the school program has been invaluable, providing biologist time and greatly reduced fares to Low Isles.

The other half of the GBRMPA requisite, for protection and wise use of the reef, is the area of most concern and contention between reef tourist operators and conservation minded groups. This is certainly a valid point when you consider the vast increase in tourist reef use over the last decade. The number of day trippers to the reef has increased 35 fold while the number of operators is up by a factor of 10. This is largely due to the advent of high speed catamarans offering fast and comfortable transport to the outlying reef areas on a large scale.

It could also be argued that the speed of development has overtaken the speed of acquisition of the knowledge needed to ensure the protection of the very reef they visit. Certainly now there are strict requirements operators must adhere to right from the initial proposal and accompanying environmental impact statement (EIS) to continued monitoring of the reef area of operation. These are at the moment being formalised and structured to monitor the effects tourist operation has on the reef and to develop methods to keep these effects well below an acceptable level.

Reef Biosearch has over the last 4 years been carrying out research and monitoring programs. The site of a pontoon installation at Agincourt 4 is being examined for changes in fish and coral communities and water quality. This research is a requirement of the operators permit and information from it will result in increasingly better management guidelines for tourist reef use.

The symbiosis between tourism and reef education has led to large scale employment of marine biologists in the field. Increased public awareness of the reef and its importance leads not just to the employment of marine biologists as educators but also to corporate funding for relevant research. Money in research is always in hot demand and short supply. The research carried out by on site biologists can be very productive in data intensity and sampling frequency due to the greatly reduced boat costs and easy accessibility.

The biologists of Reef Biosearch have expertise in a variety of fields including coral taxonomy, marine mammals, biochemistry and statistics. Rostering of work times is flexible enough to allow for irregular research programming while still maintaining full-time work status. The result is a variety of research programs run by Reef Biosearch and also in collaboration with other research institutions. Daily interaction in reef waters gives invaluable recorded observations, through all seasons, to investigate otherwise unforeseen or unconnected biological events of importance.

In general at Reef Biosearch we are in the unique position to combine education and research in a tourist framework. This should be increasingly carried out by other operations both on the GBR and areas such as the rainforest and mangroves.

The most important aspects are:

1 The conversion from tourist to ambassadors for reef protection via education and involvement.

2 The overall expansion of research funds and projects.

The employment of concerned biologists can only increase the concern and care a tourist operation has for their immediate environment.

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DIVING AND THE LAW
A SHORT HISTORY OF THE REGULATION OF SCIENTIFIC DIVING IN AUSTRALIA

E.A.Drew

Introduction

The first scientific diving in Australia was carried out under the direction of (Sir) Maurice Yonge at Low Isles during the 1928-29 Great Barrier Reef Expedition. They used the diving helmet shown in Figure 1, a piece of equipment initially developed by a Paris fire chief to allow access to smoke-filled buildings and subsequently used by Professor Milne Edwards to study marine biology down to 7.5 m (25 ft) in Sicily in 1856. Similar equipment was used in the Caribbean in the 1920s by William Beebe to depths of 18 m (60 ft) and was still being used by Jack Kitching to study kelp in Scotland in 1940.

Although the aqualung was brought to Australia in 1952, early scientific diving work by CSIRO in 1957 to study the pearl beds of northern Australia used Greek sponge divers with hard-hat diving equipment. Indeed, scientific diving in conjunction with both the pearl and abalone industries in Australia still uses the same equipment as the commercial operators in those industries, namely hookah (surface supplied air from a petrol driven compressor) diving. Initially, use of the aqualung was restricted to recreational spearfishermen, but scuba-based scientific diving in Australia began in the late 1950s and blossomed during the 60s.

