

TASMANIA'S AQUACULTURE INDUSTRY: A TEN-YEAR REVIEW OF IMPROVED DIVING SAFETY

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(with four tables, two text-figures and two plates)

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Tasmania's marine finfish aquaculture industry has developed from humble beginnings in 1986 to become a leading export earner for the state. Marine aquaculture is diving intensive, and divers have made a significant contribution to product quality. The early years of the industry were hampered by significant levels of diver morbidity due to risky diving activities. This ten-year review outlines the major improvements in safety which have been achieved by broad-based changes to diving training, operations and procedures. The number of divers treated annually for decompression illness has fallen from 5.5 per 2100 dives in 1988–90 to 0.5 per 8768 dives in 1996–98. The industry now has a decompression illness incidence of 0.57 cases per 10 000 dives and is in line with world's best practice.

Key Words: marine farms, aquaculture, diving, bounce diving, yo-yo diving, safety, Tasmania, Atlantic salmon.

INTRODUCTION

Tasmania possesses a rich maritime heritage. Since European settlement, the Tasmanian economy has been reliant on its close links with the sea for trade. The unpolluted waters off its coastline support a substantial wild fishing industry. Tasmanians have always enjoyed access to quality seafood. Until the 1970s, wild fisheries were the only significant source of revenue from fishing in the State. A natural progression of the Tasmanian's close relationship with the sea has been the development of marine aquaculture. After initial success with oyster and mussel farming in the 1970s, Atlantic salmon farming commenced in 1986. More recently, marine farming ventures have explored scallop, abalone and striped trumpeter aquaculture. The aquaculture industry is a major contributor to Tasmania's economy, now producing 35% of total fisheries value of \$213.9 million (ABARE 1998). From small origins, the marine finfish aquaculture industry grew to employ over 500 people directly in 1997, producing exports worth \$64 million (Tasmanian Salmonid Growers Association 1997, ABARE 1998).

Atlantic salmon farming and ocean trout farming are the main sectors of the aquaculture industry which employ divers. Divers contribute substantially to the quality of these fish, which obtain premium prices on world markets. The fish are farmed in floating pens up to 120 m in circumference, which enclose the fish in a cylindrical net suspended from the surface (pl. 1). Pens vary in size, depending on the type of fish farmed and the size of the farm's operations. An aerial photo of a typical lease is shown in plate 2. Divers in the marine aquaculture industry undertake many roles including maintenance of mooring lines and farm perimeter nets, supervising the setting of fish pens, and undertaking checking and repairs of individual fish pens with removal of dead fish from the pens. In addition, they perform many "land-based" activities. In 1990, two of the authors provided an overview of the industry and described how salmon were farmed from smolt to the finished product bound for interstate and international markets (Smart & McCartney 1990). The industry is further described elsewhere (Tasmanian Salmonid Growers Association 1997).



PLATE 1

Diver entering a typical aquaculture pen.

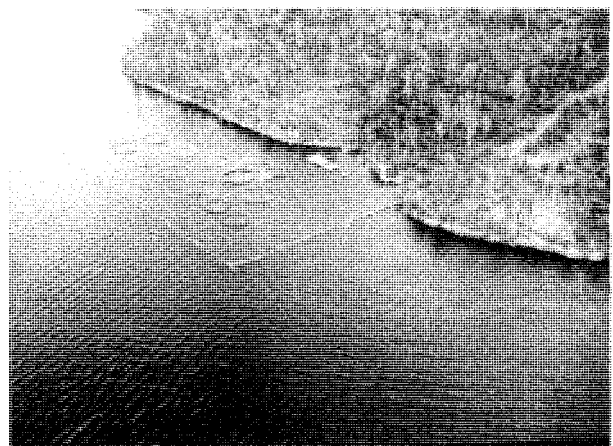


PLATE 2

Aerial photo of an aquaculture lease showing perimeter net around circular fish pens.

The 1990 study by Smart and McCartney found significant levels of diver morbidity occurring in Tasmania's fledgling aquaculture industry, due to high risk diving practices (table 1). Land-based activities also had some impact on levels of post-diving morbidity.

