Since the first humans went fishing, it is likely that fishermen have blamed other fishermen for reducing the numbers of fish that they would like to catch. So it should come as no surprise that the same goes for billfish anglers. Commercial fishing is nearly always seen as the main threat to healthy billfish populations, particularly the fleets of tuna longline vessels that have plied the oceans of the world since the mid-20th century.

Certainly, as we will see, longliners do catch a considerable amount of marlin as bycatch, as do many other fishing operations, ranging from sophisticated purse seine boats to subsistence village fishermen. However, the big question that I’d like to address here is, how many billfish are taken annually by all methods, including game and sportfishing, and more importantly, are these catches sustainable?

The world’s oceans are big places, so let’s focus our attention on the main area that accounts for most billfish catches – the Western and Central Pacific Ocean, which I will refer to as the WCPO from now on. The entire Pacific Ocean is so large that fisheries management there is divided in half. The Eastern Pacific is looked after by the Inter-American Tropical Tuna Commission (IATTC), and the western and central half by the Western and Central Pacific Fisheries Commission (WCPFC). The majority of tuna fishing takes part in the western and central side, and as a result, that is where most of the billfish are taken.

The map of the WCPO shows the scale of this vast area, covering almost 20 per cent of the earth’s surface, with many, many countries fishing for tuna throughout its boundaries. Monitoring and attempting to manage this fishery is obviously a complex and difficult job.

Because of their primary interest to gamefish anglers, I will focus here on the three marlin species: blue, black and striped, since statistics are usually separated for those species. Swordfish are also well documented in commercial stats, but are relatively insignificant in recreational catches, and while sailfish are obviously recreationally important, they are poorly documented in commercial catch statistics.
How many marlin are caught in the Pacific Ocean each year, who is catching them and is it sustainable? Does an occasional marlin kept and eaten by recreational anglers make much difference to the general health of their populations? Dr Julian Pepperell delves into the labyrinth of international fisheries statistics to provide numbers and answers to these important questions.

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Trying to calculate the numbers of marlin caught across such a vast region is obviously fraught with difficulty, and not made any easier by all the various fishing methods that are used to catch marlin in the region. Two of these methods – longlining and purse seining – were described in an earlier article on tuna sustainability in *BlueWater* (Issue 95). I will briefly describe them again here in relation to catching marlin, along with outlines of the other marlin-catching methods.

**LONGLINE**

Longline vessels work around the clock, constantly setting and hauling their lines. As the mainline is paid out, branch lines with baited hooks are clipped to the mainline at predetermined intervals. Marlin are particularly susceptible to more surface-oriented sets, which are usually set to target yellowfin tuna, but there is also evidence that marlin often take the moving baits as the line is being hauled.

The catch rate of marlin on longlines is usually an order of magnitude less than that of the targeted tuna, but the sheer number of hooks being set means that the total catch of marlin by this method becomes substantial. In fact, over 80 per cent of commercial marlin catches are taken by longline.

Taiwan, Korea and China all have major longline fleets that fish throughout the WCPO. Japan is also a major player, but less so than in previous decades. Many smaller countries have active ‘domestic’ longline fisheries that fish mainly, but not exclusively, in their own 200-mile fishing zones. These include Australia, New Caledonia, Fiji, Papua New Guinea, Samoa and Tonga. Most Pacific Island nations also issue permits to foreign countries to fish in their waters. In 2011, there were 3667 longline vessels active in the WCPO (less than 50 of which were Australian).

**PURSE SEINE**

Tuna purse seine nets are often very large, capable of encircling areas the size of a football field. The net is paid out behind a fast-moving boat to encircle a school of fish, with the weighted lead line of the net sinking rapidly, creating a circular wall around the catch. The bottom of the net is then closed by pulling on a rope passed through rings – in the same way that a purse string is tightened.

