NSW Gamefish Tournament Monitoring – Angling Research Monitoring Program. Final report to the NSW Recreational Fishing Trust.

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4. METHODS AND RESULTS

4.1. Data collection

The Gamefish Tournament Monitoring Program (GTMP) collects data from the larger inter-club type tournaments along the NSW coast. Many of these tournaments are held annually though some of those monitored were one-off events.

Data are derived from the system of scheduled radio reporting (‘scheds’) between the tournament organisers and the participating vessels, the final tournament results data, tag cards submitted and interviews conducted at selected tournaments (described in Murphy et al. (2002) and Lowry and Murphy (2003), see Figure 6). The radio scheds are a mandatory system of vessel reporting imposed by tournament organisers. Vessels must report the number of persons on board (on the first sched), their activity (trolling, drifting, travelling or anchored), their alphanumeric position on the tournament’s grid chart and the number of strikes, hook-ups and captures for the period. Also, for captures, the angler’s name and the fate of the fish captured are recorded: whether tagged or retained for weighing. The vessels also must sign off at the end of their fishing day. The purpose of this system is mainly for safety and any vessels not reporting for more than two scheds are penalised. The information from scheds is also used to verify results, especially for tagged fish, and to ‘count-back’ where there is a tied result. The system also provides a commentary of the tournament to participants.

Data collection by the GTMP has been focussed on the major tournaments and has not included data from individual club point-score competitions. Some historic Queensland tournament data are available, though this data is somewhat old and incomplete and is not, therefore, used in this report.

This report includes data collected from 16 NSW ports with between 4 and 15 of these ports monitored in any one fishing season. This has involved up to 22 different tournaments (including events within tournaments such as Ladies Days) covering up to 57 days in a season.

4.2. Data aggregation

The data were aggregated in three ways: by fishing season, by taxa targeted and by latitudinal zone.

Most pelagic species targeted in NSW game fishing tournaments have a habitat preference that is tropical or subtropical. Their occurrence off NSW is mostly seasonal and associated with the warm East Australian Current that flows south along the NSW coast in summer and autumn. The austral summer encompasses two calendar years so the tournament data are aggregated into fishing season (e.g., 2004/05) rather than calendar years in this report. A fishing season was defined as from July 1 to June 30 for this exercise and hence was the same as a financial year.

The Australian Fisheries Management Authority (AFMA) provided commercial longline data aggregated to calendar years; so where resource sectors are compared in Section 4.9, tournament data are given in calendar years. As the main tournament period begins in January and covers the first and second quarters of the year the calendar year versus fishing season data are consistent in most tournaments, though use of calendar years aggregates spring tournaments (such as the Coffs Harbour Hot Current Tournament, held in spring) with those of the previous season. This produced differences between summaries that used the alternative annual format.
To determine directed effort, each vessel’s fishing day was classified by their target group. The two main target groups were billfish/tuna targeting and shark targeting. Interviews and sched reporting were used to assign a vessel’s targeting. The principal tool used to assign targeting was the post-fishing interviews. Where the crew were interviewed their nominated target group for the day was used. If more than one target group was nominated then the one where the majority of time was spent was used. For the other crews not interviewed, their sched reports were used. Those that reported “trolling” in most of the shed reports were classified as targeting billfish and those that were predominantly “drifting” were classified as targeting sharks. Two annual events in which yellowfin tuna are targeted are held in late autumn. The vessels in these tournaments may drift (most commonly using cubes of small pelagic species such as pilchards as berley) for tuna and may also have a shark line out. These were analysed separately and not included in the CPUE calculations for billfish species or the seasonal sportfish species other than tuna.

There is a perception by anglers that fish size and catch rates differ for some species with latitude along the NSW coast. To determine latitudinal differences, the coast was divided into three ‘Zones’: Northern (29°S – 32°S), Central (32°S – 35°S) and Southern (35°S – 38°S) (Figure 8). The boundaries were selected to be evenly spaced along whole degrees of latitude and three degrees apart so as to characterise what is commonly regarded as the north, central and south coasts of NSW.

