It is interesting to consider the very famous photographs below (figure 1) which are plastered across the internet which supposedly shows an example of how the Great Barrier Reef (GBR) has been damaged. The photo on the left shows a reef in the late 19th century and the right photographs supposedly shows the same reef today. These photos are also found in the Great Barrier Reef Marine Park Authority's GBR Outlook Report 2014 which states that "Historical Photographs of inshore coral reefs have been especially powerful in illustrating changes over time, and that the change illustrated is typical of many inshore reefs" (see appendix B).

Figure 1 Historic photo's near Bowen supposedly at the same location circa 1890 (left) and 1994 (right)

I have always been highly sceptical of these photographs as the commonly used reason to explain that this reef has been killed is due to increased sediment runoff since European settlement. My own work has shown that this explanation is virtually impossible especially for locations such as this. In addition it does not take account of the fact that these inshore reefs can change dramatically with time especially with the passage of cyclones which can temporarily obliterate them. Ten years after a cyclone they may have fully recovered.

The presentation of the photographs also gives us the impression that we know where the original 100 year old picture was taken. In fact we can only guess within a kilometre or two, and in this area it would not be unusual to find great coral in one spot and nothing a kilometre away (see appendix A). The selection of the position of where the modern photo was taken can thus decide what message we see. Finally, seeing dead reef does not necessarily mean that it died recently. In fact there are literally hundreds of square kilometres of dead reef-flat on the GBR which was killed due to the slow sealevel fall of about a meter that has occurred over the last 5000 years. This has left a lot of coral high and dry at low tide which kills the coral. It is easy to take a picture of a dead reef, but it does not mean it died recently.

A month or so ago I decided to see if there was good coral in the area that these pictures were taken so I asked a couple of my field technicians to take some photographs in the area with the same island backdrop as the two original pictures (figure 2 and 3). You will note that there is spectacular coral living there – at least in many spots within the area that the original photos were taken.

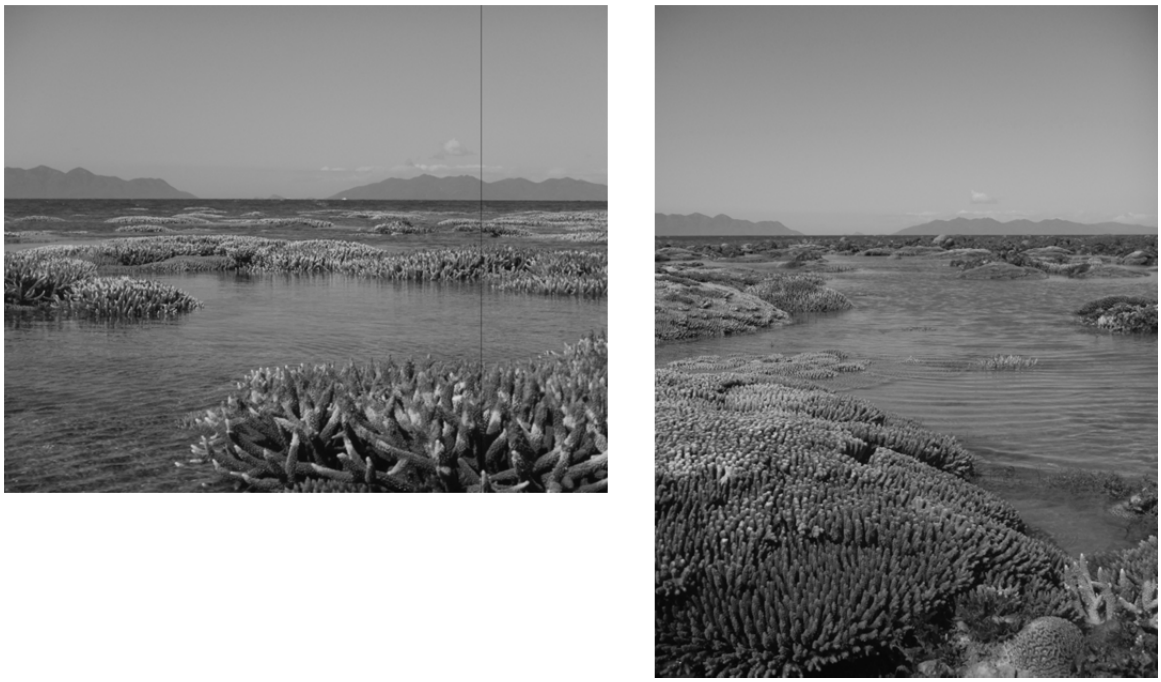

Figure 2: Black and white picture of corals near Bowen showing spectacular coral growth.

