PEARL PRODUCERS ASSOCIATION (INC.)

PROJECT TITLE :*PEARL DIVERS DIVING SAFETY & IMPROVED HARVESTING EFFICIENCY OF PEARL OYSTERS THROUGH MODIFICATION TO DIVE PROFILES.*

PROJECT NUMBER : *91/015 & 94/098*

CHIEF RESEARCHER : *DR. R. WONG*

30th January 1996

:REPORT INDEX:

Financial Summary
&
Explanation

Mick Buckley
PPA Executive Officer

FINANCIAL SUMMARY:

The following is an explanation and summary of the research funds for the 1993/94 and 1994/95 financial year. This covers the end of the 'Pearl Divers Diving Safety' project (1993/94) and the (91/015) start of the 'Improved Harvesting Efficiency Of Pearl Oysters Through Modification To Dive Profiles' project (1994/95). 94/098.

Attached for your information and reference is a spreadsheet summary of the 'Pearl Divers Diving Safety' project (1992 - 1994) which I forwarded to you previously. At the back of this document there are the Financial Audit Statement's for the last two years.

1993/94:

As per the 3 year summary sheet, you will notice that for the 1993/94 year we received from FRDC $ 42, 798 which consisted of $ 28,532 (first 6 months) and $ 14,266 (1/2 of the final 6 months). We were informed that the balance of the final 6 months was held back until the final report for 'Pearl Divers Diving Safety' project was submitted.

The final report has been submitted, however, as we had a surplus of funds left over we didn't request the balance of the final payment ($ 14,266).

In the Financial Audit Statement for the same year, 1993/94, you will notice that the $ 14266 has been listed as a Current Asset Receivable and has been bought to account in the Income and Expenditure Statement. The Excess of Income over Expenditure for that year was listed at $11,405 which included the $ 14,266 that was bought to account from the receivables. As we never received the $ 14,266 the actual result should be read as Excess of Expenditure over Income was ($ 2,861).

The attached spreadsheet is different to the Audit Statements because it is a cashbook spreadsheet and not an accrual document as is the Audit Statement i.e. it doesn't allow for any depreciation throughout the 3 years of the research. The 1993/94 Audit Statement on page 13 shows an accumulated surplus balance of $ 34,561 for the project, however this is actually $ 20,295 once the $ 14,266 is subtracted.

Over the 3 year period of the research the Fisheries Department of W.A. has contributed $151,991 plus another $ 30,000 grant prior to the start of the project to initiate the research while waiting for the project approval from FRDC. This is a total Fisheries grant of $ 181,991 where as FRDC has contributed a total of $ 136,456.

This means that the Fisheries Department of W.A. has contributed more funds **($ 45,535)** to the project than FRDC. It was with this understanding that we approached the Fisheries Department to obtain approval to roll over the surplus funds into the new project 'Improved Harvesting Efficiency Of Pearl Oysters Through Modification To Dive Profiles' project (1994/95) the result of which was a limited request for funds from both FRDC and Fisheries as compared to the projected budget for 1994/95.

It is on this basis that I do not believe that any of the surplus funds at the end of the 1992 - 1994 Pearl Divers Diving Safety project should be refunded to the FRDC due to the fact that they are excess funds from the contributions of the Fisheries Department of W.A and FRDC obtained the benefit of these funds through a reduced call on their funds i.e. $ 14,266 in 1993/94 and $31,204 in 1994/95.

If you believe that this is not a suitable way of reconciling the surplus funds at the end of the 1992 - 1994 project and wish to discuss this further please contact me.

1994/95

The 1994/95 year was the start of the new (continuing) 'Improved Harvesting Efficiency Of Pearl Oysters Through Modification To Dive Profiles' project which is essentially a continuation of the previous 'Pearl Diver Diving Safety' project.

As explained for the 1993/94 year, there was a surplus of funds at the end of the previous project which were rolled over into the new project with the permission of the Director of W.A. Fisheries. This surplus of funds was offset against the call on the budgeted grant monies from both FRDC and the Fisheries Department for the 1994/95 year.

The approved budget figures from both FRDC and W.A. Fisheries for 1994/95 was $ 62,407 from both organisations. Due to the surplus from the previous year we only requested $ 31,204 from FRDC and $ 27,329 plus a $ 3,875 computer from the W.A. Fisheries Department.

In the Audit Statement you will notice a Research Grants Income figure of $ 48,142. This figure was arrived at from the actual $ 58,533 received minus the $14,266 accrued to the 1993/4 year as receivable in that year (to balance last years accounts) plus the value of the computer - $ 3,875.

As you can see from the Accumulated Funds Balance on page 14 of the Audit Statement this action has essentially consumed the surplus of accumulated funds.

If you have any queries regarding the 1994/95 Audit Statement please contact me and I will endeavour to answer them.

1995/96:

For your information, the 1995/96 year has seen the research progress as explained in the Principal Researchers report, however, we have not called on any funds from FRDC so far this year.

We have received the first 6 months funding from the Fisheries Department of W.A. and are waiting on the second payment, however there was a levy raised from the pearling companies for divers wages in the chamber trials ($ 35,640) which has sustained the research by holding back on wages payments to the companies suppling the divers.
As per the attached letter the PPA will require the full 1995/96 funds from FRDC in the near future so that it can pay some of the large expenses that are being held pending funds availability.

Pearl Divers Diving Safety Finacial Summary 1992-1994

Income		1992	1993	1994	3yr. Total	3yr.Budget
	General Levy		$8,620	**	$8,620	$12,800
	Resrch Grant FRDC	$44,978	$48,680	$42,798	$136,456	$151,744
***	Resrch Grant Fisheries	$46,000	$48,991	$57,000	$151,991	$151,744
	Interest Received	$393	$221	$585	$1,199	
	Total	**$91,371**	**$106,512**	**$100,383**	**$298,266**	**$316,288**
Expenditure						
	Annual Leave	$1,492	$1,614		$3,106	
	Accommodation	$4,293	$3,848	$3,043	$11,184	$16,678
	Audit Fees			$6,593	$6,593	$1,000
	Bank Fees & Interest	$36	$57	$50	$143	
	Consultancy Fees	$29,950	$18,500	$29,750	$78,200	$116,000
	Contract Divers		$8,620	$1,620	$10,240	
	F.I.D. & G.D.T.	$50	$57	$45	$152	
	Freight & Courier	$35			$35	
	General Expenses	$676	$1,831	$432	$2,939	$5,850
	Insurance Gen.	$1,414	$1,339	$1,743	$4,496	$3,331
	Medical Expenses		$58	$1,961	$2,019	
	PPS & Consumables	$1,419	$848	$675	$2,942	$1,250
	Repairs & Maint.	$821	$1,734	$3,415	$5,970	$1,000
	Software	$2,444	$15,050	$6,850	$24,344	
	Superannuation		$952	$974	$1,926	
	Telephone		$678	$508	$1,186	$600
	Travel Expenses	$7,425	$5,736	$6,195	$19,356	$42,634
	Wages	$37,308	$36,601	$37,113	$111,022	$109,055
	Assets	$5,724	$1,230		$6,954	$5,234
	Total	**$93,087**	**$98,753**	**$100,967**	**$292,807**	**$302,632**
	Balance C/F	**($1,716)**	**$6,043**	**$5,459**	**$5,459**	**$13,656**

*** The Fisheries Department gave the PPA a grant of $ 30,000 to start the Research in the 1990/91 year which is not reflected in this spreadsheet

** Resrch Grant FRDC - 1994:- does not include the $ 14,266 withheld from last payment

Principal Researcher

1995
Interim Report.

Dr. Robert Wong

Hyperbaric Medicine Consultant

1995 Annual Report

The Pearl Divers Dive Profiles are continuously being monitored at sea and tested and modified (if indicated) in the Recompression Chamber.

The following profiles were tested in the Recompression Chamber (RCC) during the financial year 1994 - 95.

- 25 msw x 2
- 11 msw
- 19 msw
- 17 msw x 2
- 15 msw x 4
- Surface Interval Trial using the 15 msw profile.
- Fast ascent trial using the 17 msw profile. The fast rate of ascent produced high bubble grades such that the trial had to be abandoned after 1 day, whereas, the 3 msw/min was successful for 10 dives on 8 consecutive days on 3 separate trials.

The advice from the statistician was to perform the trials on a "block design" to minimise diver variability to "bubbling", and this should be done for at least 3 trials per profile.

Doppler Studies were recorded at the following depth profiles at sea:-

- 11 msw
- 13 msw
- 15 msw
- 19 msw
- 21 msw

See attached Report (from Beau Bibby).

During 1995, there were 2 cases of Decompression Illness out of 18,974 dives.

Fig 1. shows the dives performed since 1992 at the commencement of this project. The incidence of Decompression has been less than 0.01%. The current accepted incidence of DCS has been quoted as:-

Commercial Diving	0.1 - 0.5%
USN	3 - 4%
Space shuttle	6%
Caisson Workers	2%

The safety of dive profiles depends not only on the incidence of DCS, but also on its manifestations. Whereas it is permissible to have musculo-skeletal types of DCS, but neurological symptoms are unacceptable. Since the modifications of the Dive Profiles, there have been 9 cases of DCS in 4 years (out of a total of 90,977 dives, with an overall incidence of less than 0.01%).

1992	4 cases
1993	3 cases
1994	0
1995	2 cases

All these cases presented with musculo-skeletal symptoms only.
It is also important to consider the long term manifestations of DCS symptoms such as Dysbaric Osteonecrosis.

DCS can occur as a random event, however, some of the contributing factors could be due to a faster than prescribed rate of ascent.

The ascent rates have been recorded:-

	1992	1993	1994
< 3 m/min	34.4%	28.6%	18.6%
< 6 m/min	45.9%	46.6%	44.7%
< 9 m/min	8.6%	10.6%	19.6%
> 9 m/min	11.1%	14.3%	17.0%

Further Trials to be completed for this Project:-

1) The remaining PPA Profiles - further sea trials on the deeper rotational profiles.
2) The 23 msw profile, which at this stage cannot be considered as acceptable for the Non-rotational profile.
3) The effects of Ascent rates.

Since it is assumed that the safety of the Profiles are due to the following factors:-

1) slow rate of ascent;
2) appropriate depth of decompression;
3) use of oxygen in decompression;
4) suitable interdive interval.

Therefore, this hypothesis has to be verified. Since the Depth of Decompression and the Use of Oxygen in decompression have been well documented in the world literature, it was prudent to proceed to test the effects of Slow rate of ascent and the effects of longer surface intervals.

ASCENT RATE :-

The current 18 msw/min ascent rate was promulgated without any scientific basis. The USN Decompression Table used 25 ft/min ascent rate, and by 1958, the rate was changed to 60 f/min and has been adopted by the diving community as the de facto standard rate.

Since then, various dive tables, dive computers and dive companies have adopted various rates of ascent. As is stated in the US Navys' Diving Manual that a slow ascent rate slower than 60 f/min will be penalised as extra Bottom time - without any scientific basis, this has confused the diving community.

During the preliminary testing, the ascent rate of 15 msw/min was compared with the PPA's slow rate of ascent of 3 msw/min. The results show that the faster rate of ascent produced higher bubble grades at earlier stage and persisted longer. However, this could have been due to diver variability. In due course, one has to compare the same pair of divers employing the same degree of "Hyperbaric Stress" expressed as P r T, which is P = absolute pressure, r - is square of time, T = time in minutes.

Another trial using the PPA's 17 msw profile was tested in the RCC substituting the ascent rate with 15 msw/min. This trial was abandoned at the end of day one due to high bubble grades; whereas, using the 3 msw/min rate of ascent, the trial was completed for 8 consecutive days. Further tests need to be done to confirm the initial findings.

SURFACE INTERVAL :-

The definition of a Repetitive Dive depends on the time available for elimination of inert gas, which in the case of air diving, is Nitrogen. Various Decompression Tables of the world quote different elimination times, viz
Rogers 6 hours,
Comex 12 hours
USN 12 hours and
DCIEM 18 hours.

Using the DCIEM Table, any dive within an 18 hour period is a repetitive dive; whereas with the US Navy Table, after 12 hours, it is a clean dive.

Essentially the figure for total elimination of Nitrogen is unknown. The calculation of Surface Interval of a particular set of Decompression Tables depends on the mathematical model on which it is based; this in turn relies on the assumption of knowledge of tissue half time for elimination of inert gas, which is therefore based on a premise which needs proof. The US Navy Decompression Tables, as with the rest of the Haldanian Tables are based on mathematical models with compartments arranged in parallel, thus are independent of one another. They use tissue half time of 5 to 120 minutes. Other Tables simply increase the number of compartments, eg Swiss Tables have 16 compartments with half time range of 4 to 635 minutes. DCIEM uses compartments arranged in series. These tables are based on "Perfusion" of tissue. Whereas, "Diffusion" theory is based on a slab concept. The elimination of inert gas is not the mirror of uptake either, various models have been designed to take this into consideration, such as linear as opposed to exponential.

The Pearl Divers Profiles have 2 sets of schedules - one is the Non-rotational, the other is the Rotational Profiles. The Non-rotational Profiles cover depth range of up to 23 msw, and every diver dives every dive, and not every dive has a decompression stop, and Surface Interval is fixed at 20 minutes. Whereas the Rotational Profiles have depth range from 25 msw to 35 msw, and the divers dive every other dive. The Surface Interval increases in duration after every dive, more akin to the conventional tables. Also each dive has a decompression stop.

In the Hard Hat diving days, the Pearl Divers used to dive to all depth ranges without any consideration of Surface Interval, - thus the Surface Intervals were fixed as the Non-rotational Profiles. The incidents of Decompression Sickness (DCS) was high in deep waters. The mode of diving in deep water with no consideration of Surface Interval could have been a contributing factor. Those divers used to adopt a Surface interval of 10 to 40 minutes. It was only at the end of the day that they attempted the elimination of Nitrogen by a prolonged decompression stop and a slow rate of ascent, which, if it was inadequate, would result in DCS.

Surface Interval obviously plays a part in the elimination of inert gas. It is effective in the conventional tables. In the RCC trials, the 23 msw profile at this stage cannot be dived as a non-rotational profile. This is due either to the inadequate surface interval or inadequate decompression time. Merely adding more oxygen during a decompression stop cannot substitute for an adequate surface interval, unless the decompression stop is very protracted.

There are a few other facts which need consideration:-

1) With the experiments using *Cragnon cragnon*, it was found that pressure pre-treatment can eliminate bubble formation when subjected to subsequent subatmospheric decompression. However, it was found that bubble re-generation does occur after some 8 - 10 hours and that after 24 hours, no evidence of pressure pre-treatment could be seen.

2) "*Taravana*" - breath-hold divers from the Tuamoto Archipelago can suffer a condition similar to DCS. If the Surface Interval was increased from their usual 3 - 4 minutes to some 10 minutes, this phenomenon disappears.

3) Using the US Navy's Probabilistic Model, it was estimated that in Yo-yo diving, if the SI was 0 minutes, the P(DCS) was the lowest; when the SI was 5 minutes, it has the highest P(DCS); and when SI was 10 - 120 minutes, the P(DCS) was in the intermediate range.

4) In the technique of Surface Decompression, the DCIEM Tables allow a maximum of 7 minutes to get from the bottom or at the 9 msw decompression stop to reach 12 msw in the RCC.

5) Flying after diving - there is no consensus. The surface interval varies with the type of diving.

It appears therefore that the body could handle a certain amount of hyperbaric stress and can be decompressed to the surface for a limited time, provided the diver is recompressed within this time frame and then subsequently perform an adequate decompression. It takes time for bubble formation to occur, depending on the hyperbaric stress. If decompression was inadequate, DCS will result. In a repetitive dive, a diver could handle a certain amount of hyperbaric stress if he was to include adequate surface intervals.

On review of the "hyperbaric stress" (expressed as PrT, that is, Pressure x square root of time) of the profiles of the PPA, it appears that the product of PrT cannot exceed 19.6 for the Non-rotational profiles for a single dive.(Fig 1) All the rotational profiles have PrT value in excess of 20, they however, have longer surface intervals. This could explain the reason why it is not possible to dive the 23 msw using the non-rotational method. Hence, following this line of argument, if one were to use PrT as a guide, then it should be possible to dive the 23 msw profile with 20 minute surface interval if one reduces the bottom of each dive to 25 minutes.
This is being verified in the RCC.

MILESTONES :-

The major milestones of the project that were listed in the application are listed below with an explanation of the results :-

a) Completion by 31 March 1995 of the testing of the profiles to 35 metre depth in the Recompression Chamber, at the same level of testing as undertaken in the 1991/92 to 1993/94 research project.

This milestone hasn't been achieved due to the failure of the 19m & 23m profile to test safely in the chamber trials. These profiles were modified several times and tested but continued to produce high bubble grades and therefore the trials had to be terminated. These profiles have since been modified again and if they fail in the next trial they will be converted to Rotational Profiles.

b) Review of the data at a workshop meeting in October 1995.

This workshop was held in October and the various reports which are attached to this document were tabled for consideration and discussion.

The question as to whether the project should be continued for the optional extra year of research was discussed and it was the opinion that the project should be extended for another year.

c) Determination in October 1995 as to whether an additional years field data are required.

This question was discussed at the workshop and there was agreement that the project will have to continue. You will receive a letter in the near future which will go into detail of the results of this meeting.

SUMMARY:-

Since the beginning of the research project, the following Profiles have been tested and modified:-

11 msw tested 3x. The first was the modification of the Original Code of Practice, which gave rise to constantly high bubble grades and was abandoned after 5 days. The 2nd modification was tested successfully twice. (3 trials).

13 msw — the original Code gave rise to 1 diver presented with symptoms of DCS; this profile was tested and modified 3 times, with 2 successes. (6 trials).

15 msw — the original code gave rise to high grades and was abandoned. The 1st modification was successfully tested for 8 days, but bubble grades were high. It was again modified, which was twice tested and giving rise to another DCS. The 3rd modification was successfully run for 8 days on 3 trials. This is currently acceptable. (7 trials).

17 msw — the original code led to DCS. The 1st modification gave high bubble grades. The 2nd modification was successfully tested for 3 trials. This is the current profile for this depth. (5 trials).

19 msw — the original code was modified before testing, even so, DCS resulted after 1.5 days. The 2nd modification was run for 5 days and resulted in consistently high grades. The 3rd modification was run for 6, 8 and 7 days - all had high bubble grades. This profile is still unsatisfactory. This depth profile gave rise to 2 out of 9 of the DCS over the past 4 years. Further modification is needed. (5 trials)

21 msw — the original Code was modified prior to testing, and this gave rise to DCS after 1 day. The 2nd modification was successfully run for 8 days but with high bubble grades. This was again modified and was successfully run for one trial. (3 trials).

23 msw — this has been the most difficult of all the profiles. The user of this profile insisted on a non-rotational system of dive with surface interval of 20 minutes, although only 3 dives at 23 msw were required, it was nevertheless difficult to achieve. It is claimed that this profile works at sea, however, the bubbles grades are consistently high, although no cases of DCS were reported diving at this depth, there is the risk that high bubble grades might lead to Dysbaric Osteonecrosis. In the RCC, this was tested 6 times with 3 modifications. The original Code produced DCS. The modifications also produced 2 cases of DCS. The 3rd modification also gave rise to high bubble grades. It was decided to drastically change the profile with a Bottom time of 25 minutes. This trial is in progress. The feeling is that this profile should be dived as a rotational profile. (7 trials).

25 msw — Original Code produced high bubbles. The modification was successful for 1 trial. (2 trials).

27 msw — successful with the original Code of Practice profile.

29 msw — original Code. (1 trial).

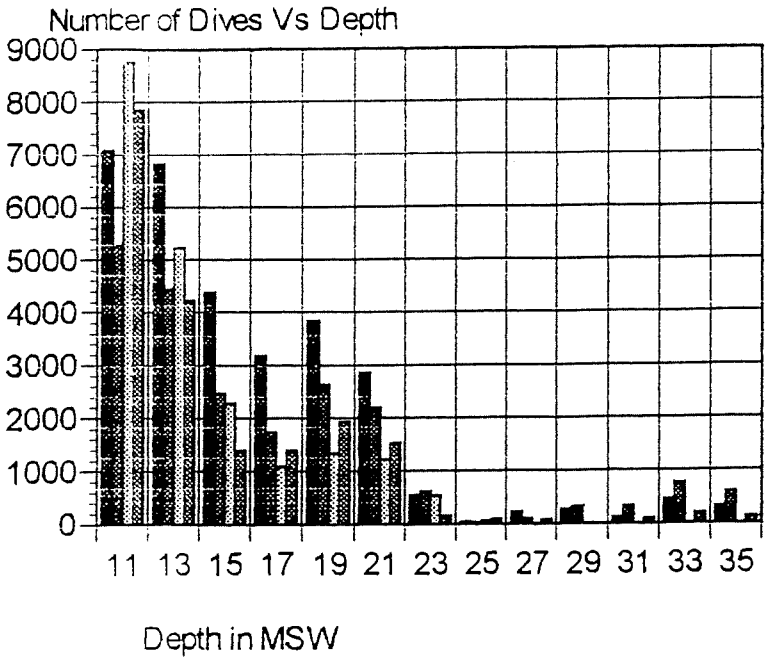
31 msw — original Code. (1 trial).

33 msw — original code. (2 trials).

35 msw — modification of original Code. (1 trial).

Dives per Depth 1992 - 1995

Figure 1.



1992	30,095	DCS 4
1993	21,452	3
1994	20,436	0
1995	18,974	2

Of the 9 cases of DCS -
4 occurred at 21 msw (44%)
2 at 19 msw (22%)
1 each at 13 msw, 17 msw & 33 msw.

Depth of Dives	1992	1993	1994	1995
11	7075	5269	6742	7842
13	6821	4429	5226	4215
15	4373	2470	2274	1383
17	3168	1738	1080	1380
19	3835	2624	1320	1926
21	2856	2189	1212	1518
23	547	621	534	144
25	35	12	48	88
27	220	88	0	78
29	269	316	0	0
31	118	332	0	88
33	455	764	0	188
35	323	600	0	124

STATISTICAL PROGRESS REPORT

ON

RECOMPRESSION CHAMBER TRIALS

RUSSEL JOHN

U.W.A. STATISTICAL CONSULTING GROUP

Progress Report on Recompression Chamber Trials

Introduction

The data analysed in this report consists of precordial rest and flex grades from some 20 divers collected in 10 recompression chamber trials as part of a not yet complete larger designed series of trials. Each chamber trial considered lasted eight days with the same two (or sometimes three) divers in the chamber throughout the trial. The depths considered in this report are 11, 13, 15 and 17m. For these depths, the diving profiles involve 9 or 10 simulated dives every day. The presence of bubbles in the blood stream is checked after every dive during the day usually some 10-20 minutes after "surfacing". The exception to this rule is the last dive of the day, where measurements of bubbles are made some 30-35 minutes after surfacing, again at 60-65 minutes and once again the following morning (before diving recommences) some six hours after the last dive of the preceding day. Every bubble measurement is made both before (rest) and after (flex) a series of squatting exercises performed by the diver.

The size and number of bubbles in the bloodstream are graded on a scale from 0 to IV, with 0 being no bubbles. The possible grades are 0, I-, I, I+, II-, II, II+, III-, III, III+ etc. For the purposes of this analysis, this scale has been condensed to 0, I, II and III, with I representing I-, I and I+, II representing II- and II, and III representing anything over II (i.e. including II+). (The - and + categories are rarely encountered at the lower end of the scale. e.g. there was only one II+ recorded in the roughly 1800 grades analysed here.) Grades higher than III would be cause to stop the trial, so none are represented in this data set. (In fact, most of the grade III results recorded are actually III-, as the table of grades categorized by diver and depth on page A.1 of the appendix shows.)