In 1990, episodes of decompression illness (DCI) from the aquaculture industry were unacceptably high. Despite employing only 6.2% of the professional divers in Tasmania, the industry produced 47.8% of the treated cases of DCI at the State's hyperbaric facility at the Royal Hobart Hospital (Smart 1994). In 1990, limited recording of diving activities created uncertainty about the number of dives undertaken in the industry each year. An estimate of 2100 dives per year, based on verbal reports of diving activity occurring at the time, was available to calculate the incidence of DCI.

A major concern identified by the 1990 study was that very few of the divers had training specific to the industry, and 44% of the injured divers had no diving experience, training or qualifications prior to commencing work as

divers (Smart & McCartney 1990). This had two potentially serious effects: not only were the diving practices high risk, but the individuals employed as divers lacked the skills and knowledge to recognise safety hazards as they undertook their daily work. The type of diving required by the industry created a further difficulty. Most divers were undertaking multiple descents and ascents in and out of the shallow fish pens (termed "bounce diving" or "yo-yo diving"), and there were no known diving tables to cover this type of diving. Bounce diving was considered to be higher risk for DCI than standard "square profile" diving, involving a single descent then ascent (Douglas & Milne 1991). This higher level of risk was supported by cases of DCI occurring in aquaculture divers who had undertaken all of their dives in less than 9 m (Douglas & Milne 1991). During 1990 and 1991, there was a strong push from the Tasmanian industry, union representatives and diving medicine specialists to improve diving operations within the industry and to protect and maintain the health of its divers. Cooperation between industry participants resulted in significant changes to many areas including diver training, operations, equipment and emergency procedures.

TABLE 1
High risk dive practices among Tasmanian
marine fish farm divers in 1990*

-
1. Diver training
 - (a) inadequate or inappropriate;
 - (b) almost 50% with no training;
 - (c) lack of specific training for the industry.
 2. Equipment
 - (a) hookah used at excessive depths (>30 m);
 - (b) no safety reserve cylinders;
 - (c) inadequate thermal protection (5 mm thick wetsuits in 10°C water);
 - (d) limited use of specialised underwater tools.
 3. Equipment Maintenance
 - (a) no maintenance schedules;
 - (b) tampering by untrained personnel;
 - (c) incorrect oil and filters in compressors;
 - (d) saltwater in regulators;
 - (e) no air purity standard maintained.
 4. Safety procedures
 - (a) no protocols for emergencies;
 - (b) no backup diver;
 - (c) no training for accidents;
 - (d) no oxygen or first aid equipment or protocols;
 - (e) no diver to surface communication.
 5. Dive schedules and profiles
 - (a) no logs of time/depth;
 - (b) no depth gauges;
 - (c) minimal consultation with tables;
 - (d) multiple (20–50) bounce dives at depths up to 8 m;
 - (e) deepest dives performed last;
 - (f) missed safety stops.
 6. Other practices
 - (a) "Vaulting" the salmon pen;
 - (b) Heavy physical work performed after the dive;
 - (c) Diving with respiratory tract infections.
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* Identified by Smart & McCartney (1990).

AIM

The aim of this paper was to review changes in the diving operations of the aquaculture industry, over a ten-year period from 1/7/1988 to 30/6/1998. We also aimed to assess the safety outcomes of changes to diving practices.

METHODS

A longitudinal review of ten years of diving activity within the aquaculture industry was conducted, assessing a number of factors:

- (1) diver participation;
- (2) evolution of diving practices;
- (3) major episodes of morbidity due to DCI.

This review used information collected from the field, surveys of participants in the diving operations, and the treatment database of the Hyperbaric Medicine Unit at the Royal Hobart Hospital (RHH). We stratified the study into five periods, each of two years. The ten-year period was chosen because it spanned the time during which most of the diving activity has occurred in the industry. It also covered the period during which substantial changes in training and work practices were made from within the industry. The selected ten-year study period overlapped with the original work of Smart and McCartney, with the exclusion of the months of April to June 1988.