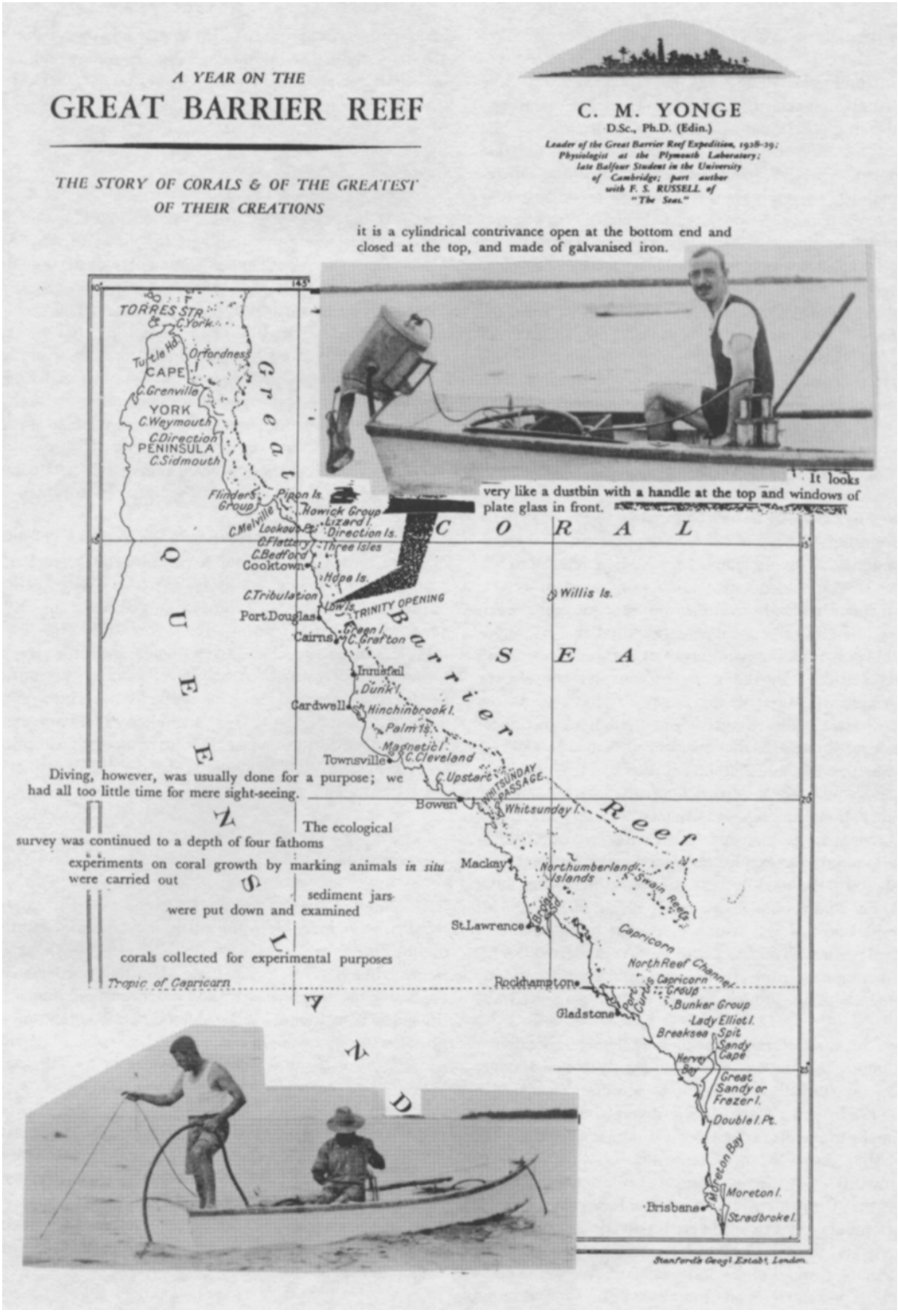

Figure 1. The diving helmet and hand pump used on the 1928-29 Great Barrier Reef Expedition. Photographs and map from C. M. Yonge (1932) "A year on the Great Barrier Reef".

Early regulations

Commercial diving was first regulated in Australia by Australian Standard CZ18 - 1972 (Work in Compressed Air) which applied to caisson workers as well as divers. The underwater component was incorporated into a separate document, AS 2299 (Underwater Air Breathing Operations), in 1979 and this applied only to professional and/or commercial underwater operations. Scuba diving was limited in that document to 20 m. There were scientific divers on the committee which developed that Standard, but it was decided not to include such activities in its scope. So, the scientific diving representatives were dropped from the committee. An amendment was subsequently added to AS 2299 (1979) allowing short dives to 30 m on scuba specifically for research diving operations, presumably to allow the commercial divers to do work for scientists!