The system of bubble grades gives a measure of how stressful a dive or series of dives is. Work elsewhere has demonstrated a correlation between the grades and incidence of decompression sickness. However, there is considerable variation between individuals in their propensity to produce bubbles, and a high grade is no guarantee of getting decompression sickness nor a low grade guaranteed immunity from it. The criterium of safety of a given profile that is accepted here is that half the divers using the profile should have bubble grades not exceeding II. It will be shown later that the profiles tested here, with the possible exception of the 17m profile, all fall well within the bounds of acceptability.

Method of Analysis

The bubble grades lie on an ordered categorical scale. That is, grade I is a lower grade than II, but not necessarily the same "distance" below II as II is below III. There really is no concept of distance apart here, only of magnitude. The analysis is thus not concerned with determining average grades, as a straightforward or conventional analysis would be, but in determining the probability of obtaining a particular grade. These probabilities may depend on the diver, the depth of the dive, the day of the trial and possibly many other indeterminable things.

The difficulty in this particular analysis is that not every diver has been tested at every depth, and it is therefore not immediately obvious whether a high grade is due to a too strenuous profile or to a diver with a propensity for bubbling. For this reason a series of trials was proposed which would enable the effects of the divers to be removed from comparisons of the profiles. This design took the form of a balanced incomplete block design, with divers as blocks. The idea is to test divers at a number of depths, and so obtain some estimate of their

propensity to bubble. To date, the series of trials constituting the design has not been completed, and so the data analysed here is unbalanced. However, it appears to be balanced enough for effects of divers and depths to be estimable. Thus it is possible to obtain the required probabilities of obtaining particular grades at each depth for an "average" diver. That is, probabilities calculated as if all divers used in the trials had indeed dived every depth.

The process used to estimate the probabilities is called ordinal logistic regression. It actually estimates the logarithm of the odds of not exceeding a particular grade. These can then be turned into probabilities of not exceeding a given grade. For example, the process might estimate the log odds of not exceeding grade II to be 0.6931. The odds of not exceeding 2 are then obtained as exp(0.6931) = 2.0. That is, the chances of being less than or equal to II are 2 to 1. In terms of probabilities, there is a 2/3 chance of not exceeding II. This should translate into 67% of divers scoring less than or equal to a grade II for that dive.

On the odds scale, the risk factors, such as depth of dive, day of trial, etc, are multiplicative in their effects. That is, if the day of the trial has a coefficient of 0.223 in the fitted model, then on each successive day, the odds of not exceeding a II (say) is diminished by a factor of exp(–0.223) = 0.8. That is, there will be a 20% reduction in the odds of not exceeding a given grade every day. There will be some corresponding diminution in the number of divers scoring less than a II over the course of an eight day trial. Over the course of an eight day trial, a 20% reduction every day corresponds to a $1 - (0.8)^8 = 83\%$ reduction overall.

Precordial rest and flex grades are analysed separately in this analysis. The table on page A.1 of the appendix (and other later tables) shows that in general, rest grades do not exceed flex grades. For the purpose of making conservative statements about safety, the analysis of flex grades is paramount. However, similar patterns tend to emerge in the rest grades, which perhaps lends some credence to the method of analysis. Intraday grades are given on page A.1 of the appendix and results from their analysis on pages A.2 (flex) and A.3 (rest). These grades are those made during the course of every day of the trial within 30 minutes of surfacing (usually within 15 minutes). They include the first measurement taken at the end of every day 30 minutes after surfacing, but not those taken at 60 minutes and six hours at the end of the day and the beginning of the next. These latter measurements are analysed separately, on pages A.4 (flex) and A.5 (rest) for the predive grades (i.e. the six hour post final dive interval) and on pages A.8 (flex) and A.9 (rest) for the final reading of every day (i.e. the 60 minute post dive interval). Also analysed separately are the 30 minute post final dive of day on pages A.6 (flex) and A.7 (rest).

Results

Analysis of the intraday flex grades (page A.2) shows that depth and day of trial are both significant risk factors. That is, increasing depth and day increases the chance of a higher grade. However, estimated probabilities of not exceeding grade II on day 8 of a trial are all in excess of 96%. For rest grades (page A.3) these probabilities are all 100%. Closer inspection of the results shows that depths 13, 15 and 17m behave similarly on day 1 of the trial and significantly worse (in terms of lower probabilities) than depth 11m. The separate coefficients for day at each depth show that the tendency to increase risk over time is really only apparent at depth 17m and to a lesser extent at depth 11m. That is, at depths 13 and 15m, there is no significant increase of risk over the course of the trial, and for depth 11 only marginally so. The pattern is similar in the rest scores (page A.3), with 11, 13 and 15m showing no convincing tendency to higher grades over time, in contrast to depth 17m. So, it appears that

day of trial is only a risk factor at the 17m depth, and that the 13, 15 and 17m profiles are more risky than the 11m. Again, these statements are made in the context of extremely high probabilities of not exceeding grade II overall.

The difficulty with the intraday measurements is that they must be taken before sufficient time has elapsed for peak bubble grades to be reached (estimated to be at 1-2 hours after surfacing). For this reason, analysis of the post final dive measurements could be more telling. Of particular concern is the presence of high grades at the start of each day's diving, indicating persistence of bubbles within the bloodstream for a long period of time (overnight). The inability of the body to quickly rid itself of dissolved nitrogen is indicative of the stress of the diving regime.

Analysis of the predive rest and flex grades (pages A.4 and A.5) show that depth is a risk factor. Day of trial is of marginal significance as a risk factor for the rest grades, but apparently not at all for flex grades. Again, 11m seems to stand apart from the other depths as being significantly less hazardous. For flex grades, the estimated probability of not exceeding grade I exceeds 74% for all depths. For grade II, the figures are close to 100%. For rest grades, the worst case scenario is on day 8 of a trial, where the estimates probabilities of not exceeding grade I are 62% for depth 13m and 73% for depth 17m. Figures for the other depths are close to 100%. The figures for grade II are all 100%.

Analysis of the last measurement of every day (at circa 60 minutes post final dive) shows some reason for concern at depth 17m. The results are given on page A.8 and A.9 for flex and rest grades respectively. The flex grades are generally higher than the intraday measurements. Some 11% of the flex grades recorded are III compared to some 3% for the intraday measurements. Depth and day of trial are significant risk factors for both rest and flex grades. As with the intraday scores, the risk over time is most apparent at the 17m depth. None of the other depths show any significant tendency for increasing flex grades over time and only depth 13m shows a marginal increase in rest grades. In contrast, both rest and flex grades show significant increase over time at depth 17m. The worst case scenario, on day 8 of a trial, shows that for depth 17m, the estimated probability of not exceeding II for flex grades has dropped to 27% (from a figure of 98% on day 1). The corresponding figure for rest grades is 86% (down from 99%). The precision of these estimates is low - for flex grades the 95% confidence interval ranges from 5% to 74% - indicating that more data would be needed to clarify the picture. For the other depths, probabilities of not exceeding grade II are all close to 100% on any day of the trial.

To see if the anomalous depth 17m result was also evident in the circa 30 minute post final dive measurements, these grades were analysed separately with results on pages A.6 (flex) and A.7 (rest). The flex grades did display a similar pattern, with strong evidence of increased risk over time at 17m only. The estimated probability of not exceeding grade II on day 8 of a trial for this depth was 66%, again with a wide confidence interval. The rest grades showed no tendency for increased risk over time.

On pages A.10-12, the final measurements of each day are again analysed, this time including grades from an old 13-15m profile which trialled successfully twice (i.e. went for 8 days without being aborted for safety reasons) but whose oxygen regime was subsequently altered. The analysis of the flex grades shows that the 17m and the old 15m profile are alone in having a significant tendency for increased risk over time. Comparison of the day 8 probabilities of not exceeding any given flex grade show that these two profiles are behaving similarly.

Conclusion

The estimated probabilities of not exceeding grade II are well above the 50% "safety limit" for depths 11, 13 and 15m for every type of measurement - intraday, post final and predive, both flex and rest. For depth 17m, the estimate for the 60 minute post final dive flex grade falls below the 50% line. The 17m profile behaves similarly in this respect with an abandoned 13-15m profile. However, the precision of the estimates in this anomalous case are not high, and perhaps more data should be collected before the change of the profile is contemplated.

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Precordial Flex Grades (PCFG)

Depth	Diver	Trial	0	I	II	III		Total
	1	10	39	29	2	0		70
9 -11	2	10	35	34	1	0		70
(Pr 10)	23	26	2	59	11	0		72
	26	26	2	65	5	0		72
Total			78	187	19	0		284
	4	5	0	1	45	26	[0,25,1]	72
	7	16	18	36	2	0		56*
11-13	17	16	9	49	14	0		72
(Pr 5)	20	38	0	63	15	1	[1,0,0]	79
	69	38	0	63	18	0		81
	76	38	1	50	27	2	[0,1,1]	80
Total			28	262	121	29	[1,26,2]	440
	1	37	0	46	33	0		79
	26	37	0	68	10	1	[0,0,1]	79
13-15	31	37	12	65	2	0		79
(Pr 25)	74	33	2	60	18	0		80
	75	33	0	26	52	1	[0,0,1]	79
Total			14	265	115	2	[0,0,2]	396
	4	29	0	43	13	0		56*
	7	6	0	34	36	9	[0,7,2]	79
15-17	11	34	1	39	37	3	[0,3,0]	80
(Pr 6)	69	29	0	63	14	2	[0,2,0]	79
	75	6	1	31	47	1	[0,0,1]	80
Total			2	210	147	15	[0,12,3]	374
Total			122	924	402	46	[1,38,7]	1494

Precordial Rest Grades (PCRG)

Depth	Diver	Trial	0	I	II	III		Total
	1	10	59	11	0	0		70
9-11	2	10	54	16	0	0		70
(Pr 10)	23	26	27	44	1	0		72
	26	26	28	44	0	0		72
Total			168	115	1	0		284
	4	5	0	2	65	5	[0,5,0]	72
	7	16	46	10	0	0		56*
11-13	17	16	39	33	0	0		72
(Pr 5)	20	38	14	63	2	0		79
	69	38	28	48	5	0		81
	75	38	25	49	5	1	[0,1,0]	80
Total			152	205	77	6	[0,6,0]	440
	1	37	9	66	4	0		79
	26	37	18	59	1	1	[0,0,1]	79
13-15	31	37	56	23	0	0		79
(Pr 25)	74	33	38	41	1	0		80
	75	33	6	60	13	0		79
Total			127	249	19	1	[0,0,1]	396
	4	29	22	32	2	0		56*
	7	6	5	46	28	0		79
15-17	11	34	13	58	9	0		80
(Pr 6)	69	29	34	45	0	0		79
	75	6	8	60	12	0		80
Total			82	241	51	0		374
Total			529	810	148	7	[0,6,1]	1494

Precordial flex and rest grades for divers and depths (Pr = profile number) taken after every dive of an 8 day simulated neap (those marked * represent 6 days only due to non-dive related illness). No start of day (pre-dive) measurements are included, and only the first end of day measurement (approximately 30 minutes post-dive) is included. All grades above II (i.e. II+, III-, and III) are scored as III for the purposes of this analysis. Figures in square brackets after the III column give the breakdown into II+, III- and actual III grades respectively.

Results of ordinal logistic regression for PCFG:

	df	dev	Δdf	Δdev	
Const	1491	2875			
+ diver	1478	2471	13	404	(p<0.001)
+ depth	1475	2383	3	88	(p<0.001)
+ day	1474	2372	1	11	(p<0.001)
+ day.depth	1471	2364	3	8	(p=0.045)

Coeffs of day and depth from penultimate model:

	coeff	se	t
DEPTH 13	2.497	0.4667	5.35
DEPTH 15	2.561	0.2803	9.14
DEPTH 17	2.302	0.4174	5.52
DAY	0.081	0.0247	3.30

Coeffs of day and depth from final model:

	coeff	se	t
DEPTH 13	2.741	0.565	4.85
DEPTH 15	3.258	0.436	7.47
DEPTH 17	2.178	0.532	4.10
DAY.DEPTH 11	0.1326	0.0566	2.34
DAY.DEPTH 13	0.0715	0.0459	1.56
DAY.DEPTH 15	-0.0237	0.0492	-0.48
DAY.DEPTH 17	0.1591	0.0480	3.31

Estimated odds (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG 0		I		II	
Depth						
9-11	0.43	(0.23,0.79)	36.09	(18.21,71.53)	713.97	(338.55,1505.68)
11-13	0.03	(0.02,0.05)	2.63	(1.62,4.28)	52.04	(29.43,92.03)
13-15	0.02	(0.01,0.04)	1.90	(1.20,3.02)	37.55	(21.75,64.84)
15-17	0.05	(0.03,0.08)	3.88	(2.53,5.93)	76.68	(45.03,130.57)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG 0		I		II	
Depth						
9-11	0.30	(0.19,0.44)	0.97	(0.95,0.99)	1.00	(1.00,1.00)
11-13	0.03	(0.02,0.05)	0.73	(0.62,0.81)	0.98	(0.97,0.99)
13-15	0.02	(0.01,0.04)	0.66	(0.54,0.75)	0.97	(0.96,0.98)
15-17	0.04	(0.03,0.07)	0.79	(0.72,0.86)	0.99	(0.98,0.99)

Estimated odds (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG 0		I		II	
Depth						
9-11	0.17	(0.08,0.36)	14.27	(6.41,31.75)	282.27	(120.23,662.71)
11-13	0.02	(0.01,0.04)	1.59	(0.87,2.93)	31.55	(16.14,61.67)
13-15	0.03	(0.01,0.05)	2.24	(1.24,4.07)	44.34	(22.82,86.18)
15-17	0.02	(0.01,0.03)	1.27	(0.72,2.24)	25.17	(13.41,47.26)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG 0		I		II	
Depth						
9-11	0.14	(0.07,0.26)	0.93	(0.87,0.97)	1.00	(0.99,1.00)
11-13	0.02	(0.01,0.04)	0.61	(0.46,0.75)	0.97	(0.94,0.98)
13-15	0.03	(0.01,0.05)	0.69	(0.55,0.80)	0.98	(0.95,0.99)
15-17	0.01	(0.01,0.03)	0.56	(0.42,0.69)	0.96	(0.93,0.98)

Results of ordinal logistic regression for PCRG:

	df	dev	Δdf	Δdev	
Const	1491	2850			
+ diver	1478	2490	13	360	(p<0.001)
+ depth	1475	2429	3	61	(p<0.001)
+ day	1474	2421	1	8	(p=0.005)
+ day.depth	1471	2315	3	6	(p=0.11)

Coeffs of day and depth from penultimate model:

	coeff	se	t
DEPTH 13	2.015	0.460	4.38
DEPTH 15	1.787	0.244	7.31
DEPTH 17	1.650	0.416	3.97
DAY	0.069	0.024	2.87

Coeffs of day and depth from final model:

	coeff	se	t
DEPTH 13	1.806	0.555	3.25
DEPTH 15	2.064	0.410	5.03
DEPTH 17	1.164	0.532	2.19
DAY.DEPTH 11	0.0498	0.0549	0.91
DAY.DEPTH 13	0.0865	0.0431	2.01
DAY.DEPTH 15	-0.0142	0.0480	-0.30
DAY.DEPTH 17	0.1515	0.0480	3.15

Estimated odds (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCRG 0		I		II	
Depth						
9-11	2.42	(1.30,4.51)	77.73	(40.00,151.03)	2728.3	(987.2,7540.3)
11-13	0.37	(0.23,0.60)	11.86	(7.10,19.81)	416.4	(165.9,1045.1)
13-15	0.35	(0.22,0.57)	11.22	(6.79,18.52)	393.7	(157.2,986.2)
15-17	0.62	(0.40,0.95)	19.80	(12.28,31.93)	695.2	(280.4,1723.7)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCRG 0		I		II	
Depth						
9-11	0.71	(0.57,0.82)	0.99	(0.98,0.99)	1.00	(1.00,1.00)
11-13	0.27	(0.19,0.38)	0.92	(0.88,0.95)	1.00	(0.99,1.00)
13-15	0.26	(0.18,0.36)	0.92	(0.87,0.95)	1.00	(0.99,1.00)
15-17	0.38	(0.29,0.49)	0.95	(0.92,0.97)	1.00	(1.00,1.00)

Estimated odds (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCRG 0		I		II	
Depth						
9-11	1.71	(0.82,3.57)	54.84	(25.42,118.31)	1925.0	(648.6,5712.8)
11-13	0.20	(0.11,0.37)	6.47	(3.48,12.02)	227.2	(85.6,603.2)
13-15	0.39	(0.21,0.71)	12.39	(6.65,23.09)	435.0	(161.7,1170.0)
15-17	0.21	(0.12,0.39)	.6.86	(3.79,12.42)	240.7	(91.4,633.8)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCRG 0		I		II	
Depth						
9-11	0.63	(0.45,0.78)	0.98	(0.96,0.99)	1.00	(1.00,1.00)
11-13	0.17	(0.10,0.27)	0.87	(0.78,0.92)	1.00	(0.99,1.00)
13-15	0.28	(0.17,0.41)	0.93	(0.87,0.96)	1.00	(0.99,1.00)
15-17	0.18	(0.11,0.28)	0.87	(0.79,0.93)	1.00	(0.99,1.00)

			PCFG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	3	2	1	0	6
9 -11	2	10	3	3	0	0	6
(Pr 10)	23	26	0	6	1	0	7
	26	26	4	3	0	0	7
Total			10	14	2	0	26
	4	5	0	0	6	1	7
	7	16	5	1	0	0	6*
11-13	17	16	3	4	0	0	7
(Pr 5)	20	38	0	7	0	0	7
	69	38	0	5	2	0	7
	76	38	1	5	1	0	7
Total			9	22	9	1	41
	1	37	0	2	3	2	7
	26	37	0	6	1	0	7
13-15	31	37	4	3	0	0	7
(Pr 25)	74	33	3	4	0	0	7
	75	33	0	7	0	0	7
Total			7	22	4	2	35
	4	29	1	2	2	0	5*
	7	6	1	5	1	0	7
15-17	11	34	0	4	3	0	7
(Pr 6)	69	29	1	5	1	0	7
	75	6	0	6	1	0	7
Total			3	22	8	0	33
Total			29	80	23	3	135

Precordial flex grades at the start of each day (excluding the first).

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	132	277.2			
+ diver	119	227.0	13	50.2	(p<0.001)
+ depth	116	205.4	3	21.6	(p<0.001)
+ day	115	205.0	1	0.4	n.s.
+ depth.day	112	199.0	3	6.0	(p=0.11)

Coeffs of depth from second model:

	coeff	se	t
DEPTH 13	5.16	1.78	2.89
DEPTH 15	4.24	0.95	4.46
DEPTH 17	4.95	1.65	3.01

Estimated odds (and 95% confidence interval) of not exceeding a particular grade for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	6.40	(0.84,48.77)	498.85	(41.42,6007.87)	9841.23	(577.81,167615.91)
11-13	0.04	(0.01,0.22)	2.88	(0.58,14.28)	56.79	(7.97,404.45)
13-15	0.09	(0.02,0.47)	7.17	(1.40,36.78)	141.43	(18.90,1058.09)
15-17	0.05	(0.01,0.22)	3.54	(0.88,14.23)	69.84	(11.37,428.96)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	0.86	(0.46,0.98)	1.00	(0.98,1.00)	1.00	(1.00,1.00)
11-13	0.04	(0.01,0.18)	0.74	(0.37,0.93)	0.98	(0.89,1.00)
13-15	0.08	(0.02,0.32)	0.88	(0.58,0.97)	0.99	(0.95,1.00)
15-17	0.04	(0.01,0.18)	0.78	(0.47,0.93)	0.99	(0.92,1.00)

			PCRG			
			0	I	II	Total
Depth	Diver	Trial				
	1	10	4	2	0	6
9 -11	2	10	5	1	0	6
(Pr 10)	23	26	6	1	0	7
	26	26	6	1	0	7
Total			21	5	0	26
	4	5	0	1	6	7
	7	16	6	0	0	6*
11-13	17	16	7	0	0	7
(Pr 5)	20	38	4	3	0	7
	69	38	5	1	1	7
	76	38	5	2	0	7
Total			27	7	7	41
	1	37	0	4	3	7
	26	37	5	1	1	7
13-15	31	37	7	0	0	7
(Pr 25)	74	33	7	0	0	7
	75	33	6	1	0	7
Total			25	6	4	35
	4	29	2	3	0	5*
	7	6	3	3	1	7
15-17	11	34	4	3	0	7
(Pr 6)	69	29	5	2	0	7
	75	6	3	4	0	7
Total			17	15	1	33
Total			90	33	12	135

Precordial rest grades at the start of each day (excluding the first).

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	133	224.1			
+ diver	120	176.0	13	48.1	(p<0.001)
+ depth	117	165.2	3	10.8	(p=0.013)
+ day	116	160.0	1	5.2	(p=0.023)
+ depth.day	113	158.0	3	2.0	n.s.

Coefficients of depth and day from penultimate model:

	coeff	se	t
DAY	0.250	0.113	2.22
DEPTH 13	4.97	1.80	2.77
DEPTH 15	2.46	0.96	2.56
DEPTH 17	4.47	1.65	2.70

Estimated odds (and 95% confidence interval) of not exceeding a particular grade for an "average" diver on day 1 and day 8 of a trial:

	PCRG 0		PCRG I	
	Day 1	Day 8	Day 1	Day 8
Depth				
9-11	108.5 (8.83,1334.0)	18.9 (1.9,192.5)	1344.1 (82.7,21848.7)	233.9 (18.1,3025.1)
11-13	0.76 (0.13,4.50)	0.13 (0.02,0.75)	9.36 (1.44,61.02)	1.63 (0.29,9.28)
13-15	9.29 (1.18,73.2)	1.62 (0.24,10.8)	115.1 (12.4,1067.0)	20.0 (2.7,147.3)
15-17	1.24 (0.25,6.04)	0.22 (0.05,0.99)	15.4 (2.8,85.3)	2.67 (0.56,12.8)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 and day 8 of a trial for an "average" diver:

	PCRG 0		PCRG I	
	Day 1	Day 8	Day 1	Day 8
Depth				
9-11	0.99 (0.90,1.00)	0.95 (0.65,0.99)	1.00 (0.99,1.00)	1.00 (0.95,1.00)
11-13	0.43 (0.11,0.82)	0.11 (0.02,0.43)	0.90 (0.59,0.98)	0.62 (0.22,0.90)
13-15	0.90 (0.54,0.99)	0.62 (0.20,0.91)	0.99 (0.93,1.00)	0.95 (0.73,0.99)
15-17	0.55 (0.21,0.86)	0.18 (0.04,0.49)	0.94 (0.73,0.99)	0.73 (0.36,0.93)

			PCFG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	2	4	1	0	7
9 -11	2	10	1	6	0	0	7
(Pr 10)	23	26	0	4	4	0	8
	26	26	0	6	2	0	8
Total			3	20	7	0	30
	4	5	0	0	1	7	8
	7	16	1	5	1	0	7*
11-13	17	16	1	5	2	0	8
(Pr 5)	20	38	0	6	1	1	8
	69	38	0	7	1	0	8
	76	38	0	1	5	2	8
Total			2	24	11	10	47
	1	37	0	2	6	0	8
	26	37	0	6	2	0	8
13-15	31	37	0	7	1	0	8
(Pr 25)	74	33	0	3	5	0	8
	75	33	0	0	8	0	8
Total			0	18	22	0	40
	4	29	0	2	3	0	5*
	7	6	0	3	3	2	8
15-17	11	34	0	0	7	1	8
(Pr 6)	69	29	0	5	3	0	8
	75	6	0	0	7	1	8
Total			0	10	23	4	37
Total			5	72	63	14	154

Precordial flex grades for the penultimate reading of every day (at circa 30 mins post final dive)

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	151	323.5			
+ diver	138	250.4	13	73.1	p<0.001
+ depth	135	245.5	3	4.9	n.s.
+ day	134	243.5	1	2.0	n.s.
+ depth.day	131	232.5	3	11.0	p = 0.01

Coefficients for day and depth in the final model:

	coeff	se	t
DEPTH 13	3.76	1.90	1.98
DEPTH 15	3.25	1.44	2.26
DEPTH 17	1.15	1.82	0.63
DAY.DEPTH 11	0.259	0.193	1.34
DAY.DEPTH 13	-0.145	0.140	-1.04
DAY.DEPTH 15	-0.040	0.152	-0.27
DAY.DEPTH 17	0.518	0.166	3.13

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	0.09	(0.01,0.46)	0.90	(0.48,0.99)	1.00	(0.97,1.00)
11-13	0.01	(0.00,0.03)	0.31	(0.09,0.69)	0.95	(0.78,0.99)
13-15	0.01	(0.00,0.04)	0.38	(0.11,0.74)	0.96	(0.83,0.99)
15-17	0.02	(0.00,0.09)	0.62	(0.28,0.87)	0.99	(0.93,1.00)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	0.02	(0.00,0.18)	0.58	(0.11,0.94)	0.98	(0.83,1.00)
11-13	0.01	(0.00,0.11)	0.56	(0.15,0.90)	0.98	(0.87,1.00)
13-15	0.01	(0.00,0.08)	0.45	(0.10,0.85)	0.97	(0.82,1.00)
15-17	0.00	(0.00,0.01)	0.04	(0.01,0.25)	0.66	(0.23,0.93)

			PCRG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	5	2	0	0	7
9 -11	2	10	4	3	0	0	7
(Pr 10)	23	26	0	8	0	0	8
	26	26	2	6	0	0	8
Total			11	19	0	0	30
	4	5	0	0	7	1	8
	7	16	3	4	0	0	7*
11-13	17	16	5	3	0	0	8
(Pr 5)	20	38	1	6	1	0	8
	69	38	0	8	0	0	8
	76	38	1	4	2	1	8
Total			10	25	10	2	47
	1	37	0	8	0	0	8
	26	37	0	8	0	0	8
13-15	31	37	2	6	0	0	8
(Pr 25)	74	33	1	7	0	0	8
	75	33	0	4	4	0	8
Total			3	33	4	0	40
	4	29	0	4	1	0	5*
	7	6	0	3	5	0	8
15-17	11	34	0	5	3	0	8
(Pr 6)	69	29	3	5	0	0	8
	75	6	0	2	6	0	8
Total			3	19	15	0	37
Total			27	96	29	2	154

Precordial rest grades for the penultimate reading of every day (at circa 30 mins post final dive)

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	151	299.0			
+ diver	138	223.0	13	75.9	p<0.001
+ depth	135	214.0	3	9.0	p = 0.03
+ day	134	213.2	1	0.8	n.s.
+ depth.day	131	212.1	3	1.1	n.s.

