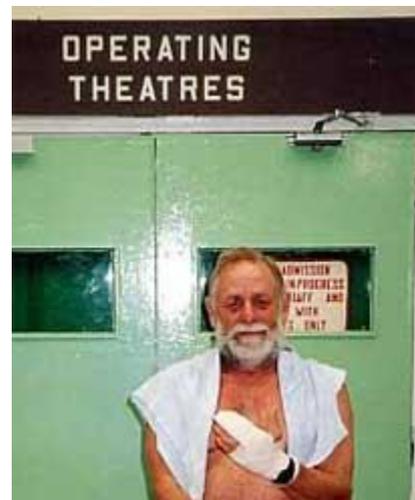


Professor J. Howard Choat

Introduction: July 1998 Alan Butler, AMSA President

This year's Silver Jubilee Award recipient has been one of the outstanding figures in Australian marine biology for 30 years. He has a fundamental interest in ecological processes of all environments and has done research in coral reefs, rocky reefs at temperate latitudes, soft substrata and the pelagic environment. He has made major contributions to our understanding of fish taxonomy, evolution, general biology, early life history and ecology in both temperate and tropical waters of Australia and New Zealand, and still found time to publish on cephalopod life history and on the distribution and abundance of kelps.



Our recipient was a pioneer in coral reef fish ecology in the 1960s, and his early work on sex change in parrotfishes and wrasses is a major contribution toward our appreciation of the differences between tropical marine systems and terrestrial ones. Along the way, he has sorted out much of the taxonomy of this group of fishes.

Over many years, his work in temperate and tropical reef systems has shed light on both the ecology and the physiology of herbivory in the sea. In this, as in all his work, he has combined solid natural history with a quantitative, experimental approach to asking the right questions. Major paradigm shifts in our understanding of herbivory can be traced to the research of Howard and his co-workers.

He has led the way in applying and, more importantly, evaluating unconventional sampling techniques in the study of the pelagic portion of the early life history of fishes. He has thus contributed to major advances in understanding of the complex life cycles so widespread in marine animals. This has also led to his work on pelagic cephalopods.

This year's award winner, unlike the last two, is an academic. He has inspired dozens of students in both Australia and New Zealand. It is significant that many of his former students continue to collaborate with him, and this clearly contributes to the breadth and multidisciplinary nature of his work. However, Howard is no "ivory-tower academic"; he has always been highly involved in applied issues. He is truly a well-rounded researcher whose contributions to our understanding of marine biology have been both broad and deep.

Silver Jubilee Address

Postgraduate Education and Training in Marine Science

How can the training process accommodate the requirements of a degree program and the needs of the private sector?

I must initially thank the Australian Marine Sciences Association for endorsing my nomination for the Jubilee award. It should come as no surprise that my address will concern the question of research education and training and the role of the graduate student in the enterprise of marine science. I am taking this approach for a number of reasons. One of the reasons that I am in a

position to receive this award reflects the quality of the graduate students that I have been fortunate enough to be associated with.



The dissemination of the draft of Australia's Marine Science and Technology Plan has provided an impetus for reviewing the training and education process in marine science. As professional development in marine science usually requires enrolment in a postgraduate program it is appropriate to discuss these issues in the context of tertiary education and its role in the on-going planning process. The main strategic element concerns the maintenance and expansion of Australia's marine science skills base which will underpin our claim for international recognition in the field of marine science over the next two to three decades.

Postgraduate Education is in a process of change. This reflects both external influences driven by the end-users of postgraduate education and by internal influences where tertiary institutions are seeking to make education more cost-effective and also responding to issues raised by the postgraduate students themselves. These influences generate tension in the postgraduate education process which needs to be recognised. My core argument will be that in resolving these issues, and they are resolvable, we must not lose sight of the need to maintain the intellectual integrity of the process from the students viewpoint. In the long term Australia's success in marine science will reflect the intellectual health of the next generation of marine scientists, today's graduate students. I believe that the CRC's have provided a framework for considering many of these issues. However the process still needs a brokering agency to help resolve issues. My argument will be that a re-designed Australian Marine Sciences Consortium is the appropriate tertiary education representative in this context

Why postgraduate students?

The magnitude of public funding involved. \$22,900 EFTSU in Australia. Average level of funding is \$21,000 per annum from University operating grant, a \$470 million annual investment. Add PhD scholarship with stipend public subsidy over 3.5 years is \$105,000. For science students \$3-4,000 in additional funds is required for research support. Even if marine science students make up only 5% of this total this is still a major investment in the tertiary sector.

The question of infrastructure and access to the marine environment. In terms of person hours most of the hands-on research in marine systems will be carried out by graduate students. It is essential that any schemes for the development of marine science consider this aspect.