We selected the number of decompression incidents requiring treatment at the RHH as our principal outcome measurement. Since the RHH receives all decompression emergencies for the State of Tasmania, this allowed us to capture all *treated* cases of DCI. Information relating to decompression episodes was readily accessed from the Hyperbaric Medicine database; divers who presented symptoms after diving but were not referred for treatment at the hyperbaric facility were excluded. Recording of these incidents was unreliable at the aquaculture farms in the years 1988–91. We did not include minor diving incidents such as ear and sinus barotrauma or other non-diving trauma as outcome measures.

Data were sourced by the following methods:

- (1) A telephone and/or written survey of all finfish aquaculture industry participants was undertaken. A structured questionnaire was administered, covering the number of divers employed, the use of log books, the number of dives from logged data, the depths of the dives, the type of diving and its frequency, limits placed upon bounce diving and specific tables used, diving equipment used, safety procedures, diver training and measures to reduce reliance on diving. Data were collected, tabulated and added to data from a previous survey in 1994.
- (2) Data on diving activity from the 1988–90 period had been sourced during the preparation of the 1990 paper by Smart and McCartney. Telephone surveys or visits to industry participants had been used to obtain diver numbers. Because of direct contact made with industry members by two of the authors, the number of divers for the 1988–90 period was considered reliable. However, due to a lack of systematised recording, only estimates could be provided of the diving activity occurring in the industry, and we recognised from the outset that the initial data on the number of dives were unreliable.
- (3) Field surveys were undertaken to allow direct inspection and assessment of diving practices and procedures, and of equipment.
- (4) Information from the industry and also from the Tasmanian Department of Primary Industry and Fisheries was used to calculate the total number of divers in the State and the productivity of the industry.
- (5) During the survey process, the authors attempted to identify other issues relevant to diver safety in the industry.

Figures were then tabulated over a ten-year period to allow comparison of the data trends over the period of the study. Because of the difficulties in obtaining accurate statistics of the total number of dives undertaken in the industry in its early years, a number of criteria were used to assess diver safety over this ten-year period.

A numerator was chosen: the number of divers with proven decompression illness requiring treatment at the Royal Hobart Hospital.

Denominators were also chosen as follows:

- (1) number of divers employed in the industry;
- (2) number of dives undertaken.

During the survey, it became necessary to define what was meant by a “dive” in order to maintain consistency between reports from each of the industry participants. For the purposes of this study, a dive was defined as “the period of time during which the diver was undertaking continuous diving activity with surface intervals of less than 15 minutes”. Hence, where a diver entered and exited through multiple pens during the course of work, it would be counted as a single dive (multiple bounces) if the surface intervals between pens were less than 15 min.

Data were tabulated onto spreadsheets and statistical analysis was undertaken using Graphpad™ Prism software (San Diego, California, USA). Chi-squared analysis was undertaken for rates and proportions, with *p* values of < 0.05 being regarded as significant. Confidence intervals at the 95% level were provided, where relative risks and odds ratios were calculated.

RESULTS

Study information was obtained from all seven marine fish farm operations in Tasmania. Two of the farms had most or all of their diving operations subcontracted and, in these cases, further surveys were undertaken to ascertain the diving practices of the contractors and obtain a complete picture of the diving being undertaken in the industry. It was of particular interest that the fundamental purpose of diving in the aquaculture industry had not changed over the decade of the study. Divers still undertook the same tasks (outlined in the introduction), which were originally described in 1990 (Smart & McCartney 1990). However, there had been significant changes to the way in which diving was undertaken since the original study. The results of the present study have been grouped under the same broad headings as outlined in table 1.