Coefficients for depth in the second model:

	coeff	se	t
DEPTH 13	3.48	1.51	2.31
DEPTH 15	2.32	0.88	2.66
DEPTH 17	3.23	1.34	2.41

Estimated probability (and 95% confidence interval) of not exceeding a particular grade for an "average" diver:

	PCRG					
	0		I		II	
Depth						
9-11	0.51	(0.15,0.86)	0.99	(0.94,1.00)	1.00	(1.00,1.00)
11-13	0.03	(0.01,0.13)	0.79	(0.46,0.95)	0.99	(0.95,1.00)
13-15	0.09	(0.02,0.30)	0.92	(0.76,0.98)	1.00	(0.98,1.00)
15-17	0.04	(0.01,0.13)	0.83	(0.58,0.95)	0.99	(0.97,1.00)

			PCFG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	0	7	0	0	7
9 -11	2	10	1	6	0	0	7
(Pr 10)	23	26	0	2	6	0	8
	26	26	0	7	1	0	8
Total			1	22	7	0	30
	4	5	0	0	1	7	8
	7	16	3	3	0	0	6*
11-13	17	16	0	6	2	0	8
(Pr 5)	20	38	0	3	5	0	8
	69	38	0	4	4	0	8
	76	38	0	2	4	2	8
Total			3	18	16	9	46
	1	37	0	1	7	0	8
	26	37	0	2	5	0	7
13-15	31	37	0	6	2	0	8
(Pr 25)	74	33	0	5	3	0	8
	75	33	0	0	8	0	8
Total			0	14	25	0	39
	4	29	0	0	3	2	5*
	7	6	0	1	6	1	8
15-17	11	34	0	0	7	1	8
(Pr 6)	69	29	0	4	2	2	8
	75	6	0	0	6	2	8
Total			0	5	24	8	37
Total			4	59	72	17	152

Precordial flex grades for the last reading of every day (at circa 60 mins post dive)

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	149	322.9			
+ diver	136	243.2	13	79.7	(p<0.001)
+ depth	133	222.5	3	20.7	(p<0.001)
+ day	132	215.7	1	6.8	(p=0.01)
+ depth.day	129	207.2	3	8.5	(p=0.04)

Coefficients for day and depth in the penultimate model:

	coeff	se	t
DAY	0.215	0.084	2.57
DEPTH 13	2.502	1.606	1.56
DEPTH 15	3.155	0.893	3.53
DEPTH 17	4.285	1.464	2.93

Coefficients for day and depth in the final model:

	coeff	se	t
DEPTH 13	1.61	1.97	0.81
DEPTH 15	3.11	1.42	2.19
DEPTH 17	1.47	1.91	0.77
DAY.DEPTH 11	0.055	0.195	0.28
DAY.DEPTH 13	0.139	0.145	0.96
DAY.DEPTH 15	0.059	0.166	0.36
DAY.DEPTH 17	0.672	0.184	3.64

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	0.06	(0.01,0.41)	0.85	(0.37,0.98)	1.00	(0.98,1.00)
11-13	0.01	(0.00,0.08)	0.50	(0.15,0.85)	0.99	(0.93,1.00)
13-15	0.00	(0.00,0.02)	0.20	(0.04,0.59)	0.96	(0.80,0.99)
15-17	0.00	(0.00,0.03)	0.28	(0.08,0.64)	0.98	(0.86,1.00)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Depth						
9-11	0.04	(0.00,0.44)	0.80	(0.21,0.98)	1.00	(0.96,1.00)
11-13	0.00	(0.00,0.05)	0.27	(0.04,0.75)	0.98	(0.80,1.00)
13-15	0.00	(0.00,0.02)	0.15	(0.02,0.60)	0.95	(0.64,0.99)
15-17	0.00	(0.00,0.00)	0.00	(0.00,0.04)	0.27	(0.05,0.74)

			PCRG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	5	2	0	0	7
9 -11	2	10	4	3	0	0	7
(Pr 10)	23	26	0	8	0	0	8
	26	26	1	7	0	0	8
Total			10	20	0	0	30
	4	5	0	0	6	2	8
	7	16	6	0	0	0	6*
11-13	17	16	4	4	0	0	8
(Pr 5)	20	38	0	7	1	0	8
	69	38	1	6	1	0	8
	76	38	0	3	4	1	8
Total			11	20	12	3	46
	1	37	0	5	3	0	8
	26	37	0	7	0	0	7
13-15	31	37	2	6	0	0	8
(Pr 25)	74	33	2	6	0	0	8
	75	33	0	3	5	0	8
Total			4	27	8	0	39
	4	29	0	3	2	0	5*
	7	6	0	3	4	1	8
15-17	11	34	0	1	7	0	8
(Pr 6)	69	29	1	4	3	0	8
	75	6	0	0	8	0	8
Total			1	11	24	1	37
Total			26	78	44	4	152

Precordial rest grades for the last reading of every day (at circa 60 mins post dive)

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	149	334.1			
+ diver	136	253.0	13	81.1	p<0.001
+ depth	133	235.1	3	17.9	p<0.001
+ day	132	230.4	1	4.7	p = 0.03
+ depth.day	129	221.8	3	8.6	p = 0.04

Coefficients for day and depth in the penultimate model:

	coeff	se	t
DAY	0.173	0.080	2.16
DEPTH 13	2.09	1.49	1.40
DEPTH 15	2.63	0.86	3.08
DEPTH 17	4.12	1.40	2.94

Coefficients for day and depth in the final model:

	coeff	se	t
DEPTH 13	1.37	1.76	0.78
DEPTH 15	4.27	1.35	3.15
DEPTH 17	3.12	1.72	1.81
DAY.DEPTH 11	0.169	0.177	0.95
DAY.DEPTH 13	0.336	0.149	2.26
DAY.DEPTH 15	-0.188	0.160	-1.17
DAY.DEPTH 17	0.431	0.168	2.57

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCRG					
	0		I		II	
Depth						
9-11	0.49	(0.12,0.87)	0.99	(0.89,1.00)	1.00	(1.00,1.00)
11-13	0.15	(0.03,0.47)	0.93	(0.70,0.99)	1.00	(0.99,1.00)
13-15	0.03	(0.00,0.14)	0.67	(0.31,0.91)	0.99	(0.95,0.99)
15-17	0.02	(0.00,0.12)	0.65	(0.30,0.89)	0.99	(0.95,1.00)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCRG					
	0		I		II	
Depth						
9-11	0.23	(0.03,0.77)	0.96	(0.63,1.00)	1.00	(0.99,1.00)
11-13	0.02	(0.00,0.13)	0.55	(0.13,0.91)	0.99	(0.90,1.00)
13-15	0.09	(0.01,0.46)	0.88	(0.51,0.98)	1.00	(0.98,1.00)
15-17	0.00	(0.00,0.01)	0.08	(0.01,0.42)	0.86	(0.47,0.98)

			PCFG				
			0	I	II	III	Total
Depth	Diver	Trial					
	1	10	0	7	0	0	7
9 -11	2	10	1	6	0	0	7
(Pr 10)	23	26	0	2	6	0	8
	26	26	0	7	1	0	8
Total			1	22	7	0	30
	4	5	0	0	1	7	8
	7	16	3	3	0	0	6*
11-13	17	16	0	6	2	0	8
(Pr 5)	20	38	0	3	5	0	8
	69	38	0	4	4	0	8
	76	38	0	2	4	2	8
Total			3	18	16	9	46
	2	2	0	0	2	6	8
13-15	5	2	0	2	4	1	7
(Pr 2	7	18	0	3	3	2	8
& 15)	18	18	0	3	5	0	8
Total			0	8	14	9	31
	1	37	0	1	7	0	8
	26	37	0	2	5	0	7
13-15	31	37	0	6	2	0	8
(Pr 25)	74	33	0	5	3	0	8
	75	33	0	0	8	0	8
Total			0	14	25	0	39
	4	29	0	0	3	2	5*
	7	6	0	1	6	1	8
15-17	11	34	0	0	7	1	8
(Pr 6)	69	29	0	4	2	2	8
	75	6	0	0	6	2	8
Total			0	5	24	8	37
Total			4	67	86	26	183

Precordial flex grades for last reading of day (circa 60 mins post dive) - including old 13-15m profile.

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	180	396.6			
+ diver	165	301.8	15	94.8	p<0.001
+ profile	161	280.7	4	21.1	p<0.001
+ day	160	270.4	1	10.3	p = 0.002
+ profile.day	156	262.3	4	8.1	p = 0.09

Coefficients of day and profile from penultimate model:

	Coeff	se	t	
DAY	0.236	0.075	3.15	
PROFL 5	2.551	1.542	1.65	a
PROFL 2&15	4.366	1.622	2.69	b
PROFL 25	3.100	0.880	3.52	ab
PROFL 6	4.092	1.407	2.91	b

Coefficients from final model:

PROFL 5	1.77	1.89	0.94
PROFL 2	2.46	2.00	1.23
PROFL 25	3.05	1.40	2.18
PROFL 6	1.68	1.82	0.92
DAY.PROFL 10	0.054	0.193	0.28
DAY.PROFL 5	0.141	0.141	1.01
DAY.PROFL 2	0.452	0.191	2.36
DAY.PROFL 25	0.055	0.161	0.34
DAY.PROFL 6	0.580	0.169	3.44

Estimated probabilities (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG					
	0		I		II	
Profile						
10	0.08	(0.01,0.50)	0.89	(0.44,0.99)	1.00	(0.98,1.00)
5	0.01	(0.00,0.08)	0.54	(0.20,0.84)	0.99	(0.93,1.00)
2&15	0.00	(0.00,0.03)	0.24	(0.05,0.65)	0.95	(0.73,0.99)
25	0.00	(0.00,0.04)	0.28	(0.06,0.68)	0.96	(0.78,0.99)
6	0.01	(0.00,0.04)	0.34	(0.12,0.67)	0.97	(0.87,0.99)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG 0		I		II	
Profile						
10	0.06	(0.00,0.52)	0.85	(0.26,0.99)	1.00	(0.95,1.00)
5	0.00	(0.00,0.05)	0.30	(0.06,0.74)	0.96	(0.77,1.00)
2&15	0.00	(0.00,0.00)	0.01	(0.00,0.15)	0.45	(0.06,0.91)
25	0.00	(0.00,0.03)	0.21	(0.03,0.69)	0.94	(0.63,0.99)
6	0.00	(0.00,0.00)	0.01	(0.00,0.07)	0.36	(0.08,0.79)

			PCRG 0	I	II	III	Total
Depth	Diver	Trial					
	1	10	5	2	0	0	7
9 -11	2	10	4	3	0	0	7
(Pr 10)	23	26	0	8	0	0	8
	26	26	1	7	0	0	8
Total			10	20	0	0	30
	4	5	0	0	6	2	8
	7	16	6	0	0	0	6*
11-13	17	16	4	4	0	0	8
(Pr 5)	20	38	0	7	1	0	8
	69	38	1	6	1	0	8
	76	38	0	3	4	1	8
Total			11	20	12	3	46
	2	2	0	0	7	1	8
13-15	5	2	0	0	7	0	7
(Pr 2	7	18	0	6	2	0	8
& 15)	18	18	1	4	3	0	8
Total			1	10	19	1	31
	1	37	0	5	3	0	8
	26	37	0	7	0	0	7
13-15	31	37	2	6	0	0	8
(Pr 25)	74	33	2	6	0	0	8
	75	33	0	3	5	0	8
Total			4	27	8	0	39
	4	29	0	3	2	0	5*
	7	6	0	3	4	1	8
15-17	11	34	0	1	7	0	8
(Pr 6)	69	29	1	4	3	0	8
	75	6	0	0	8	0	8
Total			1	11	24	1	37
Total			27	88	63	5	183

Precordial rest grades for last reading of day (circa 60 mins post dive) - including old 13-15m profile.

Results of ordinal logistic regression:

	df	dev	Δdf	Δdev	
Const	180	402.6			
+ diver	165	293.7	15	108.8	
+ profile	161	273.3	4	20.4	
+ day	160	265.7	1	7.6	
+ profile.day	156	255.7	4	10.0	p = 0.04

Coefficients of day and profile from penultimate model:

	Coeff	se	t
DAY	0.2036	0.0747	2.72
PROFL 5	2.37	1.56	1.53
PROFL 2	4.39	1.67	2.63
PROFL 25	2.58	0.84	3.08
PROFL 6	4.37	1.46	3.00

Coefficients from final model:

	Coeff	se	t
PROFL 5	1.58	1.81	0.88
PROFL 2	3.65	2.00	1.82
PROFL 25	4.21	1.33	3.16
PROFL 6	3.18	1.76	1.81
DAY.PROFL 10	0.167	0.176	0.95
DAY.PROFL 5	0.360	0.151	2.38
DAY.PROFL 2	0.338	0.183	1.84
DAY.PROFL 25	-0.190	0.160	-1.18
DAY.PROFL 6	0.477	0.175	2.72

Estimated probabilities (and 95% confidence interval) of not exceeding a particular grade on day 1 of a trial for an "average" diver:

	PCFG 0		I		II	
Profile						
10	0.52	(0.12,0.90)	0.99	(0.88,1.00)	1.00	(1.00,1.00)
5	0.13	(0.03,0.41)	0.91	(0.67,0.98)	1.00	(0.99,1.00)
2&15	0.02	(0.00,0.14)	0.58	(0.16,0.91)	0.99	(0.96,1.00)
25	0.02	(0.00,0.18)	0.69	(0.29,0.93)	1.00	(0.97,1.00)
6	0.02	(0.00,0.17)	0.62	(0.28,0.88)	1.00	(0.97,1.00)

Estimated probability (and 95% confidence interval) of not exceeding a particular grade on day 8 of a trial for an "average" diver:

	PCFG 0		I		II	
Profile						
10	0.25	(0.03,0.81)	0.96	(0.61,1.00)	1.00	(0.99,1.00)
5	0.01	(0.00,0.10)	0.45	(0.09,0.87)	0.99	(0.92,1.00)
2&15	0.00	(0.00,0.02)	0.11	(0.01,0.57)	0.95	(0.66,0.99)
25	0.11	(0.01,0.52)	0.89	(0.51,0.99)	1.00	(0.99,1.00)
6	0.00	(0.00,0.01)	0.06	(0.01,0.33)	0.89	(0.53,0.98)

PEARL DIVING DATA

FIELD REPORT

BEAU BIBBY

RESEARCH TECHNICIAN

Method

Fieldwork has involved the collection of two types of data; Profiles data - recording of particulars of the dive profile for each day, and Doppler data - recording of Doppler scores from testing done for each day.

1) Profiles data.

The recording of dive profiles since the research started has been carried out primarily with a digital watch and a calibrated depth guage worn by one of the subject divers. Times were recorded on a SEIKO Sports 150 digital watch. These are +/- one minute, as seconds are not recorded. The following times are recorded: time the subject diver leaves the surface on decent, time the ascent signal is given from the boat, and the time the subject diver reaches the surface. From these times the following are calculated:

Bottom time - from start of descent to start of ascent (signalled to the divers from the boat).

Ascent rate - time from leaving the bottom to reaching the surface, minus staging time.

Staging times - time spent decompressing at 9m according to the head diver.

Surface interval - time from surfacing to the start of the next decent.

Maximum depth up until 1993 was recorded on a UWATEC digital depth guage. this guage was tested in the Recompression Chamber at 2m intervals. Correction factors were obtained, and the figures recorded in the field were adjusted accordingly (these correction factors were minor). For 1994 and 1995 maximum depth was recorded on a SUUNTO Solution dive computer. This guage was also tested in the RCC but found to be very accurate - no correction factors were required.

As well as this primary profile recording, over the years we have tried various ways of recording the dive profiles in more detail. The first attempt was with a locally built depth logger designed to log a depth reading every 10 seconds. This piece of equipment was difficult to use, bulky and unreliable, and eventually abandonned. The second attempt was the SUUNTO Solution dive computer. This instrument was not designed for the sort of work we required and had many other functions which made its use difficult. However it did have a log facility which recorded a depth reading every 3 mins. Though this gave a more detailed veiw of the profile than we had before, it was not detailed enough to observe ascent rates and decompression stops effectively. Finally in 1995 we started using an AQUALAND Hyperaqualand dive watch. This instrument is small, simple, and has a log which records a depth reading every 15 seconds. It is very useful for closely examining pearl diving profiles. However a reading every 15 seconds for a whole days diving is a lot of readings - realistically, it's log function can only be used for specific samples of profiles.

2) Doppler Data.

Doppler testing is carried out on pearling boats on a neap by neap basis (a different boat each neap). The divers on a particular pearling vessel are tested throughout a diving neap. Two divers are monitored closely - before, during and after each days diving. These "Subject divers" form the basis of the data collection. They are nominated by the Skipper/Head diver or by agreement among the divers themselves. The "Subject divers" do not change for the duration of the neap. The remaining divers ("Other divers") are only tested at the end of the day, 30 - 70 mins after surfacing from the last dive of the day. Doppler evaluation of "Other divers" is voluntary.
Set testing schedules were developed, for the subject divers, for each type of diving - rotation/non rotation diving.
These are set out on the following page:

a) No Rotation

Schedule 1

- Predive : immediately before the first dive for the day.
- Post-dive 2: 10 - 15 mins after surfacing from the 2nd dive.
- Post-dive 4: 10 - 15 mins after surfacing from the 4th dive.
- Post-dive 6: 10 - 15 mins after surfacing from the 6th dive.
- Post-dive 8: 10 - 15 mins after surfacing from the 8th dive.
- 1st Final: 30 - 40 mins after surfacing from the last dive for the day.
- 2nd Final: 60 - 70 mins after surfacing from the last dive for the day.

Schedule 2

- Predive : immediately before the first dive for the day.
- Post-dive 1: 10 - 15 mins after surfacing from the 1st dive.
- Post-dive 3: 10 - 15 mins after surfacing from the 3rd dive.
- Post-dive 5: 10 - 15 mins after surfacing from the 5th dive.
- Post-dive 7: 10 - 15 mins after surfacing from the 7th dive.
- Post-dive 9: 10 - 15 mins after surfacing from the 9th dive.
- 1st Final: 30 - 40 mins after surfacing from the last dive for the day.
- 2nd Final: 60 - 70 mins after surfacing from the last dive for the day.

The two subject divers each started with a different schedule on day one (either 1 or 2) and swapped each day for the rest of the neap.

b) Rotation - two teams

- Predive: immediately before the first dive for the day.
- Postdive __ : 30 - 40 mins after surfacing from every dive during the day.
  "
  "
  "
- 1st Final: 30 - 40mins after surfacing from the last dive for the day.
- 2nd Final: 60 - 70 mins after surfacing from the last dive for the day.

Both divers were tested every day by this schedule.

Achieving these schedules depended on the cooperation of the divers involved. If the divers refused to do the full schedule, only part results were obtained. The use of these schedules for non-rotation dives commenced at the start of the 1993 drift diving season. During 1992 a single subject diver was tested after the third and seventh dives during the day (readings at the start and end of the day as above). Rotation dives as above.

Readings were taken from two sites; Precordial, and Subclavian (both left and right veins). Readings before and during diving activities were generally restricted to the precordial site because of restrictions in diving dress (wetsuits) which generally remain on the diver during surface intervals. Both precordial and subclavian readings were done at the end of the day and before diving when wetsuits are removed. All evaluations were scored using the Kisman/Masurel code.
Subject information questionaires were filled out during the neap. (same questionaires as used for RCC trials).

Results

The Doppler study on pearl diving activities in the field commenced in earnest in 1992 (1991 pilot year). Since then we have carried out 2198 Doppler evaluations, on 51 different divers, over four season of drift diving. During this time the drift diving profiles used by the pearling industry, have changed sustantially, mainly as a result of our testing program in the RCC, but also our testing at sea. The nature of this change has been highly specific. The oxygen decompression system employed by the industry is where the vast majority of the changes have been made. Major decreses in bottom time (and thus profitability have so far been avoided). The tables below illustrate the changes:

Total Bottom Times (mins) 1991 - 1995

PROFILE	1991	1992	1993	1994	1995	% Change
11	500	500	500	500	500	0
13	500	500	500	500	500	0
15	450	450	450	450	450	0
17	400	400	400	400	400	0
19	400	400	400	400	400	0
21	360	360	360	360	360	0
23	360	360	360	320	320	-11
25	200	200	200	200	200	0
27	175	175	175	175	175	0
29	150	150	150	150	150	0
31	125	125	125	125	125	0
33	125	125	125	125	125	0
35	100	100	100	100	100	0

Table 1/ The total bottom time for a full days diving for each profile from 1991 to 1995.

Total Oxygen Decompression (mins) at 9m 1991 - 1995

PROFILE	1991	1992	1993	1994	1995	% Change
11	0	0	25	25	25	0 to 25mins
13	0	0	30	30	30	0 to 30mins
15	10	10	25	30	35	250
17	10	15	40	40	40	300
19	20	30	60	60	60	200
21	20	45	80	80	80	300
23	30	100	100	140	140	367
25	50	50	50	60	60	20
27	75	75	75	75	75	0
29	75	75	75	75	75	0
31	90	90	90	90	90	0
33	90	90	90	90	90	0
35	70	70	70	70	70	0

Table 2/ Total oxygen decompression at 9m for a full days diving for each profile from 1991 to 1995.

