

Final Report of Project Fiordland 2002-2003



Don Asprey, Graham Wright, Elizabeth Prins, Thomas Coventry, Robert Conway and Adel Heenan.

A CD copy of this report, and further information about Project Fiordland and future expeditions is available by contacting donasprey@yahoo.co.uk.

TABLE OF CONTENTS

<u>ACKNOWLEDGEMENTS</u>	$\frac{3}{4}$
Above Water Photographs	
1. <u>INTRODUCTION</u>	<u>6</u> 7
Introduction	7
Background	7
Aims and Objectives	8
Methodology	9
Map of Survey Sites	11
Map of Fiord Regions	12
2. <u>BLACK CORAL ANALYSIS</u>	<u>13</u>
Introduction	14
Methodology	14
Results	14
Discussion	17
Black Coral Photographs	18
3. <u>SPECIES DIVERSITY ANALYSIS</u>	<u>20</u>
Introduction	21
Methodology	21
Results	22
Discussion	25
4. <u>COMMONLY ENCOUNTERED SPECIES</u>	<u>26</u>
Commonly Encountered Fish Species	27
Underwater Fish Photographs	28
Commonly Encountered Invertebrate Species	31
Underwater Invertebrate Photographs	32
Commonly Encountered Algae Species	33
5. PHYSICAL DATA SUMMARY	34 35
Introduction	
Summary Physical Data	35
PRE-EXPEDITION TRAINING	<u>39</u>
Pre-Expedition Training	40
Training Photographs	41
DIVING OFFICER'S REPORT	<u>43</u>
Diving Officer's Report	43
Diving Photographs	45
MEDICAL OFFICER'S REPORT	<u>46</u>
TREASURER'S REPORT	<u>47</u>
TEAM MEMBERS	<u>49</u>
REFERENCES	46 47 49 51 53 54 55
APPENDIX 1 (Black Coral Data)	<u>53</u>
APPENDIX 2 (Algal, Fish and Invertebrate Data)	<u>54</u>
APPENDIX 3 (Physical Data)	<u>55</u>

Acknowledgements

This expedition was made possible through generous sponsorship from the following organizations, without which our work would not have been possible:

University of Edinburgh

Wier Fund for Field Studies Barnson Bequest Davis Expedition Fund James Rennie Bequest

The Carnegie Trust for the Universities of Scotland Carnegie Vacation Scholarship

Royal Geographical Society (with the Institute of British Geographers)

Rio Tinto plc.

The British Sub-Aqua Club Jubilee Trust PADI Project AWARE (Asia Pacific) The Explorers Club (New York).

We would like to thank **Chris Paulin** (Museum of New Zealand Te Papa Tongarewa), **Dr. Miles Lamare** (University of Otago) and **Dr. Richard Grigg** (University of Hawaii) for their expert advice on Fiordland and Black Coral. We are also grateful for the support given to us by **Dr. Graham Stone**, and the help with statistical analyses provided by **Dr. Andrew Read**.

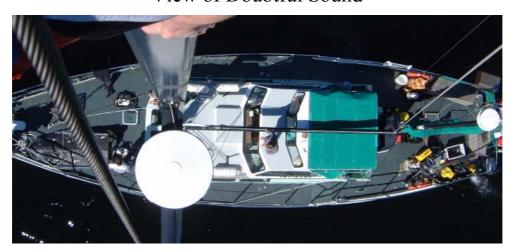
We would like to acknowledge **Edinburgh University Sub-Aqua Club**, who kindly provided us with equipment during Pre-Expedition Training, and for the expedition itself.

In particular, we would like to thank **Peter and Iris Tait**, of Talisker Charters, without whom we would have had much more trouble travelling to the In-Field Phase of the expedition, and whose expertise was fundamental to the successful completion of the expedition.

FIORDLAND ABOVE THE WATER



View of Doubtful Sound



Talisker – our charter



Bottlenose Dolphins







New Zealand Fur Seal

Fern



Collecting fresh water



Fiordland sunrise



1. Introduction

Introduction

Project Fiordland is a student expedition which was initiated in 2001 to conduct surveys of the marine ecosystem in Fiordland, New Zealand. This work was carried out by Students from the University of Edinburgh.

In December 2002 Project Fiordland sent a team of research divers to a unique marine environment situated on the South West Coast of the South Island, New Zealand. The team studied the largest known population of Black Corals in the world, and other unique coral colonies in the area, including Red Hydrozoan corals, solitary Stony Corals and various Gorgonian Sea Fans. These are found in Fiordland, a region of towering peaks, heavy rain, steep fiords and a unique ecology. The team surveyed the previously unstudied populations of Black Coral *Antipathes fiordensis* in Dusky Sound, with the associated fish, invertebrate and algal species.

Background

New Zealand covers a great range of latitude, and its territorial waters stretch from the sub-tropical through to the sub-Antarctic. With a reputation as a land with magnificent, raw scenery, New Zealand hosts a wide variety of endemic Fauna and Flora from the Kiwi-bird to tall tree ferns, a huge ground-dwelling parrot, the Kakapo, and an alpine parrot, the Kea. New Zealand is also well known among the diving community all over the world for the variety of brilliant underwater spectacles, from the wreck of the *Rainbow Warrior* to the famous Poor Knight's Islands, described by Jacques Cousteau as one the ten best dive sites in the world.

Marine ecosystems suffer over-exploitation and damage from fishing and pollution. Stocks of fish and Rock lobster have been over-fished and reduced to low levels, and in some cases seriously stressed. Current stock size is known only for 33 of the 236 quota stocks

There are currently 17 established Marine Reserves in New Zealand, protecting species in 7% of New Zealand's territorial waters. However, 99% of the protected areas are concentrated in 2 large reserves around the Kermedec and Auckland Islands. The New Zealand Biodiversity Strategy (NZBS) is working to create up to 15 new reserves by 2005, and has funded new site investigations, management and programs designed to increase public support. Having marine protected areas, including no-take marine reserves, marine parks and marine mammal sanctuaries with restrictions on pollution, development and fishing will ensure there are regions where marine life can flourish and replenish nearby areas.

Fiordland is a truly amazing and unique place. But its extraordinary marine environment is also vulnerable. Until recently Fiordland has been protected by difficult access, and what can only be described as 'changeable weather'. However, the difficulties of access are being steadily overcome. An increasing number of visitors are participating in a variety of new activities, from fishing and lobstering, to kayaking and SCUBA diving.

As a result the environment is coming under greater pressure. There is an urgent call for improvement in the management of human impact in the Fiords.

There are two marine reserves where all life is protected. These sites were proposed by the New Zealand federation of Commercial Fishermen and established in October 1993. The Piopiotahi Marine Reserve protects the entire northern shore of Milford Sound, the only fiord with direct road access. The Te Awaatu Channel Marine Reserve protects a small, unique area known as The Gut, near the eastern end of Bauza Island in Doubtful Sound. The Gut contains the highest known diversity of species known in the fiords, and is one of the areas where sea pens are found at divable depths. Project Fiordland hopes to identify areas in different parts of Fiordland, to be highlighted as possible sites for Voluntary Marine Reserves, to protect some of the other fiords from increasing human impact.

Interestingly, Dusky Sound was Captain Cook's first port of call after his visit to Antarctic waters in 1773. On this voyage Cook had Kendall's duplicate of John Harrison's Chronometer. At Astronomer's Point in Pickersgill Harbour, Cook observed the transit of Venus, having chopped down a ring of trees to do so. Cook tested the accuracy of the Chronometer against the transit of Venus, and was thus able to establish the longitude of New Zealand for the first time, as well as verifying the ability of the chronometer to determine longitude on a ship, the first method of doing so.

The Aim of Project Fiordland:

Our aim is to survey and map the colonies of precious corals in Dusky Sound, Fiordland, and to survey the associated fish and invertebrate species. We are to produce baseline data on the population of corals, fish and invertebrates in the area and assess the potential threats this ecosystem is under. We aim to identify areas 'of scientific interest' for the Department of Conservation, and NZBS as part of a plan to set up protected Marine Areas in Fiordland.

Objectives:

To carry out underwater baseline transect surveys in some of the lesser-known Fiords in Fiordland, recording black coral colony age and frequency, fish and invertebrate species diversity and habitat areas.

