



# SPEARFISHING – IS IT ECOLOGICALLY SUSTAINABLE?

Adam Smith<sup>1</sup> and Seiji Nakaya<sup>2</sup>

<sup>1</sup> Australian Underwater Federation (AUF) C\ 4 Seaward Cres, Townsville QLD 4810, Australia

<sup>2</sup> Department of Environment, PO Box 917, Nuku'alofa, Tonga

## Abstract

Spearfishing or underwater fishing is an activity that generates emotion and debate. Is it the most ecologically sustainable method of catching a fish or is it an activity of environmental vandalism and needless slaughter? Proponents argue that spearfishing is ecologically sustainable because a diver is restricted to shallow water, a diver is very selective and can target the size and species of his/her capture without the negative impacts of other fishing methods such as bycatch, bait, loss of gear and damage to habitat.

Scientific research supports the view that spearfishers catch a very small proportion of fish – less than 1% compared to recreational and commercial fishers and that fishery indicators such as catch per unit effort (CPUE) and average weight have remained stable over time. I present data from several surveys of spearfishing (mostly competitions) in South Australia, New South Wales and Queensland which support these statements. Opponents argue that spearfishers have been partly responsible for the decline of some species such as grey nurse sharks and also scare fish, which are important for scuba diver tourism.

This presentation overviews methods, catches and management of spearfishing throughout Australia. There have been major changes in the past 50 years, such as the banning of SCUBA spearfishing, formation of the Australian Underwater Federation (AUF) to self-regulate the sport, protection of large 'icon' species such as groupers and wrasses, increasing amount of marine parks, and blue-water hunting for pelagic species. It is anticipated that there will be pressures for further restrictions on spearfishing and these will be supported if there are valid environmental reasons, but will be opposed if they are biased and unjustified.

It is concluded that the future management of spearfishing by voluntary organisations such as the AUF and statutory fisheries departments appears to be based on sound principles of sustainability.

## Introduction

Spearfishing or underwater fishing is an activity that generates emotion and debate. Is it the most ecologically sustainable method of catching a fish or environmental vandalism and needless slaughter? Proponents argue that spearfishing is ecologically sustainable because a diver is restricted to shallow water, is very selective and can target the species and size of the target without the negative impacts of other fishing methods such as bycatch, bait, loss of gear and damage to habitat.

There is scant information on spearfishing. Scientific research and anecdotal information supports the view that spearfishers catch a small proportion of fish – less than one percent compared to recreational and commercial fishers, and that fishery indicators such as catch per unit effort (CPUE) and average weight have remained stable over time. We present data from several surveys of spearfishing (mostly competitions) in South Australia (SA), New South Wales (NSW) and Queensland (Qld) which support these state-

