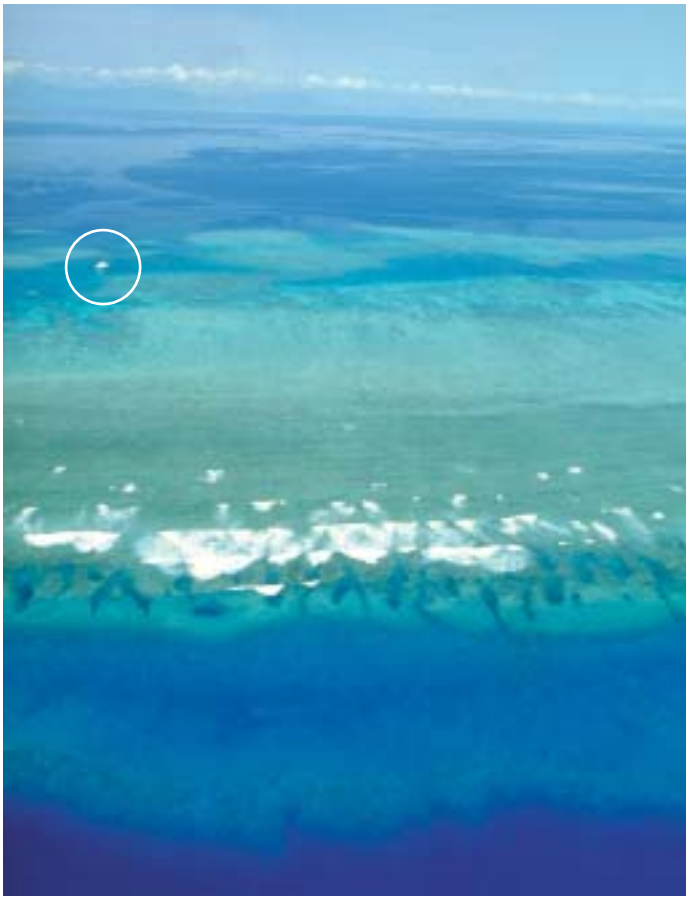
FISHY CLAIMS OF OVERFISHING

A broad consensus of academics, administrators, politicians and the general public all widely believe the Great Barrier Reef is threatened by overfishing. However there is no real evidence for that, nor even any sound reason to suspect it might be true. Abundant comparative data shows that fishing pressure on the GBR is so low as to be effectively almost non-existent. How popular belief concerning a significant environmental issue has become so diametrically opposed to the reality is the subject of this analysis.



Escape Reef with the author's research vessel 'El Torito' circled. Indeed a lonely ship on a lonely sea despite GBRMPA's claims

Introduction

An overwhelming majority of both public and scientific opinion is in agreement that overfishing by commercial and recreational line fishermen is a significant problem on the Great Barrier Reef and that it must be further restricted to protect the reef. However, catch statistics, extensive underwater surveys of the most heavily fished species, and directly observable conditions on the reef all overwhelmingly indicate very low fishing pressure on the Great Barrier Reef.

Environmental concerns tend to be complex and fraught with uncertainties. Application of the precautionary principle to every possibility is an un-affordable luxury leading only to misuse of resources. It is essential we distinguish real problems from imaginary ones, else the real will multiply, either from neglect or by the unintended consequences of misguided solutions to non-problems. Understanding how opinion, even so-called expert opinion, can become so diametrically opposed to the facts of overfishing on the GBR is instructive because this example illustrates an increasingly common pattern in environmental issues.

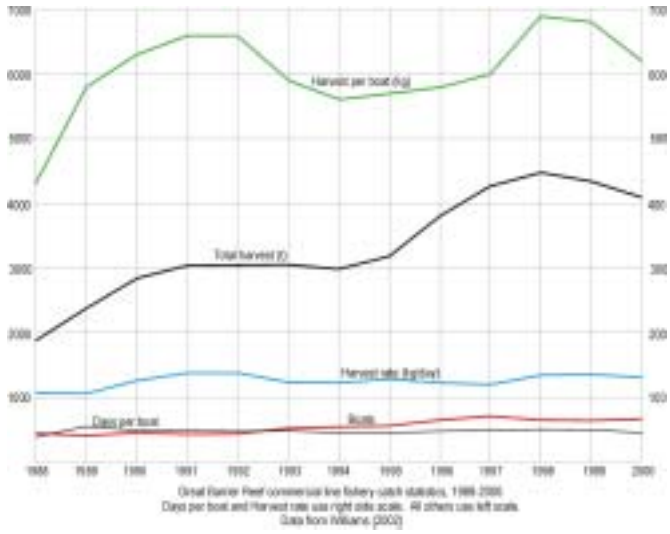
To undertake objective examination of such a complex social and scientific issue as the need for increased fishing controls over the Great Barrier Reef World Heritage Area, the first priority must be to set aside our cultural bias of deciding issues on sociological consensus. Although majority opinion may be a desirable means of governance, it is not a recipe for determining truth. Both history and the current world around us provide abundant examples of once popular beliefs that are now discarded, and current beliefs that are contrary to any reason or evidence. For the purpose of this analysis, then, I shall disregard unsubstantiated opinion and simply consider the reasons and evidence.

The Great Barrier Reef

The Great Barrier Reef is the largest contiguous area of coral reefs in the world. Distance, weather and a relatively small population in the region mean that most of the GBR is rarely even visited. Of the estimated 2,900 reefs in the complex, only a few dozen are regularly used for tourism. The total annual fish harvest per square kilometre is less than one per cent of what reefs elsewhere commonly sustain (Adams and Farman 1996). What then is the evidence for overfishing?