The 32nd parallel of latitude clearly separates the charts of the two Northern Zone tournaments from those of the Central Zone (Figure 8). The 35th parallel dividing the Central and Southern Zones bisects Jervis Bay. While this is a prominent coastal feature that affects the flow of the EAC and logically divides the NSW Central Coast from the NSW South Coast, this boundary does divide the Kiama, Shoalhaven and Huskisson tournament grid charts. For these tournaments the effort and catch were assigned to the correct Zone based on their reported grid positions at each sched.

Each tournament chart is subdivided into a system of grids identified with an alphanumeric code (Figure 7). When the tournament charts were compiled the grids were non-systematic, and where charts overlapped the grids were of differing sizes and centroid locations. Some tournament charts had grids that varied in size over the one chart. When examining the spatial distribution of effort, catch and CPUE, to ensure consistency in comparing areas covered by tournaments, sched data were aggregated to ¼ × ¼ degree grids of latitude and longitude.

Monitoring is reliant on utilising organised tournaments, their scheduling and boundaries govern the location and timing of data collection (Figure 7). Tournaments tend to be held when fishing is perceived to be at its best for targeted species in the area. Also the number of participants at tournaments is determined by the prestige of the tournament, the perceived quality of fishing in the area and accessibility. Hence the GTMP is not representative of the whole coast nor all seasons. However most of the tournaments are held annually and with a dedicated corps of enthusiastic and skilled anglers. Therefore there is some consistency in the monitoring and it does provide a series of snap-shots that can give an indication of the relative quality of gamefish angling off NSW as well as some indices of abundance for the targeted species that inhabit the NSW coast.
Figure 6. Radio sched reporting in tournament radio room at the NSW Interclub Tournament, Port Stephens.

Figure 7. Outlines of the sched charts used by the tournaments monitored by the Gamefish Tournament Monitoring Program.

Figure 8. Zone demarcation for aggregated data into Northern, Central and Southern Zones. Frontiers of the grid reference maps used by the Clubs at each of the major ports covered. Courtesy of R. Summerson, BRS.
4.3. Catch and effort

There were 31,228 vessel-days of gamefishing tournament data collected in the monitoring period 1993/94 – 2004/05, though about 15% had insufficient data to be classified to a targeting type. Those that were not classified were not used in the calculations of directed effort for CPUE. The targeted effort over the 12 seasons comprised 26,791 vessel-days of fishing effort with 22,661 (85%) having been classified as billfish-targeting days compared to 4,107 classified as shark-targeting days (Table 3).

A total of 192 tournaments comprising 469 tournament days were monitored over the period. The number of tournaments monitored varied between 5 and 22 per annum; the seasons 1996/97 and 1997/98 had the least number of tournaments monitored (5 and 7 respectively). There were between 14 (1996/97, 1997/98) and 57 (1999/00) tournament days monitored annually representing between 1,164 (1996/97) and 3,233 (1999/00) vessel-days fishing effort per year (Figure 9). The seasons where low numbers of tournaments were monitored were during the hiatus periods when the GTMP was inactive and the data collected via other programs. The years where there were many tournaments monitored were when the GTMP was active and when there were additional one-off events such as those related to the celebrations associated with the year 2000 and the Sydney Olympics. The variability of total fishing effort and catch by year in the data are attributable to this variability in numbers of tournaments monitored. The total catch of fish at monitored tournaments for the twelve seasons was 22,065 fish of at least 30 taxa. Of the total fish caught, 36% were billfish and 14% sharks (Table 3).

The effort monitored, as vessel-days per port, was not uniformly spread across zones, 61% of effort monitored was in the Central Zone, while 31% was in the Southern Zone and 8% from the Northern Zone. Amongst the ports, 41% of effort was recorded at Port Stephens tournaments, while 21% was recorded at Bermagui tournaments. Most monitoring was in the first three months of the calendar year, 29% of effort was in February, 25% was in March and 19% in January (Table 4).