To collect oceanographic data from the survey sites, and take observations on the surrounding landscape and possible effects on the age distribution of the Black Coral colonies underwater.

To broaden the team's experience of fieldwork and of working in foreign environments, providing an opportunity for educational interaction between the *Project Fiordland* team and the local New Zealanders.

This report describes the activities of *Project Fiordland* and presents the results analyzed to date.

Methodology

Project Fiordland selected random sites for survey to be representative of different regions of Dusky Sound. These regions were Inner Fiord, Middle Fiord, Outer Fiord, the Acheron Passage and Wet Jacket Arm. The sites surveyed are shown in the map in Figure 1.1, and the regions of the Fiord shown in Figure 1.2.

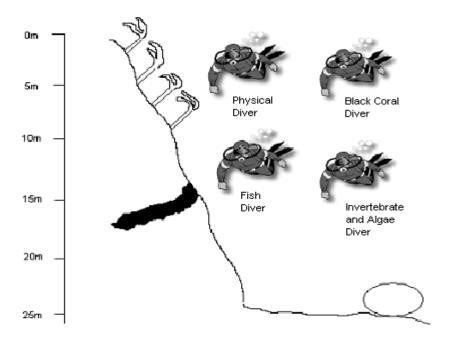
On each survey, a team of 4 divers was sent down to survey from the depth of 25m to the surface. The team of 4 consisted of:

Physical Diver: Noting down data on the substrate of the seabed, gradient, conditions and dominant life forms encountered from the site. Salinity measurements were taken from 25m and at the surface. This enabled a cross section map of each survey site to be drawn. In addition, any signs of human impact, from anchor damage to pollution, were noted.

Invertebrates Diver: Noting down data on the invertebrates encountered and abundance between the depth of 25m and the surface.

Fish Diver: Noting down data on the fish species encountered and abundance from 25m and the surface.

Plant Divers: Noting down data on the plants encountered and abundance from 25m and the surface.



All surveys were divided into 5m depth increments, to provide data on the common life forms encountered at different depths.

Survey teams worked gradually up from a depth of 25m to the surface in a direction perpendicular to the shoreline. The team was accompanied by an underwater photographer, taking pictures throughout the survey. Upon completion of the transect, divers sent up a delayed Surface Marker Buoy to signal to the boat.

The location of transects were recorded using Global Positioning Systems (GPS) and taking positional cues using landmarks on shore, and transects superimposed on a map of the sites we survey. The associated plant, fish, invertebrate data and Black Coral was analyzed together with the Oceanographic data. For details of methodology for Diversity and Black Coral analysis please refer to the relevant chapters.

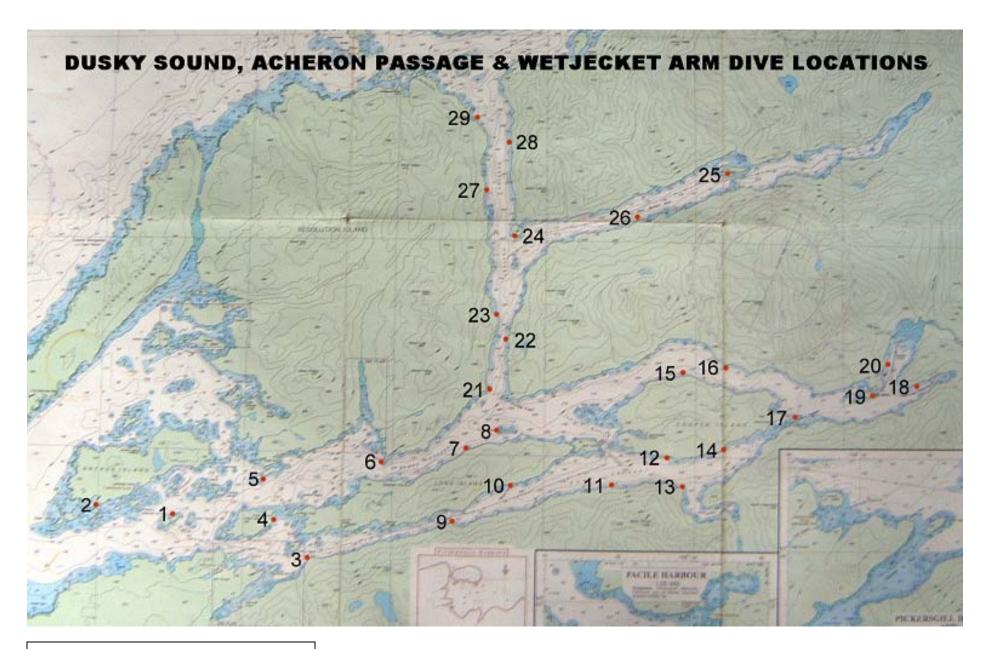


Fig 1.1: Project Fiordland survey sites.

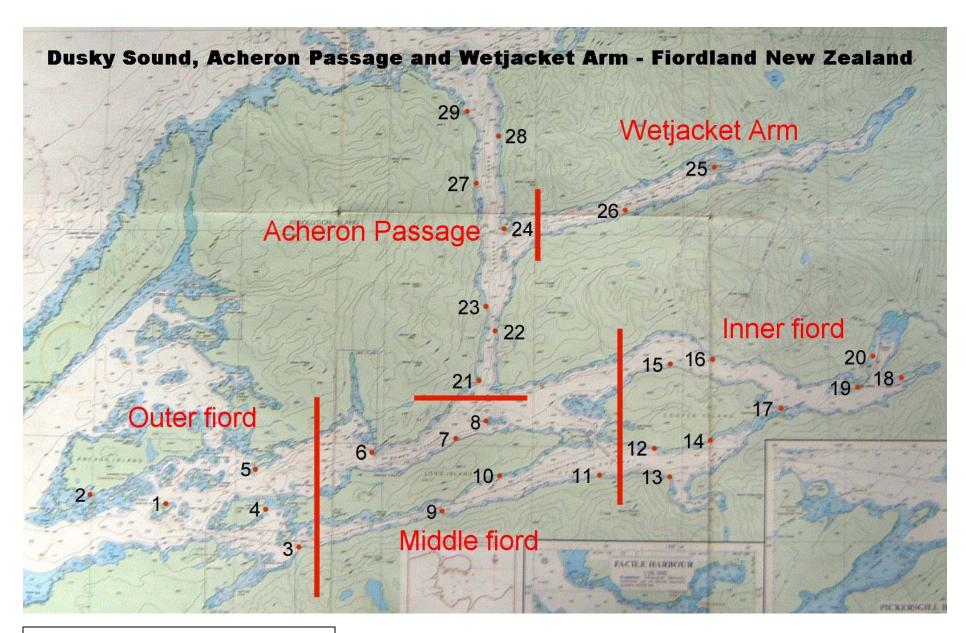


Fig 1.2: Project Fiordland Survey Regions



2. Black Coral Analysis

Introduction

Fiordland hosts the largest known population of Black Coral in the world. Project Fiordland investigated the differences between the Population Structures of Black Coral in different parts of Dusky Sound, the Acheron Passage and Wet Jacket, to identify regions of the fiord where conditions suited the recruitment and growth of the Black Coral *Antipathes fiordensis*. Black Coral divers surveyed 29 sites throughout Dusky Sound, measuring Black Coral colonies encountered in the surveys.

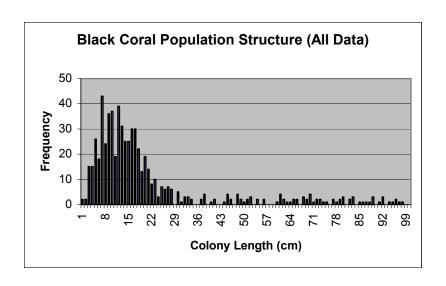
Methodology

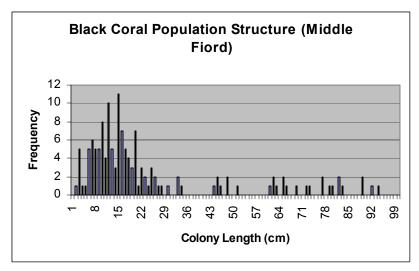
Black Coral (*Antipathes fiordensis*) surveys were conducted throughout Dusky Sound, the Acheron Passage and Wet Jacket Arm. The sites were chosen randomly but selected to be descriptive of different areas in the Fiords. SCUBA divers were sent to measure the colony lengths of all Black Coral colonies encountered between the depths of 25m to the surface on a perpendicular transect of the coastline. Surveys were conducted during a 15-day period in December 2002. Colonies that measured over 1m were ignored due to the inaccuracy of measurement of large colonies. Colonies larger than 1m are estimated to constitute less than 3% of the total population (Grange 1985), distinct size classes are unlikely to be found for such a minority of the population. We tallied those colonies larger than 1m to verify the estimate above. The depth limit of 25m was imposed for safety reasons and because most of the Black Coral population in the Southern Fiords of New Zealand occur between 15 and 25m (Grange 1985).