Two key indicators in fisheries management are the annual yield and the catch per unit of effort. The current annual commercial catch of reef fishes from the GBR is just over 4,000 tonnes and the recreational catch is estimated to be about 2,000 tonnes (Williams, 2002: p.66 et seq.). From 1989 to 1995 the annual harvest grew from about 2,400t to 3,200t. From 1995-98 the total then increased by about 430t each year, peaking at 4,475t in 1998 and declining to 4,095t in 2000 (Fig. 1).

Fig. 1



Four thousand tonnes can be an impressive amount of fish or a negligible one depending upon the size of the region from which it is produced. Salmon farming, for example, currently produces about 12,000t annually from a few small bays in Tasmania. (see: www.dpiwe.tas.gov.au/inter.nsf/webpages/egil-5kd7d6?open)

In reef fisheries assessment, the yield per unit of area is a widely used and important measure. Normally this is quantified in terms of annual yield in tonnes per square kilometre of reef and lagoon area. Curiously, this most important measure seems never to be provided or even mentioned in GBR management discussion or decisions. To ignore one of the key measurements of harvest in the context of a discussion of overfishing cannot but seem either incompetent or deliberately deceptive.

Annual yield

Catch per unit of area is easy to derive. It is simply the total annual yield divided by the area of reef and lagoon from which it is harvested. With some 346,000km of reef and lagoon area on the GBR the total annual catch in 2000 was about 17kg/km^2.

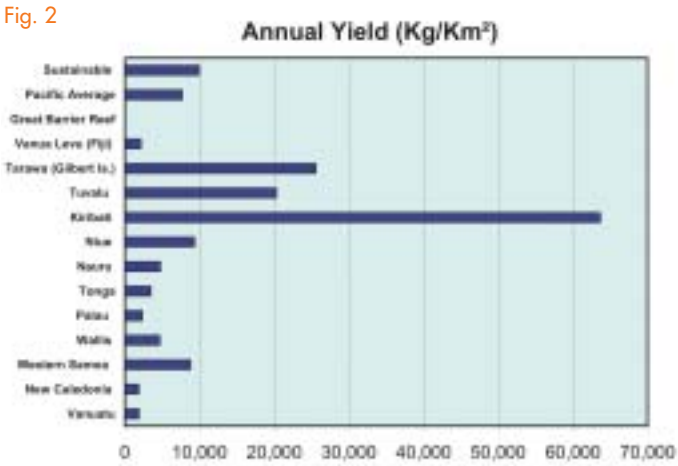
This is a minuscule figure on which to base a claim of overfishing. Elsewhere, over a wide range of Pacific reefs, the annual harvest averages some 7,700kg/km^2, a figure which is generally considered by fisheries biologists to be sustainable (Adams et al., 1996). In actual practice this level of catch is ongoing. Thus expert opinion in this instance is consistent with observable fact.

Maintaining that the GBR is overfished at an annual harvest of 17kg/km^2 when over a broad range of other Pacific reef areas an average of 7,700kg/km^2 (Fig. 2) is sustainable is not a credible argument.

By WALTER A. STARCK

Jennings and Polunin (1995) have suggested, based on observations at different sites in Fiji subject to different levels of fishing activity, that a fin-fish yield of at least 10,000kg/km² of reef is sustainable, at least where reefs are subject to low influence from human land-based activities. Although the above figures have been introduced by the author into recent public debate over further restrictions on fishing activity on the GBR, the proponents of overfishing claims have been unwilling to address them. The sole response (other than uninformed personal attack) has been to argue that actual reef area only comprises about 30 per cent of the total seabed within the World Heritage area. However, even if one were to consider the entire harvest to come from only 30 per cent of the area, the catch per unit of area would still only amount to some 56.6kg/km². In actual fact though, a large portion, probably over half, of the total GBR catch does not come from reefs themselves but from the lagoon area between reefs. The only counter argument offered, if presumed to be valid, is thus not only quantitatively insignificant but worse still reveals a fundamental lack of knowledge of the actual fishery of which the same opinions are being cited as expert.

Fig. 2



Catch per unit effort

In conjunction with annual yield, catch per unit of effort is perhaps the most important measure of fishing pressure and in particular, overfishing. The theoretical ideal of fisheries management is maximum sustained yield. When the harvest exceeds the sustainable yield, the population left to spawn is inadequate to provide the number of new recruits necessary to replenish the population. A progressive population decline results. When this occurs, the total harvest and the catch per unit of fishing effort decline in tandem.

Figures for catch per unit of effort in Great Barrier Reef waters are maintained by the Queensland Department of Primary Industries (Fig.1). This long established and globally used measure of fishing sustainability is therefore readily available, but strangely it too remains unmentioned by those making the claims of overfishing on the GBR.

From 1988 – 2000 the number of boats participating in the GBR commercial line fishery ranged from 410 in 1989 to 714 in 1997 (Fig. 1). In 2000 the figure is 666 boats. The harvest rate in kg/day/boat ranged from 108 in 1989 to 140 in 1992 with the 2000 rate being 134 kg/day/boat. The number of days per boat per year varied from 39 to 54 while the total harvest per boat ranged from 4.3 tonnes in 1988 to 6.9 tonnes in 1998. The catch per unit of effort simply does not show any evidence of decline, as would be expected if overfishing was indeed taking place.