![Figure 9](image_url)  
**Figure 9.** The number of tournaments and tournament fishing days monitored per annum. Catch given as number of fish reported and effort as vessel-days reported for the period of monitoring.
Table 3. Summary statistics of monitored tournaments. The number of tournaments monitored, the number of tournament days and actual active vessel-days are given. Interviews were conducted dockside and at boat ramps during tournament days for tournament vessels.

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Table 4. Effort coverage as vessel-days aggregated for the monitoring period by month, zone and port. The figure shows the temporal and spatial occurrence of the tournament monitoring.

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4.4. Species composition

The composition of species varied over the years of monitoring. In numbers of fish caught over the twelve seasons, the dominant six species were yellowfin (22%), striped marlin (16%), black marlin (14.8%), mahi mahi (13.4%), albacore (8.5%) and mako sharks (5.2%) (Figure 10). Notable trends in the composition were the relative decline of albacore and a corresponding increase in the proportion of mahi mahi after about 1999/00. The relative proportion of the catch of striped and black marlins also varied inversely according to which species was dominant each year (Figure 11). The proportion of shortfin mako sharks compared to other shark species appeared to increase over the monitoring period (Figure 12).

Figure 10. Species composition of the catch for the monitoring period. The order of species from bottom to top is in decreasing total number reported for the entire period.

Figure 11. Species composition as a proportion of the marlin reported caught for the monitoring period. The order of species from bottom to top is in decreasing total number reported for the entire period. Number reported at tournaments for the season is included.
Figure 12. Species composition as a proportion of the catch of sharks for the monitoring period. The order of species from bottom to top is in decreasing total number reported for the entire period. Number reported at tournaments for the season is included.

4.5. Targeting

Vessels were separated according to whether they were targeting billfish/tuna or sharks for the day. Priority was given to the interview data over the sched data.

Of the 26,791 of vessel-days assigned a target, approximately 85% were classified as billfish/tuna targeting while about 15% were shark target days (Figure 13). There was a very small component of mixed shark/billfish fishing (0.02%) and other (demersal) fishing (0.03%). Over the twelve years there was a general increase in the proportion of effort (days) dedicated to billfish fishing compared to shark fishing. In the 1993/94 season 80% of the fishing effort was directed at billfish, in 2004/05 this was about 86% (Figure 14). The proportion of effort targeting billfish/tuna peaked in 2003/04 at 92%, though this and the previous season (2002/03) were years of relatively low effort covered by the GTMP. This trend may be related to the increased targeting of striped marlin in recent years.

Figure 13. Directed effort as vessel-days for all the monitoring period. N=26,791.
Figure 14. Directed effort determined from interviews and sched reports as number of vessel-days per season.

4.6. Strike rates

Sched reports include the number of strikes and hook-ups as well as catches for the sched period completed. This is to broadcast the success of vessels as a form of commentary on the tournament and assists tournament organisers with scoring, particularly in ‘count-back’ situations.

Strike rates and hook-up rates were compared with catch rates for the data collected from scheds to determine overall frequency of interaction of anglers with fish. As it is this interaction that the crew anticipate, this has some relevance to the quality of angling as well as the potential for abundance indices (Campbell, Pepperell et al. 2000).

For all vessels there was an average of 1.38 strikes, 1.12 hook-ups and 0.73 captures reported on sheds per vessel-day (Figure 15). Thus 81% of the strikes resulted in hook-ups and 65% of the hook-ups resulted in the capture of the fish. In comparison, the black marlin charter vessel fishery raise/hook-up/catch per day for the 1990s was 3.28/1.89/0.90 (Campbell, Pepperell et al. 2000).

The strike rates of vessels trolling for billfish/tuna and sportfish were higher with 1.41 strikes, 1.13 hook-ups and 0.74 captures per vessel-day. Thus 80% of the strikes hooked up and 66% of the hook-ups resulted in captures. The average interaction rate for shark fishermen was lower than this with 1.18 strikes, 1.08 hook-ups and 0.67 captures reported per vessel-day. The strike to hook-up ratio of 91% was much higher for shark fishermen than the billfish/tuna trollers. This is probably due to the nature of shark fishermen offering drifting dead baits compared to a moving lure. The hook-up to capture rate was slightly lower for shark fishermen (62%), perhaps a factor of the more dogged nature of the fight with sharks.