Black Coral growth bands have been shown to be strongly correlated to colony height (Grange 1985), a frequency distribution of colony height should correspond to a frequency distribution of age. Tagged colony experiments over the course of 7 years were conducted in Doubtful sound and *Antipathes fiordensis* is estimated at 24.4mmyr⁻¹ (Grange 1997) although the growth rate, as with all colonial organisms is potentially indeterminate (Jackson 1977). However, a comparison of length distribution would provide comparative data with which to compare the age distribution and therefore the population structure of Black Coral in different areas of the Fiord. The survey area was divided into 5 different areas as shown by the map, Inner Fiord, Middle Fiord, Outer Fiord, Acheron Passage and Wet Jacket Arm. Different areas were to be compared for differences in the size distribution of Black Coral populations.

Results

Black Coral colonies were encountered throughout the Fiord. 33 colonies larger than 1m in length of 670 Black Coral colonies were encountered at all sites, corresponding to the estimate by Grange of 3% of the total population. The size frequency distributions (population structure) of Black Coral populations in different areas of the Fiord are shown in Figure 2. Analysis revealed that the populations did not correspond to Normal Distributions even after calculating \log_{10} of the heights, and populations in different areas did not have equal variances. Therefore the assumptions for parametric tests were not met.





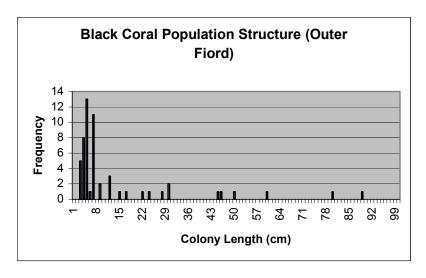
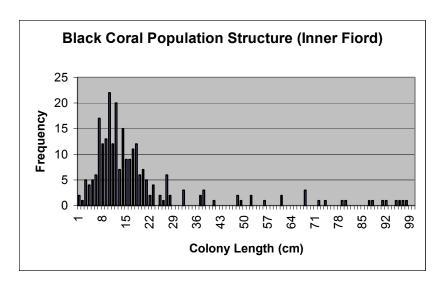
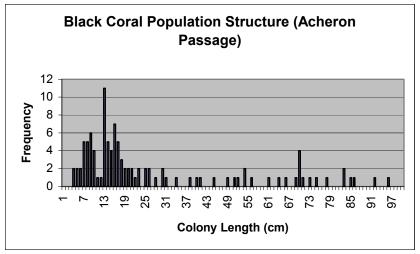


Figure 2: Population Structure of Black Coral Populations in different regions Dusky Sound, Acheron Passage and Wet Jacket Arm.





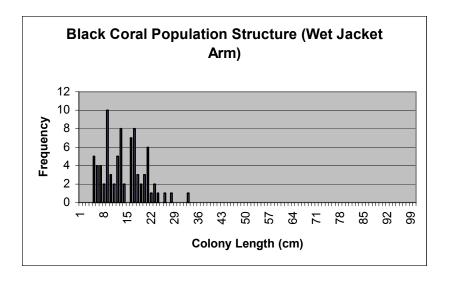


Figure 2 (cont.): Population Structure of Black Coral Populations in different regions Dusky Sound, Acheron Passage and Wet Jacket Arm.

Statistical comparisons of the different populations were conducted using the non-parametric Kruskal-Wallis test for differences in the median colony length. The Kruskal-Wallis test suggests that the median colony lengths for the Inner Fiord areas of Inner Dusky Sound and the Wet Jacket Arm to be shorter than that of the more exposed sites of the Acheron Passage, Middle and Outer Fiords (Outer, Middle and Acheron median colony length = 16cm, Inner and Wet Jacket Arm median = 13cm). Therefore a Mann-Whitney U test was performed to confirm the differences between the Colony Frequency Length distributions between exposed and Inner Fiord sites:

Black Coral populations are larger in more exposed areas of the fiord. Median colony length for the Outer Fiord, Middle Fiord and Acheron Passage were significantly longer (Median = 16cm) than in the Inner Fiord and Wet Jacket Arm (Median 13cm, Mann-Whitney U = 108264, p < 0.00001). The frequency distribution histograms (figure 2.1) of exposed and sheltered sites reveal that it is the lower frequency of larger colonies, i.e. colonies above the height of 50cm, that result in the significantly different population structures between the populations.

Discussion

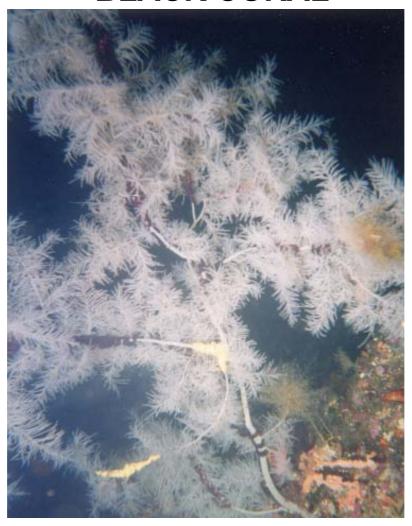
The results presented here indicate that longer Black Coral colonies (*Antipathes fiordensis*) are more frequent in the Outer and Middle Fiord Areas than in Inner Fiord Areas. This suggests the Middle and Outer Fiord Areas are more favorable for the growth of larger Black Coral Colonies.

The faster currents that occur in more exposed areas of the Fiord may result in a greater food supply for Black Coral colonies. This is similar to the situation in Coral Reef areas where there is a greater abundance of species and healthier coral in areas exposed to faster currents, such as passes through a barrier reef. Grange (1988) suggested that Rockslides might cause a higher mortality of Colonies in areas where the incline of the slope are greatest in the fiords. However, there is no evidence here to suggest this could cause differences between the areas in a Fiord. The physical data here shows no significant difference between the inclines in different areas of the Fiord.

The low frequency of smaller colonies (<10cm) can be attributed to sampling error, as encountered by the Operation Raleigh Expedition (Grange 1988). Small colonies can easily be mistaken for other organisms, especially coelenterates, and they are difficult to spot by a diver using SCUBA. Unfortunately this limited the ability to identify regions of the Fiord where recruitment of Black Coral colonies is high. We recommend a longer period in the field for future studies, where more careful and detailed surveys of sites may aid the identification of smaller colonies to investigate differences in Black Coral recruitment between different areas of the Fiord.

The results here indicate that there is a greater concentration of large Black Coral colonies in Middle and Outer Fiord Areas, and suggest that any future conservation plans for the protection of Black Coral populations should concentrate in these areas.

BLACK CORAL



Black Coral, *Antipathes fiordensis*, with associated snake stars, *Astrobranchion constrictum*.



Measurement of black coral size



Black coral, *A. fiordensis,* with associated snake stars. *A. constrictum.*



Measurement of black coral size



3. Species Diversity Analysis

Introduction

Fiordland hosts a unique and diverse marine environment, which is recognized internationally among scientists and SCUBA divers. The fiords are characterized by near vertical walls that plunge several hundred meters to the fiord floor, with only limited narrow ledges and shelves (Ryan & Paulin, 1998). High rainfall causes the presence of a Low Salinity Layer that is stained with Tannin and Humic acid, such that the Layer often resembles weak black tea. The layer becomes larger further up the fiord where forces that mix the fresh water and salt water (currents, waves and wind) are reduced. The fresh water run-off causes the Low Salinity Layer to flow out of the fiords, to be replaced by salt water from the Ocean, known as estuarine circulation. This weak current carries larvae of organisms from deep water. As a result, and also due to the low penetration of sunlight through the Layer, a variety of deep water organisms can be found in fiordland at shallower depths than they are to be found elsewhere. This phenomenon is known as Deep Water Emergence.