Alterations to other profile characteristics since 1991 have been confined to the ascent rates on a few specific profiles. The original profiles deeper than 15m required a very slow ascent from the final decompression stop : 2mins/m for the 17m, 19m, and 21m profiles, and 3mins/m for the 23m profile. These ascents are now all 3m/min.

Virtually all the changes to these profiles were made before the start of the 1993 drift diving season. There have been increases to oxygen decompression times in only two non-rotation profiles (15m and 23m profiles) since then.

The purpose of this analysis is to summarise each years data, to see if the changes made to the profiles since 1992 (unfortunately we have no data for 1991) have made a difference to the Doppler grades recorded at sea. The data from 1993, 1994 and 1995, has also been combined and analysed as a single set to look specifically at the non-rotation profiles which have not changed since 1993. Unfortunately the lack of data on rotation diving, and the virtual absence of changes to these profiles makes an analysis of this set difficult and probably pointless.

In any analysis it must be emphasized that the doppler data recorded at sea over the past 4 years is not to any statistical design. It is merely a record which follows the movements of the pearling boats in their normal fishing operations each year, and is subject to the same changes in the seemingly endless list of variables which affect the readings , predictable and otherwise. It follows then that this data can not really be analysed in a terribly thorough, mathematical way as with the RCC data. Its use lies in illustrating broad trends over longer periods of time with much larger data sets.

The datasets we have accumulated for each year are certainly large, however the inadequacies of even this ammount of data are soon evident when you start breaking things down. Most of the fishing in the last 4 years has been done at the shallow end of the non-rotation profiles - 11m, 13m, and 15m profiles. Hence we have quite good datasets on these three profiles since 1992, with the exception of the 11m profile which unfortunately was not covered during 1992, making before and after comparisons impossible. For deeper non - rotation profiles the picture becomes far more sketchy, with in many cases hopelessly small or biased (few divers) datasets. Despite this there are in some cases interesting trends among these profiles from year to year.

The Analyses

Page 1/ Data from each year is first presented as a total data set, with the depths dived in rough categories. The data represents every doppler reading taken for that year divided only into Precordial rest and Precordial flex scores.

Page 2/ The total data set from page 1 has been divided up according to when the doppler readings were taken. There are three discrete types of reading taken during the course of a diving day. "Predive" readings are those taken before diving starts, having done no diving for around 12 hrs (day before). If adequate decompression has taken place the day before, the readings after 12 hrs on the surface should be quite low. "Day" readings are taken during the surface intervals between dives. Due to the short time on the surface before the reading in rotation profiles (usually 10 - 15 mins) these should be of limited significance. It is interesting to note however that grades greater than II+ have been recorded in Day readings from all years. "End of Day" readings are those taken at half an hour and an hour after surfacing at the end of each day. For the next two pages the "Predive" and "End of Day" readings are combined to form one dataset - "Final" readings. They are both essentially readings after the last dive. Separately the sample size is reduced (the "Predive" subset is always small) and the analysis further complicated. The "Day" subset is usually still larger than the other two combined.

Page 3/ The percentage of grades greater than II+ for each neap is displayed alongside a distibution of depth categories for each neap, for "Day" and "Final" readings. Changes in depths dived often produce a corresponding change in the level of grades. The boats tend to concentrate on a particular area for the majority of a neap so often neaps reflect depth quite well. The compostite 1993, 1994 and 1995 series does not have this analysis as there is little continuity in depth between the same neaps of different years, and such a treatment just muddles things up.

Pages 4 and 5/ The last two pages show graphs of the whole seasons data divided into respective profiles. Page 4 shows the Precordial rest and flex subsets of the "Day" readings. Page 5 shows the Precordial rest and flex subsets of the "Final" readings. This is probably the most useful way of looking at the data, however when interpreting the graphs one must be careful to consider the sample size of each profile. As stated previously, appart from the 11m, 13m, and 15m profiles, sample sizes are generally too small and inenevitably cover a small number of divers (usually 2 or 3).

Discussion

Though the first pages of each booklet provide useful background information about each years work, the real "nuts and bolts" are contained in the profile graphs in the last two pages. This is where this brief discussion will concentrate - on "before and after" comparisons of profiles, as they have changed, from 1992 onwards.

Before and After

For the 11m profile unfortunately no data is available from 1992 for comparison. However in the composite sample (Figures 56 and 57) 0% of the rest grades, and 17% of the flex grades of the "Final" subset were greater than II+. Of the flex grades only 2% were the higher grade III's.

For the 13m profile the highest grade scored in both before and after datasets was III. In the "Final" readings datasets (Figures 11,12,56,57) the improvement in grades is clear. In 1992 (Figures 11 and 12) the frequency of grades greater than II+ was 14.5% of rest, and 34% of flex readings. For the composite dataset (figures 56 and 57) the frequency of grades greater than II+ was 3% at rest and 21% for flex. The frequency of flex readings of the higher grade III bubbles dropped from 20% of the 1992 sample to just 6% of the composite sample.

The 15m profile has evolved through a number of changes over the 4 years. By far the biggest change was the initial increase in total oxygen decompression by some 150% between 1992 and 1993. In the field in 1992 (Figures 11 and 12), 13% of the rest grades, and 27% of the flex grades from "Final" readings were greater than II+. In 1993 (Figures 23 and 24) 4% of the rest grades and 22% of the flex grades from "Final"readings were greater than II+. The frequency of flex readings of the higher grade III bubbles dropped from 17% of the 1992 sample to just 4% of the composite sample. Since 1993 the 15m profile has had 5 mins added to the total oxygen decompression time each year as a result of work in the RCC. The result of these further smaller changes is less clear (Figures 35,36,47 and 48) and though the incidence of the higher grade III's still remains relatively low 2% in 1994 (Figure 36) and 10% in 1995 (Figure 48) the comparisons suffer a bit from the relatively small sample size.

The 17m and 19m profiles are inadequately represented in all years data to be able to make comparisons of before and after. These depths are seldom dived as the main pearlshell grounds lie in the shallow water (10 - 15m 80 mile beach), the mid water (around 20m at the Lacepedes), and the deep water (Compass Rose 30m+).

The 21m profile unfortunately also suffers from small sample size. In this profile the oxygen staging has been increased by 300% since 1992. However other aspects of this profile have also changed during this time. The final staging was originally followed by a very slow ascent to the surface (2m/min). This is now the standard 3m/min. In 1992 (Figures 11 and 12), 21% of the rest, and 32% of the flex readings of the "Final" subset were greater than II+. In 1995 (Figures 48 and 49), 17% of the rest, and 47% of the flex readings of the "Final" subset were greater than II+. However most of the flex readings from 1995 were III-. Though the sample sizes are very small, the readings done during 1993 (Figures 23 and 24) are very interesting. This year was the first year the increased oxygen times were used, and the divers on this boat, out of habit, continued using the slow ascent (2min/m) after the last decompression stop as well. Of the few readings recorded in the "final" subset for this year none were greater than grade II (either rest or flex). In 1994 the slow ascent dissappeared and was replaced with the standard 3m/min.

The 23m profile has almost never been used while we have conducted the research.

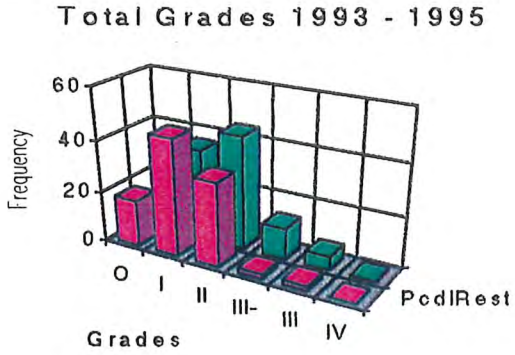
The deep water rotation profiles were only dived substantially in 1992. There has been only one minor alteration to one of these profiles since then (25m).

SUMMARY OF FIELD WORK

1993, 1994 AND 1995 Combined

1993, 1994, 1995 Combined Fieldwork

During drift diving operations in 1993, 1994 and 1995, 1554 doppler evaluations were carried out on 31 different divers over sixteen fishing neaps. Of all the Doppler tests done in the field over these years, 96% of the precodial rest and 82% of the precordial flex readings were grade II or less. This "Total" data set is simply every grade recorded during the fieldwork for these three years.



Total Grade Frequency (%) 1993, 1994 and 1995.		
Grade	*Rest*	*Flex*
O	18	2
I	45	36
II	33	44
III-	2	12
III	2	5
IV	0	0
n	1554	1554

Figure 49/ Of all the Doppler tests done in the field during 1995, 96% of the precodial rest and 82% of the precordial flex readings were grade II or less.

Note: "Minus" and "plus" grades are rounded to nearest whole grade except for grade III- (eg: II- counted as II).

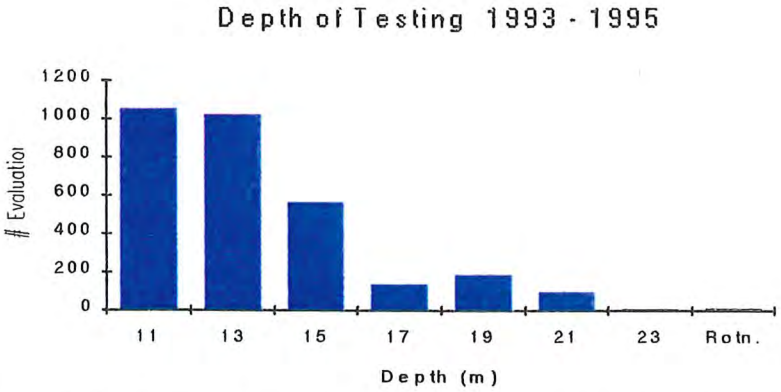
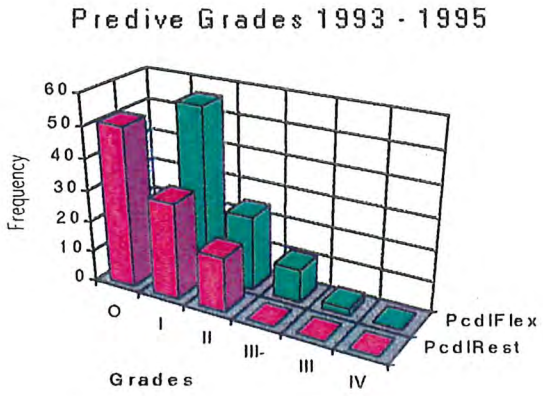


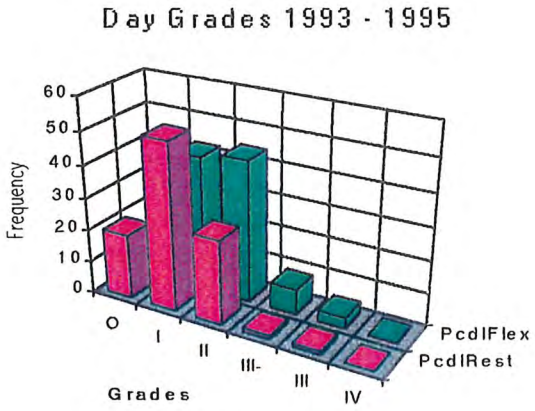
Figure 50/ Of the 3120 man-dives over which Doppler testing was carried out during these years, the majority were less than 15m depth.

The "Total" data set can be divided into three subsets based on when readings are taken. Doppler evaluations are done on subject divers at the start of each day before diving (Predive readings), after various dives during surface intervals (Day readings), and after the last dive of the day (End of Day readings).



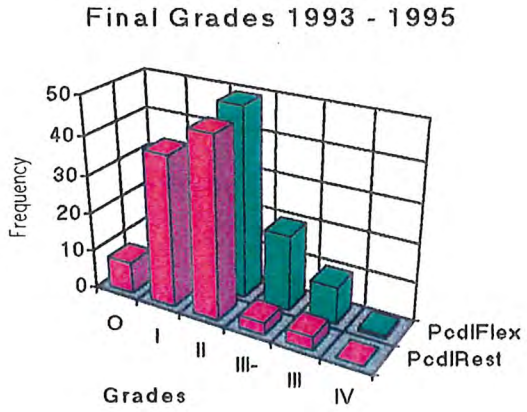
Predive Grade Frequency (%)		
Grade	*Rest*	*Flex*
O	51	8
I	31	56
II	18	24
III-	0	11
III	0	2
IV	0	0
n	208	208

Figure 51/ 82% of Predive rest readings and 64% of Predive flex readings were either O or I. None of the precordial rest readings of the Predive subset were higher than grade II, but 13% of precordial flex readings were grade III- or III.



Day Grade Frequency (%)		
Grade	*Rest*	*Flex*
O	20	3
I	52	42
II	26	44
III-	1	8
III	1	3
IV	0	0
n	806	806

Figure 52/ 98% of rest readings, and 89% of flex readings taken in surface intervals during the day were grade II or less.



End of Day Grade Frequency (%)		
Grade	*Rest*	*Flex*
O	8	1
I	39	20
II	46	49
III-	3	19
III	3	9
IV	0	1
n	540	540

Figure 53/ 93% of rest readings, and 70% of flex readings taken after the last dive were grade II or less.

The following series of graphs represent the fieldwork data divided into respective profiles. This is possibly the most useful way of compiling the fieldwork data but one must still be careful in interpreting the graphs to pay attention to the sample size of each profile.

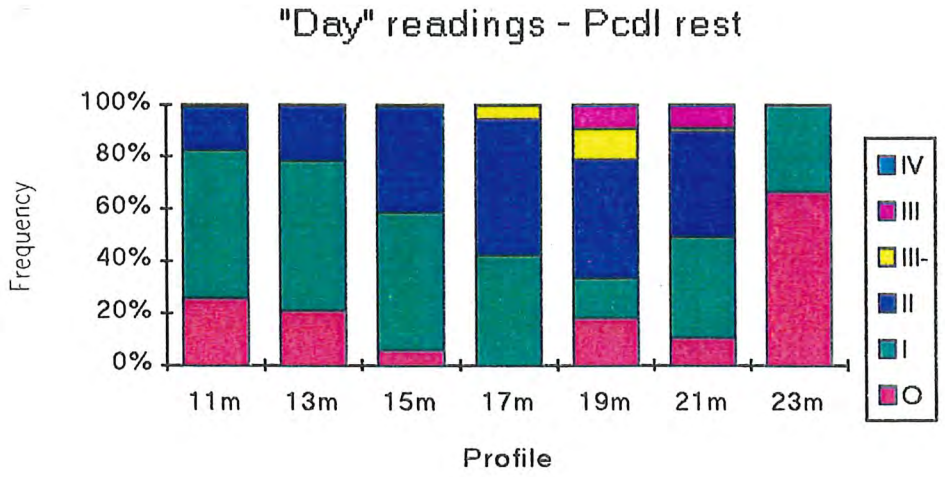


Figure 54/ In the 3 year "Day/Rest" dataset there appears to be a gradual increase in grades with increasing depth. A decrease in grades towards the 23m profile is suggested, however the 23m dataset for these years comprises only six readings.

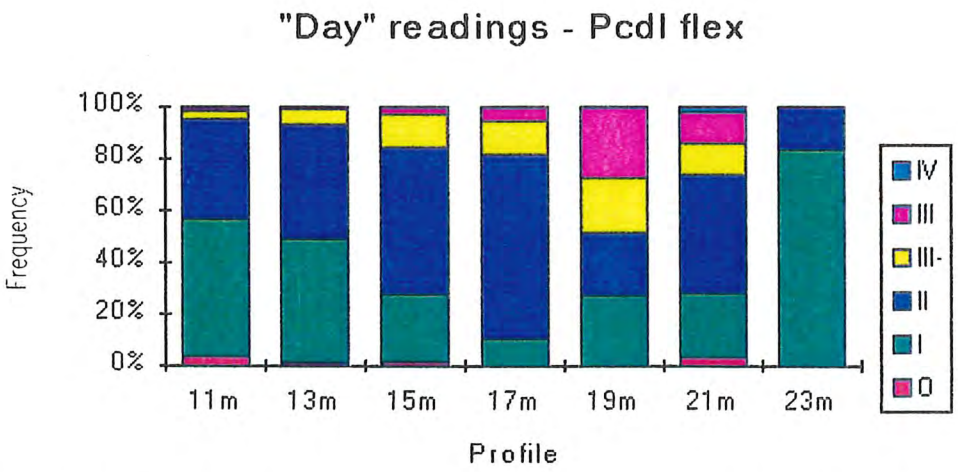


Figure 55/ The same trend is evident in the "Day/Flex" dataset (as in Fig. 54) but off a higher base. In the "Day" readings subset for the 3 year sample, the 19m profile resulted in the highest grades.

Tally of precordial rest grades recorded from each profile for readings during the day.

	11m	*13m*	*15m*	*17m*	*19m*	*21m*	*23m*
O	76	63	7	0	6	6	4
I	166	170	61	16	5	22	2
II	49	64	47	20	15	23	0
III-	2	0	1	2	4	1	0
III	1	1	0	0	3	5	0
IV	0	0	0	0	0	0	0
n	294	298	116	38	33	57	6

Tally of precordial flex grades recorded from each profile for readings during the day.

	11m	*13m*	*15m*	*17m*	*19m*	*21m*	*23m*
O	11	4	2	0	0	2	0
I	155	142	30	4	9	14	5
II	114	132	66	27	8	26	1
III-	10	18	15	5	7	7	0
III	4	2	3	2	9	7	0
IV	0	0	0	0	0	1	0
n	294	298	116	38	33	57	6

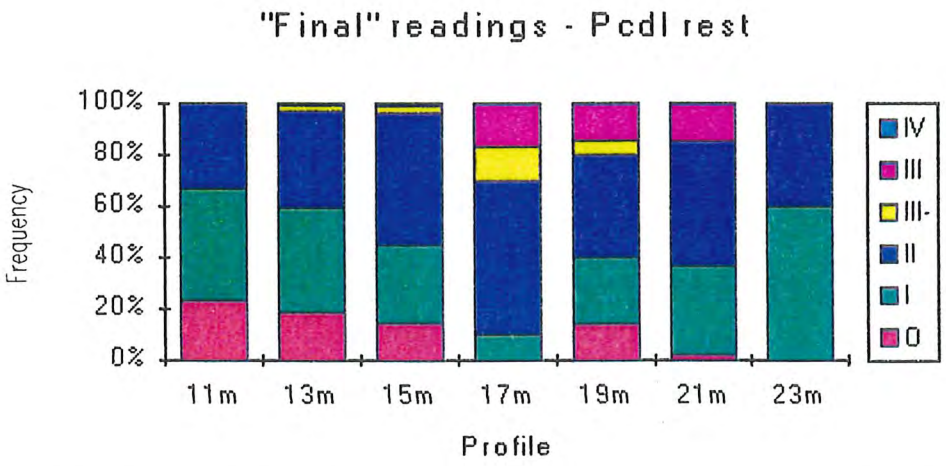


Figure 56/ In the 3 year "Final/Rest" dataset there again appears to be a gradual increase in grades with increasing depth.

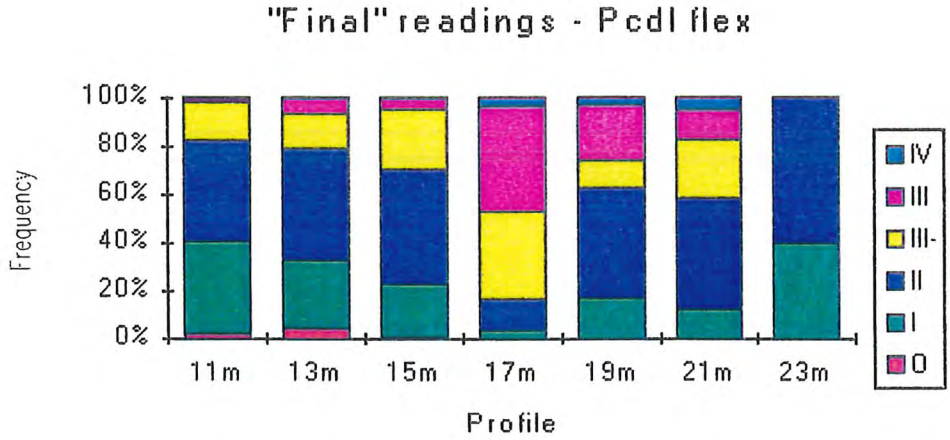


Figure 57/ The same trend is evident in the "Final/Flex" dataset (as in Fig. 56) but again off a higher base. In the "Final" readings subset for the 3 year sample, the 17m profile resulted in the highest grades.

Tally of precordial rest grades recorded from each profile for Final readings.

	11m	*13m*	*15m*	*17m*	*19m*	*21m*	*23m*
O	40	56	16	0	5	1	0
I	75	121	33	3	9	14	3
II	57	112	56	18	14	20	2
III-	0	7	3	4	2	0	0
III	0	2	1	5	5	6	0
IV	0	0	0	0	0	0	0
n	172	298	109	30	35	41	5

Tally of precordial flex grades recorded from each profile for Final readings.

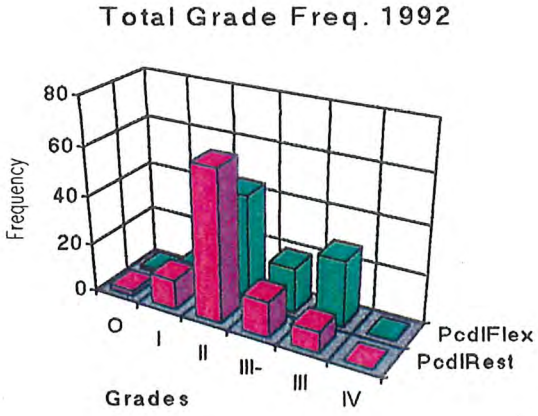
	11m	*13m*	*15m*	*17m*	*19m*	*21m*	*23m*
O	4	13	1	0	0	0	0
I	66	85	24	1	6	5	2
II	72	138	52	4	16	19	3
III-	27	43	27	11	4	10	0
III	3	19	5	13	8	5	0
IV	0	0	0	1	1	2	0
n	172	298	109	30	35	41	5

SUMMARY OF FIELD WORK

1992

1992 Fieldwork

During the drift diving season of 1992, 644 Doppler evaluations were carried out on 35 different divers over eight fishing neaps. Of all the Doppler tests done in the field during 1992, 76% of the precodial rest and 55% of the precordial flex readings were grade II or less. This "Total" data set is simply every grade recorded during the 1992 fieldwork.



Total Grade Frequency (%) 1992		
Grade	*P.Rest*	*P.Flex*
O	2	2
I	12	9
II	62	44
III-	15	19
III	9	27
IV	0	0
n	644	644

Figure 1/ Of all the Doppler tests done in the field during 1992, 76% of the precodial rest and 55% of the precordial flex readings were grade II or less.
Note: "Minus" and "plus" grades are rounded to nearest whole grade except for grade III- (eg: II- counted as II).

No grade IV's were recorded during 1992.