Fish census data

If overfishing was occurring it would surely be reflected in declining populations of the most heavily targeted species. Coral trout *(Plectropoma spp.)* are the most heavily fished species on the GBR and constitute 40-45 per cent of the catch. Over the past two decades the Great Barrier Reef Marine Park Authority (GBRMPA) has contracted with Dr. Anthony Ayling for him to conduct extensive underwater visual surveys of coral trout numbers on the GBR. This body of information now totals hundreds of surveys encompassing the entire GBR region. These surveys are based on a well designed and conducted methodology and the results have been treated with appropriate and powerful statistical analysis. In fact, they make up the most extensive and long term body of population information available for any reef fish anywhere in the world.

It is also important to bear in mind that this work is not based on estimates or models but on actual counts of individual fish. The only reasonable probability for error is that coral trout are somewhat cryptic and there will be some fish present that will be hidden in the coral and not seen. Actual numbers on the reef therefore may be somewhat higher but will never be less than are counted.

Remarkably, this exceptionally valuable body of information exists only as unpublished reports in the library of the Marine Park Authority. Certainly, GBRMPA must have deemed this work important and competently conducted to have continued to support it at substantial expense for so long. It is difficult to avoid wondering if the reason for non-publication of the Ayling studies is that it was not desired that this information be readily available to the public. Had the findings revealed evidence for overfishing, it seems unlikely that they would have been left to languish in a regional library.

For a while, those interested in considering the details of Dr. Ayling's studies were able to read his informative summary posted on the web at: www.fastinternet.net.au/~rock/trout.htm This summary was entitled: WHERE ARE ALL THE CORAL TROUT? In September 2003 I drew attention to the availability of this document on the internet during a public debate about overfishing on the GBR. Shortly thereafter the article was removed, and apparently it is no longer publicly available. I therefore provide the following précis of Ayling's findings as reported in this document.

The Ayling census of coral trout on the Great Barrier Reef

Ayling reported in 2003 on the results of surveys made over the previous 14 years. The research included repeat surveys on some reefs over a period of 10 years. Surveys were made of both protected reefs, where fishing is prohibited, and of reefs open to fishing.

Major survey results included the following:

- A 1986 survey of the Capricorn-Bunker area at the southern end of the GBR sampled 12 reefs, including six that had been closed to fishing for five years. The average coral trout density was 57 per hectare on the protected reefs and 49/ha on the fished reefs. Variability between individual counts was such that this small average difference was not statistically significant.
- In 1991 a large number of reefs were surveyed in the Cairns Section of the Marine Park, between Dunk Island and Lizard Island. 29 of these reefs were open to fishing while 18 had been closed to fishing for seven years. The average coral trout density on the protected reefs was 33.9 fish/ha compared to 34.6/ha on the fished reefs.
- In 1992 another set of counts in the Cairns Section surveyed five closed reefs and five fished reefs. Again there was no significant difference between the closed and the open reefs. The average was 28.4 fish/ha on the protected reefs and 27.8/ha on the fished reefs.
- Between 1983 and 1994, counts from three regularly fished reefs off Townsville found that the average density of coral trout was 34/ha in 1983, 34.3/ha in 1989 and 66/ha in 1994.
- In the Cairns Section repeated counts from the same reefs were conducted in 1983 and 1991. In 1983 the average density was 22.5 fish/ha and this had increased to 31.7/ha in 1991.
- Off the Whitsunday Islands, counts on three reefs (Hook, Line and Hardy) found 57/ha in 1984, 84/ha in 1988 and 124/ha in 1994.

These results demonstrate the occurrence of a marked *increase* in the numbers of coral trout on all of the sampled reefs during the 1980s and 1990s. Furthermore, all the reefs sampled were close to population centres. They thus had been subjected to much more regular fishing pressure than most of the GBR which, being remote and difficult of access, is rarely fished at all.

The concept of "catchability"

The absence of figures that demonstrate decreases in fish abundance has not prevented the emergence of a popular view that a decline has occurred in Great Barrier Reef fish catches over recent decades. This decline is inferred from anecdotal evidence by individual fishermen and can be attributed to fish learning to become wary, i.e. to a reduction in fish "catchability".

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For example, catch rates by commercial fisherman on protected reefs (for intentionally experimental purposes) were cited by Ayling as being three to four times greater than those from regularly fished reefs despite comparable population densities prior to fishing. He also cited similar results from Heron Island near the southern end of the GBR. Reduced catchability of fish in areas subjected to frequent fishing, and not depleted fish populations, was concluded by Ayling to be the basis for the popular perception of overfishing.

Finally, Ayling et al. (2000) in a report to the Queensland Fish Management Authority again reported finding no effect of reef zoning on coral trout density.

Regional population of coral trout

An estimate was made by Ayling of about 1,200 major reefs for the GBR. Each reef was said to have an average of about 500 hectares of reef slope where coral trout are common, and about 2,500 hectares of reef flat and lagoon where they are less common. His surveys indicated an average density of about 50 fish/ha on the reef slope and about 10 fish/ha in the lagoon and reef flat. Size estimates showed that on average half of these fish were over 38 cm long and thus able to be taken by fishermen.

Based on these data, about 30 million adult coral trout were estimated for the whole GBR population. However, because large areas of broken ground, which also support coral trout, occur between individual reefs, the total figure was acknowledged to possibly be twice or more the 30 million calculated.

The total annual catch of coral trout from the GBR was estimated at two million kilograms. Given the average size of coral trout, this represents about three million fish, or about 10 per cent of the available stock. Annual recruitment being about 40 per cent of the available stock, fish replenishment is in fact far higher than the annual catch, which is therefore sustainable.