Figure 3: Colour picture of corals near Bowen showing spectacular growth.

The questionable pictures were originally published by David Wachenfeld and the paper describing them can be found here (http://www.gbrmpa.gov.au/__data/assets/pdf_file/0019/9802/gbrmpa-ws23.pdf (go to page 142). It should be noted that in this paper David Wachenfeld cautions that

> "from the results of the Historical Photographs Project so far, the number of locations that do not appear to have changed since the historical photographs were taken **throws doubt on the proposition that the GBR is subject to broad scale decline, whatever the proposed cause**."

So the original author said these pictures should **not** be used to demonstrate damage to the GBR and yet they pop up all the time in important documents such as the official Great Barrier Reef Marine Park Authority 2014 GBR Outlook Report (see http://www.gbrmpa.gov.au/cdn/2014/GBRMPA-Outlook-Report-2014/index-33.html see page 17 of the report or Appendix B),

In addition they are found in

(a) Reports from our most august scientific institution working on reefs such as the Australian Research Council Centre of Excellence for Coral Reef Studies 2012 annual report: See page 32

http://www.coralcoe.org.au/wp-content/uploads/2013/04/Annual-Report-2012-Web.pdf (see page 32)

(b) in the quality mainstream media e.g an ABC website

http://splash.abc.net.au/home?WT.tsrc=Email&WT.mc_id=Innovation_Innovation-Splash%7CSecondary_email%7C20150311#!/media/1542275/reef-of-life (go to 20 second mark on video.

(c) Or the web everywhere, for example

http://kw.dailyflick.com/18-stunning-pictures-of-the-great-barrier-reef-that-prove-it-looks-as-good-as-it-did-50-years-ago/ (go to image 15), and

http://cmbc.ucsd.edu/Research/student_research/Earth_Altered/Transformed_Landscapes/view.php?p=Stoneisland1895

Of course this is a relatively trivial, although visually spectacular, example of some of the bad science on the GBR. I can send you a document (an ARC grant application in fact) which talks about other more fundamental problems if you like. However returning to these pictures, they are actually a dramatic example of how scientific organisations are quite happy to spin a story for their own purposes, in this case to demonstrate that there is massive damage to the GBR. In fact any decent marine scientist or boat owner around Bowen, could have told you that there is lots of coral around Bowen and that it is spectacular. It was always a very unlikely proposition that this area had suddenly lost all its coral. GBRMPA, and the ARC Centre of Excellence should check their facts before they spin their story.

Most importantly this raises the question of what quality assurance processes are in place for much of this “public good science”. My view is that there is almost no quality assurance. This is a huge problem. I can send you a short document on this issue in relation to the GBR.

If you would like to do a story on this issue you would be welcome to use the photographs that we have taken. In addition I think it would be worthwhile asking the Head of GBRMPA and also the Head of the ARC Centre of Excellence the following.

(a) How much confidence that they have in the veracity of the original photographs?
(b) Would they expect that if you as a journalist went to this site, would you see good coral?
(c) How sure are they that the sequence of pictures in their reports are in fact taken in the same location
(d) Given that the original author cautioned against using these pictures to demonstrate “broad scale decline” of the GBR, why did their organisations use them to do exactly that?

My guess is that they will both wiggle and squirm because they actually know that these pictures are likely to be telling a misleading story - and they will smell a trap. If they wiggle and squirm then the next two questions must be

(e) If you are not sure about these pictures, why have they been included in your reports ?

And finally and most importantly

(f) What quality assurance procedures do you have in place to make sure that your science is likely to be correct?