Start of the present problem

Standards Australia's Committee SF17 began work on redrafting AS 2299 in 1984. A document was issued to the commercial diving industry for public comment in late 1986. This coincided with a number of important factors. There was a marked down-turn in work for commercial divers, the federal government proposed that all states should begin to develop uniform Occupational Health and Safety (OH&S) legislation, environmental consultancy companies who used diving began to emerge, and the police rescue divers wanted clear regulations to protect them against unreasonable operational demands. The result was that the public comment response from the state regulatory authorities in particular called for other forms of occupational diving, and especially rescue and scientific diving, to be included in the scope of AS 2299 in order to provide a basis for regulation under future OH&S legislation. Presumably with an eye to obtaining more work for commercial divers, particularly in the area of consultancies but also within the research organisations, the Professional Divers Association of Australasia (PDAA), a trade union exerting rigid closed-shop control over the commercial diving industry, wholeheartedly supported this.

So, without actually consulting the scientific diving community, their activities were summarily included simply by rewriting the Scope section of the new draft Standard. In early 1987, whilst the scientific divers were themselves beginning to exercise a degree of self-regulation through the Australian Marine Sciences Association (AMSA), we learnt unofficially of this major change. We immediately contacted the 30 organisations we knew did scientific diving to determine the number of divers involved, their degree of activity and their thoughts about a number of potentially threatening features of the draft Standard. We were able to get two representatives on Committee SF17. One was from the Australian Marine Sciences Association and the other from the archaeologists' association, the Australian Institute for Maritime Archaeology (AIMA). Standards Australia also suggested at that time that we should develop a preliminary draft for a standard which would be acceptable to scientific divers.

Strategies

At this point we formed a National Working Group on Scientific Diving to coordinate the views of AMSA, AIMA, the universities, state government research organisations and the consultants. AMSA also carried out a more detailed survey of scientific diving activities over the previous 11 years (1977 to 1987) and the results from the responses from 203 divers are set out in Figure 2. Particularly interesting was the overwhelming emphasis on boat diving, the lack of surface support personnel, the number of usually fairly shallow dives amounting to an average of 36 dives per year, the large proportion of divers doing at least some decompression diving, a significant amount of hookah diving (8%) and the small number of accidents (see Table 1).

Armed with annual updates of such statistics (Table 2), an Australian Scientific and Archaeological Divers Register, currently listing details of 984 individuals in 120 institutions throughout Australia (Figure 3), and a quarterly newsletter called Scientific Diving News we have been making some progress, some new friends, and some waves. In January 1991, we also formed the Australian Scientific Divers Association to provide a unified voice for the purposes set out in Figure 4. Our data indicate that more than 40,000 scientific dives are carried out each year in Australia with, on average, only one diving-related accident such as a bend.

Current situation

Despite this concerted activity and excellent safety records, we were unable to prevent the inclusion of scientific diving within the scope of the AS 2299 (1990) - Occupational Diving. This means that, when this document is applied to us, as it now is by law in Queensland, scuba is limited to 20 m, lifelines and standby-divers are mandatory, no decompression diving is allowed on scuba, on-site recompression facilities must be available for all dives below 20 m and some shallower, and training must be according to a separate Standard, AS 2815, which has no provision for recognition of recreational training and certification. The Queensland situation was slightly eased late in 1990 by a general exemption allowing scientific divers to use scuba to 30 m, dispense with lifelines, have the standby diver in the water (as the buddy), and combine the roles of dive supervisor and diver's attendant on the surface. This exemption applies to.

"Employers who employ a diver in underwater diving operations solely for the gathering of environmental data