Coral trout grow rapidly, the fastest growing individuals reaching 30cm long in about 12 months, and most individuals reach the 38cm minimum by the end of two years.

It should be noted that the extensive Ayling estimates are based on counts of actual fish seen. It should also be noted that the 30 million total population estimate covers only the reef slope areas of the 1,200 major reefs and not the same total for the five times larger but 20 per cent as densely populated reef flat and lagoon areas, nor the inter-reef area which was estimated to support as much again as the major reefs, nor the similar number of smaller reefs. Much of the actual catch in fact comes from these other areas. Thus the total coral trout population is almost certainly two to four times larger than the estimated 30 million. Accordingly, fishing pressure must in reality be only a fraction of the already low level of the Ayling estimate.

Given these data, and the estimates of fishing pressure derived from them, it is clear that present Great Barrier Reef catch levels are not any threat to coral trout numbers. It is worth recalling the conclusion by Ayling in the undated Web document: "Just remember: the number of fish that are caught does not relate to the number of fish that are there, but to how easy they are to catch."

Unpublished surveys from the Whitsunday and Palm Islands

While the exceptional body of information assembled by Ayling has been ignored in debate on overfishing, a virtually anecdotal study has been widely cited as proof of overfishing and the need for greatly increasing closed areas (e.g. James Cook University media release "Green zones could double spawning stocks of fish" www.media.jcu.edu.au/story.cfm?id=96. Unfortunately, because this work too is unpublished (see: Willamson, 2000) it cannot be examined in detail. Nonetheless, to the degree possible, I will comment on it here.

The study involved surveys of two small protected reefs, one in the Whitsunday Islands and the other near the Palm Islands, and reportedly found the presence of significantly larger numbers of coral trout than occurred on other (unprotected) reefs in the same general area.

The original protection of particular reefs by restrictive zonation was based on public submissions that the reefs in question were particularly rich and should be protected. To later attribute differences as being due to protection when such perceived differences were the basis for granting protection in the first place is not a convincing argument. To make such argument while ignoring the far more extensive and powerful findings from Ayling, and to present this opinion to the public and to government as scientific proof, goes beyond simple error or bias. Such claims are either truly ignorant, or alternatively a deliberate attempt to mislead.

More pristine Great Barrier Reef, this time Elford Reef

It should be noted that although Dr. Ayling was also involved in some of the Whitsunday and Palm Islands survey work, the widely cited interpretations are by others and are at variance with Ayling's own conclusions based on his much more extensive data from many other reefs.

The Mapstone Study

More recently Mapstone et al. (2004) have also published an extensive experimental study and model based analysis of the effect of line fishing (ELF) on the GBR. This study claims to show "…that the two main target species of the RLF (reef line fishery), the common coral trout and the red throat emperor, were significantly more abundant, larger and older in areas zoned Marine National Park 'B' (and so closed to fishing) than in adjacent General Use areas that have always been open to fishing."

In public debate leading up to the recent large expansion of reef areas closed to fishing this work was often referred to as important evidence in support of the expanded zones. Unfortunately it was unpublished at the time of this debate, thus the claims made regarding its findings could not be examined. Now that it is available one finds that the ELF study and its findings are not nearly so clear and unequivocal as has been claimed. In view of this it seems most inappropriate that the cutoff date for debate was not extended until reasonable public consideration had been given to this important evidence.

Although the ELF study was extensive, well designed, and well conducted, some key aspects should be recognised.

- The differences between closed and open reefs were generally much less than differences between regions and over time on the same reefs.
- No evidence is available as to what portion of the observed differences between the open and closed reefs was the result of fishing and what portion was due to natural environmental differences or variability.
- Of the four study areas, three were in locales subject to frequent fishing whereas most of the GBR is subject to much less fishing effort. In the less heavily fished study area no significant difference was found between the open and closed reefs, and this would be more indicative for the GBR as a whole than the data from frequently fished areas.
- The more heavily fished areas showed a greater difference between open and closed reefs, but the highest fish populations of all were in the most heavily fished areas where even the open reefs had several times the population density of closed reefs elsewhere.
- Though Dr. Ayling was a co-author of the study, and his unpublished surveys were cited, no attempt was made to address or even acknowledge his extensive research which indicates a quite different picture for the reef as a whole.
- Reason dictates that any fish removed from a reef means fewer are immediately left. The crucial question for management, however, is whether the numbers left are adequate for replenishment. The study makes no attempt to assess this vital parameter. A detectable difference is not in itself evidence of unsustainability or ecological degradation.

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- The study findings clearly show (but did not acknowledge) that even on the most heavily fished reefs coral trout remain common and catches good, with no evidence of a long term continuing decline in either the harvest or the catch per unit of effort.
- The immediate effect of high catches and a significant drop in numbers of fish when a protected reef is opened to fishing is not unexpected. Although these experiments clearly demonstrated a short term increase in catchability, they were not continued long enough to indicate the nature of ongoing effects as catchability decreased.
- Under all scenarios tested, modelling showed ongoing future yields to be less than the 1996 catch. Models however tend to produce the results they were designed to produce and typically require considerable adjustment to do so. As tools for gaining insight into the dynamics of complex phenomena they can be most useful but they are often highly unreliable for predicting actual future events. It does not require computers and sophisticated mathematics to understand that with most of the GBR either unfished or only very lightly fished in 1996, more extensive fishing thereafter would result in an increase in the total catch.