Brachiopods dominate the invertebrates to be found in the fiords, just as they did in ancient seas (Ryan & Paulin, 1998). In addition to the Brachiopods and Antipatharian corals, the Fiords host a high abundance of fish species typical of New Zealand coastal areas. Project Fiordland hoped to investigate the abundance of Algal, Invertebrate and Fish species encountered in different areas of the fiord with the aim of identifying regions of Dusky Sound with high species diversity and abundance, which would be useful in identifying suitable sites for conservation.

Methodology

Algal, Fish and Invertebrate surveys were conducted throughout Dusky Sound, the Acheron Passage and Wet Jacket Arm. The sites were chosen randomly but selected to be descriptive of different areas in the Fiords. SCUBA divers were sent to tally the abundance of different species encountered in the different 5-meter depth increments between the depths of 25m to the surface on a perpendicular transect of the coastline. Surveys were conducted during a 15-day period in December 2002. The depth limit of 25m was imposed for safety reasons and to enable surveys to be conducted in conjunction to the Black Coral surveys.

The abundance of Algal, Fish and Invertebrate species were noted according to the following Ordinal Scale:

Abundance Scale	Algae	Fish and Invertebrates
0	None	0
1	Rare	1-5
2	Occasional	6-20
3	Frequent	21-50
4	Abundant	51-250
5	Dominant	250+

The survey area was divided into 5 different areas as shown by the map, Inner Fiord, Middle Fiord, Outer Fiord, Acheron Passage and Wet Jacket Arm. Species were identified where possible to species level, although with some invertebrates and algae this was difficult. Raw data from survey dives can be found in Appendix 2. We acknowledge that the species included in the analysis are those easily encountered by SCUBA divers, other species that are difficult to find due to their size, behavioral activities or ability to remain inconspicuous were regrettably and unavoidably omitted from the data. However, Project Fiordland believes the majority of species that could have been identified were, and that the data and diversity measurements were representative of the sites that were surveyed.

Results

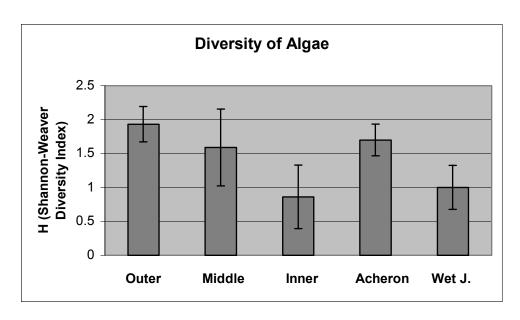
Fish, Invertebrate and Algal species were encountered in all dives. Abundance of species was analyzed to give a diversity measurement for Fish, Invertebrates and Algae using the Shannon-Weaver Diversity Index. The Diversity scores for each survey site is given in Figure 3.1 and graphical representations of diversity are presented in Figure 3.2.

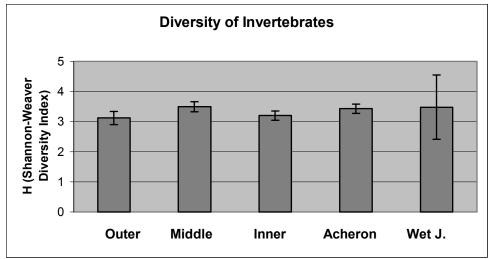
Unfortunately the low number of data points for Wet Jacket Arm made analysis difficult; therefore Wet Jacket Arm was excluded from the diversity analysis. However the diversity scores for Fish, Invertebrate and Algal species for the other Fiords conformed to Normality and Equal Variances, and the Diversity Scores analyzed using parametric Analysis of Variance (ANOVA).

Algal species diversity was greatest in the Outer, Middle and Acheron areas of the Fiord (ANOVA $F_{3,23} = 7.40$, p = 0.001). Invertebrate species abundance was found to be greater in the Middle Fiord and Acheron Passage (ANOVA $F_{3,23} = 6.17$, p = 0.003). Fish species diversity was found to be uniform throughout the Fiord areas (ANOVA $F_{3,23} = 1.75$, p = 0.186).

Dive number	Shannon Weaver Diversity Index (H)			Fiord Area
	Fish	Invert	Algae	
1	1.9338	3.2892	1.7362	Outer
2	2.4149	3.1496	2.1525	Outer
3	2.2660	3.2226	1.7251	Outer
4	2.4308	2.8289	2.1444	Outer
5	2.4582	3.1101	1.8996	Outer
6	2.0198	3.5356	1.5672	Middle
7	2.3992	3.5934	2.0788	Middle
8	1.9915	3.6920	2.3257	Middle
9	2.2161	3.2287	1.5318	Middle
10	2.6364	3.4921	1.0114	Middle
11	2.1186	3.4265	1.0114	Middle
12	2.3617	3.3854	0.5623	Inner
13	2.1767	2.8745	0.9743	Inner
14	2.2161	3.1156	0.9557	Inner
15	2.2056	3.1330	1.6916	Inner
16	1.9571	3.1583	1.3689	Inner
17	2.3517	3.1158	1.5048	Inner
18	1.6094	3.0920	0.0000	Inner
19	1.7479	3.5166	0.6931	Inner
20	1.9913	3.4220	0.0000	Inner
21	2.2243	3.3824	1.9600	Acheron
22	2.4740	3.5558	1.8239	Acheron
23	2.0977	3.6483	1.9851	Acheron
24	2.4283	3.2102	1.7548	Acheron
25	2.5521	3.3970	0.9743	We Jacket Arm
26	2.2056	3.5653	1.0253	Wet Jacket Arm
27	2.2161	3.3740	1.6591	Acheron
28	2.3046	3.5847	1.3730	Acheron
29	2.2502	3.2677	1.3624	Acheron

Figure 3.1: Shannon Weaver Diversity Scores for Fish, Invertebrate and Algal species.





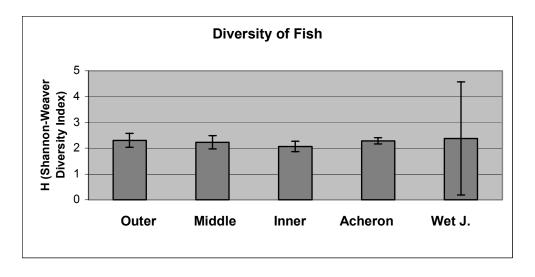


Figure 3.2: Shannon-Weaver Diversity Scores for Fish, Invertebrate and Algal species in different areas of the Fiord.

Discussion

Algal species diversity was lower in the Inner Fiord area. There was no link to any physical data of the survey site at the time of the survey. We suggest that the average depth of the LSL may have an influence. The LSL being greater in the Inner Fiord area, this reduces the sunlight penetrating into the water, especially at the frequencies that are suitable for photosynthesis. This could cause reduced Algal diversity. However we suggest further investigation into the causes of differing Algal diversity in different areas of the Fiords.

The difference in Invertebrate diversity between fiord areas remains unexplained. We suggest that possibly the increases food supply associated with greater currents from the Ocean may result in higher diversity of invertebrates in the more exposed Fiord regions, similar to that which may cause a greater frequency of older Black Coral to grow in more exposed areas. The currents carrying larvae of invertebrate organisms will be reduced in the Inner Fiords.

The reduced diversity in the Outer Fiord Area may be caused by exposure to harsher conditions, such as wave action, which may cause low recruitment. This is especially true of species which have to attach to a hard substrate in order to survive, such as Sponges, Brachiopods, Coelenterates. However, we are unsure of the causes and suggest further investigation into the causes of differing Invertebrate diversity in different areas of the Fiords.

In light of the results, future conservation in Dusky Sound to protect species diversity should concentrate in the middle Fiord areas and the Acheron Passage. Here we have identified an area of high species diversity and abundance. This area of species abundance could act as a reserve from where organisms could then migrate to the surrounding areas to replenish the ecosystem in the fiord.