Diver Training

At the commencement of the 1990s, all marine farms required their divers to be trained to a minimum level of open water recreational certification. This was further upgraded, in 1995–96, to Australian Standard 2815.2 (Restricted). Training for this was significantly more advanced than for recreational diving and equipped aquaculture industry divers with the skills necessary for diving on air to 30 m. It covered dive theory and physics, equipment maintenance, surface-supply diving, full-face masks and communications, search techniques, gas handling and testing, safety training, rescue and emergency procedures, oxygen-provider training, legislation and standards, and detailed coverage of the risks of bounce diving. In addition to training dives, a significant amount of practical work was undertaken at the marine farms; a specified duration of diving experience was included. At the time of survey (September–December 1998), the industry goal of higher level training had almost been achieved. All farms except one (three divers) were working towards AS 2815.2(R) certification for all of their divers. Five farms already had their divers trained to this standard (52 divers); one had ten divers trained and three divers with open water certification. All of the contract divers (13) were certified to a minimum of AS 2815.2(R). Hence, with 75/81 divers operating in the industry trained in accordance with AS 2815.2(R), there had been a significant move towards appropriate diver training. This compares with the 1990 study, where only two of nine divers treated for decompression illness had training appropriate to the industry (Smart & McCartney 1990).

Equipment and Equipment Maintenance

Two out of seven marine farms used “Hookah” (surface low-pressure pump) apparatus to supply air to their divers, three used high-pressure (“pods” of four cylinders) surface-supply breathing apparatus, and two farms used both (contractors using both types of apparatus). All farms had maintenance schedules for their equipment. An advantage noted for the high-pressure cylinder surface-supply “pods” was that the air purity could be independently tested, and the filling stations were subject to Australian Standard 2299 air purity

requirements. This eliminated some of the vagaries of potential malfunctions of the Hookah apparatus and their adverse effects on divers (Smart & McCartney 1990). Divers had their own personal second-stage breathing equipment (masks and regulators) at three of the marine farm operations and were responsible for its maintenance; most used safety reserve cylinders. Two of the larger operations used diver-to-surface communications, as did the contractors, and four farms used scuba as a backup to their surface-supply apparatus. All operations undertook regular maintenance of their equipment in accordance with preset schedules; cylinder pods and surface air pumps received professional maintenance and repair. Dry suits were used by many of the divers for thermal protection during colder months. Ladders were used by five farms and all contractors for divers to exit the fish pens (pl. 1). This prevented the hazardous activity of "vaulting the pen", which was described in the 1990 paper.

Safety Procedures, Diver Schedules and Profiles

At the time of survey in 1998, all of the marine farms had protocols for emergencies and carried resuscitation equipment and oxygen for use in emergencies. Individuals were appointed as safety officers and trained in first aid. Backup divers were available at four operations and were used by the contractors.

All marine farm operators and contract firms kept logs of all dives undertaken by their divers. These logs documented entry and exit times and depths for the divers, as well as documenting pre- and post-dive checks, air consumption and other dive notes. Comparisons with recognised tables also took place, in order to assign repetitive groups to the diver for residual nitrogen calculations. All farms had bounce diving limits and maximum allowable bottom times for the various depths. Table 2 summarises examples of bottom time limits provided to the authors during the survey. There were significant variations in the limits recommended by each farm. This was, however, an improvement compared with the 1988–90 period, when there was no correlation of dive times with accepted tables.

Divers were advised to undertake safety decompression stops during ascents from dives >10 m depth and to rest immediately post-diving. Recommended ascent rates at the end of each "bounce" were 5 m/min. Divers were also advised to ascend "hand over hand" in the last 3 m (aiming for 3 m/min) after their safety stop. This method has been used by the pearling industry to undertake slow ascents. Three farms included safety advice in the dive log (table 2, see example 4). With better documentation, a more comprehensive industry picture was constructed, compared with the 1990 study. The total number of dives performed annually for the period 1997–98 and the number of divers is shown in table 3. Available data allowed a calculation of the average number of ascents for each "dive". The average from all farms was 3.8 (range 3–7.3). Two farms employed contract divers to undertake most or all of their diving. None of the marine farm divers were proceeding deeper than 30 m; instead relying on contract firms to undertake this work. Contract divers undertaking deeper diving all had certification to higher level than AS 2815.2.