The Mapstone study has been interpreted as providing clear evidence that benefit will accrue from a substantial increase in areas closed to fishing. In fact, however the key findings of the study provide little support for such benefit, or are even contraindicative of it. It needs to be borne in mind too that GBRMPA was a sponsor of this study, which was conducted with their support, approval and cooperation.

The final conclusions Mapstone *et al.* (p. 108) contain several points of considerable import:

- "...the simulations indicated that under all strategy sets, populations of common coral trout were likely to remain biologically robust to harvest."
- "The likely increase in area closures under the Representative Areas Program is likely to exacerbate the decline in fishery performance."
- "There was little convincing evidence of consistent secondary effects of fishing on, for example, the prey of the primary harvest species, common coral trout."
- "The utility of the area closures was most compromised when fishing effort was greatest, and the effects of increased fishing effort were most severe when area closures were greatest."

In other words no matter what we do to manage the reef line fishery it is likely to remain "biologically robust". The RAP plan can be expected to result in poorer fishing. There was no evidence that fishing had any detrimental effect on bio-diversity or the ecological integrity of the broader reef community. And, closing more areas to fishing can be expected to increase the overall impact of fishing.

The intensity of reef fishing in context

Any suspicion that the DPI catch figures cited are too low can readily be dispelled by actually visiting the reef.

The GBR stretches along the coast of Queensland for nearly 2,000km. The reef complex incorporates over 2,000 named reefs, and many thousands more un-named patch and pinnacle reefs. With 346,000km^2 of reef and lagoon area within which to operate, the 666 boats participating in the commercial line fishery in the year 2000 enjoyed an average density of one boat per 520km^2. The average number of days fished per boat for that year however was 46, thus the mean fishing boat density per day for the year was 365/46 x 520km^2 = one boat per 4,126km^2. For all practical purposes commercial fishing pressure on the GBR as a whole is non-existent.

There are of course some more favoured and more accessible areas that do receive much more fishing pressure than the other areas but this only means that most of the region receives even less pressure than even the extremely low average figures indicate. As for these relatively more heavily fished areas however, as the Ayling surveys clearly show, even they are subject to only very moderate pressure.

Weather as a control on overfishing

The population of Queensland from the 2001 census was just under 3.7 million persons, of whom only about 20 per cent live in the coastal region adjacent to the Great Barrier Reef (Anonymous, 2002). The coastal waters of the region are naturally turbid and near shore reef development is generally sparse, with widely scattered and algal-dominated reef communities. The fully developed reefs that make up almost all of the main clear-water reef area lie from 10 to over 100km offshore. Strong SE trade winds predominate throughout the area. Periods of calms and light variable winds tend to only last a few days at a time and are concentrated in the summer months. Weather and distance therefore keep most of the reef free of recreational fishermen most of the time. Even the commercial fishermen with larger vessels and greater incentive only average 40 to 50 days of fishing per year. This low fishing density is in fact easy to confirm by direct observation. During an extended flight over the reef only occasional boats are sighted, and those participating on a commercial cruise through the reef only occasionally see other vessels.

The effect of tourism on fish populations

Tourism on the reef is dominated by large fast catamarans which carry 100 to 300 passengers each. These vessels make daily excursions to permanent pontoons moored in the shelter of offshore reefs. They arrive in mid-morning, after a one to two hour passage trip. Passengers then sunbathe, snorkel, view the reef from glass-bottomed boats and enjoy an elaborate buffet lunch which prominently features local seafood. The vessels depart in mid-afternoon. Such activity utilises only a small area around the pontoon in about a dozen fixed locations. Their impact on fisheries or the reef region in general is imperceptible.

More specialist day-fishing tourism does exist, particularly out of the larger centres such as Cairns, Townsville and the Whitsundays. In general, however, this trade is centred upon game fishing. And, anyway, the number of boats operating is restricted by the high costs involved. There is therefore only a low demand. The impact of this type of tourism on wider reef fish populations is certainly tiny, and probably immeasurable.

Most reef visits are one day events, undertaken as part of a visit that lasts a week or two for most tourists to the region. Widely cited statistics on the importance of the reef to tourism have used the total value of tourism to Queensland as a basis for claims that tourism is far more valuable than commercial fishing. Over half of Queensland tourism however takes place in southeast Queensland and does not involve the GBR. The actual value of reef tours is in fact similar to the value of reef based commercial fishing (Tables 1 and 2 below).

Also, attributing the total value of every tourism visit to the region to a one day visit to the reef is no more justifiable than would be attributing it to commercial fishing, based on the fact that most visitors eat seafood during their visit. Furthermore, the limited supply and high price of local seafood means that most of it goes to restaurants rather than into home consumption. If the restaurant value were taken into account, the total direct

Table 1. GBR gross value of passenger expenditure on commercial tourism vessels

Year	1993-94	1994-95	1995-96	1996-97	1997-98
$'000	$148,785	$145,874	$172,821	$160,046	$155,903

Source: KPMG Consulting (2000)

Table 2. GBR gross value of commercial fishing catch*.

Year	1991	1992	1993	1994	1995	1996	1997
$'000	114,486	104,700	141,722	120,630	149,429	141,458	136,180

Source: KPMG Consulting (2000) * Includes prawn trawl fishery

One of the Ribbon Reefs

economic value of the GBR fishery would probably exceed that of reef tourist excursions.

Evidential summary

The available and relevant statistics regarding fishing on the Great Barrier Reef paint a clear and unequivocal picture. The GBR line fishery, far from being overfished, harvests only a small fraction of the potential sustainable yield. Although one can usually quibble over details of statistics, those that are available for GBR fishing are so overwhelming that any errors in percentages are irrelevant.