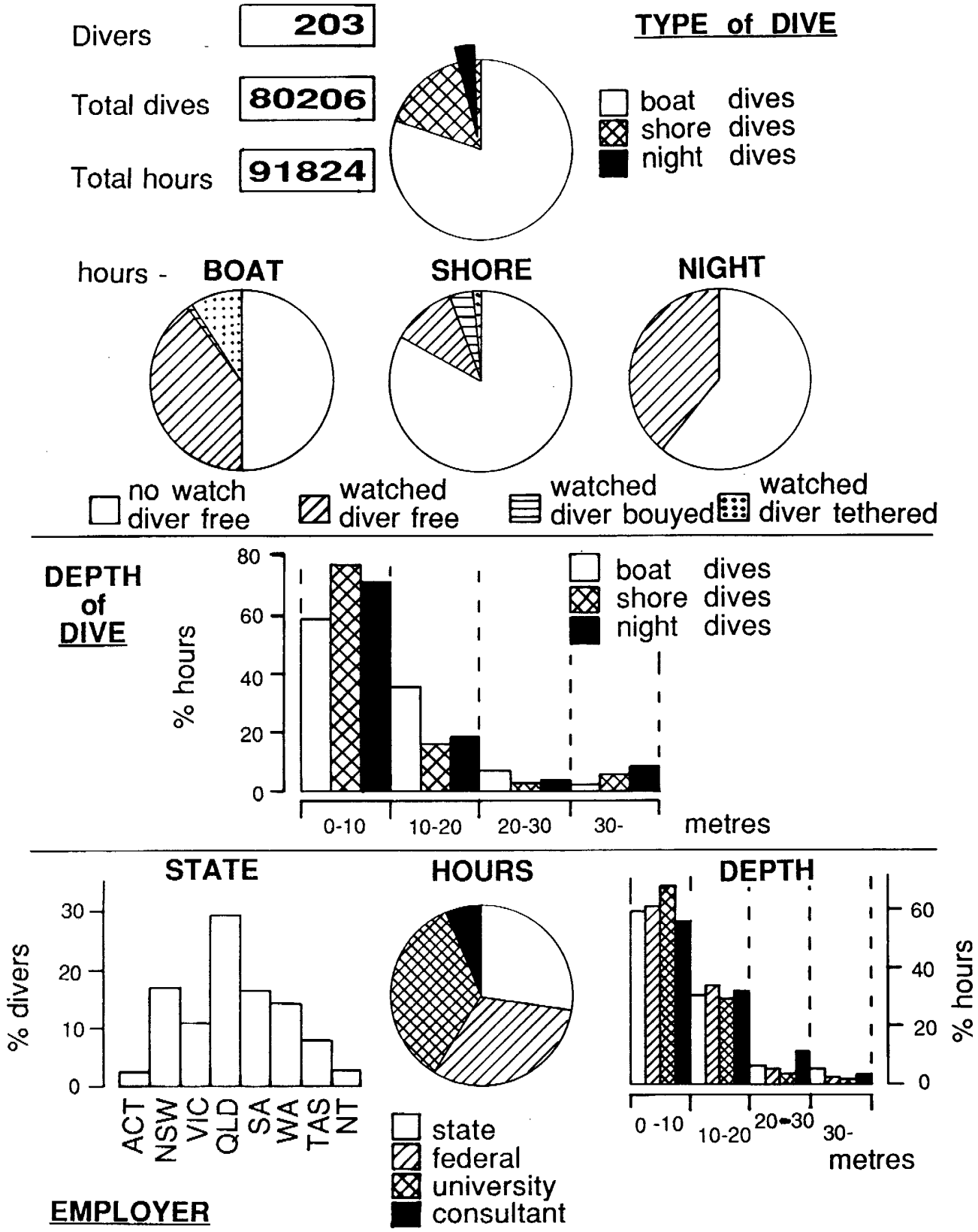

Figure 2. Summary of results from the AMSA Scientific Diving Survey, 1977-87.

TABLE 1

SCIENTIFIC DIVING ACCIDENTS FROM THE AMSA SURVEY, 1977-87.

Type	Number	Nature	Subseqent diving
Heart attack	1	fatal	not applicable
Bend	3	serious	temporarily stopped
Embolism	2	serious	permanently stopped
Ear	1	serious	permanently stopped
	4	minor	temporarily stopped
Sinus	2	minor	temporarily stopped
Tooth	1	minor	temporarily stopped
Eye	1	minor	temporarily stopped
Hypoxia	1	minor	temporarily stopped
Salt water aspiration	1	minor	temporarily stopped
Blackout	1	minor	not stopped
Shock	1	minor	temporarily stopped
Broken rib	1	minor	temporarily stopped
Burn	1	minor	temporarily stopped
Sting	1	minor	temporarily stopped

TABLE 2

ANNUAL UPDATES FOR AUSTRALIAN SCIENTIFIC DIVING.