Large tuna purse seine companies often deploy their own FADs – usually purpose-built anchored buoys, but vessels may also set nets around natural floating objects such as logs. Setting nets on FADs or logs is by
far the most efficient form of tuna fishing, although it is virtually inevitable that at least some bycatch will be caught, including billfish.

Blue and black marlin are most commonly caught in such ‘associated’ sets, although striped marlin may also be taken by this method from time to time. In 2011, there were 1488 purse seiners operating within the WCPO. This fishery now has 100 per cent observer coverage, meaning data on catches by this method should be particularly reliable.

TROLLING
Trolling lures or baits behind moving boats has always been an effective, but not particularly efficient method of catching marlin. Apart from gamefishing, there are probably no specific troll fisheries throughout the WCPO that target marlin, although some tuna troll fisheries would no doubt have relatively high marlin catch rates on occasion.

GILL NET
Coastal gill netting is a common form of fishing for mackerels and smaller tunas such as longtail and mackerel tuna. It is usually undertaken from relatively unsophisticated boats, with nets often hauled using manpower alone. Billfish are not an uncommon bycatch of this method, with the main species caught being sailfish and black marlin.

I have personally seen quite a few juvenile black marlin taken using this method in Vietnamese and Malaysian fish markets. On a recent visit to Taiwan, gillnet-caught black marlin averaging around 100kg were also a regular sight at the dock.

HARPOON
Believe it or not, there are specialised fisheries that target marlin using harpoons. Harpoon fishing for marlin has its origins in Japan, where commercial fishermen have long used the method for catching mainly striped marlin around the Izu islands in the country’s south-east.

During the 50-year Japanese occupation of Taiwan, ending after World War II, local fishermen were trained in these methods, and today there is an active billfish harpoon fishery from a number of ports off eastern Taiwan. Sailfish, blue marlin and black marlin are all caught in numbers by these skilful fishermen, each species appearing seasonally in the rich Kurishio current.

Surprisingly, harpooning marlin is common in some areas, particularly in Japan and Taiwan, where they regularly catch blue marlin, black marlin and sailfish migrating in the Kurishio current. With a skilled harpooner on the bow and a spotter up top, this vessel lines up a target off the coast of Taiwan.
GAMEFISHING

Gamefishing for marlin is very active in many countries throughout the WCPO. The fishery is extremely well organised in Australia, New Zealand and Papua New Guinea, where membership of gamefishing clubs is particularly high. Clubs in this region generally keep good records of catches and tagging programs are well established.

Hawaii is another major centre of gamefishing, and while the club structure there is not as strong, the charter fishery is extensive and catches are monitored to some extent.

In many of the other Pacific Island Nations, such as Vanuatu, Fiji, New Caledonia, French Polynesia, Tonga, the Cook Islands and so on, gamefishing is quite active but is not monitored in any way.

ARTISANAL FISHING

Finally, mention should also be made of artisanal fishing – normally defined as village-based subsistence fishing with basic gear. And it doesn’t get much more basic than using a handline from a dugout canoe. This may sound like an unlikely fishery to catch many marlin, but in some areas, the numbers may be more than imagined.

A surprising number of tagged juvenile black marlin have been recaptured using this method in Papua New Guinea and the Solomon Islands – and those are only the ones we heard about. Such catches in remote locations are usually only discovered through word of mouth, as the catches of artisanal fisheries are not monitored in any way.

WHAT’S THE CATCH?

Now for the hard part. With all these fisheries catching at least some marlin, it remains extremely difficult to estimate just how many are caught. I’ve attempted to do this by pulling together data from a number of sources.
The main data for commercial catches comes from the huge files maintained by the Oceanic Fisheries Program of the Secretariat of the Pacific Community (SPC) based in Noumea. Recreational catch estimates come from the NSW DPI (fisheries), my own records, and from John Holdsworth of Bluewater Marine Research, whose data was mostly collected under contract for the New Zealand Government.