It would require orders of magnitude greater fishing pressure to begin to approach a credible level for reasonable consideration of overfishing. Where then is the evidence for it? The answer is simple. There isn't any. The claims of overfishing are not based on evidence and analysis but simply on opinion and belief. The facts are being ignored or dismissed, and if anyone introduces them into discussion they are not addressed but instead argument is made to discredit the person.

The sociology of "protecting the reef"

The Queensland and Federal governments have recently introduced legislation that came into effect on July 1, 2004 which conveys protected status from fishing over large new areas of the GBR (for details see: www.reefed.edu.au/rap/index2.html Fishing is banned from an additional area of almost 100,000km^2, about seven times the area previously protected.

Although the re-zoning involved is ostensibly to protect the bio-diversity of the reef, fishing is in fact the only activity that will be affected. These measures will certainly greatly restrict the freedom of operation of recreational fishermen, and impose additional costs and difficulties on commercial line fisherman. It is not normally viewed as the function of governments to impose irrational hardship on selected sectors of the community.

Achieving an understanding of how the extended bans on fishing were arrived at for the GBR might help prevent similar arbitrary (and ultimately meaningless) government actions regarding other perceived environmental "problems". I therefore now address the question as to how it has been possible for the Australian public and politicians to have arrived at such an overwhelming majority belief in the existence of a GBR overfishing problem. How could the experts be so wrong? By considering the source, basis of, and motivation for the overfishing opinions, however, it becomes much clearer how they came about.

Ignorance

A core problem in this matter is ignorance. Surprisingly, this attribute is displayed not only by many persons who have been less fortunate than others in the education they have received, but also by almost all of those who have participated in the overfishing debate as experts, many of whom are highly qualified. The GBR is a national icon which is well known to every Australian, but most have nonetheless never seen it, and of those who have, the experience of almost all is limited to a few hours visit to a tourist pontoon. Such visits are completely inadequate as a basis for informed opinion regarding potential reef problems.

As for the "experts", there are two kinds of expertise. One is based on formal training and theory, and the other on a breadth and depth of actual experience. Only a rare few academics or administrators have extensive direct experience of the GBR. Fewer still have extensive experience of reefs elsewhere in the world as a basis for comparison, including both heavily fished reefs and remote un-fished ones. Australian training and theory in fisheries and resource management is almost entirely based on overseas examples where overfishing and reef degradation from multiple sources are very real problems.

When one's training and understanding emphasises the real existence of such problems, then one naturally looks for them close to home. The infinite realm of hypothetical possibilities provides an unlimited supply, and our society is not short of persons who amplify such possibilities into scares. In the absence of broad experience and realistic, discipline-balanced scientific appraisal any and all of such problems can be perceived as real even by "expert" scientists, let alone by politicians and public.

Funding for research

For academics and administrators, environmental problems also have an important additional attraction. They promote the flow of greater funding. Research and administration that addresses a problem has a much greater chance of receiving support or increasing it than would the same activity without the threat of a problem. The competition for funding promotes a strong vested interest in finding problems. And where real problems are not apparent, hypothetical possibilities are used instead. In presenting and defending an application for funding, what started as only a possible problem only too quickly becomes a belief.

In addition to exaggerating the environmental risks in their research grant applications, some reef scientists, encouraged by both media attention and special interest environmental groups, indulge in strident public advocacy for particular environmental causes. For example, in 2003 a number of leading marine biologists recommended that fishing should be banned in up to 50 per cent of Queensland's coral reef zones in order to preserve bio-diversity. When such recommendations are published in the media, the massive conflict of interest of the proponents goes unreported, and, by virtue of their scientific authority, their remarks generally stand unchallenged. In the face of such fraudulence, the general public has virtually no chance of discerning the truth.

Why the public isn't told the truth by experts who do know

There are a handful of academics and administrators who have both the credentials and experience to know that the overfishing claims about the Great Barrier Reef are untrue. Why, then, do they not speak out?

The answer, regrettably, is that it is rarely possible for them to do so because of the strong personal ostracism to which they will be subjected as a result. Speaking out against the politically correct version of an environmental problem, be it reef-related or otherwise, is a no-win situation. No matter how senior or well qualified they may be, persons who choose to combat the conventional wisdom won't be believed, and, one way or the other, end up being denigrated.

More junior persons, rightly, fear for their employment or career and, should they work for government agencies or specialist research centres, are even subject to compulsory managerial direction regarding their public statements. The peer review process used both in grant applications and when papers are

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The author's well known research vessel 'El Torito'

submitted for publication also imposes a strong and undesirable pressure for scientists to conform to prevailing views. Again, therefore, it is not surprising that the public remains uninformed.

What would fishermen know?

There is however another group of genuine experts who do seek to be heard, but whose views are generally simply dismissed – the professional fishermen.

There are many intelligent and successful fishermen who know from direct personal experience that the claims of the experts do not coincide with their own direct experience on the reef The knowledge of these experienced reef users is, however, not sought, credited, or given media attention, perhaps partly because among fishermen are some who are their own worst enemy. They tell tales of how great the fishing used to be, but how the reef has been "flogged to death", and they are all too ready to blame farmers, recreational fishermen, trawlers, tourist operators or anyone else as the cause.

Typically such complaints come from individuals who have poor equipment, spend more time in the pub than on the reef and not surprisingly have poor catches. Equally un-surprising, such opinions are generally given credence by the proponents of overfishing while the views of the successful fishermen who don't think overfishing is a problem are ignored.