The strategic dimension. Many of us in this room represent the older generation of marine scientists and we face the imperative of ensuring that our education and training programs will provide the appropriate foundation for the orderly and competitive development of our science. We have the responsibility of training the next generation of marine scientists. The main strategic element concerns the maintenance and expansion of Australia's marine science skills base which will underpin our claim for international recognition in the field of marine science over the next two to three decades.

The process of producing a postgraduate student is often poorly understood, even in the tertiary sector. Research is a creative process and to ensure that we receive in the broadest sense the full intellectual benefits of this investment, we must preserve this creative and innovative element. In so doing we will be confronted with the need to manage both intellectual freedom, intellectual property and to ensure that we strike a proper balance between creativity and accountability .

There is now increasing urgency concerning postgraduate education driven by four events.

- A shift in govt funding priorities over the last six to seven years to make research links between the private and public sector more explicit; the CRC's which, as a part of their charter, must have a tertiary education partner and an education and extension program;
- The publication of the West review of Higher Education Policy;
- The dissemination of the draft Marine Science and Technology Plan;
- New compliance requirements of workplace health and safety governing field access and need for ethical clearances in biological research.

The recent shift in emphasis of public sector funding for research is designed to improve the capacity to transfer knowledge from the research environment to user groups. This is the core of the CRC program and requires the directed research necessary to achieve particular outcomes. These issues have been given force by the publication of the draft of Australia's Marine Science and Technology Plan. This comprehensive document makes a number of references to postgraduate training and has been developed in association with a survey of employers of marine science graduates.

The problem that exercised the working party was the perceived mismatch between required skills and training and the absence of a strategy designed to rectify this. This was expressed not only in the lack of graduates with specific skills (GIS, Microbiology) but in the desirability of emphasising generic skills over knowledge.

The plan advocates a series of strategies. These will clearly be of benefit to Australian marine science, but some care needs to be taken to ensure that programs of directed strategic research are viewed in the context of the requirements of a successful postgraduate training program.

No one is going to deny the need for priorities in marine science and, as an education program leader for a CRC, I am unlikely to argue against industry links. However, I suspect that the calls for management and strategic direction in the nation's postgraduate program investment might require a process that involves the tertiary education partners, collectively and explicitly. The re-designed Australian Marine Sciences Consortium would be the appropriate body.

My main argument is the need to ensure that the \$60 million investment in postgraduate training in marine science retains the capacity to develop original and innovative approaches to problem solving, be its future practitioners the next cohort of graduate students. The important requirements of a postgraduate program involve a combination of intellectual freedoms and intellectual responsibilities. Students must operate in an intellectually stimulating and rigorous environment, but must also be provided with a knowledge of the professional requirements, opportunities and desirable skills in their disciplinary area and the relevant areas of the private sector. More importantly students must be aware of their rights and responsibilities with respect to intellectual property, their own and their sponsors. It is also clear that communication skills, especially in the written mode and the timely completion of tasks, are areas which have been identified as a potential weakness by employers.

An appropriate return on our investment in graduate programs will be achieved only if we are able to provide the most cost-effective access to marine environments. Despite the investment in student places and stipends, the funding available for the hands-on research component is often the bottle neck. It is the responsibility of the tertiary institution to provide the basic resources and access to competitive funding. However, the provision of major infrastructure requires national initiatives; if the investment in marine science education and training is to be realised then the most cost-effective solutions must be achieved. My particular hobby-horse in this debate is to ensure that investment in vessels does not proceed at the expense of coastal and island research stations.

This can be also be viewed through the eyes of the graduate student. From their perspective it is essential that the program has an intellectual foundation consistent with scientific methodology; their study program should be built around the testing of specific hypotheses. The component of intellectual freedom is a potentially difficult one, especially in directed research. However, I believe

that the process can only benefit if we provide the flexibility to allow students to identify and exploit new and innovative questions in their research programs. The trade-off in this process is an understanding and accountability in terms of the intellectual property and the ownership of the material produced. These are invariably resolvable by negotiation - a process that is helped if students have a clear understanding of the relevance of their skills, not only in the context of their employment opportunities but in the broader framework of their discipline. All of this identifies the need for clear negotiated agreements at the time of enrolment relating to the intellectual environment of the program, the ownership of the data and rights and modes of publication, and the provision of resources necessary for the research.

Clearly the CRCs have provided an impetus for such arrangements. However, in the broader context of marine science it is essential that planning with respect to education, training, and development of a skills base be linked to tertiary education partners responsible for policy in postgraduate education. The major task will be to ensure that the potential tensions between the need for directed and strategic research and the need to ensure maximum intellectual innovation and scientific rigor in the education and training process can be resolved to the satisfaction of all parties. The Australian Marine Sciences Consortium has an obvious role in this process.

Howard Choat, July 1998