There was little indication of temporal trends in strike rates for the fishers that targeted billfish/tuna. It was somewhat cyclic though the 2004/05 season appeared to have the highest rates for strike, hook-up and capture of all years.

There was a decline in the strike rates, hook-ups and captures of shark fishers over the time series. In the early years of the time sequence the average strike rate per vessel-day was similar for both
shark and billfish anglers or even higher for shark fishermen (1998/1999), however strike rate declined progressively for shark fishers. In recent years shark fishers had a much lower interaction rate than billfish/tuna trollers. This is important, as there has been less change in fishing technique by shark fishers over time whereas technology and techniques (as well as species targeted) by billfish/tuna trollers has changed more dramatically. Thus the nominal strike rate for shark fishers may be a more accurate index of target species abundance than billfish/tuna troller strike rate.

Figure 15. Average rates of strike, hook-up and capture per day per vessel. Data are aggregated by targeting group as per vessel-day, from reported scheds.
4.7. **Catch rates**

Catch Per Unit of Effort (CPUE) was determined by species from the mean number of fish reported caught by vessel-day for the season. For some species, the season period used in calculations was altered to match the peak season for that species. Details of these calculations, where applicable, are found throughout the results section.

Effort data were aggregated by vessel-day according to target group (billfish/tuna or shark targeting). Target effort group was derived from interviews and sched reporting for each vessel-day. Catches were determined from the tournament results, sched reports of captures as well as interviews. Catch data includes fish that were landed, tagged and non-point score fish (though the latter are incomplete).

The first figure of each pair by species below illustrates the CPUE for all tournaments monitored and the second figure segregates the targeted CPUE by zone to determine if trends are consistent amongst zones or whether one particular zone influenced the overall CPUE.

4.7.1. **Billfish**

In addition to selecting only the vessels targeting billfish/tuna, these data were further refined for the three target billfish species (blue, black and striped marlin) by selecting only the tournaments that occurred within the peak fishing season period of November to April inclusive. This then excluded the winter tournaments that mainly targeted sharks and tuna. This left 22,312 vessel-days of effort in this category.

4.7.1.1. **Black Marlin**

Black marlin CPUE was characterised by low mean catch rates in most years interspersed with occasional years of high catch rates. For most years, the catch rates were low at around 0.03 – 0.07 fish per vessel-day. Peaks in CPUE occurred in 1998/99 and 2004/05 when black marlin catch rates reached 0.26 and 0.32 fish per vessel-day or one fish every four and three vessel-days respectively. Black marlin CPUE was highest in 1996/97 with 0.84 fish per vessel-day though this may not be representative as a state-wide estimate as this was the season with the fewest tournaments monitored (Figure 16A). At that season’s Port Stephens Interclub, there was an extraordinary recorded catch of 852 black marlin (96% of the 890 reported at monitored tournaments that season). In the other above average seasons, 199 were caught in the 1998/99 Interclub and 494 in 2004/05. There was 627 and 624 black marlin reported caught at monitored tournaments in these seasons respectively. This shows the significance of the influence of the Port Stephens Interclub tournament in CPUE calculations, particularly for the 1996/97 season.

The breakdown by zone shows the influence of the catch rates in the Central Zone tournaments such as the Port Stephens Interclub on the overall CPUE for black marlin. The CPUE in the Southern Zone was low for all seasons. The Northern Zone CPUE was also low for most years, except 1998/99 when there was a pulse in the Northern Zone even more pronounced than that of the Central Zone. The Central Zone CPUE trends are mostly higher than the other zones and consistent with the overall CPUE (Figure 16B).
Figure 16. Black marlin mean annual CPUE for vessels targeting billfish during November to April: A) For all zones combined; and, B) Segregated to Northern Central and Southern Zones. Standard errors shown.
4.7.1.2. *Striped Marlin*

The catch rates for striped marlin have fluctuated between 0.1 – 0.2 fish per vessel-day. The highest overall CPUE was 0.225 fish/vessel-day in 1999/00 and the lowest was 0.098 fish/vessel-day in 1997/98. There is no clear overall trend though from 2000/01 to 2003/04 seasons there was an increase in CPUE. Contributing to this may be increased targeting of striped marlin through use of the switch-baiting and deep slow trolling methods. The catch rates declined slightly in the 2004/05 season (Figure 17A).