4. Commonly Encountered Species

$\underline{\textbf{Commonly encountered Fish}}$

Oblique Swimming Triplefin Zellowback Triplefin Spotty	Obliquichthys mary Forsterygin flavoni Notolabrus celidotu	igrum	
Blue Cod <i>Parapersis</i> Scarlet Wrasse <i>Pseudolab</i> Banded Wrasse <i>Notolabrus</i> Girdled Wrasse <i>Notolabrus</i>	rus miles Yellow s fucicola Butterf	back Triplefin ly Perch	Obliquichthys maryannae Forsterygin flavonigrum Caesioperca lepidoptera Notolabrus celidotus
Blue Cod Parapersis Scarlet Wrasse Pseudolab Banded Wrasse Notolabrus Girdled Wrasse Notolabrus Sea Perch Heliconlenu	rus miles Yellov s fucicola Butter s cinctus Spotty	vback Triplefin fly Perch	Obliquichthys maryannae Forsterygin flavonigrum Caesioperca lepidoptera Notolabrus celidotus Cephalosyllium isabellum
Blue Cod Parapei Scarlet Wrasse Pseudoi Banded Wrasse Notolab Girdled Wrasse Notolab Sea Perch Heliconlen	labrus miles Yellov rus fucicola Butter rus cinctus Spotty	r .	Obliquichthys maryannae Forsterygin flavonigrum Caesioperca lepidoptera Notolabrus celidotus Cephalosyllium isabellum
Blue Cod Para	persis colias dolabrus miles labrus fucicola (Yellowback Triplefin Butterfly Perch Carpet Shark Sea Perch	Forsterygin flavonigrum Caesioperca lepidoptera Cephalosyllium isabellum Heliconlenus percoides

FISH



Blue Cod – Parapercis colias



 $Banded\ Wrasse-{\it Notolabrus} \\ {\it fucicola}$



Scarlet Wrasse – *Pseudolabrus miles*



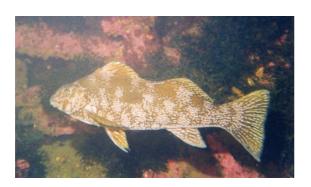
Dogfish, member of the Squalidae



Carpet shark – Cephalosyllium isabellum



Seahorse – Hippocampus abdominalis





Marblefish – Aplodactylus arctideus



Mottled triple fin – Forsterygion malcolmi



Yellow black triple fin – Forsterygion flavonigrum



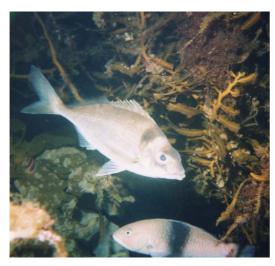
Red Gunnard - Chelidonichthys kumn



Leatherjacket – Parika scaber



Blue Moki – *Latridopsis ciliaris*



Tarahiki – Nemadactylus macrpterus

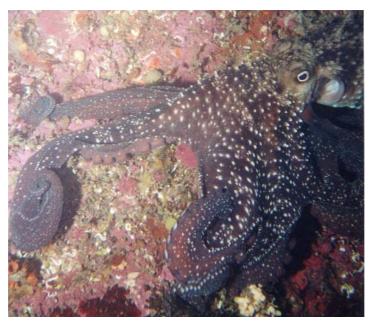


Jock Stewart or Sea Perch – Heliconlenus percoides

Commonly encountered Invertebrates

Orange anemone Orange ascidian	Anthoce albocinta Didemnum sp.		
Cup Like Sponge Golf Ball Sponge Tubeworm Acorn Worm	Azinella tricalyciformis Latruncalia sp. Protula sp. Saccoglossus sp.	Purple Sea Slug Kina Black Brachiopod Orange Ascidian	Jason mirahilis Evechinus sp. Notosaria nigricans Didemnum sp.
Cup Like Sponge Golf Ball Sponge Tubeworm Acorn Worm Purple Sea Slug	Azinella tricalyciformis Latruncalia sp. Protula sp. Saccoglossus sp. Jason mirabilis	Kina Black Brachiopod Orange Ascidian Bryozoan	Evechinus sp. Notosaria nigricans Didemnum sp. Amastiga sp.
Cup Like Sponge Golf Ball Sponge Tubeworm Purple Sea Slug Black Coral	Axinella tricalyciformis Latruncalia sp. Protula sp. Jason mirabilis Antipathes fiordensis	Kina Black Brachiopod Orange Ascidian Bryozoan Red Coral Snakestar	Evechinus sp. Notosaria nigricans Didemnum sp. Amastica sp. Errina sv. Astrobranchion constrictum
Cup Like Sponge Golf Ball Sponge Tubeworm Purple Sea Slug Black Coral	Axinella tricalyciformis Latruncalia sp. Protula sp. Jason mirabilis Antipathes fiordensis	Black Brachiopod Orange Ascidian Bryozoan Red Coral Snakestar	Notosaria nigricans Didemnum sp. Amastiga sp. Errina sp. Astrobranchion constrictum

INVERTEBRATES



Octopus – Octopus huttoni





Golf-Ball sponge – Latruncalia sp.



Nudibranch – *Jason* mirabilis Starfish – *Asterodon sp.*



Crayfish -J. edwardasi

Commonly encountered Algae

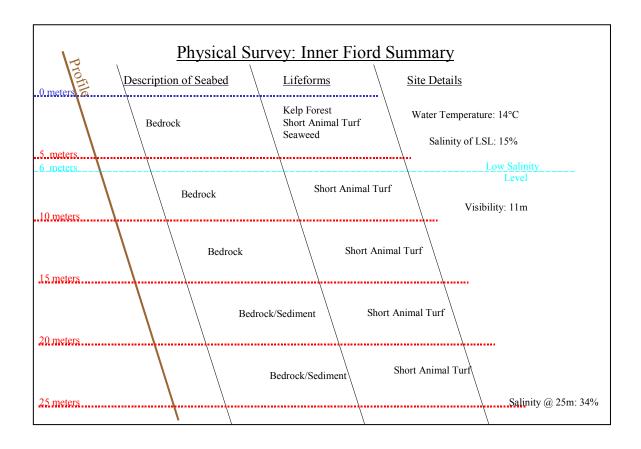
		OI
Sea Lettuce	Ulva sp.	
		5
Green Ferns	Caluerpa brownii	
Green Fingers	Codium sp.	
No Float Laminaria	Carpometria costata	
Red Ferny	Arthocardia wardii	4.0
Green Ferns	Caluerpa brownii	10
Green Fingers	Codium sp.	
No Float Laminaria	Carpometria costata	
Red Ferny	Arthocardia wardii	4-
Green Ferns	Caluerpa brownii	15
Green Fingers	Codium sp.	
No Float Laminaria	Carpometria costata	
Red Ferny	Arthocardia wardii	20
Green Ferns	Caluerpa brownii	
Green Fingers	Codium sp.	
No Float Laminaria	Carpometria costata	
Red Ferny	Arthocardia wardii	
 <u> </u>		25