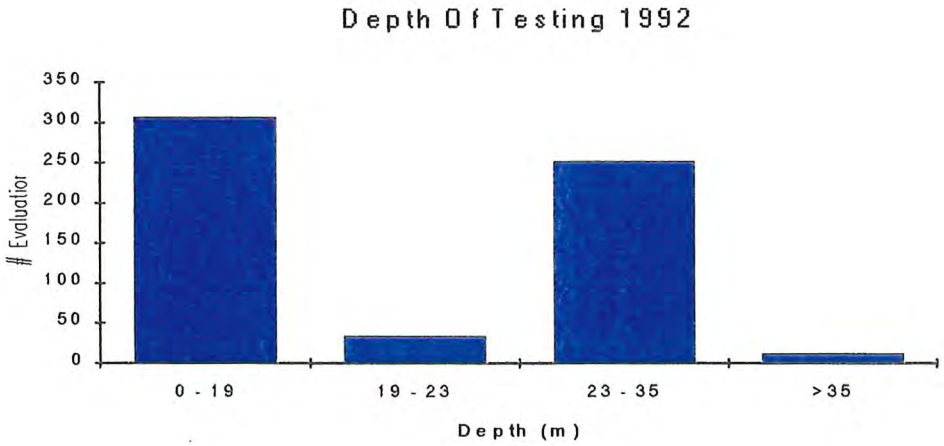
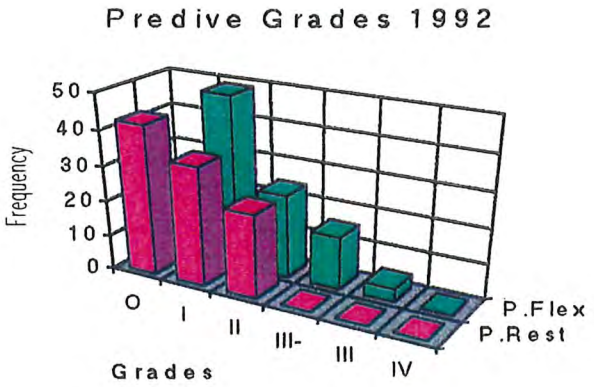


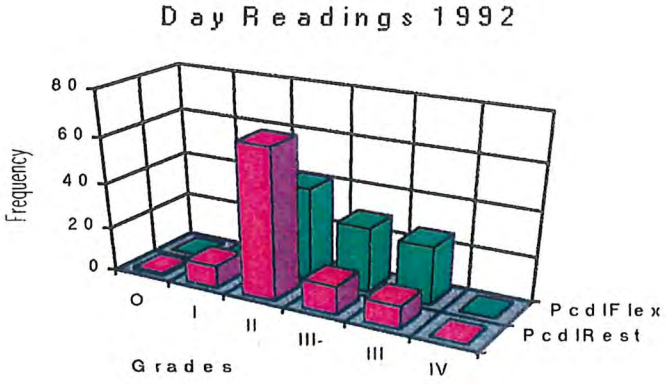
Figure 2/ Of the 644 Doppler readings carried out during the 1992 Drift diving season, A significant number were done while rotation diving between 23 and 35 metres. Though far more diving was done on non-rotation profiles, the long surface intervals involved in rotation diving allow two readings to be done during the surface intervals of most dives, thus increasing the number of doppler readings per day.

The "Total" data set can be initially divided into three subsets based on when readings are taken. Doppler evaluations are done on subject divers at the start of each day before diving (Predive readings), after various dives during surface intervals (Day readings), and after the last dive of the day (End of the Day readings).



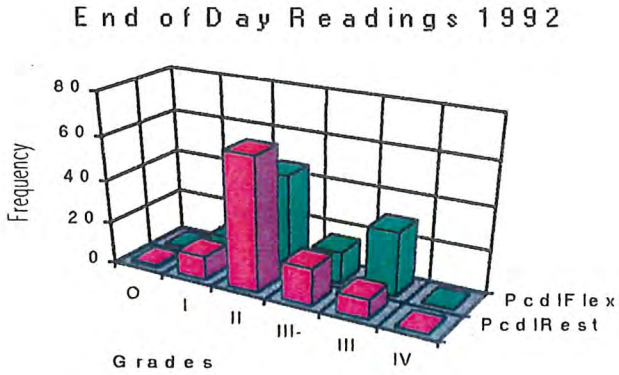
Predive Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	43	9
I	34	49
II	24	24
III-	0	15
III	0	4
IV	0	0
n	57	57

Figure 3/ 77% of Predive rest readings, and 58% of Predive flex readings were either O or I. None of the precordial rest readings of the Predive subset were higher than grade II, but 19% of precordial flex readings were grade III- or III.



Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	1	0
I	10	5
II	66	41
III-	13	29
III	10	26
IV	0	0
n	199	199

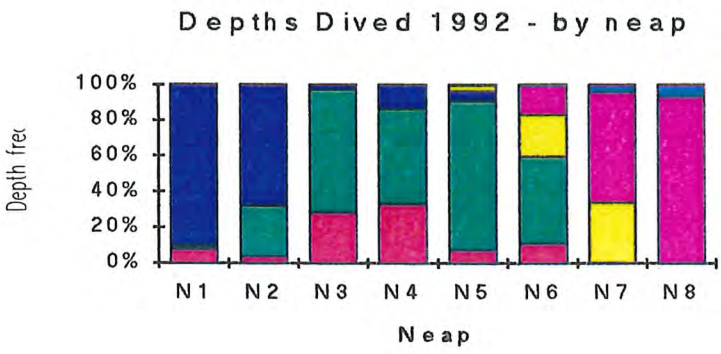
Figure 4/ The distribution of grades from readings during the day is quite different to the 3 following years. This is mostly because of the large number of high "day" readings from rotation diving in the last 3 neaps, but is perhaps also due to the virtual absence of oxygen staging during the day in most of the early non-rotation profiles.



Final Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	1	0
I	11	10
II	62	46
III-	17	15
III	9	29
IV	0	0
n	388	388

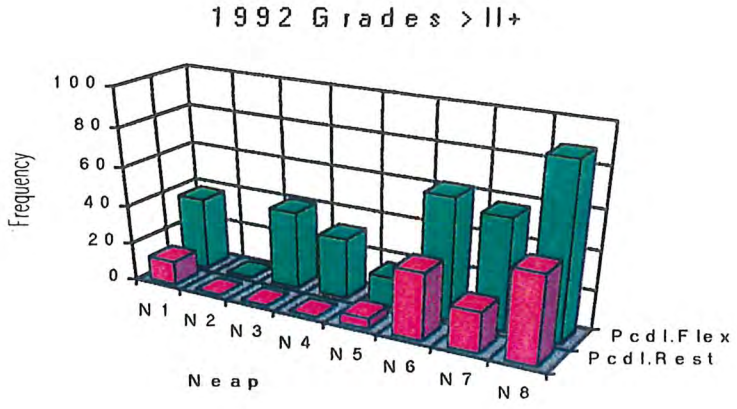
Figure 5/ 74% of rest readings, and 56% of flex readings taken after the last dive were grade II or less. 44% of precordial flex readings from this subset were grade III- or III.

The data can also be divided into respective neaps. This may be useful in following variations in grades with variations in depth, however when veiwing these graphs one must keep in mind that each neap represents readings from two different divers.



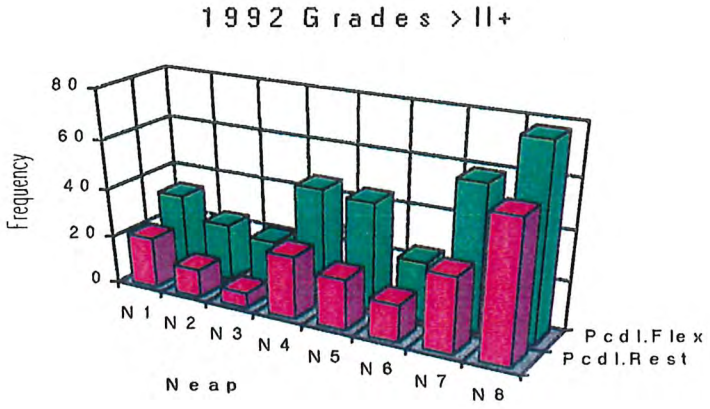
Number of readings done in following depth categories:						
	11m	*15m*	*23m*	*29m*	*35m*	*35+*
N1	4	1	46	0	0	0
N2	1	7	17	0	0	0
N3	21	51	2	0	0	0
N4	24	38	10	0	0	0
N5	4	44	3	2	0	0
N6	10	43	0	21	15	0
N7	0	0	0	50	91	6
N8	0	0	0	0	71	5
Tot	64	184	78	73	177	11

Figure 6/ Depths from which doppler readings came during the eight fieldwork neaps of 1992. A wide range of depths were covered during 1992, reflecting the scarce nature of the distribution of shell relative to susequent years.



Frequency (%) of "Day" grades greater than II+		
Neap	*Rest*	*Flex*
N1	13	38
N2	0	0
N3	0	40
N4	0	31
N5	5	16
N6	34	62
N7	21	57
N8	45	88

Figure 7/ Percentage of "Day" reading grades recorded from each neap that were greater than II+ . As could be expected, large numbers of grades greater than II+ were scored during the long surface intervals of rotation dives from the last three neaps. While relatively few grades greater than II+ were scored from rest reading of other neaps, flex readings greater than II+ were generally around 30 - 40%. Neap 2 is an interesting anomaly.



Frequency (%) of "Final" grades greater than II+

Neap	*Rest*	*Flex*
N1	21	33
N2	12	24
N3	6	20
N4	26	46
N5	21	44
N6	15	24
N7	31	59
N8	57	77

Figure 8/ The percentages of "Final" reading grades recorded from each neap that were greater than II+ were substantial, ranging from 20% ("flex" readings neap 3), to 77% ("flex" readings neap 8).

The following series of graphs represent the fieldwork data for the whole season divided into respective profiles. This is possibly the most useful way of compiling the fieldwork data but one must still be careful in interpreting the graphs to pay attention to the sample size of each profile.

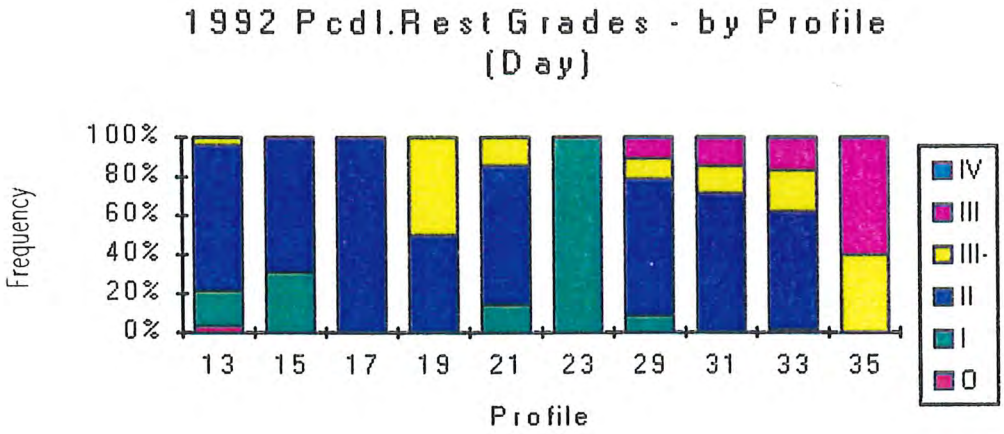


Figure 9/ Precordial rest readings from the "Day" subset appear to increase gradually with an increase in profile depth. The frequency of grades III- and higher is substantial over 19m (note sample sizes of 19m and 23m profile sets are 2 and 1 readings respectively). Even in the 13m profile grades O and I account for only 22% of the subset.

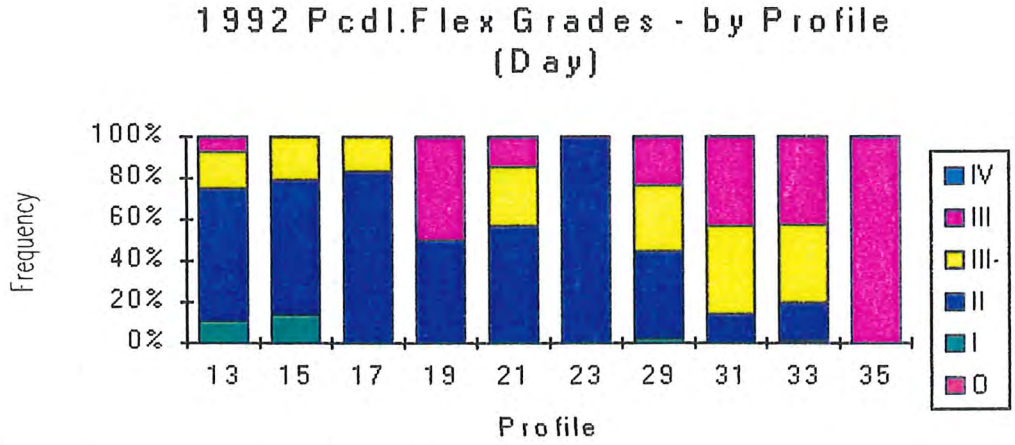


Figure 10/ As with the precordial rest grades, precordial flex grades in the "Day"subset appear to increase slightly with increasing profile depth, however off a much higher base. Grades O and I account for less than 15% of "flex" readings from readings during the day for the 13 and 15m profiles. All other profiles have virtually no grades lower than II.

Tally of precordial rest grades recorded from each profile for readings during the day

	13	*15*	*17*	*19*	*21*	*23*	*29*	*31*	*33*	*35*
O	1	0	0	0	0	0	0	0	1	0
I	5	9	0	0	1	1	4	0	0	0
II	21	20	6	1	5	0	33	5	40	0
III-	1	0	0	1	1	0	5	1	14	2
III	0	0	0	0	0	0	5	1	11	3
IV	0	0	0	0	0	0	0	0	0	0
n	28	29	6	2	7	1	47	7	66	5

Tally of precordial flex grades recorded from each profile for readings during the day.

	13	*15*	*17*	*19*	*21*	*23*	*29*	*31*	*33*	*35*
O	0	0	0	0	0	0	0	0	0	0
I	3	4	0	0	0	0	1	0	1	0
II	18	19	5	1	4	1	20	1	12	0
III-	5	6	1	0	2	0	15	3	25	0
III	2	0	0	1	1	0	11	3	28	5
IV	0	0	0	0	0	0	0	0	0	0
n	28	29	6	2	7	1	47	7	66	5

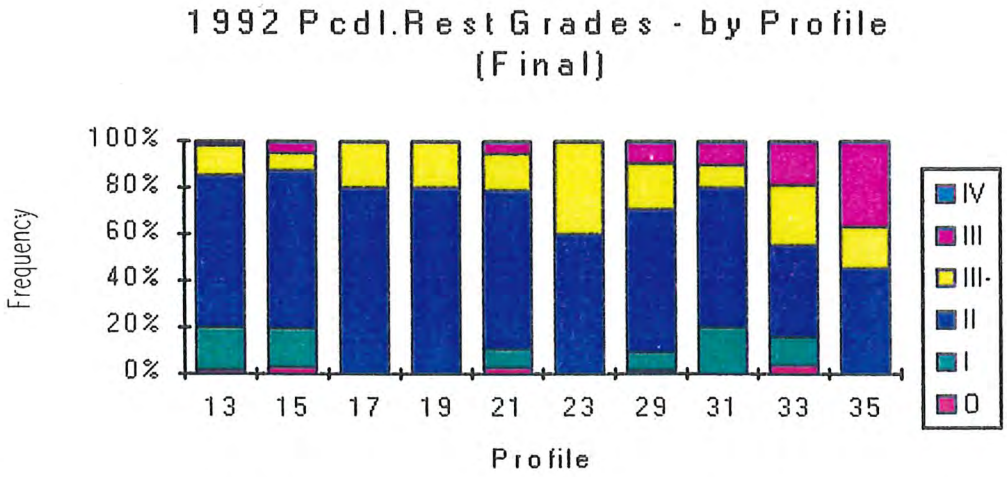


Figure 11/ A trend of grades gradually increasing with depth is less evident in the "final" readings, except for the increase in grades greater than II+ in the rotation profiles. Lower grades (O and I) are again poorly represented.

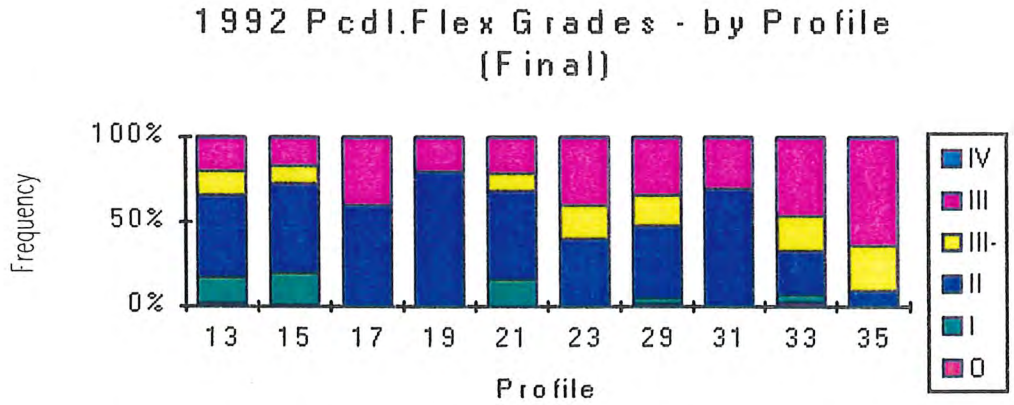


Figure 12/ Significant levels of grade III bubbles in "final" "flex" readings were observed from all profiles during 1992, ranging from 16% (15m profile) to 64% (35m profile).

Tally of precordial rest grades recorded from each profile for "Final" readings

	13	*15*	*17*	*19*	*21*	*23*	*29*	*31*	*33*	*35*
O	2	3	0	0	1	0	1	0	3	0
I	20	17	0	0	3	0	5	2	9	0
II	72	70	8	4	26	3	40	6	30	5
III-	14	8	2	1	6	2	13	1	20	2
III	2	5	0	0	2	0	6	1	14	4
IV	0	0	0	0	0	0	0	0	0	0
n	110	103	10	5	38	5	65	10	76	11

Tally of precordial flex grades recorded from each profile for "Final" readings

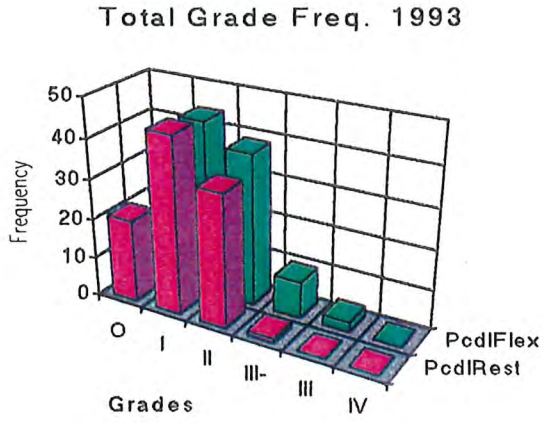
	13	*15*	*17*	*19*	*21*	*23*	*29*	*31*	*33*	*35*
O	2	1	0	0	0	0	1	0	2	0
I	17	19	0	0	6	0	2	0	3	0
II	54	55	6	4	20	2	28	7	20	1
III-	16	11	0	0	4	1	12	0	16	3
III	22	17	4	1	8	2	22	3	35	7
IV	0	0	0	0	0	0	0	0	0	0
n	111	103	10	5	38	5	65	10	76	11

SUMMARY OF FIELD WORK

1993

1993 Fieldwork

During the drift diving season of 1993, 474 Doppler evaluations were carried out on 17 different divers over 5 fishing neaps. Of all the Doppler tests done in the field during 1993, 99% of the precordial rest and 90% of the precordial flex readings were grade II or less. This "Total" data set is simply every grade recorded during the 1993 fieldwork.



Total Grade Frequency (%) 1993		
Grade	*P.Rest*	*P.Flex*
O	21	6
I	44	44
II	33	38
III-	1	9
III	0	2
IV	0	0
n	474	474

Figure 13/ Of all the Doppler tests done in the field during 1993, 99% of the precodial rest and 90% of the precordial flex readings were grade II or less. In both rest and flex readings more than 70% were grade I or II.
Note: "Minus" and "plus" grades are rounded to nearest whole grade except for grade III- (eg: II- counted as II).

No grade IV's were recorded during 1993.

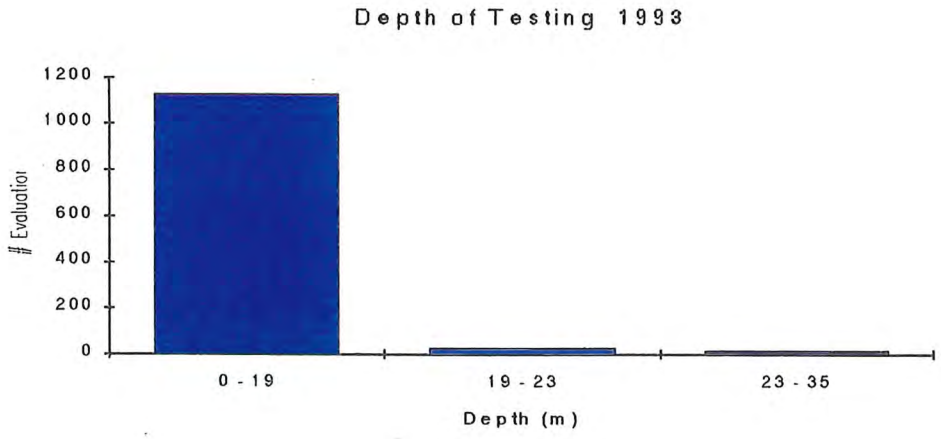
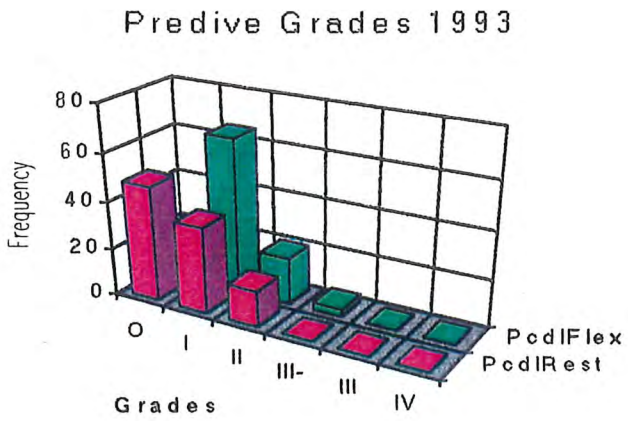


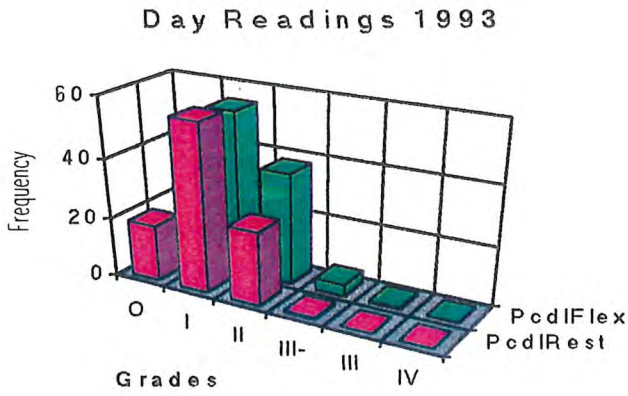
Figure 14/ Of the 1165 man dives over which Doppler tests were carried out during the 1993 Drift diving season, the vast majority were shallower than 19m. Dives between 19 and 23m were done during neap 1 off Cape Bossut, and 14 man dives were done using rotation profiles between 23 and 35m in the second neap.

The "Total" data set can be initially divided into three subsets based on when readings are taken. Doppler evaluations are done on subject divers at the start of each day before diving (Predive readings), after various dives during surface intervals (Day readings), and after the last dive of the day (End of Day readings).