Striped marlin CPUE appears to have been most influenced by the Central and Southern Zone CPUEs, though there is little consistency among zones until recent years. The peak in overall catch rates in 1999/00 is mostly due to high catch rates in the Southern Zone. In particular, large catches were reported in the Bermagui Bluewater Classic and Batemans Bay Tollgates Classic. The high catch rates in 1996/97 were due to high catch rates in the Central Zone, in particular at the Port Stephens Interclub, while the period 2002/03 to 2004/05 appears to be due to a combination of good catch rates in the Central and Southern Zones. There appears to be a trend of increasing catch rates in the Southern Zone overall that is not as pronounced in the Central Zone, in fact since 1999/00 catch rates in the Southern Zone are often significantly higher than in the Central Zone whereas in the early part of the time series the reverse was the case. The catch rates in the Northern Zone were highest in 1998/99 and have steadily declined since (Figure 17B).

The overall decrease in CPUE in 2004/05 occurred in all zones.

**Figure 17.** Striped marlin mean annual CPUE for vessels targeting billfish during November to April: A) For all zones combined; and, B) Segregated to Northern Central and Southern Zones. Standard errors shown.
4.7.1.3. **Blue Marlin**

Overall catch rates of blue marlin were the lowest of the three species of marlin caught in NSW. Blue marlin CPUE was highest during the 1997/98 and 1998/99 seasons at around 0.1 fish per vessel-day. There was a decline from this to a catch rate of only around 0.01 fish per day 2003/04 and 2004/05 seasons (Figure 18A). There has been a shift from targeting blue marlin to target striped and black marlin in recent years (Section 4.8, p.42). There may also be an inverse relationship in relative CPUEs of blue marlin compared to striped marlin per season (Figure 18A c.f. Figure 17A).

The Blue marlin CPUE for the state is dominated by the catch rates in the Central Zone tournaments, though there is little consistency among zones (Figure 18B).

**Figure 18.** Blue marlin mean annual CPUE for vessels targeting billfish during November to April: A) For all zones combined; and, B) For Northern Central and Southern Zones. Standard errors shown.
4.7.2. Sharks

4.7.2.1. Tiger Shark

There has been a trend of an overall decline in the catch rates of tiger sharks (Figure 19A). The highest catch rates were in 1996/97 and largely driven by the Port Stephens Interclub in which there were 39 tiger sharks reported caught. Most tiger sharks were caught in the Central Zone tournaments, which influences the overall CPUE. The catch rates in the Southern Zone have generally been negligible except for 1996/97 and 2000/01 (Figure 19B). The 2002/03 high catch rate in the Northern Zone in 2002/03 was an artefact of four sharks caught by only eleven vessels targeting sharks in the Coffs Harbour Hot Current Tournament.

![Tiger shark mean annual CPUE for vessels targeting sharks by season with standard errors: A) For all zones combined; and, B) For Northern, Central and Southern Zones.](image-url)
4.7.2.2. *Mako Shark*

Mako shark CPUE fluctuated through the time series. There appears to be two phases in the CPUE series with one phase prior to the 1998/99 season and the other phase from this season on. The average CPUE of the 1993/94 to 1997/98 seasons was 0.09 makos per vessel-day. Then in 1998/99 there was a dramatic increase in CPUE to a peak of 0.54 makos per vessel-day. Subsequently the annual CPUE indices steadily declined and stabilised to 0.14 makos per vessel-day in 2004/05 (Figure 20A).

The 1998/99 CPUE peak was driven by the Port Hacking Central Zone in October of 1998 when 196 of the state-wide total of 307 makos were caught, in fact 133 were reported caught on just one day of the tournament. There was a corresponding decrease in average size in the 1998/99 season (Figure 66).