Year	1988	1990	1991
Respondents			
Active divers	90	105	104
% female	23.3	21	23.5
Total dives	4,489	5,071	5,322
Total hours	4,579.6	4,416.4	5,073.2
Mean duration (minutes)	61	52	57
% from boat	85.4	89.4	
% at night	1.3	1.9	
Accidents			
bend	1	1	0
other			5
Dives/ active diver	49.9	48.3	51.2
Dives/ respondent			46.3

From the 1991 survey figures the 967 scientific divers on the Australian Scientific and Archaeological Divers register would have carried out

44,772 dives

and spent

42,533 hours underwater in 1990.

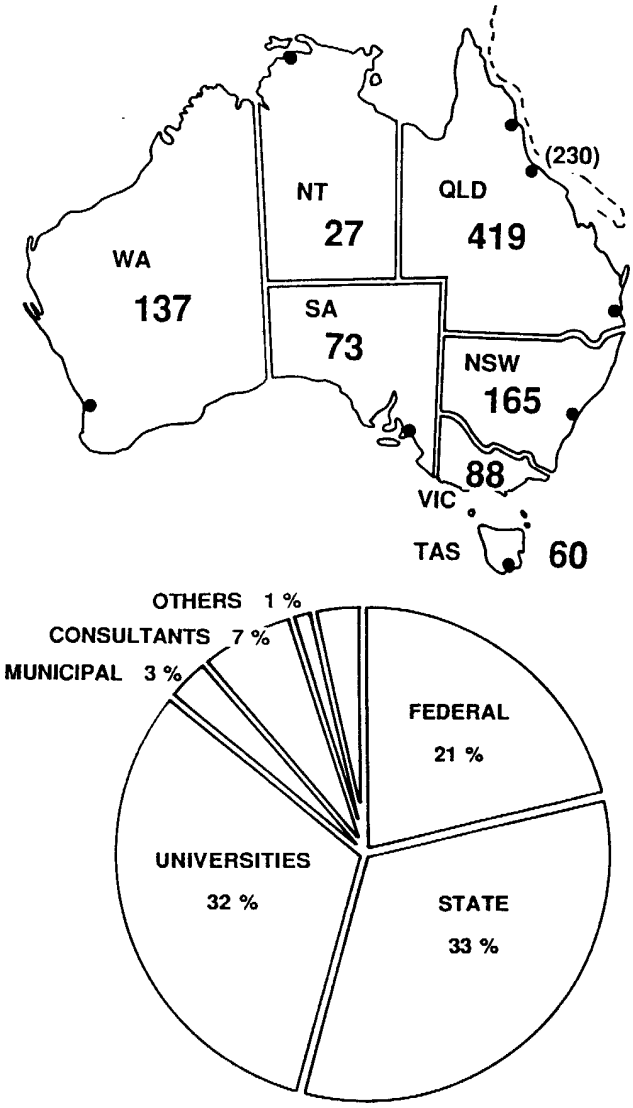

Figure 3. Distribution of Australian scientific divers by location and type of employer. Note the large concentration in Queensland, near the Great Barrier Reef, and particularly in Townsville with its three major marine-oriented research organisations.

or specimens for a research, environmental management or science education organisation or institution."

Also, the AS 2815 certification for Commercial Scuba Divers was available to us under a grandfather clause for a few months in 1990. A 3 week, $Aust3,000 course, only available so far at one locality in Australia, is now required to be able to use scuba to 20 m, and about 7 weeks, costing at least A$7,000, to go to 50 m using the mandatory SSBA equipment. However, despite the recent exemptions, a surface recompression chamber is still required for dives below 20 m, whether on scuba or SSBA, as are diver-surface communications for all dives! Queensland now has two

Started in January 1991

derived directly from the Australian Scientific and Archaeological Divers Register

to provide an independent national forum for scientific divers

to maintain a strong mandate for negotiations about the regulation of scientific diving in Australia

to maintain a national register to demonstrate:

how many scientific divers there are

who employs them and in what capacities

the amount of scientific diving done using SCUBA and HOOKAK

the excellent safety record of scientific diving

fully endorsed by AMSA and AIMA

Figure 4. The mandate of the Australian Scientific Divers Association

diving inspectors actively policing these regulations, together with other regulations which apply specifically to recreational diving instructors. Most other states will almost certainly call up AS 2299 when an accident occurs, although Western Australia is applying AS 2299 in advance to all work associated with the petroleum industry, including inshore environmental surveys nowhere near oil platforms.