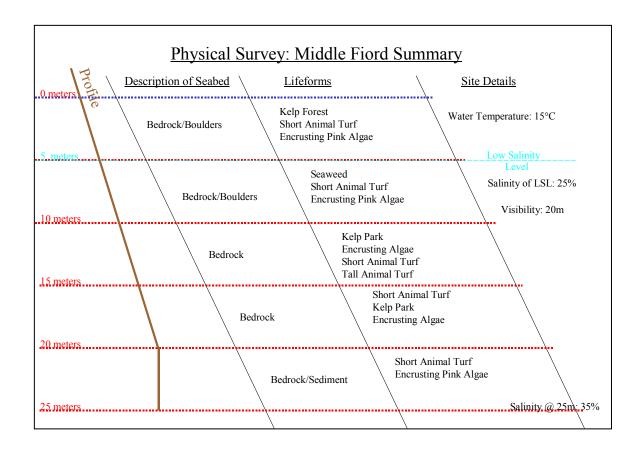


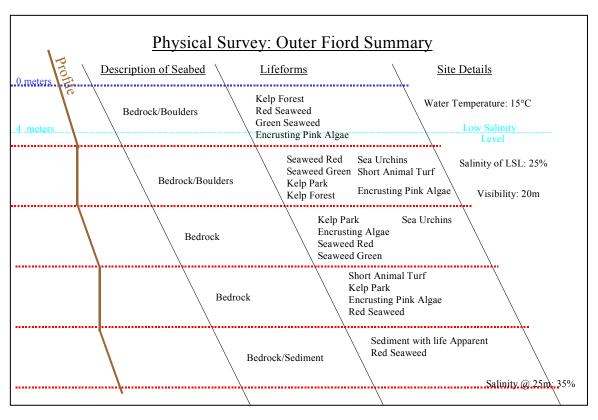
5. Physical Data Summary

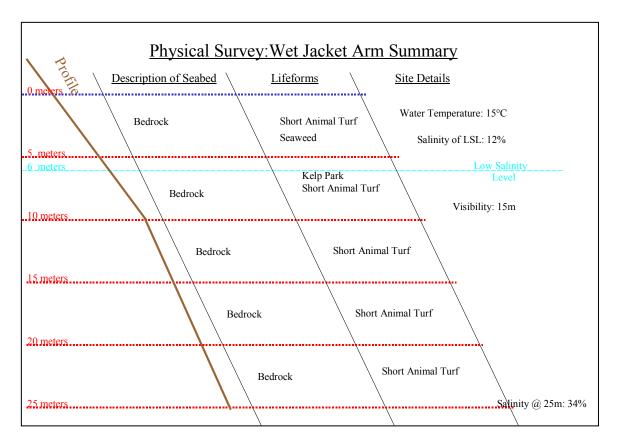
Physical Surveys

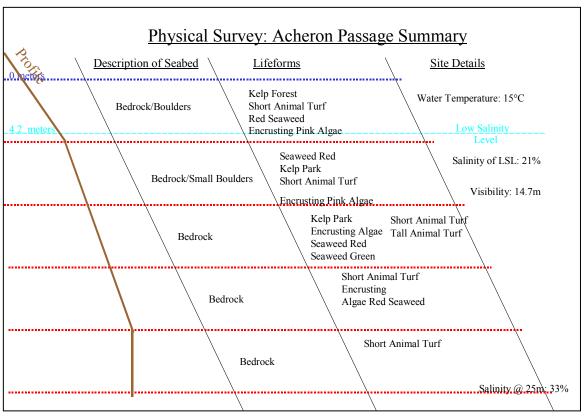
Below is a summary of the oceanographic data from the 5 regions of the Fiord. The physical survey sheet used to record the physical data can be found is shown in figure 5.1. Physical data for each individual survey site can be found in appendix 3. Description of the seabed, dominant life forms and conditions were recorded in 5-meter depth increments, and salinity samples taken at the surface and bottom depth of 25 meters. We would like to acknowledge SEASEARCH, a project of the Marine Conservation Society in the UK, and the help they provided to help us collect the physical data.











Physical survey

Site Details				
Site name:		Date:		
GPS:		S		Е
Description of location				
Time in:	Time out:		Duratio	n of dive:
Visibility:		Sea tempera	iture:	
Time in relation of tides:		-		
Conditions (currents, surge):				
Salinity at bottom depth:		Salinity of I	LSL:	
Depth of LSL:				
Description of Seabed (Per	rformed in 5 me	ter depth inci	rements)	
Deepest depth:	Shallowest dep	oth:		Gradient:
Type of seabed:				
Bed rock Bould	lers	Cobbles	;	Sand
Mixed Ground Mud_		Other		
(Underline dominant type)				
<u>Life forms</u> (Performed in 5	meter depth incr	rements)		
(Mark abundance R-rare <5°	% cover, O-occa	sional 5-50%	6, C-comm	on >50%)
Animal Turf on Rocks		Tal	1	Short
Animal Bed (note animals)				
Sediment with life apparent	(tubes, burrows	etc.)		
Barren sediment				
Kelp forest				
Kelp park				
Encrusting Pink Algae				
Mixed Seaweeds				

<u>Anything unusual or noteworthy about the seabed or marine life?</u> (e.g. large numbers of starfish grouped together, apparent covering with algae etc.)

Figure 5: Physical data recording sheet.



6. Pre-Expedition Training

Pre-expedition training

Whilst fund-raising and organisation for the expedition ensued SCUBA diving and surveying training was also taking place. Despite all team members already holding good dive qualifications we felt it good practice to all achieve a similar skill level for the specific tasks required. Initially all expedition members were individually checked for a good level of diving ability in swimming pool refresher session. This check included equipment set-up, buoyancy control, and confidence in the water (for example mask removal, regulator recovery, use of a delayed surface marker buoy and exercises such as underwater egg and spoon relays). Later, swimming pool sessions in groups allowed for practice in signalling as well as developing a good team spirit and trust.

The cold water conditions expected in New Zealand required the use of dry-suits, which to many of the team was a new experience. The differences in buoyancy control and general diving techniques were addressed in training dives at sites within Scotland. Two main dive sites were visited, the first on Scotland's South East coast around the St. Abbs and Eyemouth Voluntary Marine Reserve, and the second in Loch Long, a sea fed Loch on Scotland's West coast (see photographs). These dives offered similar underwater environments to those found in New Zealand, including a low salinity layer and wall dives.

Once experience of the conditions and the equipment was established, further dives were completed to give practice in navigation and setting transect lines. The team also conducted practice underwater surveys and analysis. A summary of a survey of a dive site in Loch Long is shown in Figure 6.

Another aspect important to efficient work on our arrival in Fiordland was to become proficient in species identification. Using books (see references) about the area at large we rigorously went over and tested ourselves in species identification of fish, invertebrate and plant life.

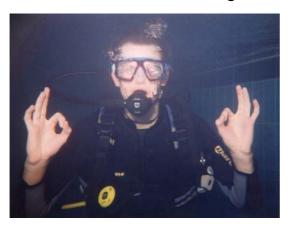
Three of the team members attended a two-day boat-handling course and further to this one member completed a course in basic engine mechanics.

First aid training was completed by each of the team members to establish a competence in basic first aid, especially in diving related illness and its effective treatment.

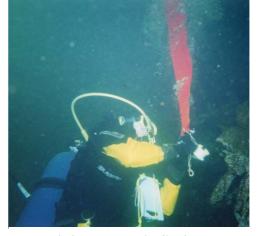
SCUBA TRAINING



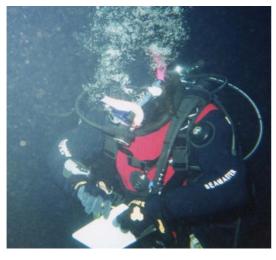
Training dives at Loch Long



Pool dives



Practicing SMB inflation



Practice with data recording



Saithe in Scottish waters

Practise survey of Conger Alley 2, Loch Long, Scotland.

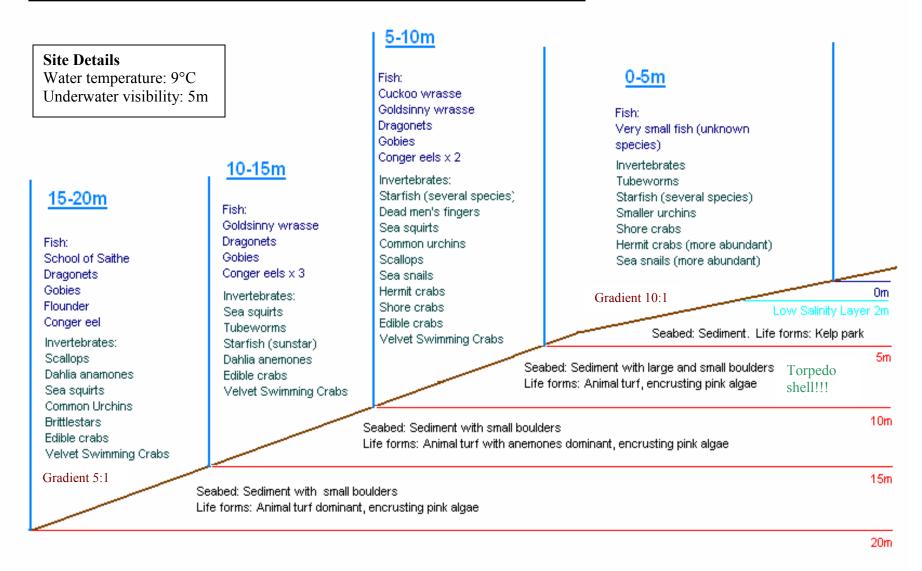


Fig 6: Pre-Expedition Practice survey of a site in Loch Long

Diving Officer's Report

The Role of the Diving Officer on an expedition is to ensure that all diving activities are carried out safely and accidents are prevented. All team members had been trained prior to the expedition, and took safety very seriously. It is for this reason that everything went smoothly, and there were no diving accidents.