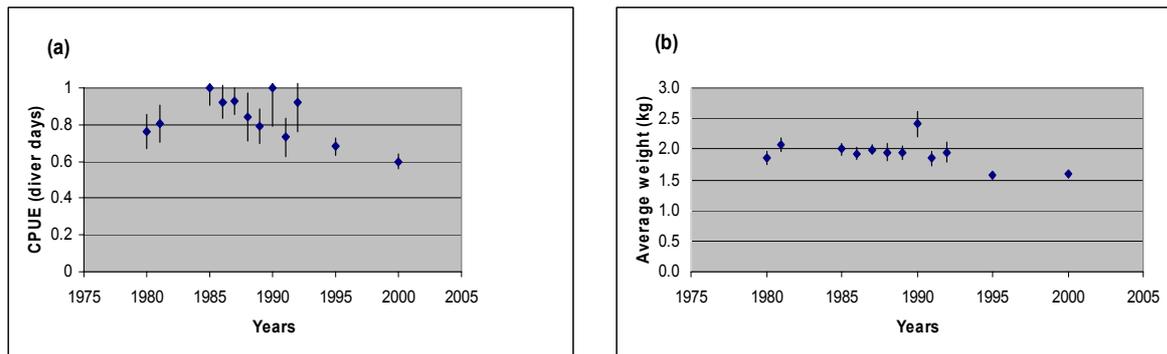
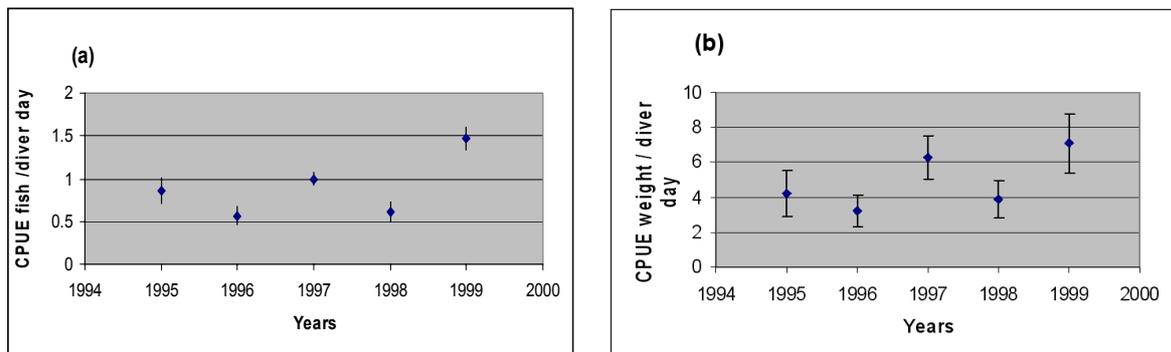
ments, and we provide some long-term data on CPUE and average weight of a popular species, the coral trout.

## Methods and results

A search of the international scientific literature covering 1971-2001 indicated there were 84 200 articles on fishing and only 145 of these had any reference to spearfishing. The number of relevant articles is much fewer. The first published scientific article on spearfishing in Australia was by Saenger and Lowe (1975) and there appears to have been only one PhD thesis on spearfishing in Australia (Nakaya, 1999). Most of the research has been on spearfishing competitions in NSW or Qld (Table 1), using catch records or questionnaires. Modern Australian spearfishing competitions involve seven to 104 competitors (Nakaya, 1999; Smith, 2000) and have restrictive rules that allow only one of each eligible species to be taken and also prescribe minimum weights during a set time (generally five hours). Catch rates of 0.09 to 2.57 fish per diver hour have been reported (Table 1).

**Table 1.** Comparison of catch per unit effort (CPUE) of spearfishing studies in Australia.

Study	Region	Period	CPUE	
			species	kg/person/hour
Smith, unpublished	Townsville (Qld)	2001	1.15 – 1.58	2.62 – 3.36
Smith, 2000	Coffs Harbour (NSW)	1995 - 99	0.09 – 0.23	0.49 – 1.09
Nakaya, 1999	Cairns, Townsville, Mackay and Yeppoon (Qld)	1979 - 96	1.20	2.9
Lincoln Smith et al., 1989	Sydney (NSW)	1975 - 76	1.45	–
Henry et al., 1988	Jervis Bay (NSW)	1988	1.40	–
Hyde 1986	Jervis Bay (NSW)	1984 - 85	1.28 – 2.57	–
Johnson, 1985a	Fleurieu Peninsula (SA)	1983 - 84	1.0 – 2.02	0.8
Johnson, 1985b	Spencer Gulf (SA)	1983 - 84	0.55 – 1.10	–
Saenger and Lowe, 1975	Bundaberg (Qld)	1963 - 74	0.10 – 1.46	0.3 – 3.9
Saenger and Lowe, 1975	Port Stephens (NSW)	1960 - 75	0.29 – 1.44	0.4 – 0.8

**Figure 1.** a, CPUE of coral trout; b, average weight of coral trout by competition spearfishers in the Great Barrier Reef Marine Park between 1980 and 2001.**Figure 2.** a, CPUE of pelagic species; b, CPUE of average weight of pelagic species by ABWC competition spearfishers in the Solitary Islands Marine Park between 1995 and 1999.**Table 2.** Comparison of catch, effort, CPUE and average weight of five species at the 1994 and 2001 national spearfishing competitions held at Townsville, Qld. (NA: no data available)