The "good old days"

To believe that fishing used to be much better than it is now is a natural human tendency, and is common and widespread. In many places factual information shows the phenomenon is a real one, and may also show it stems from overfishing (i.e. the Philippines and Indonesia). However, the belief is just as common where catch statistics provide no support for it.

There are two aspects to this perception. One is imaginary. The other is real but not a result of overfishing. The imaginary aspect stems from a mix of nostalgia, selective memory and seniority. We tend to remember the times when we had good catches and forget the times when we did not. Relating tales of experience inaccessible to one's audience also has its appeal in confirming one's own senior status.

Overfishing vs. catchability

Where it can be factually demonstrated that catches have declined, there are two main possible explanations. The first is overfishing. The second rests on the understanding that intensive fishing makes fish wary and harder to catch. A common example of the latter situation occurs around many docks and piers where one can often find dense schools of resident fishes exposed to almost constant fishing but extremely difficult to catch.

At the other extreme on isolated oceanic reefs that have been rarely or never fished, fish are very easy to catch. Any small object dropped in the water will attract attention and may be mouthed by curious fish. Under such circumstances fish may even be caught with a bare un-baited hook.

On the GBR, a few reefs near population centres are relatively frequently fished and fish there are harder to catch. However, as the Ayling surveys have shown, populations of the most heavily fished species on these reefs show no significant statistical difference from those on nearby reefs which have been closed to fishing. It is worth noting also, in the context of the discussion in the previous section, that it is these same few readily accessible reefs that are the source of most local residents' experience of the GBR.

Catchability, rather than actual abundance, is therefore the basis for many fishermen's perception of overfishing. It is widely known among fishermen and fishing lure manufactures that new techniques and lures that are at first highly effective become much less so as they become widely used. Good fishermen are always experimenting with new methods, baits, and lures. Poor fishermen do nothing different until they see everyone else doing it. They remain behind the curve and blame their poor catches on a lack of fish.

The GBR finfish fishery is entirely a line fishery. The nets, traps, chemicals, and explosives commonly used on overfished reefs elsewhere are simply not a factor on the GBR. Unlike these other means of harvest, line fishing requires the active cooperation of the fish. It is also highly targeted and has no direct effect on juveniles, other fishes or the broader reef community. Line fishing is a constant contest of wits between fish and fishermen. Fish that readily take a bait or lure are caught. Those that are wary survive and reproduce making it increasingly difficult to catch a fish even though they may actually still be abundant. Reef fishes live in complex environments that present a wide range of varied and varying dangers. They must be and are, able to learn quickly and be highly adaptable in their behaviour.

I can find no described instance anywhere of a reef fish population, other than sharks (which are not commercially fished on the GBR), being severely depleted by line fishing alone, and there are numerous examples of abundant fish in locales subject to near constant fishing. Furthermore, underwater censuses that count fish actually present, like those of Ayling, must be believed. Opinions to the contrary reveal more about their source than about their subject.

Lobby group activity and the media

Various national and international environmental organisations have played a role in propagating, amplifying and lending further credibility to beliefs of overfishing. The concern and motivations of such organisations may be genuine enough but their knowledge of the actual local situation is minimal. Further, to help achieve their preconceived aims, such organisations often elect not to seek genuine understanding and they are certainly highly resistant to views, however well justified, which conflict with their political aims.

Because of the large financial resources at their command, and their expertise in media manipulation, the large environmental political organisations exert an influence which completely overshadows the weak or non-existent scientific basis for their beliefs. For the environmental lobby groups, the GBR is a natural icon of world renown. "Saving" it is a sure bet for publicity, popularity, and donations. Regrettably, given the gross inadequacy of the science on which their views are claimed to be based, such lobby organisations generate a significant effect on public and political opinion.

The media in turn, often under the skillful manipulation of the lobby groups, find threats to the GBR to be perennially newsworthy. For over three decades, not a year has passed without major media attention being given some new threat to the GBR or the rehashing of an old one. Over thirty years of these unfilled prophesies seems to have done nothing to diminish their being accorded credibility as "news" and their sources being described as "expert".

The general public seeing only a consensus of "expert" opinion and concern can hardly think otherwise about something they themselves have never seen or of which they have only experienced a brief glimpse. Political leaders being equally misinformed, and sensing the popularity of the issue, understandably favour imposing further restrictions on fishing, most especially as doing so entails little or no budgetary cost yet generates significant returns at the ballot box.

Precaution is not without risk

Provided the GBR is "saved", why should we care about whether or not the reasons given are fraudulent? Isn't it better to err on the side of caution in protecting a unique and beautiful natural heritage?

Well, perhaps if there was any real threat, and if the effect of our actions was indeed beneficial. But, in reality, neither is the case.

Australia can have both a significant GBR line fishery and a beautiful reef as well; the two are not in conflict Reef waters are

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capable of sustaining a much larger fishery than the present one and still maintaining a healthy ecosystem. Various Pacific island reefs have indeed done so for hundreds and even thousands of years. No reef fish has ever been exterminated by line fishing. There is no risk in permitting the GBR fishery to expand, and imposing local restrictions only when evidence of some need develops.

There may appear to be no financial or environmental cost to limiting the GBR fishery to its current level, or even to reducing it, but in fact there are very real though non-obvious costs. Ecology, like economics, is by nature holistic, and not all effects are immediate or obvious. A balanced, sustainable use of resources makes possible a healthy human ecology. Unnecessary restrictions on particular resources, such as reef fish, only puts more pressure on others.