Scientific divers visiting from overseas can still operate even in Queensland provided they can demonstrate training and experience equivalent to AS 2815, although the exact details of who can authorise them to dive are unclear as the scuba part of the Standard is still to be finalised. A number of visitors have already had to do a 1 week, A$900 upgrade course.

Up to now, the 200 scientific divers in federal government organisations, such as the CSIRO and AIMS, are exempt from such State laws and the federal OH&S organisation, ComCare, has not yet adopted any particular regulations. However, this is set to change within the next year or so.

Erratic progress

Recent developments have included the formation of a special Standards Australia committee (MS53) to develop an Australian Standard for Scientific Diving. That committee consisted mainly of representatives of organisations involved in scientific diving. On their recommendation, Standards Australia issued the draft developed by the National Working Group, generally known as the AMSA Standard, for public comment between May to July 1991. It is basically a prescriptive subset of the UNESCO Code of Practice for Scientific Diving with additions from various other national and organisational documents. It aims to set out in detail our current practices which have, after all, allowed us to do a lot of diving very safely. As recompression facilities are relatively scarce in Australia, one important recent addition we have made to this document is Dr Des Gorman's risk assessment criteria to decide when a surface recompression chamber is really necessary on site. Also, we have incorporated a training and certification scheme (Table 3) into this draft Standard to avoid the need for more than one regulatory document. The level of certification of Australian scientific divers is set out in Table 4. There is probably some room for improvement on the 61% with only Basic Scuba certification although the majority of those have 20 to 30 years diving experience.

Unfortunately, the work of Committee MS53 has now stopped because another organisation, Worksafe Australia, declared that, as they rather than Standards Australia are now responsible for occupational standards, they will develop a single new, all-embracing, hazard-based standard for occupational diving. That initiative was to see the National Standards Commission, aided by a 12-person Expert Group themselves supported by a much larger reference Group including the old Standards Australia committees, create a better and more widely applicable version of AS 2299 within a few months. Intensive lobbying by a wide range of non-commercial divers caused that initiative to collapse on September 17, 1991 and it was replaced with a decision simply to call for further submissions from the various interested parties. While the Worksafe Australia initiative rose and fell, the Queensland Government's Division of Workplace Health and Safety had become increasingly aware that the blanket application of AS 2299 was unsatisfactory for others beside the scientific divers. Eventually, after many complaints, culmination in heated interaction with the Underwater Visual Producers Association of Australasia led by the well-known underwater photographers Ron and Valerie Taylor, they instituted a Review of

TABLE 3

PROPOSED LEVELS OF CERTIFICATION FOR AUSTRALIAN SCIENTIFIC DIVERS.

ALL SCIENTIFIC DIVERS MUST
- be at least 18 years of age
- have a current certificate of medical fitness to dive

Trainee scientific divers
- Certification to CMAS two-star.

Scientific divers
- As for trainee, plus
  - At least 15 hours experience with at least 7 hours below 10 m.
  - Current recognised certification in CPR, oxygen resuscitation and first aid.
  - Knowledge of and ability to use decompression tables for single, combined and repetitive dives.
  - Knowledge of the current diving regulations.

Advanced scientific divers
- As for scientific diver, plus
  - At least 15 hours additional experience with at least 7 hours below 20 m.
  - Certification equivalent to CMAS three-star.
  - Other appropriate certifications.
  - CMAS Scientific Diver Brevet recommended for international reciprocity.

Diving officers
- Certification equivalent to CMAS four-star.
- At least 3 years scientific diving experience.

Visiting scientific divers
- To be temporarily assigned to visiting trainee, visiting scientific or visiting advanced categories according to certification and log-books presented and subject to a check-out dive.

TABLE 4

CURRENT CERTIFICATION STATUS OF AUSTRALIAN SCIENTIFIC DIVERS.

Recreational		
Basic/ Open water/ C card		237
Highest certification for 61% of divers		
Advanced		61
Highest certification for 13% of divers		
Divemaster		31
Advanced divemaster		3
Instructor		17
Rescue/ Research/ Deep diver		10
Commercial		
AS 2815.1	Scuba to 20 m	135
AS 2815.2	SSBA to 20 m	9
AS 2815.3	Scuba to 50 m	1

the Regulation of Occupational Diving. The first information paper was circulated at exactly the same time as the Worksafe initiative faltered, and it contains a number of refreshing comments including the possibilities of having specific codes of practice for the different sectors of the industry, acceptance of recreational certifications, no surface personnel under safe and sheltered conditions, specific reference to hookah diving, and re-examination of the stringent medical requirements.