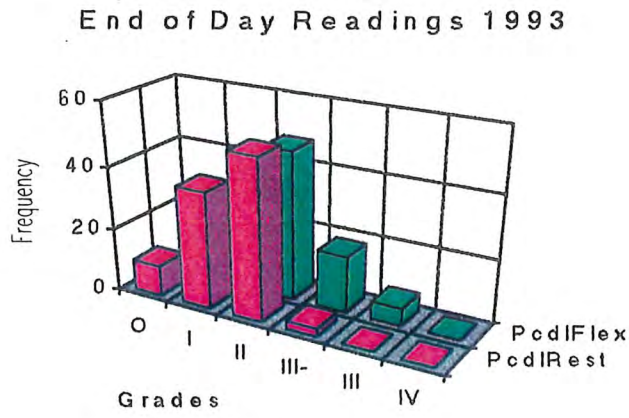
Predive Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	48	12
I	36	65
II	15	20
III-	0	3
III	0	0
IV	0	0
n	66	66

Figure 15/ 100% of the precordial rest and 97% of the precordial flex readings recorded "Predive" during 1993 were grade II or less.



Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	19	4
I	56	55
II	25	37
III-	0	4
III	0	0
IV	0	0
n	211	211

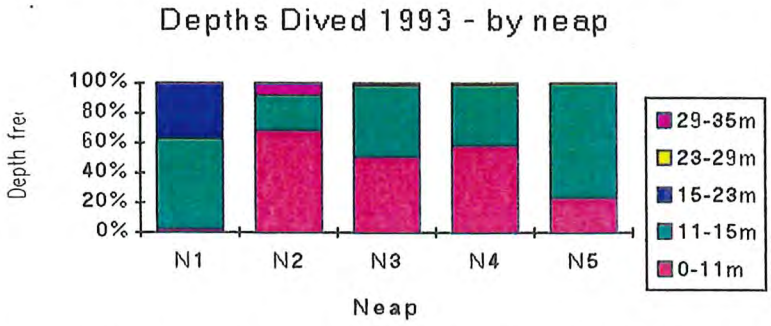
Figure 16/ 100% of rest readings, and 96% of flex readings taken in surface intervals during the day were grade II or less.



End of Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	10	3
I	37	27
II	51	47
III-	3	18
III	0	6
IV	0	0
n	197	197

Figure 17/ 97% of rest readings, and 76% of flex readings taken after the last dive were grade II or less.

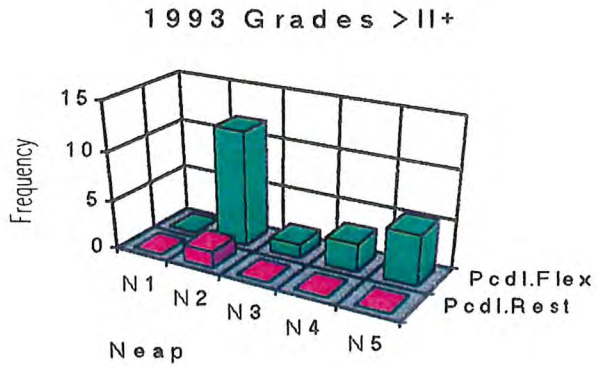
The data can also be divided into respective neaps. This may be useful in following variations in grades with variations in depth, however when veiwing these graphs one must keep in mind that each neap represents readings from two different divers.



Number of man -dives done in following depth categories:

Depth	*11*	*15*	*23*	*29*	*33*	*35+*	*Total*
N1	6	142	87	0	0	0	235
N2	124	43	0	0	14	0	181
N3	213	198	6	0	0	0	417
N4	130	90	2	0	0	0	222
N5	26	84	0	0	0	0	110
Total	499	557	95	0	14	0	1165

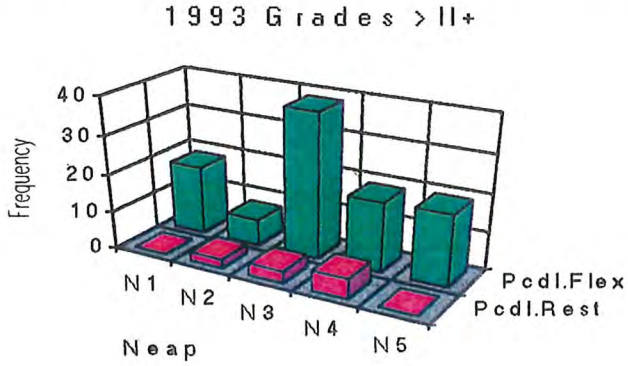
Figure 18/ Depths dived during the five fieldwork neaps of 1993. A significant number of dives deeper than 15m were done during neap 1 (between 15 and 23m : non-rotation profiles). Apart from one days diving at the start of neap two there was no other rotation diving during 1993.



Frequency (%) of "Day" grades greater than II+

Neap	*Rest*	*Flex*
N1	0	0
N2	2	12
N3	0	1
N4	0	3
N5	0	5

Figure 19/ Percentage of "Day" reading grades recorded from each neap that were greater than II+ . Relatively few grades greater than II+ were scored during the day from 1993 neaps. Interestingly the first neap, of which 2 days were spent diving in about 20m depth, showed no grades greater than II+. The higher precentage of grades greater than II+ recorded during the day from neap 2 is probably due to readings done during the longer surface intervals of rotation dives on the first day.



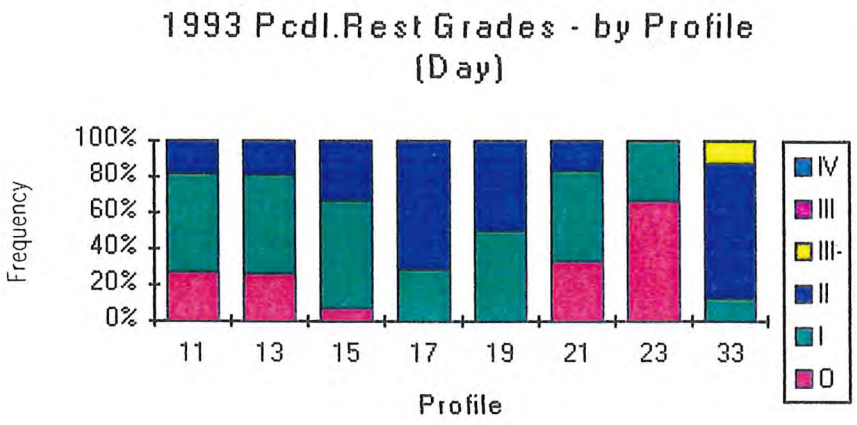
Frequency (%) of "Final" grades greater than II+

Neap	*Rest*	*Flex*
N1	0	18
N2	2	7
N3	3	38
N4	5	18
N5	0	19

Figure 20/ Percentage of "Final" reading grades recorded from each neap that were greater than II+ . There appear to be two anomalies in this graph - neaps 2 and 3. Neap 2 has a very low frequency of grades greater than II+. If you refer back to figure 6 you will notice that almost 70% of the readings were taken in depths less than 11m. Neap 3 is interesting in that the precordial flex readings were markedly higher than other neaps. This was the only neap in 4 seasons that I was able to test the entire crew at the end of each day. For this neap there are more than twice the number of "end of day" readings than most other neaps.

In both figures 7 and 8 above, an important feature is that despite neap 1 containing a sustantial number of readings in depths between 15 and 23m (figure 6) the frequency of grades greater than II+ is low. The lack of high grades from the 21 and 23m profiles for this year becomes obvious in the next series of graphs, and despite the unfortunately small sample size of redings from this depth I think there is a significant reason for this. This neap was just after the introduction of greatly increased oxygen decompression times in the 21 and 23m profiles. On this particular boat it had been standard practice over the years to do a slow ascent (about 3m/min) on oxygen from the decompression stop on the last dive when diving this depth. For this neap they continued this practice despite the increased oxygen decompression throughout the day. I do not believe this practice continues.

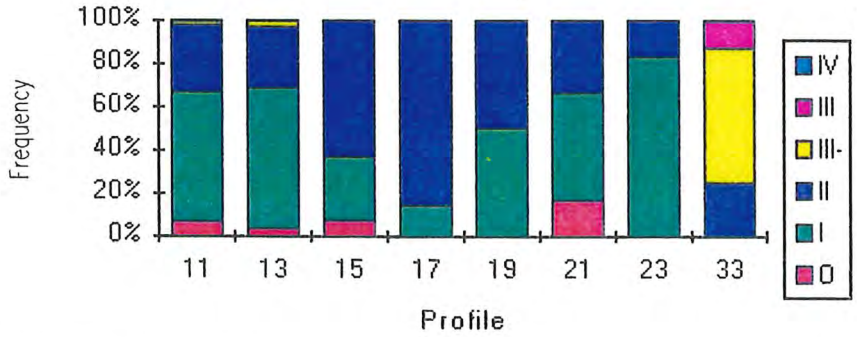
The following series of graphs represent the fieldwork data for the whole season divided into respective profiles. This is possibly the most useful way of compiling the fieldwork data but one must still be careful in interpreting the graphs to pay attention to the sample size of each profile.



Tally of precordial rest grades recorded from each profile for readings during the day

	11	*13*	*15*	*17*	*19*	*21*	*23*	*33*
O	28	28	2	0	0	2	4	0
I	56	58	16	2	1	3	2	1
II	19	20	9	5	1	1	0	6
III-	0	0	0	0	0	0	0	1
III	0	0	0	0	0	0	0	0
IV	0	0	0	0	0	0	0	0
n	103	106	27	7	2	6	6	8

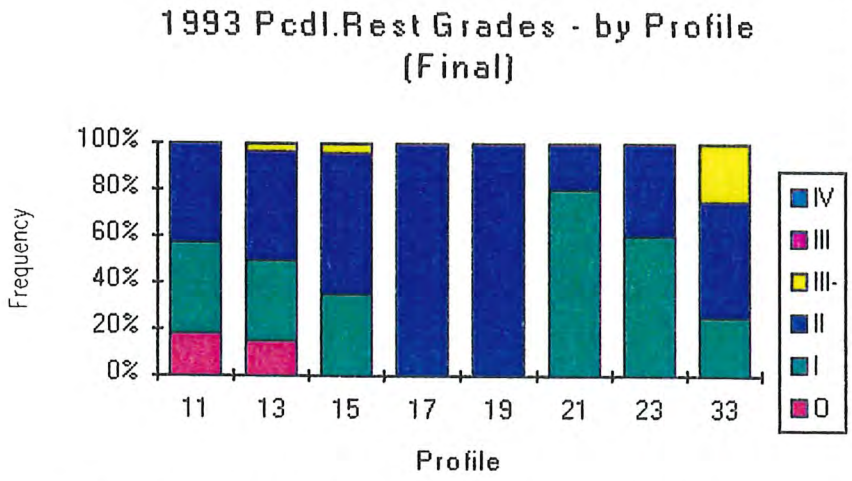
Figure 21/ Precordial rest readings from the "Day" subset appear to increase gradually with an increase in profile depth except for the 21 and 23m profiles.



Tally of precordial flex grades recorded from each profile for readings during the day

	11	*13*	*15*	*17*	*19*	*21*	*23*	*33*
O	7	4	2	0	0	1	0	0
I	62	69	8	1	1	3	5	0
II	32	30	17	6	1	2	1	2
III-	2	3	0	0	0	0	0	5
III	0	0	0	0	0	0	0	1
IV	0	0	0	0	0	0	0	0
n	103	106	27	7	2	6	6	8

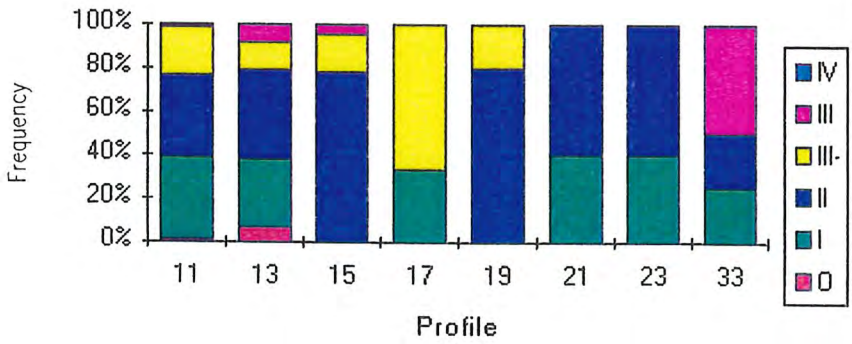
Figure 22/ The pattern of distribution of precordial flex grades in the "Day"subset appears similar to the precordial rest subset. The high frequency of grades greater than II+ recorded during the day from 33m is due to readings done during the longer surface intervals of rotation dives.



Tally of precordial rest grades recorded from each profile for "Final" readings

	11	*13*	*15*	*17*	*19*	*21*	*23*	*33*
O	14	13	0	0	0	0	0	0
I	30	30	8	0	0	4	3	1
II	33	41	14	3	5	1	2	2
III-	0	3	1	0	0	0	0	1
III	0	0	0	0	0	0	0	0
IV	0	0	0	0	0	0	0	0
n	77	87	23	3	5	5	5	4

Figure 23/ Again a similar trend of grades gradually increasing with depth with the 21 and 23m profiles standing out as exceptions is evident in the "Final" rest readings dataset.



Tally of precordial flex grades recorded from each profile for "Final" readings

	11	*13*	*15*	*17*	*19*	*21*	*23*	*33*
O	1	6	0	0	0	0	0	0
I	29	27	0	1	0	2	2	1
II	29	36	18	0	4	3	3	1
III-	17	11	4	2	1	0	0	0
III	1	7	1	0	0	0	0	2
IV	0	0	0	0	0	0	0	0
n	77	87	23	3	5	5	5	4

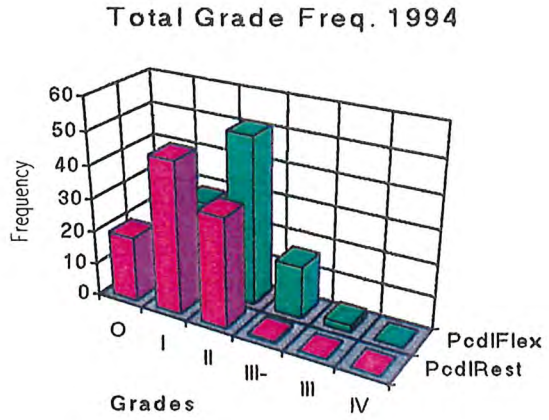
Figure 24/ Grades increasing with depth is less evident among flex readings of the "Final" subset, however the 21 and 23m profiles still stand out.

SUMMARY OF FIELD WORK

1994

1994 Fieldwork

During the drift diving season of 1994, 494 Doppler evaluations were carried out on 15 different divers over five fishing neaps. Of all the Doppler tests done in the field during 1994, 99% of the precodial rest and 82% of the precordial flex readings were grade II or less. This "Total" data set is simply every grade recorded during the 1994 fieldwork.



Total Grade Frequency (%) 1994		
Grade	*P.Rest*	*P.Flex*
O	20	3
I	46	28
II	33	51
III-	1	16
III	0	2
IV	0	0
n	494	494

Figure 25/ Of all the Doppler tests done in the field during 1994, 99% of the precodial rest and 82% of the precordial flex readings were grade II or less.
Note: "Minus" and "plus" grades are rounded to nearest whole grade except for grade III- (eg: II- counted as II).

No grade IV's were recorded during 1994.

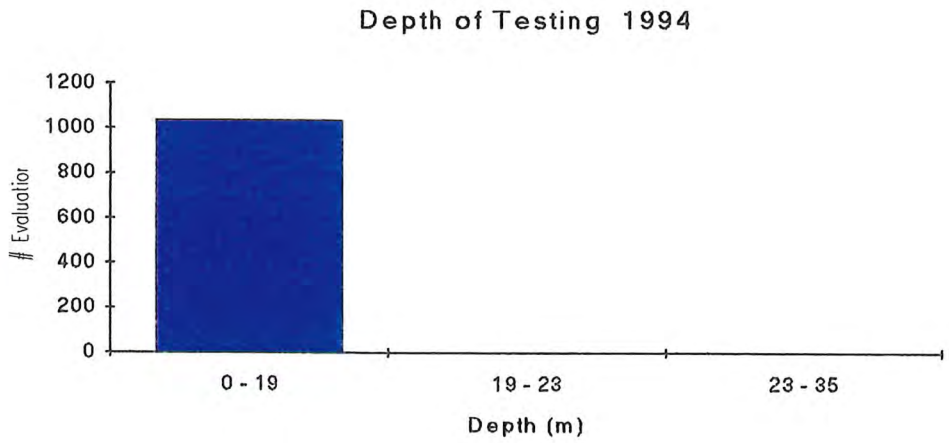
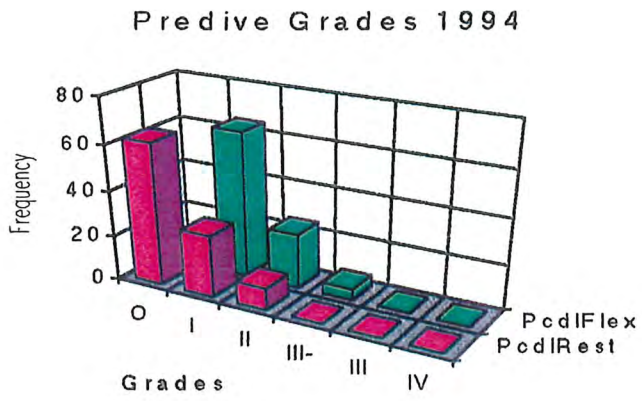


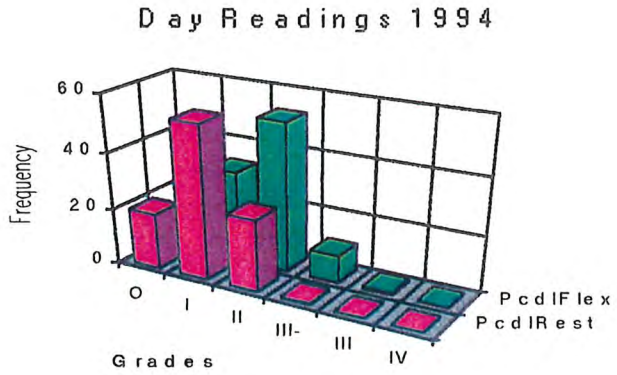
Figure 26/ Of the 1035 man-dives that Doppler testing was carried out over during the 1994 Drift diving season, all were shallower than 19m.

The "Total" data set can be initially divided into three subsets based on when readings are taken. Doppler evaluations are done on subject divers at the start of each day before diving (Predive readings), after various dives during surface intervals (Day readings), and after the last dive of the day (End of Day readings).



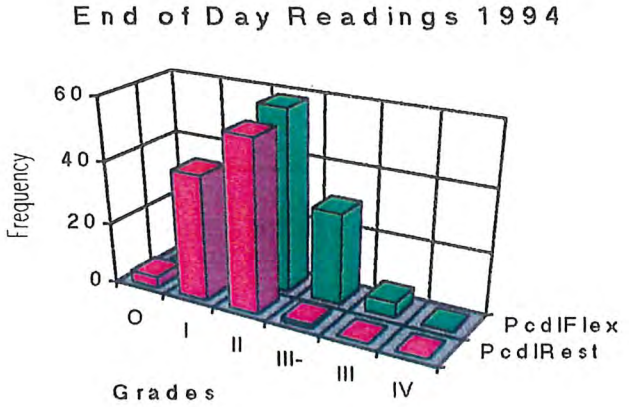
Predive Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	63	6
I	27	65
II	10	24
III-	0	5
III	0	0
IV	0	0
n	62	62

Figure 27/ More than 70% of Predive readings (both rest and flex) were either O or I. None of the precordial rest readings of the Predive subset were higher than grade II, but 5% of precordial <u>flex</u> readings were grade III-.



Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	20	5
I	54	32
II	26	53
III-	0	10
III	0	1
IV	0	0
n	266	266

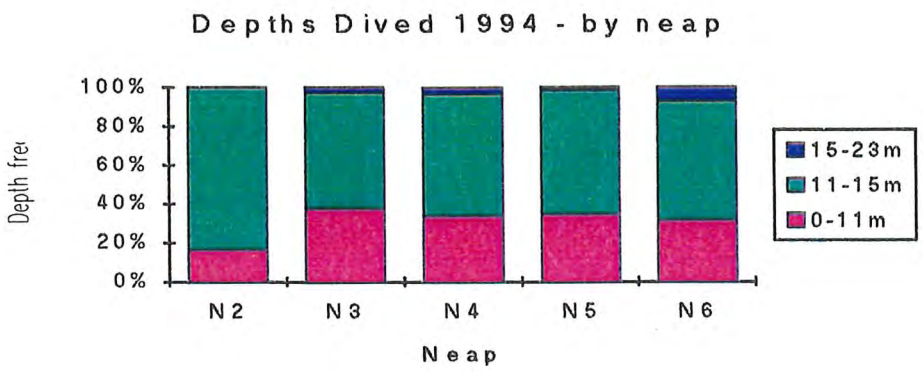
Figure 28/ 100% of rest readings, and 89% of flex readings taken in surface intervals during the day were grade II or less.



End of Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	4	0
I	40	7
II	55	58
III-	1	30
III	0	5
IV	0	0
n	166	166

Figure 29/ 99% of rest readings, and 65% of flex readings taken after the last dive were grade II or less.

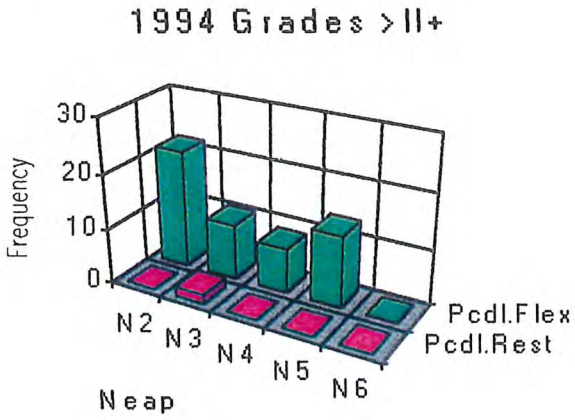
The data can also be divided into respective neaps. This may be useful in following variations in grades with variations in depth, however when veiwing these graphs one must keep in mind that each neap represents readings from two different divers.



Number of dives done in following depth categories:

	11m	*15m*	*23m*
N2	41	203	0
N3	116	182	8
N4	57	104	6
N5	46	84	2
N6	59	114	13
Total	319	687	29

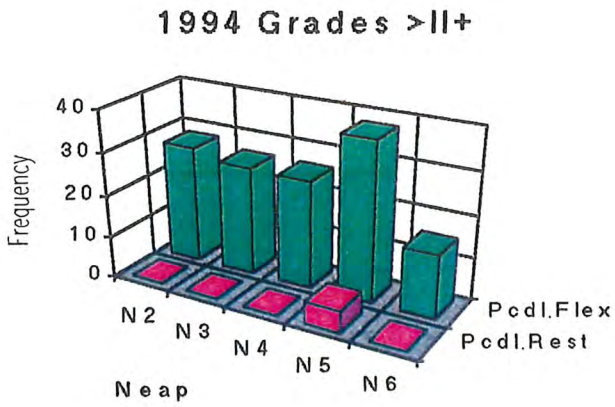
Figure 30/ Depths dived during the five fieldwork neaps of 1994. Very few dives were over 15m, none of these were deeper than 17m. All were off the 80 mile beach.



Frequency (%) of "Day" grades greater than II+

Neap	*Rest*	*Flex*
N2	0	22
N3	2	10
N4	0	8
N5	0	13
N6	0	0

Figure 31/ Percentage of "Day" reading grades recorded from each neap that were greater than II+ . Relatively few grades greater than II+ were scored during the day from 1994 neaps. Appart from the last neap (no "day" readings greater than II) the low incidence of high grades is fairly consistent.