TABLE 2
Examples of current practice in Tasmania's aquaculture industry

	Limits on bounce diving and bottom times		
	Depth (m)	Bottom time	Maximum bounces
Example 1	10		8
	> 10		6
Example 2*	6	150	8
	12	120	8
	15	60	4
	18	40	2
	21	30	1
	30	15	1
Example 3	9–12	150	8
	12–15	75	6
	15–18	50	4
Example 4†	0–6	240	10
	7–9	180	8
	10–12	110	8
	13–15	75	4
	16–18	50	4
	19–21	35	2

* Maximum depth.

† Safety advice provided to divers on this dive log:

- (1) Do the deepest dive first
- (2) Always use maximum depth when finding no decompression times
- (2) Add 10 min. to bottom time for every bounce
- (4) Ascend slowly (hand over hand last 3 m)
- (5) After diving > 10 m or bounce diving, take a safety stop at 3m for 5 min.
- (6) Reduce dive times when working hard underwater.

TABLE 3
Number of divers and annual number of dives in Tasmania's aquaculture industry

Marine farm identifier	Number of divers	Number of dives
A	6	150
B	9	150
C	13	468
D	0*	0
E	3	100
F	3	100
G	34	5950
Contract pooled	13	1850
Totals	81	8768

* Contract only.

Other Practices

Creative thinking from within the industry has led to a number of other improvements in diver safety. In order to reduce bounce diving and improve productivity, larger deeper pens were introduced in the early to mid 1990s. This permitted more fish to be held in individual pens (15 000 versus 5000 previously), with reductions in maintenance and other procedures created by the economy of scale. For the divers, this meant deeper diving but less ascents and descents in their daily work, and overall less diving. In the early phase of development of the industry, a significant proportion of diving was undertaken to remove dead or diseased fish each day from the pens. The development of "mort cones" reduced the need to dive for these fish on some leases. The mort cone was a wide conical net which was lowered into the deepest part of the centre of the pen, to catch fish as they died and sank to the bottom. Perimeter nets have been traditionally used to keep seals out of the aquaculture leases. These required maintenance and were frequently in very deep water (greater than 40 m) — adding to the risk for divers undertaking maintenance. Changes in practices reduced the need for these perimeter nets in some leases. Seals were trapped using baits, then transported many kilometres away from the lease. Stronger, tensioned nets, set from the surface, and "double nets" have reduced the ability of seals to injure fish and reduced seal-bite holes in the net, which previously allowed fish to escape. The ability to set from the surface has also reduced the number of dives required. Some farms were also investigating the use of video to assist inspection processes.

Safety Outcomes Measured by Key Performance Criteria

Figure 1 demonstrates the number of cases of DCI treated at the Royal Hobart Hospital in two-year periods over the ten years, 1988 to 1998. There has been an increase in the number of cases treated, particularly over the last four years. Conversely, there has been a progressive reduction in numbers of aquaculture divers with DCI, which was statistically significant using the Chi squared test for trend, $P < 0.0001$. Table 4 shows the number of divers employed in the aquaculture industry for three of the two-year periods 1988–90, 1992–94 and 1996–98, and the number of cases of DCI treated at Royal Hobart Hospital. The table also

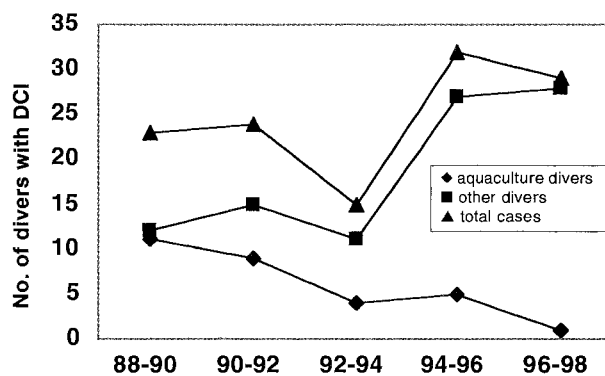


FIG. 1 — Cases of DCI treated at the Royal Hobart Hospital Hyperbaric Unit, 1 July 1988–30 June 1998. Test for trend, $\chi^2 = 17.34$, $p < 0.0001$.