Future possibilities

With all other discussions on diving regulations in Australia virtually suspended, this Queensland initiative became the current focus. Could they at last produce some rational regulatory documents acceptable to all sectors of the occupational diving community and free from the overwhelming influence of the commercial diving industry and the PDAA (now amalgamated with the Seamans Union of Australia)? We shall certainly be advocating use of our own self-regulatory document which has already been declared acceptable by all our scientific divers.

Imminent developments

At this moment, June 1992, we await details of the new Queensland Code of Practice for Occupational Diving which will, in theory, replace mandatory compliance with AS 2299 in low risk occupational diving. However, we still do not know on what basis the risks have been classified and how appropriate the classification will be. With an amended, slightly more acceptable version of AS 2299 now very close to publication, our major concerns at present centre on training requirements. We do know that, under the new Queensland Code of Practice, persons with recreational rather than AS 2815 certification will be permitted to do some low risk work. This is probably the biggest step forward this document will bring and may set a more reasonable stage for the next big national initiative on occupational diving.

The Worksafe Australia initiative, begun almost 2 years ago, is now under way again and they will hold the first meeting of their Expert Group on Occupational Diving very soon. That initiative, which aimed from its inception to produce a new, fully risk-based national standard for occupational diving within less than a year, appears to have been held up for some time by a lack of concensus on which so-called “experts” should be on the committee! The simi-

larity of the Expert Group to Standards Australia's Committee SF17 is probably unavoidable, but so too, it seems, is the associated controversy Worksafe thought they could avoid.

Epilogue

Australia's 1,000 scientific divers accept that we have stimulated much of the current controversy over occupational diving regulations. We do not, however, regret in any way the firm stand we have taken, at all levels of bureaucracy, against arbitrarily imposed, restrictive regulations. The largest single occupational diving community in Australia has been carrying out research essential to the national economy in a demonstrably safe and cost effective way for more than 30 years. We cannot allow that to be compromised by convenient but inappropriate over-regulation and the hidden agendas of other occupational diving groups.

We await with bated breath, and not a little apprehension, the new Worksafe document.

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Documents cited

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AQUATIC WORLD AWARENESS, RESPONSIBILITY AND EDUCATION IN DIVER TRAINING AND TOURISM

Drew Richardson

Introduction

We know little about the ultimate impact of man's destructive activities on the world's oceans, such as pollution, dredging and dumping. However, there is another activity we are learning a great deal about through direct observation. Interaction between divers and the sea has never been greater. Unfortunately, some of it has been at the expense of the marine ecology. Damage to coral reefs is an example.

Unfortunately divers can endanger an ecosystem. The coral reef environment is a precious resource we, as divers, hold close to our hearts. However, we are fortunate that we, as individual divers, have the power to protect it.

In general, divers genuinely care about the well-being and welfare of the ocean and its inhabitants. Certainly, we are not a destructive or malicious group. Given that scuba divers actively interact with the sea, we are in an excellent position to shed laissez-faire attitudes to conservation and do our part to actively preserve the reef evironment.

As divers and diving educators, the responsibility for protecting this resource falls on all of our shoulders. Our numbers have grown. We are not just a small band of adventurers, but a growing and vital community. Let us take a lesson from the deterioration of our terrestrial natural wonders. Multiply one foot-print, one broken twig, one aluminium by one thousand, and each is no longer insignificant.

Our non-destructive coexistence with the coral reef hangs on a thread of awareness. Although an individual presence may seem insignificant in a vast ocean, the numbers visiting the same area over time can leave a visible trail. Each careless swipe of a fin, hand or camera is another proverbial "nail in the coffin" of the coral reefs.

The first step toward responsible interaction with the coral reef system (or any marine ecosystem) is an accurate understanding of how your personal activity can affect the creatures who make it their home. Diving instructors have a key responsibility to help divers appreciate the coral reef environment. The entire ecological system will benefit from divers who have learned how to interact appropriately with the coral reef environment. This begins with education.