The team underwent prior training in Scotland, in Loch Long and St Abb's and Eyemouth Marine Reserve. The team were introduced to Drysuits, and performed practice surveys, with the equipment that was to be used in New Zealand. Prior training in First Aid and CPR was also provided.

Team members conducted 3 surveys a day. Multi-Level Dive profiles were calculated using the PADI (DSAT) Wheel, as follows:

		Depth 15m	Actual time 15 min
		Max. allowable time 35 min	Pressure Group O
Depth 25m	Actual time 15 min		
Max. allowable time 27 min	Pressure Group H		

Surface Interval 2 hours, Pressure Group B

		Depth 15m	Actual time 15 min
		Max. allowable time 23 min	Pressure Group S
Depth	Actual time		
25m	15 min		
Max. allowable time	Pressure Group		
20 min	M		

Surface Interval 2 hours, Pressure Group B

		Depth 15m	Actual time 15 min
		Max. allowable time 23 min	Pressure Group S
Depth 25m	Actual time 15 min		
Max. allowable time 20 min	Pressure Group M		

With the intensive diving schedule of the expedition, Decompression Sickness (DCS) was a major consideration. We reduced the chances of anyone getting a DCS by taking a rest day once every three days throughout the expedition. The maximum diving depth imposed was 25m, divers planned their dives according to PADI regulations and tables, and all divers took safety stops at 5 meters for 3 minutes. Thankfully, our evacuation plan to a recompression chamber in Dunedin was not needed.

Diving in the fiords proved very simple, with negligible currents in the majority of dives and very good visibility beneath the Low Salinity Layer. Indeed there was more light penetrating through the LSL than we had expected, and conditions were favorable compared to the sites we had dived in Scotland. The only problem encountered during the expedition was with that of ears, several team members were unable to dive due to sinus congestion at the beginning of the expedition. We suspect that on the long outbound flights to New Zealand some of us may have caught a cold or something similar

Project Fiordland managed on average 3 surveys a day in the field, with each team member participating individually in approximately 30 dives. The expedition encountered no problems, and enjoyed some very good diving. The ability to plan Multi-Level Dives was essential for the intensive diving schedule of the expedition. With future expeditions I strongly recommend that training in the use of the PADI Wheel by team members be conducted prior to the expedition.

The use of Talisker Charters made the logistics of diving very easy. With a compressor on board, tanks to hire, the use of a Zodiac in addition to the charter boat, GPS and a Depth Sounder Dive planning was very easy. The only problem arose with the use of British equipment in New Zealand. Diving cylinders in New Zealand are imported from the USA, as a result not all the regulators used on the expedition was fully compatible with the cylinders. However, this was only a minor problem that was easy to overcome with a bit of tinkering before each dive. In future expeditions to New Zealand, I would recommend that equipment be checked, especially regulators, for their compatibility with American cylinders valves. Adel Heenan would also like to add that testing drysuits for leaks prior to the expedition is essential, having experienced first hand the disadvantages of using what could only be described as a Semi-Drysuit. We would like to thank Talisker Charters and Peter Tait for the help given, Peter's knowledge of the Fiords and Diving ensured the success of the expedition.

I would like to end by saying that it was a great challenge to be the Diving Officer for the expedition, and am thankful for the opportunity. Personally I learnt a great deal and I hope future Diving Officers will benefit in the same way that I have.

DIVING & TECHNIQUES











Medical Report

New Zealand holds pathogens that expedition members would not have been exposed to in the UK. All safety and diving regulations were adhered to and no major incidents occurred whilst in the field.

The main problems encountered by the team were:

Sinus problems

Due to the temperature of the water, team members experienced problems in equalising internal airspaces after repetitive dives. Symptoms of sinus problems were seen and team members were rested until equalisation was possible.

Sand flies

The sandfly is endemic to the Fiords of New Zealand. These bite causing itching. Sandflies were found to bite at all times of the day, but were not active when it rained. Sandfly bites often started itching hours after being bitten. Team members used insect repellent and covered limbs to reduce the possibility of being bitten.

Rashes from dry suit seals

Dry suit seals are tight to stop water entering the suit. Some seals caused contact rashes on individuals, especially around the neck region. The application of talcum powder around the seal reduced the contact rash and sudo cream was used on the rash to reduce symptoms.

Sun Exposure

Sun exposure is very strong in New Zealand, related to the state of the Ozone Layer above the country. Suntan lotion was used to reduce the risk of sunburn.

The research vessel had the ability to be in radio contact with the shore at all times and any diving or non-diving emergency situations could have been dealt with immediately.

Treasurer's Report

The Project Fiordland 2002 - 2003 expedition gratefully acknowledges financial support to all those organisations mentioned in the summary of income below.

SUMMARY OF INCOME	GBP (£)
University of Edinburgh Weir fund for Field Studies and Barnson Bequest Davis Expedition Fund James Rennie Bequest The Carnegie Trust for the Universities of Scotland Carnegie Vacation Scholarship awarded to Don Asprey Royal Geographical Society (with the Institute of British Geographers) Rio Tinto plc. The British Sub-Aqua Club Jubilee Trust PADI Project Aware The Explorers Club (New York)	2,000 5,600 900 2,000 630 1,000 1,000 417.39 664.59
Fund-raising Cousteau Creates night RBS interest to account Personal Contributions	519.71 25.71 3,000
GRAND TOTAL OF INCOME	17,757.40
SUMMARY OF EXPENDITURE PRE EXPEDITION	
Insurance Transport (flights & coach) Boat Charter	564.52 7715.18 6452.38
Administration Application fees Phonebill Training (rental, fills, courses)	20 5.15 368
Equipment Books Tools Dive equipment Medical kit Photographic & Batteries Fund-raising events (club & flyers) Other SUB-TOTAL	45 6.95 291.54 59.82 72 290 69.25 15,959.79

IN FIELD

Transport	
Transfers	247.71
Ferries	221.15
New Zealand departure tax	49.72
Equipment	
Medical kit	4.47
Electronic	6.61
Accommodation	
73.24	
Food	57.17
Other	113
SUB-TOTAL	773.07
EXTRAS	
Bank charges	31.08
Postage costs	56.21
Printer ink, CD-R's, Paper	23.44
Report printing (predicted)	400
SUB-TOTAL	510.73
GRAND TOTAL OF EXPENDITURE	17,243.59
REMAINING BALANCE	513.81

The remaining balance will go towards any as yet unforeseen costs and dissemination of the report to all those who supported and have shown interest in the expedition. Any money remaining will be kept in the account in the hope that future projects will be undertaken.

Team Members

Don Asprey. Team Leader, Diving Officer and Underwater Photographer. Currently studying in his 4th year for a BSc in Biological Sciences with Honours in Zoology, at the University of Edinburgh.







Graham Wright. Treasurer and Photographer. Currently studying in his 4th year for a BSc in Biological Sciences with Honours in Plant Science, at the University of Edinburgh.







Adel Heenan. Fundraising Secretary. Currently studying in her 4th year for a BSc in Biological Sciences with Honours in Zoology, at the University of Edinburgh.







Elizabeth Prins. Publicity. Currently studying in her 3rd year for a BSc in Biological Sciences, with Honours beginning next year, at the University of Edinburgh.







Thomas Coventry. Logistics. Currently studying in his 3rd year for a BSc in Biological Sciences, with Honours beginning next year, at the University of Edinburgh.

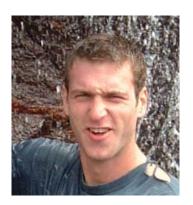






Robert Conway. Medical Officer. Graduate of Edinburgh University with a BSc in Biological Sciences, with Honours in Immunology, at the University of Edinburgh. Currently studying Medicine in his 1st year at St. George's College.







References

Barsky, S., Long, D. & Stinton, B. 2002. Dry Suit Diving (3rd Ed.). Best Publishing Company.

Bennett, Q. 1986. Diving Fiordland. New Zealand Dive Magazine 8 (4): 4-6, 44-45.