documents the annual number of dives undertaken by the divers, although the 1988–90 figure is an estimate because no formal records were kept. Data were not available on diver activity for the years 1990–92 and 1994–96. Using available data, it was possible to calculate incidence of DCI per 100 divers per year and per 10 000 dives. When comparing the first two years of the survey, to the last two years, relative risk reductions for decompression illness have been significant across both parameters:

DCI per 100 divers relative risk reduction = 16.15
 (95% CI = 2.11 to 123.4)

DCI per 10 000 dives relative risk reduction = 45.81
 (95% CI = 5.91 to 354.9)

Hence divers were less likely to suffer major morbidity in the form of decompression illness in 1996–98, compared with 1988–90.

DISCUSSION

There are parallels to be drawn between the early development of the Tasmanian aquaculture industry and the South Australian tuna farming industry. A report by Kluger and co-workers in 1994 outlined similar roles for divers in the tuna farming industry and similar challenges relating to level of training, multi-ascent dives, lack of tables and high levels of diver morbidity (Kluger *et al.* 1994). Kluger's paper did not provide data on the incidence of DCI from the tuna

TABLE 4
 Cases of decompression illness* from the aquaculture industry

2 year period	No. of divers	No. of dives/year	2 year cases DCI†	DCI rate per 100 divers/year	DCI rate per 10 000 dives
1988/90	50	2100	11	11	26.19
1992/94	86	5600	4	2.32	3.57
1996/98	81	8768	1	0.62	0.57
Chi squared value (2 DF)				$\chi^2 = 18.03$	$\chi^2 = 46.26$
P value				$P = 0.0001$	$P < 0.0001$

* Treated at the Royal Hobart Hospital.

† For three separate periods where diving activity was known.

industry; however, the problems faced by the South Australian industry were identical to those faced by the Tasmanian aquaculture industry at the end of the 1980s.

Information obtained in this survey of Tasmanian marine farms has demonstrated significant improvements in the industry's diving operations, when compared with the 1990 study by Smart and McCartney. The changes have addressed many problem areas, and it is pleasing to note that the process has been initiated and driven from within the industry.

Prior to the 1990s, training of divers in the aquaculture industry was ad hoc and, in some cases, non-existent. During the early 1990s, all divers were trained to a minimum level of open water certificate. This has been followed by further training by most operations in accordance with AS 2815.2(R). Compressed-air diving is unforgiving of anyone ignoring established practices and safety procedures. By equipping divers with appropriate knowledge and skills to perform their activities, the industry has invested in a safe working environment and improved productivity. With appropriate training, divers have been empowered to dive safely within established guidelines and limits, also to recognise hazardous procedures and correct them. Diving activity is now carefully recorded, depth, time and bounce limits observed, and safety measures such as decompression stops implemented. Ascent rates (3–5 m/min.) are slower than conservative recommendations of dive tables (6 m/min. in the last 6 m, summarised by Wong 1996a). Equipment is now appropriate for the tasks and maintained in accordance with established schedules. The industry has accepted that safety procedures and protocols for emergencies are an essential component of its operations. Creative thinking has reduced the amount of diving in certain activities (for example setting nets and mort diving). Use of ladders has prevented the "Polaris missile" ascent required by the diver to "vault the fish pens".

As a result of many improvements in the diving procedures of Tasmania's aquaculture industry, a significant improvement in diver safety has been demonstrated over the decade 1988–98. The incidence of decompression illness in 1998 was 0.57 per 10 000 dives (0.0057%). The reduction in risk to divers has been achieved with a background of steadily rising fish production (fig. 2). The risk of DCI in the aquaculture industry now compares favourably with Pearlring Industry reports of 0.015% (Wong 1996a), and reports from the Scottish fish farm industry of 0.03% (Wilcock *et al.* 1992).