We can get a pretty good visual picture of the geographic spread of the commercial marlin catch in the WCPO by looking at a composite map of catches over the decade from 2000 to 2009. (Note that the map also includes catches of swordfish, shown in orange, although this is largely irrelevant in the context of this article).

On inspection of this map, several aspects stand out. First, it’s pretty obvious that blue marlin dominate the commercial marlin catch across the tropics, and that there have been very large catches near Taiwan over the past decade.

The main commercial catches of black marlin are centred north of PNG, near Taiwan and in the area to the east of the Solomon Islands. Bear in mind that it is illegal for commercial fishermen to take black or blue marlin within Australia’s 200-mile fishing zone, and for this reason very few black marlin show up in figures from eastern Australia.

On the other hand, the main commercial catches of striped marlin are off Australia, near Vanuatu, around French Polynesia and in the vicinity of the Hawaiian islands. There are also some striped marlin catches in the northern Pacific to the east of Japan, although this stock may well be separate from that found in the south-west Pacific.

Graph 1 shows the estimated catch by longline of the three marlin species in the WCPO through time. As for the map, it’s important to note here that the catches are not numbers of fish, but metric tonnes (the usual way of expressing commercial catches). This shows that catches of blue marlin were always relatively high, with a dip between 1965 and 1975, and then a steady rise, with some fluctuations ever since – albeit with a flattening out over the past five years.

Striped marlin catches were initially the highest of all three marlin species, but subsequently declined before levelling off for about 20 years up until the early 2000s. Since then, the catch has dropped to historic lows.

Interestingly, catches of black marlin don’t appear to show any clear trends over this extensive time series, although it should be noted that the highest catches during the early 1970s have never been matched since.

**RECREATIONAL CATCHES**

As mentioned, a significant proportion of the recreational catch of the three marlin species has been monitored in Australia and New Zealand through two sources: self-kept records of landed catches by gamefishing clubs, and records of fish tagged by gamefishing programs operating in both countries. (In both cases, marlin are also tagged in small numbers in neighbouring Pacific Island countries such as Papua New Guinea, Fiji, Vanuatu, etc).

Graph 2 shows the numbers of marlin tagged on the Australian program through time.

“Commercial catches are orders of magnitude higher than the recreational catches.”
The important point to note here is not so much the fluctuations in tag and releases, but the order of magnitude of the catches. Since the early 1990s, about 1800 black marlin have been tagged on average each year, plus about 900 striped marlin and about 270 blue marlin. Records of numbers of each species landed and weighed would also need to be added to those numbers, and similarly for the New Zealand data.

The trick now is to compare apples with apples. While fisheries statistics always present catch data as tonnages of fish caught, in the case of billfish I feel that numbers of fish are more meaningful, especially since that is how recreational catches (and taggings) are normally recorded. This means that the commercial catches in metric tonnes need to be converted to numbers. Such estimates of total numbers of marlin caught by commercial fishing will therefore depend very much on the average size of fish caught. An added problem here, however, is that the reported tonnage is usually, but not always, based on headed and gutted (‘dressed’) fish.

Taking these issues into consideration, the table above shows two conversions into fish numbers – one based on an average size of 80kg per fish, and the other based on an average size of 50kg. Data from observer programs throughout the WCPO show that the average size of all three marlin species over the past 10 years has been quite close to 50kg, and therefore, the numbers calculated on that basis would appear to be closer to the mark.

For the recreational catch, it is not necessary to count fish that are tagged and released and survive; we only need to know the number that subsequently died. Taking this into account, I have used two scenarios – 10 and 20 per cent post-release mortality. I would consider the figure of 20% mortality to be at the high end, based on accumulating data on the survival rates of marlin tagged with pop-up satellite tags. In fact, these studies have shown that survival rates of released marlin approach 100 per cent for fish caught on either circle hooks or lures.