High catch rates occurred in the Northern Zone in 1999/00 and in the Southern Zone in 2003/04. There was little consistency among zones by season for makos (Figure 20B).

![Figure 20. Mako shark mean annual CPUE for vessels targeting sharks by season, with standard error: A) For all zones combined; and, B) For Northern, Central and Southern Zones.](image-url)
4.7.2.3. **Blue Shark**

There was an overall decline in blue shark catch rates. Catches reached a peak in the 1995/96 season at 0.3 fish per vessel-day. This was largely due to some large catches at the Port Stephens Interclub; one vessel caught eight blue sharks in one day. The CPUE has declined since 1998/99 to about 0.01 fish per vessel-day in 2003/04 and 2004/05 (Figure 21A).

The Central Zone CPUE mostly influences the overall trend, though the 1998/99 Southern Zone CPUE was high due to some large catches at the Bermagui Yellowfin Tournament, which also influenced the state average CPUE for the season (Figure 21B).

The overall numbers caught were relatively low in recent years. Blue sharks are not specifically targeted as they only receive half the points of other sharks when weighed (See 3. “Point-Score” Calculations).

![Graph A](image1.png)

**Figure 21.** Blue shark mean annual CPUE for vessels targeting sharks by season, with standard errors: A) For all zones combined; and, B) For Northern, Central and Southern Zones.
4.7.2.4. **Hammerhead Sharks**

Hammerheads have had a low average annual CPUE, this was generally between 0.02 – 0.04 sharks per vessel-day (Figure 22.A). Hammerheads generally will not take the relatively large baits set for tiger sharks and so are usually only targeted when sighted. The relatively high CPUE in 1996/97 of 0.13 sharks/vessel-day was influenced by the Port Stephens Interclub in which 33 of the season’s monitoring total of 39 hammerhead sharks were caught. The CPUE has declined in the past three years; the 2004/05 CPUE was only 0.003 sharks per vessel-day. There was some consistency of CPUE between the Central and Southern Zone though the CPUE of the Northern Zone differed, it had the highest CPUE of 0.44 hammerheads per vessel-day in 1994/95 (Figure 22.B).

![Figure 22.](image)

**Figure 22.** Hammerhead shark mean annual CPUE for vessels targeting sharks by season, with standard errors: A) For all zones combined; and, B) For Northern, Central and Southern Zones.
4.7.2.5. Whaler Sharks

The reported catch rate of whaler sharks peaked at 0.27 per vessel-day in the 1997/98 season and subsequently declined (Figure 23A). The current catch rates are less than 0.01 per vessel-day. The Central Zone dominates the state-wide trend (Figure 23B).

Figure 23. Whaler sharks mean annual CPUE for vessels targeting sharks by season, with standard errors: A) For all zones combined; and, B) For Northern, Central and Southern Zones.
4.7.3. **Sportfish**

4.7.3.1. **Yellowfin Tuna**

Yellowfin tuna catch rates were calculated for those targeting billfish/tuna for all tournaments including the winter months. CPUE fluctuated around 0.1 – 0.5 fish per vessel-day. The overall average catch rate of yellowfin tuna was a low 0.19 per vessel-day. There are no clear temporal trends. The overall annual CPUE was highest in 1995/96 at 0.53 per vessel-day (Figure 24A).

Catch rates for the Bermagui and Batemans Bay yellowfin tournaments are overlaid on Figure 24A. The two yellowfin-dedicated tournaments held in Bermagui and Bateman’s Bay (Canberra Yellowfin Tournament and Bateman’s Bay Yellowfin Tournament respectively) had similar patterns of catch rates to the other data though with more exaggerated trends. The high catches of the 1995 Canberra GFC Yellowfin tournament in Bermagui resulted in the CPUE for the tournament of 1.35 yellowfin per vessel-day. This was driven by some large individual catches including one vessel that was reported to have tagged 60 yellowfin tuna on 20 May 1996.