They will talk about peer review but this is insufficient QA as this often only involves a quick read of the work by a couple of people who may well be ones friends. (I can send you more information on this as well if you are interested.)

Prof Peter Ridd

JCU

Appendix A

The 1890 picture was published in a book by Saville-Kent, see
http://www.biodiversitylibrary.org/item/40631#page/108/mode/1up

It is Plate IX.

Referring to the supposed Stone Island picture the original book does not say it is on Stone Island. It says, “The scene of this illustration is in close vicinity to that of the Madrepore islet that forms the subject of Plate V, No 1.” So what does Saville Kent say about plate V. “This exceedingly picturesque reef-view is typical of the coral growth that predominates over a large area in the vicinity of Stone Island.

So we can say that the image (Plate IX) is in the vicinity of a large area in the vicinity of Stone Island. – not very precise. We certainly cannot be sure it is even on Stone Island.

Appendix B

Excerpt from Great Barrier Reef Marine park Authority GBR Outlook Report 2014 showing historic photographs and implying they show decline of the GBR (see figure caption)

2.2.2 Shifting baselines

When looking at the Great Barrier Reef today, people tend to compare it with their own previous experiences. However, what is considered natural gradually shifts as changes in the environment accumulate — a 'shifting baseline'. Such shifts are particularly an issue in marine environments where the technology to study the ecosystem has been developed only recently. In fact, much marine research has been conducted in ecosystems that are already degraded to some extent, and there is little understanding of how these ecosystems operated in the absence of human activity.[16]

On the Great Barrier Reef, most scientific research and monitoring began in the 1970s and 1980s, but there is increasing evidence of significant changes in the Reef well before then, some stretching back over the past 200 years. The lack of such long-term scientific data across a number of habitats and groups of species presents a significant challenge for assessing the true condition and trend of the ecosystem, including the risk of using a shifted baseline to make the assessment. For example, the first systematic surveys of subtidal reefs in the late 1960s began after an outbreak of crown-of-thorns starfish had affected coral reef habitats along much of the Great Barrier Reef.[16] Understanding the significance of recent declines in coral reefs[17,18] depends critically on the context of those past declines.

Evidence for shifted baselines in the Great Barrier Reef has come from older people who remember how conditions were different[19] or from observations recorded in images such as those of Stone Island near Bowen[20] (Figure 2.2), journals and ships' logs. Traditional Owners and many older people in the broader community[19] consider that fish stocks and other marine resources have declined from the very considerable early bounty that was available on the Reef. Subsequent surveys suggest coral trout stocks on studied reefs were markedly depleted before widespread monitoring began.[21]

2.3 Current condition and trends of habitats to support species

The Great Barrier Reef ecosystem consists of a wide variety of habitats from mangroves and seagrass meadows to coral reefs and open waters (Figure 2.3). Even within each of these habitats there is substantial variation, depending on a complex interplay of ecological factors. Variations of habitats across the continental shelf and beyond — from inshore, shallow water habitats to deep, offshore ocean habitats — are more pronounced than those along the length of the Reef.[22] The overall condition of the Region's biodiversity depends on maintaining the condition of all its habitats and the interconnections between them. Habitats for the conservation of biodiversity are one of the four criteria on which the Reef's world heritage listing is based.[23]

2.3.1 Islands

The Great Barrier Reef ecosystem includes approximately 1050 islands, comprising coral cays, continental islands and mangrove islands. Of these, 70 Commonwealth islands are part of the Region, with the remainder under Queensland Government jurisdiction. The diversity of islands and the habitats they provide are attributes that contribute to the Reef's outstanding universal value.[23]

Figure 2.2 Inshore coral reefs over time, Stone Island, offshore Bowen
Historical photographs of inshore coral reefs have been especially powerful in illustrating changes over time. The changes in the fringing reefs at Stone Island are typical of many inshore reefs. They largely took place before monitoring programs began — illustrating that modern assessments of the condition of coral reefs are likely to be based on an already shifted baseline. (2012 photograph © The University of Queensland, courtesy of Tara Clark)