Very few of the numbers contained in the table are perfect, and may include both under and over estimates in some cases. Perhaps the most rubbery figures are the estimates of total recreational catches of marlin in Pacific Island nations other than Australia and New Zealand. These are based on a rough survey of gamefishing activities in over 20 countries in the WCPO in 1998. It is not certain how these numbers were obtained, but they appear to be guesstimates at best. The figure of 6900 blue marlin caught by recreational fishing in Hawaii, French Polynesia and Guam is largely due to estimates for 'other Pacific countries', which came out at 199, 180 and 90 tonnes respectively. Converting these estimated tonnages to numbers by dividing by an average size of 80kg leads to surprisingly high estimates. For example,
the estimated number of blue marlin landed by recreational anglers (including charter boats) in Hawaii would convert to 2500 fish per year, which to my mind seems rather inflated. Nevertheless, these are the only attempts at such estimates to date, so we have to run with them for the time being.

Other problem areas with these figures include the fact that there are no estimates from commercial statistics of non-reported or discarded catches (due, for example, to shark or whale damage), both of which may be significant, and therefore lead to underestimates of commercial catches.

On the recreational side of the ledger, the non-club estimates of catches in Australia and New Zealand are, at best, guesses and may also be underestimates, although they are based on some understanding of the proportion of gamefishers who belong to clubs.

It should be noted that the table does not include any estimates of catches of marlin by artisanal fishermen, which, as mentioned earlier, may be higher than expected, particularly in PNG and the Solomon Islands.

**THE BOTTOM LINE**

All this discussion on fisheries catch statistics may seem convoluted and even boring, but having now considered many of the problems in coming up with the estimates, what is the bottom line? How many marlin are being caught in the Western and Central Pacific, and by whom?

Well, it is clear from the table that the commercial catches of all three marlin species are orders of magnitude higher than the recreational catches. Hundreds of thousands of blue marlin, and tens of thousands of striped and black marlin, are taken by commercial fisheries throughout the region each year. Longlining accounts for 83% of the total catch, other methods such as gillnetting for 13% and purse seining for 3%.

In contrast, the recreational landed catch of blue marlin in the region may be as high as 7000 fish per year. Although this figure is debatable, it would still represent only 1.5 to 3% of the total catch. For striped marlin, the total landed catch is probably less than 2000 fish (1.6 to 2.9% of the commercial catch), while for black marlin it is less than 1000 (1.3 to 2.5%). Bear in mind that many more are tagged and released, while release mortality must also be taken into account.

It comes as no great surprise that the commercial catch of the three marlin species throughout this vast region is far greater than the recreational catch, but the real questions are whether this level of commercial catch is sustainable, and does it have an impact on recreational fishing for marlin?

Given that these sorts of numbers of billfish have been taken for decades and that with the exception of striped marlin stocks are generally considered to be in reasonable shape, this still means that the current biomass of billfish is much less than it would be in the absence of fishing.

The aim of good commercial fisheries management is to maximise the catch without tipping into the zone of overfishing.

On the other hand, if just managing recreational fishing was the objective, the aim would be to have maximum ‘contact rate’ with billfish – meaning that the numbers of available fish need to be maximised – or conversely, that the total fishing mortality would need to be minimised.

Ultimately, the impact of commercial fishing on recreational strike rates depends very much on whether or not marlin are mixing over the areas shown on the map. For example, if black marlin rarely move into the southern hemisphere from the waters off southern Japan and Taiwan, or if the blue marlin caught near Hawaii rarely move into Australian or PNG waters, then commercial fishing in those areas would have little impact. If, on the other hand, mixing is broad and rapid, fishing in any region will have flow-on effects on catches in other areas.

Which leads to another bottom line – the need for research and knowledge. Thanks to research involving genetics and electronic tagging, we know much more today about the interconnectedness of marlin populations than we did a decade ago. However, we still have much to learn if we are to really understand the nature of billfish resources in the western half of the great Pacific Ocean.

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Although generally caught as bycatch while targeting tuna, marlin are still a popular food fish in many countries, such as Japan, where this large blue marlin was cut up for sale in the Tokyo fish market.