The large CPUE values observed in 1995/96 and 2001/02 were highest in the Northern Zone rather than in the Southern Zone where the dedicated tournaments occurred. High catches occurred in Coffs Harbour in both these seasons (578 and 331 yellowfin respectively); this resulted in CPUE indices for the Northern Zone of 3.7 and 1.6 yellowfin per vessel-day respectively (Figure 24B).

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**Figure 24.** Yellowfin mean annual CPUE for vessels targeting billfish and tuna, with standard errors: A) For all zones combined with the dedicated yellowfin tournaments at Bermagui and Batemans Bay in blue; and, B) For Northern, Central and Southern Zones.
4.7.3.2. Mahi Mahi (Dolphinfish)

The overall mahi mahi CPUE during summer tournaments for vessels trolling in the monitoring period was 0.1 fish per vessel-day. The CPUE for mahi mahi increased over the monitoring period: the first seven seasons the mean CPUE was 0.5 mahi mahi per vessel-day, whereas that of the last five seasons it was 0.15 fish per vessel-day (Figure 25A). The highest mahi mahi catch rate was in 2000/01 with 0.36 per vessel-day and the following season 2001/02 was also high at 0.18 per vessel-day. The lowest CPUE was the (1999/00) season prior to the peak, with only 0.016 per vessel-day.

Catch rates for mahi mahi were generally highest in the Central Zone. The highest was in the Central Zone at 0.58 per vessel-day. This was influenced by the Port Stephens Interclub, in which 655 mahi mahi were caught, which resulted in a catch rate of 0.81 per vessel-day for the event. The high CPUE in the Northern Zone in 2004/05 (0.34) was due to 76 mahi mahi caught in the Port Macquarie Golden Lure Tournament, a tournament catch rate of 0.59 (Figure 25B).

![Figure 25. Mahi mahi mean annual CPUE for vessels targeting billfish and tuna, with standard errors: A) For all zones combined; and, B) For Northern, Central and Southern Zones.](image-url)
4.7.3.3. Albacore

The albacore catch rates appear to have an approximate two-year cycle. Overlaying this cycle is an overall decline from an average 0.43 albacore per vessel-day caught in 1993/94 to less than 0.01 albacore per vessel-day for the past four years (Figure 26A).

The albacore CPUE was highest in the Southern Zone, 0.23 albacore per vessel-day overall. There were also two seasons in which albacore were caught in the Northern Zone giving an average overall CPUE of 0.02, yet almost no albacore were caught in the Central Zone producing an average of 0.002 albacore per vessel-day (Figure 26B).

**Figure 26.** Albacore mean annual CPUE for vessels targeting billfish and tuna, with standard errors: A) For all zones combined; and, B) Segregated to Northern Central and Southern Zones.
4.7.3.4. **Kingfish**

Kingfish catch rates have increased overall. This may be a result of increased targeting for tagging points or increased reporting (Figure 27A). The high catch rate for the 2000/01 season was not isolated to one particular event and was evident in all zones. It is the Southern Zone tournaments that have the highest catch rates of kingfish and tend to target kingfish for tagging points. The high CPUE in 2004/05 in the northern zone were due to high catch rates in the Port Macquarie Golden Lure Tournament (Figure 27B).

![Graph A](image1.jpg)

![Graph B](image2.jpg)

**Figure 27.** Kingfish mean annual CPUE for vessels targeting billfish and tuna with standard errors: A) For all zones combined; and, B) For the Northern, Central and Southern Zones.
4.7.3.5. **Wahoo**

The catch rates for wahoo were calculated from vessels targeting billfish and tuna during the summer/autumn season. Catch rates are very low, with a maximum of 0.02 fish per vessel-day in 1998/99 and all other years the average is below 0.01 fish per vessel-day (Figure 28A). Only 92 wahoo were reported caught for the whole monitoring period, and in some years no wahoo were reported. Wahoo CPUE appears to have a cyclic nature that is consistent in the Northern and Central Zones and no Wahoo were reported in the Southern Zone tournaments (Figure 28B).

![Wahoo CPUE graph](image)

**Figure 28.** Wahoo mean annual CPUE for vessels targeting billfish and tuna, with standard errors: A) For all zones combined; and, B) For the Northern, Central and Southern Zones.