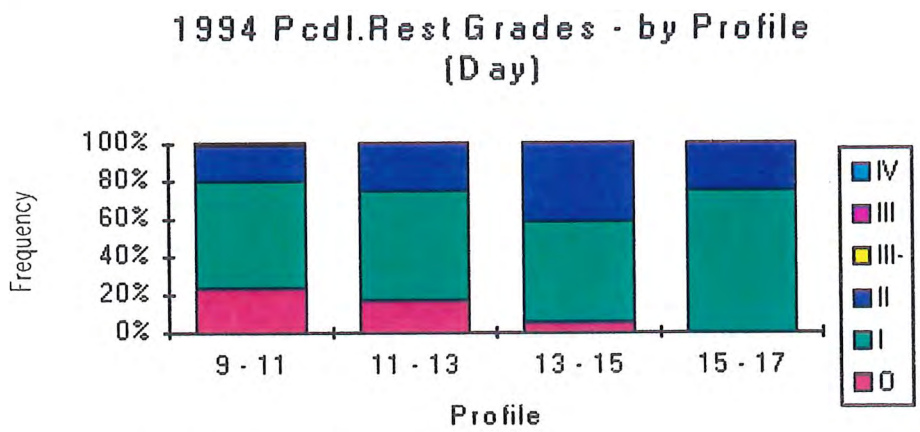


Frequency (%) of "Final" grades greater than II+

Neap	*Rest*	*Flex*
N2	0	28
N3	0	26
N4	0	26
N5	5	38
N6	0	15

Figure 32/ Percentage of "Final" reading grades recorded from each neap that were greater than II+ . As with the "Day" readings there was little difference between most neaps. Very few precordial rest readings, and less than 40% of precordial flex readings were greater than II+.

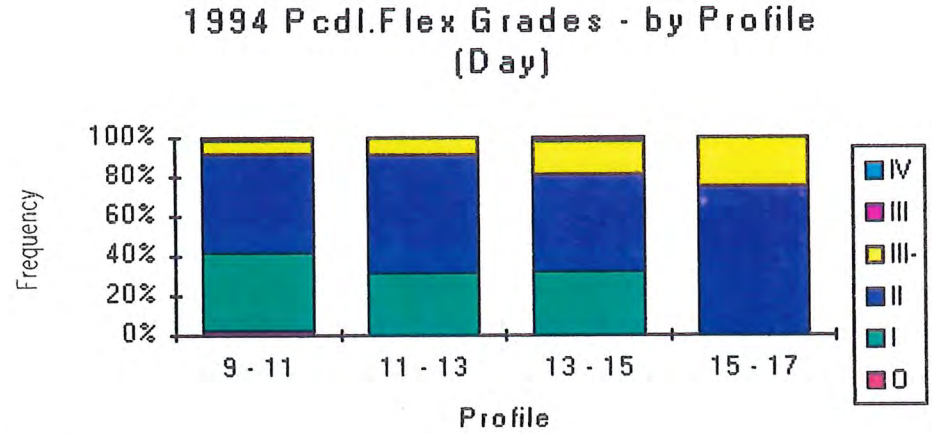
The following series of graphs represent the fieldwork data for the whole season divided into respective profiles. This is possibly the most useful way of compiling the fieldwork data but one must still be careful in interpreting the graphs to pay attention to the sample size of each profile.



Tally of precordial rest grades recorded from each profile for readings during the day

Grade	*11*	*13*	*15*	*17*
O	20	20	3	0
I	47	66	28	3
II	16	29	22	1
III-	1	0	0	0
III	0	0	0	0
IV	0	0	0	0
n	84	115	53	4

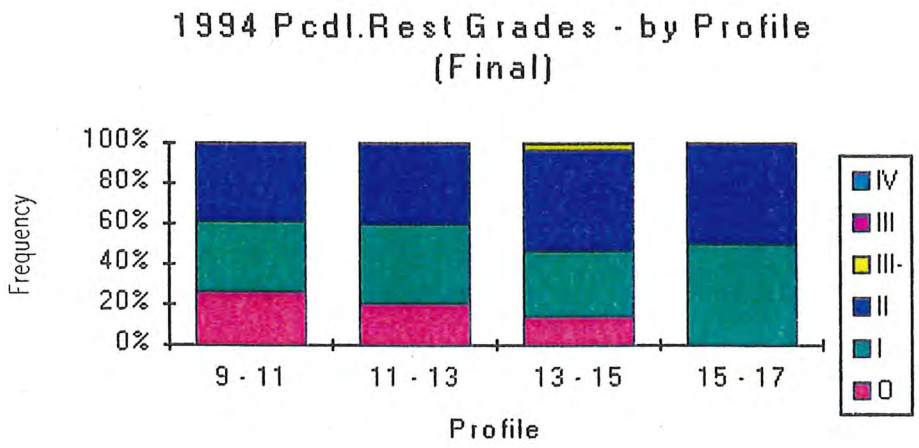
Figure 33/ Precordial rest readings from the "Day" subset appear to increase gradually with an increase in profile depth. One grade greater than II+ was recorded ; in the 11m profile. In all the profiles the majority of grades were O or I.



Tally of precordial flex grades recorded from each profile for readings during the day

Grade	*11*	*13*	*15*	*17*
O	2	0	0	0
I	33	36	17	0
II	42	69	26	3
III-	6	10	9	1
III	1	0	1	0
IV	0	0	0	0
n	84	115	53	4

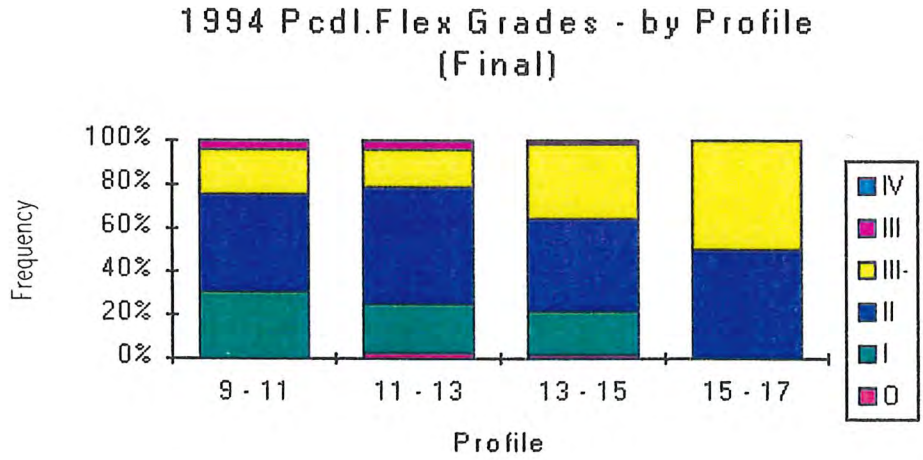
Figure 34/ As with the precordial rest grades, precordial flex grades in the "Day"subset appear to increase slightly with increasing profile depth. Grades greater than II+ form a greater proportion of the flex dataset.



Tally of precordial rest grades recorded from each profile for "Final" readings

Grade	*11*	*13*	*15*	*17*
O	13	24	8	0
I	17	46	18	3
II	19	47	28	3
III-	0	0	2	0
III	0	0	0	0
IV	0	0	0	0
n	49	117	56	6

Figure 35/ A similar trend of grades gradually increasing with depth is reflected in the "Final" readings dataset as well. Only 2 readings greater than II+ were recorded; from the 15m profile.



Tally of precordial flex grades recorded from each profile for "Final" readings

Grade	*11*	*13*	*15*	*17*
O	0	3	1	0
I	15	26	11	0
II	22	63	24	3
III-	10	20	19	3
III	2	5	1	0
IV	0	0	0	0
n	49	117	56	6

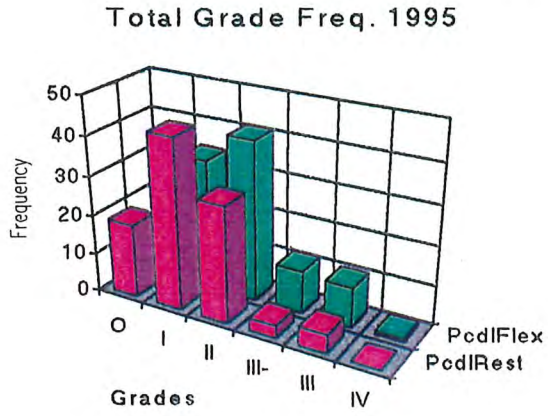
Figure 36/ Significant levels of grades greater than II+ were recorded from all profiles for the flex readings of the "Final" subset. Again grades appear to increase slightly with increasing profile depth.

SUMMARY OF FIELD WORK

1995

1995 Fieldwork

During the drift diving season of 1995, 586 Doppler evaluations were carried out on 12 different divers over six fishing neaps. Of all the Doppler tests done in the field during 1995, 92% of the precodial rest and 78% of the precordial flex readings were grade II or less. This "Total" data set is simply every grade recorded during the 1995 fieldwork.



Total Grade Frequency (%) 1995		
Grade	*P.Rest*	*P.Flex*
O	19	4
I	43	33
II	30	41
III-	3	11
III	5	10
IV	0	1
n	586	586

Figure 37/ Of all the Doppler tests done in the field during 1995, 92% of the precodial rest and 78% of the precordial flex readings were grade II or less.
Note: "Minus" and "plus" grades are rounded to nearest whole grade except for grade III- (eg: II- counted as II).

Of the 598 readings, 5 of the precordial flex readings were grade IV- (four minus). Four of these were from one diver in 19 - 21m of water in the Lacepede Channel (17,19 and 21m profiles)on the first neap for 1995, all except one were end-of-the-day readings. The other was recorded on the last neap in 18m (21m profile) of water.

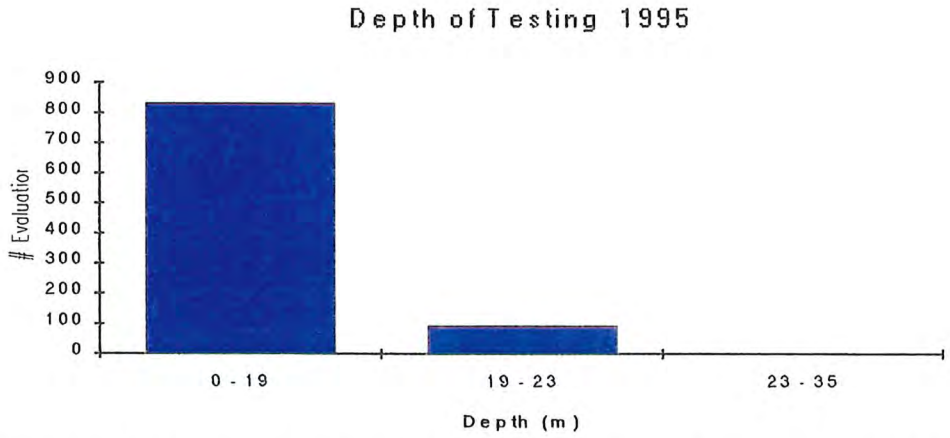
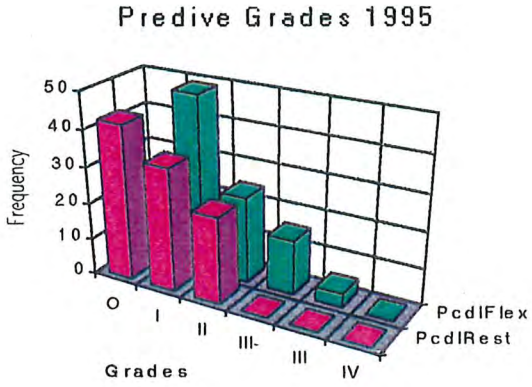


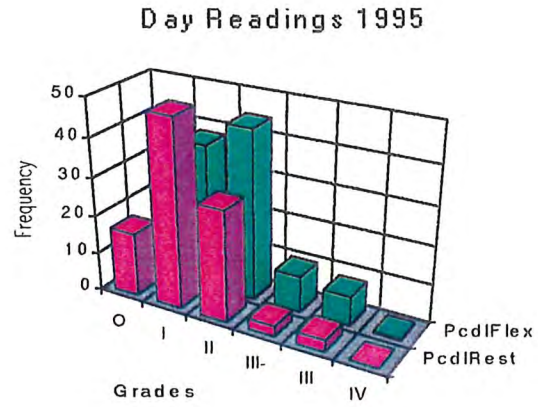
Figure 38/ Of the 920 man-dives over which Doppler testing was carried out during the 1995 Drift diving season, 830 were shallower than 19m, the remainder were between 19 and 23m. Most of the deeper dives were done in the Lacepede Channel in the first 1.5 neaps.

The "Total" data set can be initially divided into three subsets based on when readings are taken. Doppler evaluations are done on subject divers at the start of each day before diving (Predive readings), after various dives during surface intervals (Day readings), and after the last dive of the day (End of Day readings).



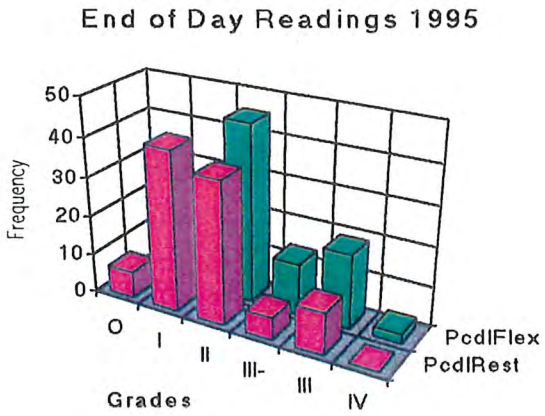
Predive Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	43	9
I	34	49
II	24	24
III-	0	15
III	0	4
IV	0	0
n	80	80

Figure 39/ More than 50% of Predive readings (both rest and flex) are either O or I. None of the precordial rest readings of the Predive subset were higher than grade II, but 19% of precordial flex readings were grade III's (most of these III-).



Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	17	1
I	49	38
II	29	44
III-	3	9
III	3	8
IV	0	0.3
n	329	329

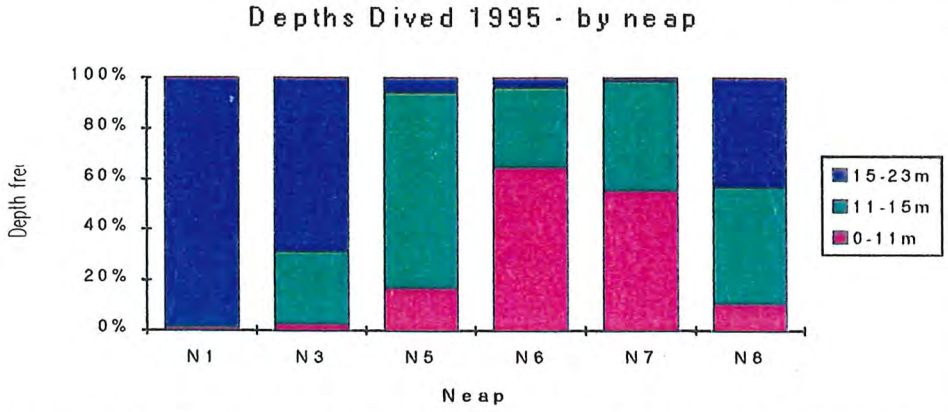
Figure 40/ 95% of rest readings, and 83% of flex readings taken in surface intervals during the day were grade II or less. One grade IV- was recorded on the last neap in 18m of water (precordial flex).



End of Day Grade Frequency (%)		
Grade	*P.Rest*	*P.Flex*
O	7	0
I	41	21
II	36	45
III-	6	13
III	11	19
IV	0	2
n	177	177

Figure 41/ 84% of rest readings, and 66% of flex readings taken after the last dive were grade II or less.

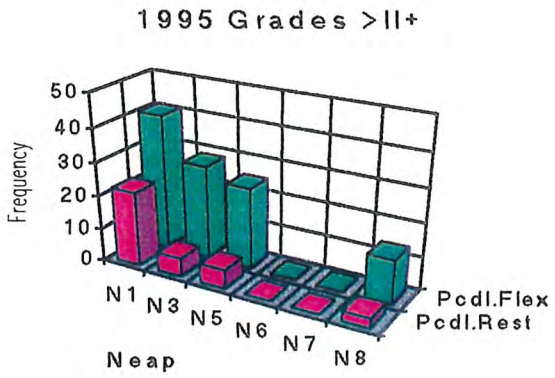
The data can alo be divided into respective neaps. This may be useful in following variations in grades with variations in depth, however when veiwing these graphs one must keep in mind that each neap represents readings from two different divers.



Number of readings done in following depth categories:

	9-11	*11-15*	*15-23*
N1	2	0	130
N3	4	41	100
N5	24	110	8
N6	104	50	6
N7	88	68	2
N8	20	84	79
Tot	242	353	325

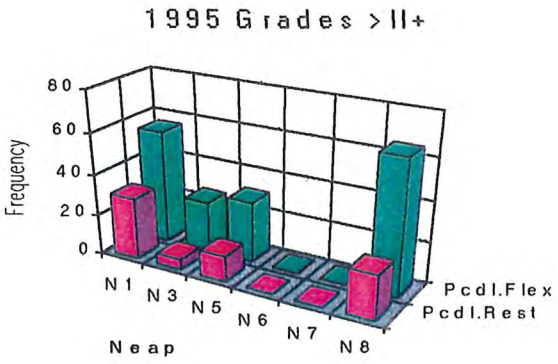
Figure 42/ Depths dived during the six fieldwork neaps of 1995. Most of the deeper dives in the first 2 neaps were around 20m in the Lacepede Channel, whereas the deeper dives during later neaps (including the last) were around 17m off the 80 mile beach.



Frequency (%) of "Day" grades greater than II+

Neap	*Rest*	*Flex*
N1	22	41
N3	6	28
N5	6	25
N6	0	0
N7	0	0
N8	3	13

Figure43/ Percentage of "Day" reading grades recorded from each neap that were greater than II+ . Higher grades during the day are recorded predominantly in neaps of greater average depth.

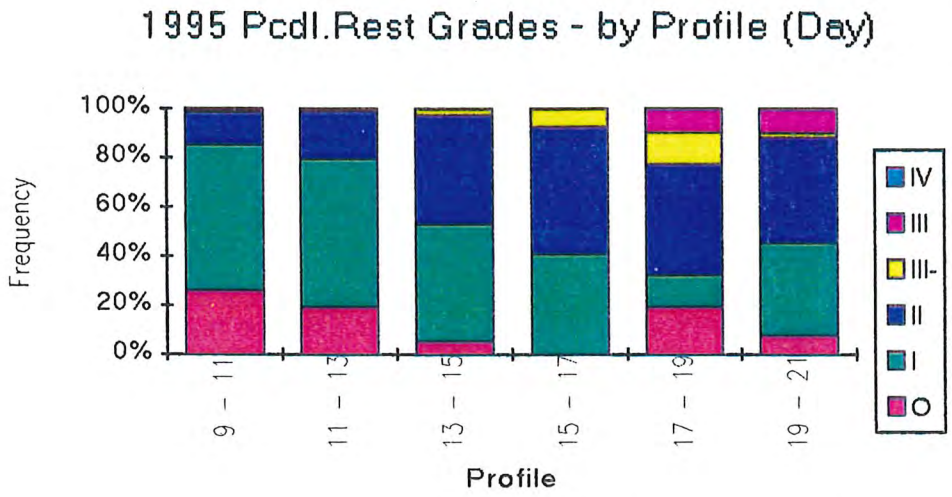


Frequency (%) of "Final" grades greater than II+

Neap	*Rest*	*Flex*
N1	31	56
N3	5	25
N5	13	30
N6	0	0
N7	0	0
N8	22	65

Figure 44/ Percentage of "Final" reading grades recorded from each neap that were greater than II+ . Higher grades at the end day are also recorded predominantly in neaps of greater average depth.

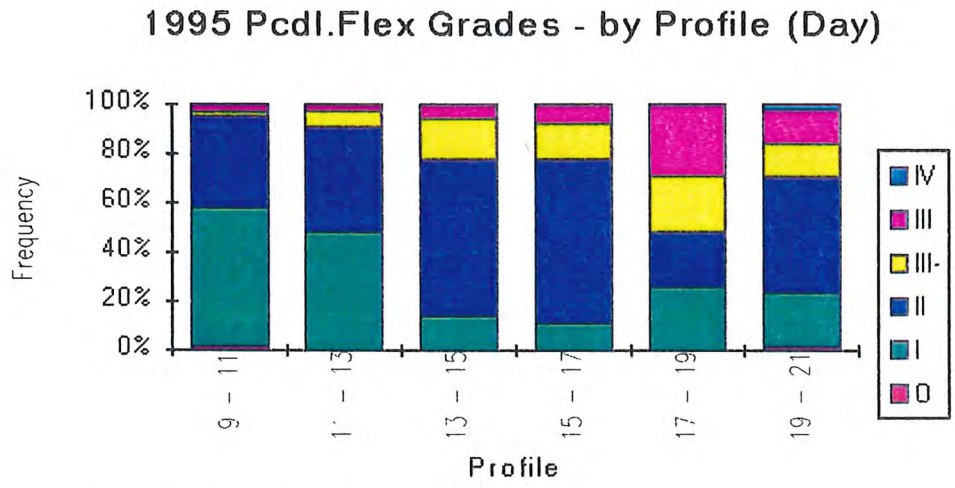
The following series of graphs represent the fieldwork data for the whole season divided into respective profiles. This is possibly the most useful way of compiling the fieldwork data but one must still be careful in interpreting the graphs to pay attention to the sample size of each profile.



Tally of precordial rest grades recorded from each profile for readings during the day

	11	*13*	*15*	*17*	*19*	*21*
O	28	15	2	0	6	4
I	63	46	17	11	4	19
II	14	15	16	14	14	22
III-	1	0	1	2	4	1
III	1	1	0	0	3	5
IV	0	0	0	0	0	0
n	107	77	36	27	31	51

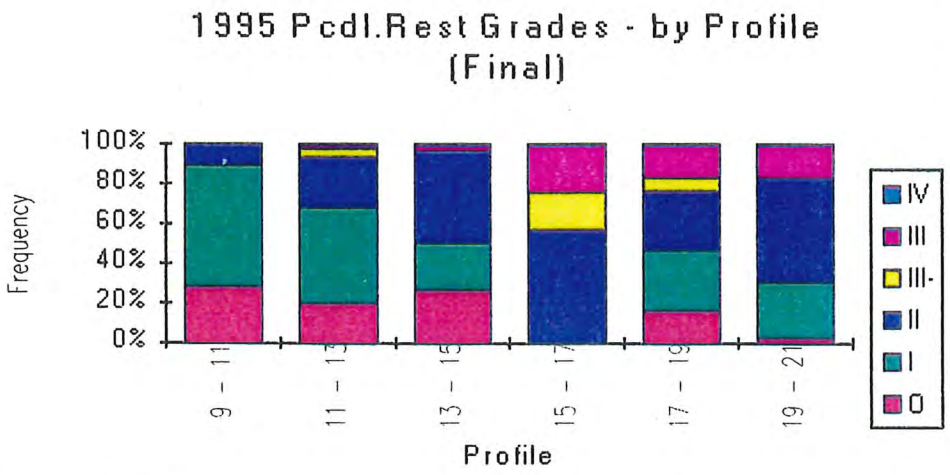
Figure 45/ In the "Day/Rest" dataset there appears to be a gradual increase in grades with increasing depth. There may be a slight fall in grades from the 21m profile.



