

This project has again clearly shown the many benefits which can be derived from a funded and organized monitoring and sampling operation at game fishing tournaments. Such benefits have been summarized in previous reports, and they are again worth outlining below:

- Scientific utilization of fish brought to the weigh station by facilitating the collection of valuable biological data on otherwise difficult to access species. This has included the whole range of pelagic species, viz, billfish, sharks, tuna and other gamefish such as mahi mahi and wahoo.
- The provision of such data for the use in management of various species. Some, such as blue and black marlin, are recreational-only species while others (eg striped marlin) are subject to allocation between the recreational and commercial sectors.
- Provision of a hands-on training ground for students interested in possible research careers in fisheries science, providing them with not only practical experience but also suitable payment for their work. This has been a particularly pleasing aspect of the project and continues to attract keen students.
- The familiar presence of scientific staff at tournaments provides a vehicle for anglers to report interesting specimens, observations and information, such as tag recaptures, unusual specimens or parasites, longline hooks found in fish, plastic bands around sharks and other wildlife and so on. Direct feedback to the fishery has obvious benefits, especially with respect to continued cooperation from the fishery.
- Flow-on benefits include providing access to otherwise unobtainable research material to researchers from other institutions, education of the general public who attend the tournament weigh-ins in large numbers, both directly and through the print and electronic media, who take great interest in the scientific aspects of such events, and demonstration of cooperation of the NSW Game Fishing Association with ongoing scientific research.

It is important to record that the Recreational Fishing Trust always receives due acknowledgement through all of the above activities and as such, the Recreational Fishing Licence is demonstrated to be of direct benefit, not just to the game fishing sector, but to the wider community who are interested in the marine world in general.

Acknowledgements

The point has been made in previous reports that this project could not be undertaken without the generous assistance of many game fishing club and tournament officials who make the scientific personnel welcome at all events that we attend. They are too numerous to mention, but to all those on the tournament committees of the following clubs and associations, our heartfelt thanks: Sydney Game Fishing Club, Bermagui Big Game Anglers Club, Botany Bay Game Fishing Club, Lake Macquarie Game Fishing Club, the NSW Game Fishing Association, Broken Bay Game Fishing Club and Canberra Game Fishing Club.

To all the anglers, boat owners and crew who permitted their fish to be examined, poked, prodded, measured and cut, your patience is always appreciated.

The sampling staff who assisted throughout the season all performed their tasks to a high degree of diligence, often in difficult circumstances. Their persistence and careful work and record keeping are much appreciated. This year they were Daniel Nehl, Glen Cuthbert, Cameron Blaber and Richard Tilzey. The assistance at the Port Stephens tournament in sampling and studying landed sharks by Dr Nick Otway, Dr Megan Ellis and Adam Ellis is especially acknowledged.

Lastly, my sincere gratitude are extended to the recreational fisheries staff of NSW Fisheries, especially Bryan van der Walt, Phil Bolton and Danielle Williams for their help whenever needed, and also, and very importantly, to the Recreational Fishing Trust Committee for supporting this project.



Scientific team at 2009 Interclub tournament, Port Stephens. Left to right: Cameron Baber, Daniel Nehl, Dr Julian Pepperell, Adam Ellis, Dr Megan Ellis and Dr Nick Otway.

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