Species	Year	Fish	Effort (diver days)	CPUE (species \ day)	Avg wt (kg)
Coral trout ( <i>Plectropomus leopardus</i> )	1994	98	143	0.68	1.58
	2001	111	188	0.59	1.60
Barramundi cod ( <i>Cromileptes altivelis</i> )	1994	23	143	0.16	2.47
	2001	44	188	0.23	2.52
Maori wrasse ( <i>Cheilinus undulatus</i> )	1994	9	143	0.06	13.23
	2001	NA			
Napoleon parrotfish ( <i>Bolbometopon muricatum</i> )	1994	14	143	0.10	12.41
	2001	NA			
Netted sweetlip ( <i>Plectorhinchus flavomaculatus</i> )	1994	50	143	0.34	1.74
	2001	NA			

CPUE is considered to be an indicator of fish density. In theory, catch is proportional to fishing effort. Several studies have been combined to analyse CPUE data over a longer-term (Nakaya, 1999; Smith unpublished) and there is no overall trend in CPUE or mean size of several key species. However, it is interesting that the CPUE of coral trout has been around 0.8 fish per diver day since 1979, but appears to have declined by about 25% in recent years (Figure 1a). The average weight of coral trout has remained fairly stable at 2.0kg from 1980 to 1992, but appears to have declined by some 25% to about 1.5kg in 1995 and 2001 (Figure 1b). CPUE and average weight of barramundi cod appear to have increased slightly in recent years (Table 2). Some baseline data on CPUE and average weight is provided on three species of fish; maori wrasse, napolean parrotfish and netted sweetlip, that were captured at a national competition in 1994. These fish species were voluntarily removed from the eligible list for the national competition in 2001 (Table 2).

The annual Australian Blue Water Classic (ABWC) is a selective spearfishing competition which targets large pelagic species. The catch rates are very low with an average of only one fish per day (Figure 2a) and an average weight of 4 to 7kg (Figure 2b). There is no trend in CPUE for fish or weight, although the most recent year provided the highest values (Figure 2a-b).

A questionnaire was used to determine spearfisher's views about management of the Great Barrier Reef Marine Park in general and whether they were satisfied or dissatisfied with management of spearfishing (Nakaya, 1999). Overall, about 50% were dissatisfied with management because of weak controls on commercial fishing compared with recreational fishing. Specifically they were dissatisfied because they think they are discriminated against by being excluded from areas where line fishing is allowed (Nakaya, 1999).

Spearfishers were questioned also about their preferred management tools. The respondents strongly supported minimum size limits, preservation zones, bag

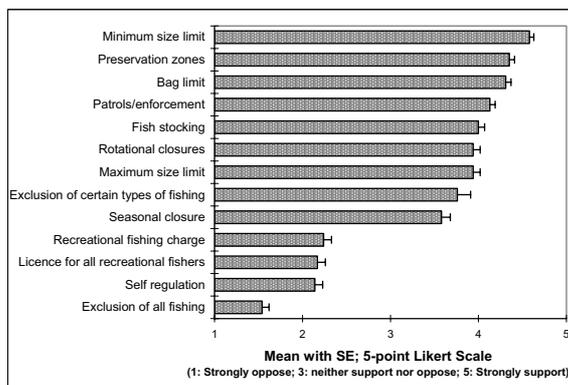


Figure 3. Support and opposition by spearfishers to potential managing tools.

limits and patrols/enforcement (Figure 3), were equivocal about stocking, rotational closures, maximum size limit, exclusion of certain types of fishing, and seasonal closures but opposed charges, licence, self-regulation and strongly opposed exclusion of all fishing (Figure 3).