The GBR could effortlessly meet the total local demand for seafood, with spare to sell-on, but because of the many unnecessary and growing restrictions on fishing it does not. When such a valuable local economic and employment activity as reef fishing is needlessly limited, the supermarkets of the area turn instead to selling mostly imported seafood. First, therefore, there is a negative effect on employment of those formerly working in the fishing industry, and on the local economy from which income must be removed to pay for the imports. Second, the environmental impact does not disappear but is merely transferred elsewhere.

Generally, where substitute seafood is imported, the environmental impact is added to that associated with already over exploited marine resources, often in underdeveloped countries. It also has to be paid for by local economic activity which, whatever it may be, has its own environmental impacts. Should former seafood consumption be replaced, for example, by red meat consumption instead, there are still attendant downstream environmental consequences. The logic, not to mention morality, of such a chain of events is at the very least questionable, and it is little short of amazing that politicians can introduce restrictive legislation without first demonstrating to the public that they have fully comprehended and analysed these various issues.

Conclusions

Beyond the misuse of a valuable resource, the false claims of overfishing on the GBR also entail a broader and even more important problem, the misuse of science itself. Modern environmentalism has become much more than simply a concern for a healthy environment. It has developed into a peculiar quasi-religious blend of new-age nature worship, science, left wing political activism, and anti-profit economics.

Environmentalism incorporates a strong element of political correctness, whereby reason and evidence are welcome only so far as they support the predetermined agenda. Information which combats the environmental scare-of-the-day is ignored or denied, and those who attempt to bring it to public attention are attacked and denigrated.

Probably of most concern of all, many of the scientists who are currently involved in studying environmental issues have taken up attitudes and approaches similar to those of the activists. Science, by becoming advocacy, has made itself and its practitioners part of the problem, and greatly weakened its power to provide real solutions for real problems.

Most national parks are only small to modest in size. The management aim is to maintain conditions as pristine as possible consistent with a requirement for a sustainable level of public access and recreation. The GBR is an exception in that it is not only vast but it also incorporates important regional resources. Management must thus accommodate a range of recreational and commercial uses.

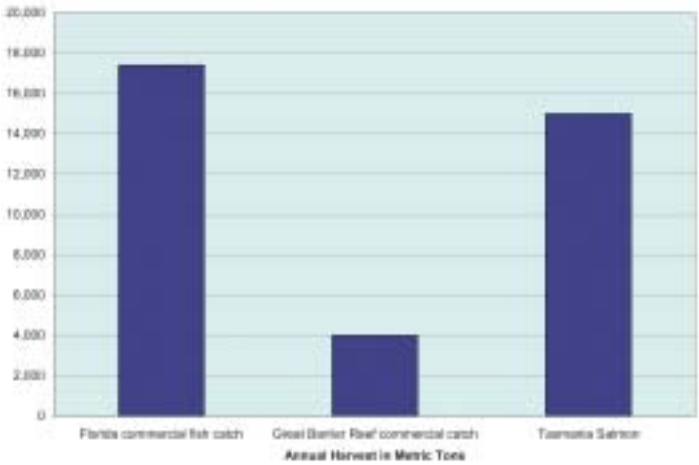
How this might be achieved and the aims, balances, trade off's, effectiveness and costs involved, has received far too little analysis. This difficult issue is compounded by the complex and dynamic nature of reef communities and our generally poor understanding of their functioning, current condition, variability, and trends.

Coral reefs are robust and flexible communities that readily recover from relatively frequent natural perturbations. No endangered species are involved. There is little risk in monitoring the situation and addressing problems if and when they become apparent, rather than trying to take elaborate pre-emptive action to avoid an endless array of imaginary possibilities. In view of our ignorance and the complexity of the matters involved, it would also be prudent to test measures before applying them on a broad scale and to carefully assess their results when implemented.

The present management approach is largely an ad hoc reactive one based on opinion and anecdotal information. It amounts to an attempt at remote control management. Hypothetical solutions are applied to imaginary problems, with no attempt taken to assess either the reality of the purported problems or the results of any measures taken. The main virtues of this approach are that it can be done entirely from an office, and that "success" can be proclaimed with little chance of contradiction.

A much clearer analysis of management objectives with particular reference to the balances and broader consequences of the various reef uses is badly needed, as is a much more empirically based approach. Most importantly GBRMPA, to do an effective job, needs to be restructured and re-focused toward developing the sound body of knowledge essential to meaningful management of the reef.

Management by theory and hearsay without broad and ongoing knowledge of either actual conditions, or the results of management measures, amounts to an expensive charade. It creates the appearance of doing something but is of little actual benefit to the reef while at the same time impeding its sensible use and enjoyment.



Personal note

The author has a PhD in marine science including post graduate training and professional experience in fisheries biology. His reef experience includes some 50 years of fishing and diving on coral reefs including those in the eastern, central and western Pacific areas as well as the Indian Ocean and tropical western Atlantic region. He has had the opportunity to study two reefs every year for 10 years each. One was in Florida the other on the GBR. He has also been able to extensively dive reefs in both overfished areas and sustainably fished ones as well as a number of remote un-fished oceanic reefs. His Barrier Reef experience includes over 1000 dives ranging from far northern Cape York to the Capricorn group at the southern end of the GBR.

From this perspective the impression of the GBR is essentially that of an un-fished reef but with a greater abundance of large fishes than is typical of isolated oceanic reefs probably because of greater nutrient supply.

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