When combined with slow ascent rates, limits on bounce diving for the Tasmanian aquaculture industry may have contributed to improvements in safety. The recommended limits on the number of ascents during bounce diving for Tasmanian aquaculture divers were empirically derived, because of lack of data in this area. The average number of ascents undertaken on all farms was 3.8 (range 3–7.3). This figure was lower than expected, but probably reflects recent moves to larger, deeper pens by many of the industry participants. It is known that divers undertaking similar work in Scotland had an acceptable incidence of DCI when the number of ascents was limited to ten (Shields *et al.* 1993). Using the US Navy probabilistic decompression model, Parker and co-workers demonstrated increased risk of DCI for yo-yo diving when greater than ten descents were made, and a progressive increase in risk with deeper dives (Parker *et al.* 1994). Further research is required,

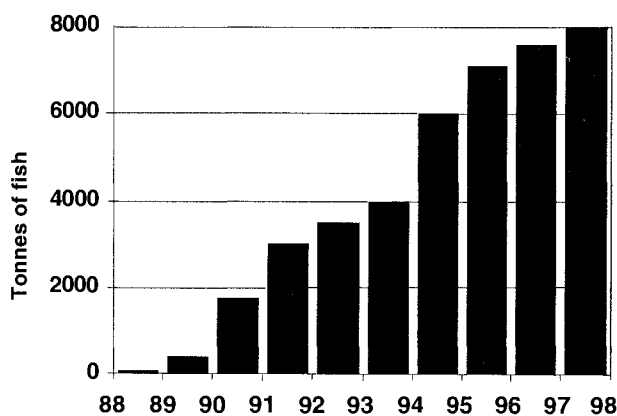


FIG. 2 — Tonnage of Atlantic salmon produced 1988–98. (Source: Tasmanian Salmonid Growers Association 1997; 1997 figures from ABARE 1998.)

undertaking carefully controlled experimental dives in sufficient numbers, before Tasmania's aquaculture industry dive schedules can be fully validated. This work should also include doppler studies using similar methodology to the pearlring industry (Wong 1996b).

Bottom time and depth limits may have also contributed to the reduction in risk of DCI. The last three examples had bottom time limits which were consistent with, or more conservative than the DCIEM (1983 model) table limits (Lauckner & Nishi 1984). These tables, developed in Canada by the Defence and Civil Institute of Environmental Medicine, are more conservative than the US Navy diving tables and have been rigorously tested during working dives in cold water (Lippman 1990). Given the added (unquantifiable) risk of bounce diving, conservative limits on diver bottom time are essential. It may be possible in the future for the industry to agree on a standard set of bounce diving tables, after further more rigorous validation of existing procedures.

Dive logs also provided general advice on reducing risk of DCI. Some of the advice covered factors identified as risky practices from the 1990 study (table 1). In 1990, Smart and McCartney described aquaculture diving activity to depths in excess of 40 m. Deeper dives have been identified as an independent risk factor for DCI (Edmonds *et al.* 1992, Lippmann 1993). Since 1992, marine farm diving has been limited to depths less than 30 m (in most cases less than 21 m). Depth restrictions may also have contributed to reduced risk of decompression illness.

Improvements in diver safety have occurred with a background of increasing output from 380 tonnes of fish in 1989–90 to 8000 tonnes in 1997–98. The risk to divers of injury in 1990 was 45.8 times the risk in 1998. If the initial rates of diver injury had persisted, in 1996–98 the additional treatment costs for the industry would have been \$551 000 (based on the average hyperbaric treatment cost of \$3000). This figure does not include costs of lost productivity or rehabilitation expenses. These cost savings would have significant positive impact for the industry as a whole, independent of the long-term health benefits to the divers.

CONCLUSIONS

This ten-year review of Tasmania's marine finfish aquaculture diving operations has demonstrated significant improvements in diver safety, on a background of rising output from the industry. A cooperative approach, driven from within the industry, has made substantial improvements in many areas, including training, equipment and equipment maintenance, diving procedures, dive schedules and profiles, and emergency procedures. Multifactorial improvements have led to significant reductions in the number of divers treated for decompression illness from the industry. Based on the improvements in diver safety demonstrated in this paper, marine farming operations in Australia and other countries may be able to profit from the experience and achievements of Tasmania's aquaculture industry.

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