## Discussion and conclusions

There have been major changes in management of spearfishing over the past 50 years, such as the banning of SCUBA spearfishing, banning of commercial spearfishing, formation of the Australian Underwater Federation to self-regulate the sport, formal and informal protection of large 'icon' species such as groupers and wrasses (see Table 2), increasing numbers of marine parks, and blue-water hunting for pelagic species. These changes have occurred largely without the support of scientific information. It is acknowledged that good information is scarce, but available information indicates that spearfishing provides consistent results as there has been no demonstrable changes in CPUE or average weight of key species indicative of overfishing, although a recent 25% decline in CPUE for coral trout in Qld waters may be of concern. However, one of the difficulties in this example is that it is difficult to attribute this potential impact to spearfishing compared with the impacts of other fishing methods on the same species.

It is surprising that about 50% of spearfishers in Queensland are dissatisfied with management, but we believe that this figure would be less in other parts of Australia. It is suggested that managers need to consult spearfishers specifically and review current, perhaps inequitable, management arrangements.

Is spearfishing sustainable? A rigorous answer could consider whether spearfishing satisfies the Commonwealth Government requirements for a demonstrably ecologically sustainable fishery, which must operate under a management regime that meets two principles (Environment Australia, 2002). The first principle is: "A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability that the stock(s) will recover". We believe that spearfishing satisfies this first principle and does not lead to overfishing for most species. We have demonstrated stable CPUE and consistent average weights of key species. Also, there are over 440 species of fish that have been captured by spearfishers (Smith, 2000) and we have been able to find only anecdotal reports of local overfishing for one or two species such as blue groper or cods, with anecdotal and scientific evidence of recovery. The second principle is: "Fishing operations should be managed to minimise their impact on the structure,

productivity, function and biological diversity of the ecosystem". We believe that spearfishing satisfies this second principle and perhaps, is one of the most ecologically sustainable methods of fishing because it is selective, is restricted to shallow water, has no bycatch, uses no bait, causes no habitat damage, causes no harm to endangered species and causes no pollution.

Spearfishing is a method that has been used to catch fish for thousands of years. In modern times, spearfishing has evolved to become a recreational activity. The activity has been regulated heavily. It is anticipated that there will be pressures (political and emotional) for further restrictions on spearfishing and these will be supported if there are valid environmental reasons, but will be opposed if they are biased and unjustified. It is concluded that spearfishing in Australia is ecologically sustainable.

### References

- Environment Australia, 2002. Guidelines for the Ecologically Sustainable Management of Fisheries. <http://www.environment.gov.au/marine/fisheries/assessments/guidelines.html>
- Johnson JE, 1985a. *Spearfishing competitions in South Australia (1983/84). I. Shore and boat events*. Fisheries Research Paper. Department of Fisheries SA, No. 12
- 1985b. *Spearfishing competitions in South Australia (1983/84). II. Australian Skindiving Convention*. Fisheries Research Paper. Department of Fisheries SA, No.14.
- Henry GW, Smith AK and Murphy JJ, 1988. *Commercial and recreational fishing and diving in Jervis Bay*. NSW Department of Agriculture and Fisheries, NSW.
- Hyde DA, 1986. The effects of spearfishing competitions on the biota of Jervis Bay and its environs. Australian Underwater Federation Scientific Committee Report 86(1).
- Lincoln-Smith MP, Bell JD, Pollard DA and Russell BC, 1989. Catch and effort of competition spearfishermen in southeastern Australia. *Fisheries Research* 8:45–61.
- Nakaya S, 1999. Understanding behaviour, motivations and attitudes of spearfishers on the Great Barrier Reef through the multidimensional specialisation concept. PhD, James Cook University, Australia.
- Saenger P and Lowe G, 1975. A preliminary analysis of Australian spearfishing data. Prepared for the Sporting Committee of the Australian Underwater Federation.
- Smith AK, 2000. *Underwater fishing in Australia and New Zealand*. Mountain, Ocean and Travel Publications, Australia.
- Smith AK and Henry GW (eds), 1999. *Underwater Guide*. NSW Fisheries, Sydney.