Tally of precordial flex grades recorded from each profile for readings during the day

	11	*13*	*15*	*17*	*19*	*21*
O	2	0	0	0	0	1
I	60	37	5	3	8	11
II	40	33	23	18	7	24
III-	2	5	6	4	7	7
III	3	2	2	2	9	7
IV	0	0	0	0	0	1
n	107	77	36	27	31	51

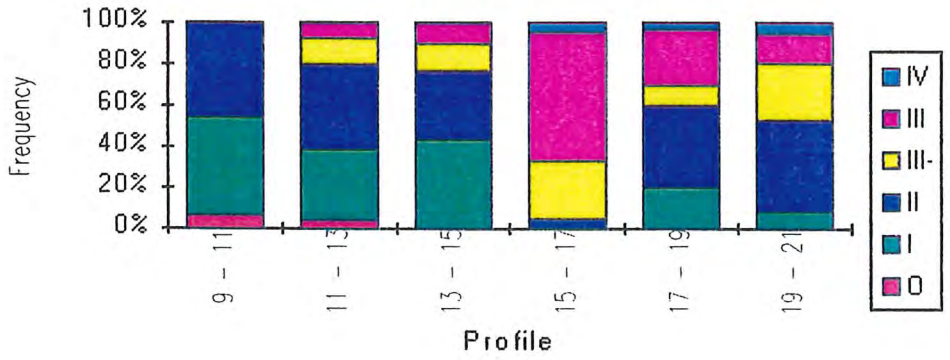
Figure 46/ In the "Day/Flex" dataset the same gradual increase is evident, but the fall in grades for the 21m profile is more marked. One grade IV was recorded in the 21m subset.



Tally of precordial rest grades recorded from each profile for "Final" readings

	11	*13*	*15*	*17*	*19*	*21*
O	13	19	8	0	5	1
I	28	45	7	0	9	10
II	5	24	14	12	9	19
III-	0	4	0	4	2	0
III	0	2	1	5	5	6
IV	0	0	0	0	0	0
n	46	94	30	21	30	36

Figure 47/ In the "Final/Rest" dataset a gradual increase in grades with increasing profile depth is evident, and the fall in grades for the 21m (and perhaps 19m) profile is clear.



Tally of precordial flex grades recorded from each profile for "Final" readings

	11	*13*	*15*	*17*	*19*	*21*
O	3	4	0	0	0	0
I	22	32	13	0	6	3
II	21	39	10	1	12	16
III-	0	12	4	6	3	10
III	0	7	3	13	8	5
IV	0	0	0	1	1	2
n	46	94	30	21	30	36

Figure 48/ In the "Final/Flex" dataset again the gradual increase in grades with increasing profile depth is evident, and though the fall in grades from the 17m to 19m profiles is clear, the 19m and 21m seem about even. Grades III or higher were recorded in all profiles except 11m, but predominantly from the 17m, 19m, and 21m profiles. Grade IV's were recorded from the same 3 profiles. In the above two graphs of the "final" dataset, the 17m profile appears to be more stressfull than the two deeper profiles, having substantially higher frequencies of the higher grades. However I think this is exaggerated by limitations of the 17m dataset, and may not accurately represents its place in this series. Unfortunately the 17m profile was not dived often during 1995 - you will notice it has the smallest sample size of all profiles. In fact all the readings for this profile come from one neap and hence only two divers - both of whom are on the high side of average, one in particular, who I would categorize a high bubbler contributed many III's and the grade IV. You will also notice the complete absence of grade O's from the 17m profile subset.

Financial Report

1994.

PEARL PRODUCERS ASSOCIATION INC.

FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30TH JUNE 1994

SOMES & COOKE
CHARTERED ACCOUNTANTS,
1304 HAY STREET,
WEST PERTH 6005

PH: (09) 322 4853
FAX: (09) 481 5645

PEARL PRODUCERS ASSOCIATION INC.

FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30TH JUNE 1994

I N D E X

SOMES & COOKE
CHARTERED ACCOUNTANTS
1304 Hay Street West Perth WA 6005
PO Box 709 West Perth WA 6872
Telephone (09) 322 4853
Facsimile (09) 481 5645

KC Somes FCA
J Cooke FCA ACIS

INDEPENDENT AUDIT REPORT

TO THE MEMBERS OF PEARL PRODUCERS ASSOCIATION (INC.)

SCOPE

We have audited the special purpose financial report comprising the Statement of Financial Position, Operating Statement, Cash Flow Statement and Notes to the Financial Statements, of Pearl Producers Association Inc. for the year ended 30 June 1994. The association's Committee of Management is responsible for the preparation and presentation of the financial report and the information contained therein, and have determined that the basis of accounting used is appropriate to the needs of the members. We have conducted an independent audit of the financial report in order to express an opinion to the members of Pearl Producers Association Inc. on its preparation and presentation. No opinion is expressed as to whether the basis of accounting used is appropriate to the needs of the members.

The financial report has been prepared for distribution to members for the purpose of fulfilling the Committee of Management's accountability requirements under the association's constitution. We disclaim any assumption of responsibility for any reliance on this report or on the financial report to which it relates to any person other than the members, or for any purpose other than that for which it was prepared.

Our audit has been conducted in accordance with Australian Auditing Standards. Our procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial report and the evaluation of significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial report is presented fairly in accordance with the basis of accounting described in Note 1 to the financial statements.

The audit opinion expressed in this report has been formed on the above basis.

AUDIT OPINION

In our opinion, the financial report presents fairly the financial position of Pearl Producers Association Inc. as at 30 June 1994 and the results of its operations for the year then ended in accordance with the basis of accounting described in Note 1 to the financial statements so as to present a view which is consistent with our understanding of the associations financial position, the results of its operations and its cash flows.

SOMES & COOKE
CHARTERED ACCOUNTANTS

J. COOKE
PARTNER

Perth, W.A.
Dated: 30th September 1994

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT BY COMMITTEE MEMBERS

In our opinion,

(i) the income and expenditure statement is drawn up so as to give a true and fair view of the results of the body corporate for the period ended 30th June, 1994.

(ii) the balance sheet is drawn up so as to give a true and fair view of the state of affairs of the body corporate at 30th June, 1994.

..... Hon. Treasurer

..... Chairman

PERTH, W.A.
DATED: 30th SEPT. 1994.

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT OF ASSETS & LIABILITIES

AS AT 30TH JUNE 1994

	NOTE	1994	1993
		$	$
CURRENT ASSETS			
Cash at Bank		-	1,833
Cash at Bank - Divers Safety Fund		16,124	-
Cash at Bank - Fighting Fund		709	9,566
Cash at Bank - Grading Research Fund		4,467	-
Receivables	2	6,995	2,535
Receivables - Divers Safety Fund	3	15,119	20,820
Receivables - Fighting Fund	4	1,034	26
Receivables - Grading Research Fund	5	20,184	-
Inventories		3,124	4,602
Other - Prepayments		23,656	5,994
Other - Divers Safety Fund-Prepayments		368	764
		91,780	46,140
NON CURRENT ASSETS			
Property, Plant & Equipment	6	3,846	5,538
Property, Plant & Equipment - Divers Safety Fund	7	4,563	6,840
		8,409	12,378
TOTAL ASSETS		100,189	58,518
CURRENT LIABILITIES			
Creditors & Borrowings	8	22,461	27,689
Creditors & Borrowings-Divers Safety	9	-	3,654
Creditors & Borrowings-Fighting Fund	10	250	940
Creditors & Borrowings-Grading Research	11	13,300	-
Provisions-Divers Safety Fund	12	1,614	1,614
		37,625	33,897
TOTAL LIABILITIES		37,625	33,897
NET ASSETS		$62,654	$24,621

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT OF ASSETS & LIABILITIES

AS AT 30TH JUNE 1994

	NOTE	1994	1993
		$	$
MEMBERS FUNDS			
Accumulated Funds	13	15,160	(7,187)
Divers Safety Research Fund	14	34,561	23,156
Fighting Fund-Kimberley Land Claim	15	1,492	8,652
Grading Research Fund	16	11,351	-
		$62,654	$24,621

PEARL PRODUCERS ASSOCIATION INC.
DIVERS SAFETY RESEARCH FUND

INCOME AND EXPENDITURE STATEMENT

FOR THE YEAR ENDED 30TH JUNE, 1994

	1994 $	1993 $
INCOME		
General Levy	-	8,620
Research Grants	114,064	97,671
Interest Received	585	221
	114,649	106,512
EXPENDITURE		
Annual Leave	-	1,614
Accommodation	3,043	3,848
Accountancy	6,593	-
Bank Fees & Interest	50	57
Consultancy Fees	29,750	18,500
Contract Divers	1,620	8,620
Depreciation	2,277	2,964
F.I.D. & G.D.T.	45	57
General Expenses	432	1,831
Insurance - General	1,743	1,339
Medical Expenses	1,961	58
PPS & Consumables	675	848
Repairs & Maintenance	3,415	1,734
Software	6,850	15,050
Superannuation	974	952
Telephone	508	678
Travelling Expenses	6,195	5,736
Wages	37,113	36,601
	103,244	100,487
Excess of Income over Expenditure Before Income Tax	11,405	6,025
Less Income Tax Thereon	-	-
Excess of Income over Expenditure After Income Tax	$ 11,405	$ 6,025

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1994

1. This special purpose financial report has been prepared for distribution to the members to satisfy the Committee of Management's accountability requirements under the Association's constitution. The accounting policies used in the preparation of this report are consistent with previous years and are described below.

   (a) The financial report has been prepared on an accrual basis of accounting including the historical cost convention and the going concern assumption.

   (b) The requirements of the Australian Accounting Standards promulgated by the accounting profession do not have mandatory applicability to Pearl Producers Association Inc. in relation to the year ended 30 June 1994 because the Association is not a "reporting entity" as defined therein. The Committee of Management has, however, prepared the financial report in accordance with all Australian Accounting Standards with the following exceptions:

      (i) Related Parties (AASB1017): there is no disclosure of transactions with related parties.
      (ii) Income Tax (AASB1020): future income tax benefit and provision for deferred income tax are not disclosed.
      (iii) Segment Reporting (AASB1005): segment information for each geographical or industry segment has not been presented.

   (c) Trust Funds and Reserves
   Income relating to investments set aside in respect of Trust Funds and Reserves is credited directly to those funds.

   (d) Employee Entitlements
   Employee provisions in the nature of holiday pay and long service leave have been computed in accordance with statutory requirements.

   (e) Fixed Assets
   Depreciation, calculated on the diminishing value method, is brought to account over the estimated lives of property, plant & equipment.

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1994

		1994 $	1993 $
2.	CURENT ASSETS - RECEIVABLES		
	Consultancy Fees Overpaid	2,083	2,083
	Levies Receivable	4,812	452
	AGM Expenses Receivable	100	-
		6,995	2,535
3.	CURRENT ASSETS - RECEIVABLES - DIVERS SAFETY RESEARCH FUND		
	Grants Receivable	14,266	14,000
	Levies Receivable	664	6,631
	TFN Tax Receivable	189	189
		15,119	20,820
4.	CURRENT ASSETS - RECEIVABLES - FIGHTING FUND		
	Levies Receivable	1,008	-
	TFN Tax Receivables	26	26
		1,034	26
5.	CURRENT ASSETS - RECEIVABLES - GRADING RESEARCH FUND		
	Grants Receivable	20,184	-
6.	NON CURRENT ASSETS - PROPERTY, PLANT & EQUIPMENT		
	Plant & Equipment - at cost	10,905	10,905
	Less Accumulated Depreciation	7,059	5,367
		3,846	5,538

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1994

		1994 $	1993 $
7.	NON CURRENT ASSETS - PROPERTY, PLANT & EQUIPMENT - DIVERS SAFETY RESEARCH FUND		
	Plant & Equipment - at cost	12,127	12,127
	Less Accumulated Depreciation	7,564	5,287
		4,563	6,840
8.	CURRENT LIABILITIES - CREDITORS & BORROWINGS		
	Levy - Divers Safety Research Fund	663	-
	Bank Overdraft	6,009	-
	Prepaid General Levies	-	12,000
	Consulting Fees	13,689	13,689
	Accrued Audit Fee	2,100	2,000
		22,461	27,689
9.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - DIVERS SAFETY RESEARCH FUND		
	Bank Overdraft	-	3,654
10.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - FIGHTING FUND		
	Levy - PPA	250	-
	Legal Expenses	-	940
		250	940

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1994

		1994 $	1993 $
11.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - GRADING RESEARCH FUND		
	Consulting Fees	13,300	-
12.	CURRENT LIABILITIES - PROVISIONS		
	Provision for Annual Leave	1,614	1,614
13.	ACCUMULATED FUNDS		
	Balance at 1st July	(7,187)	11,698
	Grants Received	100,000	107,120
	Levies Received	113,696	52,300
	Interest Earned	296	290
	Sale of Books	180	-
	Less: Expenditure	(191,825)	(178,595)
	Balance at 30th June	15,160	(7,187)
14.	DIVERS SAFETY RESEARCH FUND		
	Balance at 1st July	23,156	17,131
	Grants Received	114,064	97,671
	Levies Received	-	8,620
	Interest Received	585	221
	Less Expenditure	(103,244)	(100,487)
	Balance at 30th June	34,561	23,156

Financial Report

1995.

PEARL PRODUCERS ASSOCIATION INC.

FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30TH JUNE 1995

I N D E X

INDEPENDENT AUDIT REPORT

TO THE MEMBERS OF PEARL PRODUCERS ASSOCIATION (INC.)

SCOPE

We have audited the special purpose financial report comprising the Statement of Financial Position, Operating Statement, Cash Flow Statement and Notes to the Financial Statements, of Pearl Producers Association Inc. for the year ended 30 June 1995. The association's Committee of Management is responsible for the preparation and presentation of the financial report and the information contained therein, and have determined that the basis of accounting used is appropriate to the needs of the members. We have conducted an independent audit of the financial report in order to express an opinion to the members of Pearl Producers Association Inc. on its preparation and presentation. No opinion is expressed as to whether the basis of accounting used is appropriate to the needs of the members.

The financial report has been prepared for distribution to members for the purpose of fulfilling the Committee of Management's accountability requirements under the association's constitution. We disclaim any assumption of responsibility for any reliance on this report or on the financial report to which it relates to any person other than the members, or for any purpose other than that for which it was prepared.

Our audit has been conducted in accordance with Australian Auditing Standards. Our procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial report and the evaluation of significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial report is presented fairly in accordance with the basis of accounting described in Note 1 to the financial statements.

The audit opinion expressed in this report has been formed on the above basis.

AUDIT OPINION

In our opinion, the financial report presents fairly the financial position of Pearl Producers Association Inc. as at 30 June 1995 and the results of its operations for the year then ended in accordance with the basis of accounting described in Note 1 to the financial statements so as to present a view which is consistent with our understanding of the associations financial position, the results of its operations and its cash flows.

SOMES & COOKE
CHARTERED ACCOUNTANTS

J. ~~COOKE~~
PARTNER

Perth, W.A.
Dated: 24th October 1995

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT BY COMMITTEE MEMBERS

In our opinion,

(i) the income and expenditure statement is drawn up so as to give a true and fair view of the results of the Association for the period ended 30th June, 1995.

(ii) the balance sheet is drawn up so as to give a true and fair view of the state of affairs of the Association at 30th June, 1995.

.....
Hon. Treasurer

.....
Chairman

PERTH, W.A.
DATED:

24th OCTOBER. 1995.

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT OF ASSETS & LIABILITIES

AS AT 30TH JUNE 1995

	NOTE	1995	1994
		$	$
CURRENT ASSETS			
Cash at Bank		7,285	-
Cash at Bank - Divers Safety Fund		5,781	16,124
Cash at Bank - Fighting Fund		8,898	709
Cash at Bank - Grading Research Fund		1,895	4,467
Cash at Bank - Pearl Promotion Fund		23,798	-
Receivables	2	59,562	6,995
Receivables - Divers Safety Fund	3	190	15,119
Receivables - Fighting Fund	4	1,033	1,034
Receivables - Grading Research Fund	5	11,500	20,184
Inventories		3,707	3,124
Other - Prepayments		1,939	23,656
Other - Divers Safety Fund-Prepayments		-	368
		125,588	91,780
NON CURRENT ASSETS			
Property, Plant & Equipment	6	7,000	3,846
Property, Plant & Equipment - Divers Safety Fund	7	8,105	4,563
		15,105	8,409
TOTAL ASSETS		140,693	100,189
CURRENT LIABILITIES			
Creditors & Borrowings	8	15,889	22,461
Creditors & Borrowings-Divers Safety	9	5,111	-
Creditors & Borrowings-Fighting Fund	10	-	250
Creditors & Borrowings-Grading Research	11	13,300	13,300
Provisions-Divers Safety Fund	12	2,746	1,614
		37,046	37,625
TOTAL LIABILITIES		37,046	37,625
NET ASSETS		$103,647	$62,564

PEARL PRODUCERS ASSOCIATION INC.

STATEMENT OF ASSETS & LIABILITIES

AS AT 30TH JUNE 1995

	NOTE	1995	1994
		$	$
MEMBERS FUNDS			
Accumulated Funds	13	57,004	15,160
Divers Safety Research Fund	14	6,882	34,561
Fighting Fund-Kimberley Land Claim	15	10,868	1,492
Grading Research Fund	16	95	11,351
Pearl Promotion Fund		28,798	-
		$103,647	$62,564

PEARL PRODUCERS ASSOCIATION INC.

DIVERS SAFETY RESEARCH FUND

INCOME AND EXPENDITURE STATEMENT

FOR THE YEAR ENDED 30TH JUNE, 1995

	1995 $	1994 $
INCOME		
Research Grants	48,142	114,064
Interest Received	231	585
	$ 48,373	$114,649
EXPENDITURE		
Annual Leave	1,132	-
Accountancy	1,600	3,043
Accommodation	4,056	6,593
Bank Fees & Interest	50	50
Consultancy Fees	13,400	29,750
Contract Divers	6,660	1,620
Depreciation	2,333	2,277
F.I.D. & G.D.T.	45	45
Freight & Courier	180	-
General Expenses	578	432
Insurance - General	287	1,743
Medical Expenses	-	1,961
PPS & Consumables	330	675
Repairs & Maintenance	25	3,415
Software	300	6,850
Superannuation	1,336	974
Telephone	438	508
Travelling Expenses	7,592	6,195
Wages	35,711	37,113
	$ 76,053	$103,244
Excess/(Deficiency) of Income over Expenditure Before Income Tax	$(27,680)	$ 11,405

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE

FINANCIAL STATEMENTS AT 30 JUNE 1995

1. This special purpose financial report has been prepared for distribution to the members to satisfy the Committee of Management's accountability requirements under the Association's constitution. The accounting policies used in the preparation of this report are consistent with previous years and are described below.

   (a) The financial report has been prepared on an accrual basis of accounting including the historical cost convention and the going concern assumption.

   (b) The requirements of the Australian Accounting Standards promulgated by the accounting profession do not have mandatory applicability to Pearl Producers Association Inc. in relation to the year ended 30 June 1994 because the Association is not a "reporting entity" as defined therein. The Committee of Management has, however, prepared the financial report in accordance with all Australian Accounting Standards with the following exceptions:

      (i) Related Parties (AASB1017): there is no disclosure of transactions with related parties.
      (ii) Income Tax (AASB1020): future income tax benefit and provision for deferred income tax are not disclosed.
      (iii) Segment Reporting (AASB1005): segment information for each geographical or industry segment has not been presented.

   (c) Special Funds
   Income and Expenditure relating to special activities are shown separately. Grants and Levies received for these activities are shown in each special activity income and expenditure statement.

   (d) Employee Entitlements
   Employee provisions in the nature of holiday pay and long service leave have been computed in accordance with statutory requirements.

   (e) Fixed Assets
   Depreciation, calculated on the diminishing value method, is brought to account over the estimated lives of property, plant & equipment.

   (f) Cash
   For the purposes of the statement of cash flows, cash includes deposits at call which are readily convertible to cash within two business days.

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1995

		1995 $	1994 $
2.	CURRENT ASSETS - RECEIVABLES		
	Consultancy Fees Overpaid	2,083	2,083
	Levies Receivable	57,479	4,812
	AGM Expenses Receivable	-	100
		$59,562	$ 6,995
3.	CURRENT ASSETS - RECEIVABLES - DIVERS SAFETY RESEARCH FUND		
	Grants Receivable	-	14,266
	Levies Receivable	-	664
	TFN Tax Receivable	190	189
		$ 190	$15,119
4.	CURRENT ASSETS - RECEIVABLES - FIGHTING FUND		
	Levies Receivable	1,007	1,008
	TFN Tax Receivables	26	26
		$ 1,033	$ 1,034
5.	CURRENT ASSETS - RECEIVABLES - GRADING RESEARCH FUND		
	Grants Receivable	$11,500	$20,184
6.	NON CURRENT ASSETS - PROPERTY, PLANT & EQUIPMENT		
	Plant & Equipment - at cost	15,690	10,905
	Less Accumulated Depreciation	(8,690)	7,059
		$ 7,000	$ 3,846

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1995

		1995 $	1994 $
7.	NON CURRENT ASSETS - PROPERTY, PLANT & EQUIPMENT - DIVERS SAFETY RESEARCH FUND		
	Plant & Equipment - at cost	18,002	12,127
	Less Accumulated Depreciation	9,897	7,564
		$ 8,105	$ 4,563
8.	CURRENT LIABILITIES - CREDITORS & BORROWINGS		
	Levy - Divers Safety Research Fund	-	663
	Bank Overdraft	-	6,009
	Consulting Fees	13,689	13,689
	Accrued Audit Fee	2,200	2,100
		$15,889	$22,461
9.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - DIVERS SAFETY RESEARCH FUND		
	Accrued Expenses	$ 5,111	$ -
10.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - FIGHTING FUND		
	Levy - PPA	-	250
		$ -	$ 250

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1995

		1995 $	1994 $
11.	CURRENT LIABILITIES - CREDITORS & BORROWINGS - GRADING RESEARCH FUND		
	Consulting Fees	$13,300	$13,300
12.	CURRENT LIABILITIES - PROVISIONS		
	Provision for Annual Leave	$ 2,746	$ 1,614
13.	ACCUMULATED FUNDS		
	Balance at 1st July	15,160	(7,187)
	Prior year adjustment	32	-
	Grants Received	125,000	100,000
	Levies Received	107,000	113,696
	Other Income	369	476
	Less: Expenditure	(190,557)	(191,825)
	Balance at 30th June	$ 57,004	$ 15,160
14.	DIVERS SAFETY RESEARCH FUND		
	Balance at 1st July	34,561	23,156
	Grants Received	48,142	114,064
	Interest Received	231	585
	Less Expenditure	(76,052)	(103,244)
	Balance at 30th June	$ 6,882	$ 34,561

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1995

	1995 $	1994 $
18. CASH FLOW STATEMENT		
Cash Flows from Operating Activities		
Receipts from Members	89,073	132,369
Grants Received	187,408	291,350
Payments to Consultants/Suppliers	(234,406)	(417,316)
Interest Received	951	1,144
Net Cash Outflow from Operating Activities	$ 43,026	$ 7,547
Cash Flows from Investing Activities		
Payments for Property, Plant & Equipment	$(10,660)	$ -
Net Cash Outflow from Investing Activities	$(10,660)	$ -
Net Increase/(Decrease) in Cash Held	32,366	7,547
Cash at the Beginning of the Financial Year	15,291	7,744
Cash at the End of the Financial Year	$ 47,657	$ 15,291
The above figures are reconciled to cash at the end of the financial year as follows:-		
Cash at Bank	7,285	(6,009)
Cash at Bank/(Overdraft) Divers Safety Fund	5,781	16,124
Cash at Bank Fighting Fund	8,898	709
Cash at Bank Grading Research Fund	1,895	4,467
Cash at Bank Pearl Promotion Fund	23,798	-
	$47,657	$15,291

PEARL PRODUCERS ASSOCIATION INC.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS AT 30 JUNE 1995

	1995 $	1994 $
19. RECONCILIATION OF NET SURPLUS TO NET CASH OUTFLOW FROM OPERATING ACTIVITIES		
Excess of Income over Expenditure	41,020	37,943
Depreciation	3,964	3,969
Change in Operating Assets & Liabilities:		
Increase in Current Assets	(6,805)	(37,215)
Decrease (Increase) in Inventories	(583)	1,478
Increase/(Decrease) in Operating Liabilities	5,430	1,372
Net Cash Outflow from Operating Activities	$ 43,026	$ 7,547