Fowler, J. & Cohen, L. 1990. Practical statistics for field biology. Open University Press.

Foster-Smith, R. 1995. Seasearch. Scottish National Heritage.

Francis, M. 1998. Coastal Fishes of New Zealand. Reed Publishing.

Grange, K. R. 1980. *Antipathes fiordensis*, a new species of black coral (Coelenterata: Antipatharia) from New Zealand. New Zealand Journal of Zoology 17: 279-282.

Grange, K. R. 1985. Distribution, standing crop, population structure and growth rates of black coral in the southern fiords of New Zealand. New Zealand Journal of Marine and Freshwater Research 19:467-475.

Grange, K. R. 1991. Mutualism between the antipatharian *Antipathes fiordensis* and the ophiuroid Astrobranchion constrictum in New Zealand fiords. Hydrobiologia 216/217: 297-303.

Grange, K R. Singleton, R.J. 1988. Population structure of black coral, *Antipathes aperta*, in the southern fiords of New Zealand. New Zealand Journal of Zoology 15: 481-489.

Grigg, R. W. 1975. The commercial potential of precious corals in the western Caroline Islands, Micronesia. Sea Grant technical report. UNIHI-SEAGRANT-AR-75-03. 14p.

Harper, L., Mudd, T. & Whitfield, P. 2002. The Rough Guide to New Zealand. Rough Guides.

Jackson, J. B. C. 1977. Competition on marine hard substrata: the adaptive significance of solitary and colonial strategies. Am Nat 111: 743-767.

Meads, M. 1990. Forgotten Fauna. The rare, endangered, and protected invertebrates of New Zealand. DSIR Publishing, Wellington.

Norse, E. A. (Ed.) 1993. Global Marine Biological Diversity. A strategy for building conservation into decision making. Island Press.

Parker, N. R., Mladenov, P. V. & Grange, K. R. 1997. Reproductive biology of the antipatharian black coral Antipathes fiordensis in Doubtful Sound, Fiordland, New Zealand. Marine Biology 130: 11-22.

Stanton, B. R., Goring, D. G. & Bell, R. G. 2001. Observed and modeled tidal currents in the New Zealand region. New Zealand Journal of Marine and Freshwater Research 35: 397-415.

Ryan, P. & Paulin, C. 1998. Fiordland Underwater. Exisle Publishing.

Yapor, W. Y. 2000. On-Site Management of Scuba Diving and Boating Emergencies. Best Publishing Company.



Appendix 1

Black Coral	Data, U			l Dis	10.2	l Dis	10.4	Dis	· · · ·		Divo 6		Dis	0.7	Disc	. 0		Divo 0			Divo 10			Divo 11	
Depth (m)	25-20	20-15	Dive 2 25-20	Div 25-20	20-15	Div 25-20	20-15	Div 20-15	15-10	25-20	Dive 6 20-15	15-10	Div 25-20	20-15	Div 25-20	20-15	25-20	20-15	15-10	25-20	Dive 10 20-15	15-10	25-20	Dive 11 20-15	15-10
Size (cm)																									
1													L .												
3					5								1	1					2						1
4					8								-	-					-						1
5					13														1						
6								1		1			1		1				1						1
7 8					10			1		1	2						1	1		2	1	- 1	1		
9					_			2							1					1		2			1
10								_		3	1		1	1				2				_			
11											2		1									1			
12								3		2		3		1				2							2
13 14										1		1	1		2					1					
15								1		3	1	1		1			1	1			1	1			1
16										1	1	1					1						1	1	1
17								1		2							1					1	1		
18 19										1	1	1					2								2
20										1	1		1	1								2			1
21										1															
22								1		1	1		1												
23 24									-	1	-				1										
25									1	1	1						1					1			
26										1	1														
27													1												
28			1																				1		
29 30			1		 		 		1	1												<u> </u>			
31		-		-	 	-	 	-	<u> </u>		-											 	-		\vdash
32																									
33																		1			1				
34 35																				1					
36	_	 	_	 	_	 	_	_				_		_	_	—	 	 		 					
37					L																				
38																									
39																									
40 41																									
42																									
43																									
44																					1				
45 46			1					1			1		1	1											
47								-					_												
48													2												
49																									
50 51								11					1												
51 52																									
53																									
54																									
55 56																									
57																									
58																									
59 60									1																
61											1														
62														2											
63 64					-		_																		
65											1											1			
66											1														
67 68		-			-		-	-	-		-											-	-		
69		-		-	 	-	 	-	-		-		1									 	-		\vdash
70																									
71 72					1		-			1															
73		-		-	 	-	 	-	-	1	-											 	-		\vdash
74																									
75 76																									
77		1		1	 	1	 	1	1		1	1					1					1	1		1
78																									
79 80					_		_	1					1												
80 81								1					1												
82													1	1											
83													1												
84 85		-			1		-	-	-		-											-	-		
86																									
87																									
88 89	1				1		-					1					1								
90	<u> </u>																<u> </u>								
91																									
92 93					_		_			1															
94																1									
95																									
96																									
Δ-	i i				1		-																		
97									—	_	—			-	-										
97 98 99																									
97 98 99 100																									
97 98 99	1 2	0	1 4	3 3	36	0	0	4 17	3	25	16	10	19	9	5	1	9	7	4	7	4	10	6	1	11

	Dive 12	es 12-2	Dive	e 13			Dive 14		Div	e 15		Div	n 16		1	Dive 17		Div	e 18	1	Dive 19	,	1	Dive 20	1
Depth (m)	25-20	25-20	20-15	15-10	10-5	25-20	20-15	15-10	25-20	20-15	25-20	20-15	15-10	10-5	25-20	20-15	10-5	25-20	20-15	25-20	20-15	10-5	25-20	20-15	15-10
Size (cm)																	1		1						
2											1														
3 4															_				1		3	_	1		
5	1	1				1	1														1			_	
6		2									1											1	1	1	
7 8		1	1	1		2	2				4	1	3			1				2			2	2	
9		3				_	_		1		1	1	Ū		1					1			1	4	
10		3	2		2		3	1					1					1						3	
11 12	1	4 5	1 2	1	2	2	4	1		1								1	1		1		1	1	
13		1	1			1						1	1						1	1					
14 15		2	1	4		1	2	1	1 2		1				- 1			1							
16	1	1	- '			2	2	-	1														2		
17		4				1		3	1							1								1	
18 19		4	1			1	1		1						3	1	1					1	1	1	
20		4				2				1															
21	1		1						1														1	1	
22 23		1	1						1														1		
24																									
25 26						1									1							1			
27		1													1	1		1			1		1		
28				1											1										
29 30												 			 					 		 	 		
31																									
32 33																			1			1	1		
34																									
35																									
36 37												-			-			1		-		-	-		1
38									1								1								1
39																									
40 41																									1
42																									
43 44																									
45																									
46																									
47 48									2																
49										1															
50 51																									
52												1	1												
53 54																									
55																									
56 57																									
58																									
59 60																									
61 62																		1				1			
63																									
64																									
65 66																									
67														_	_						1				
68 69															<u> </u>						L '				
70 71																									
72		1																							
73 74												1													
75																									
76 77																									
78																									
79 80			1								<u> </u>	 			 		<u> </u>	1	<u> </u>	 	<u> </u>	 	 		
81																									
82 83																									
84																									
85 86																									
87															1										
88 89											<u> </u>	1			-		<u> </u>	<u> </u>	<u> </u>	-	<u> </u>	-	-		
90																									
91 92											<u> </u>	 	1	1	 		<u> </u>	<u> </u>	<u> </u>	 	<u> </u>	 	 		
93																									
94 95				1							<u> </u>	 			 		<u> </u>	<u> </u>	<u> </u>	 	<u> </u>	 	 		
96																								1	
97 98			1												<u> </u>					<u> </u>	1	<u> </u>	<u> </u>		
99																									
100 >1m		1	1										3									1	1		
Totals	4	40	17	9	4	26	19	7	12	3	9	6		2	11	4	3	8	5	4	8	7	14		3

Black Coral																											
		Dive 21			Div	e 22		Dive	23		Dive 24				Dive 25				Dive 26		Dive 27		Dive 28			Dive 29	
Depth (m) Size (cm)	25-20	20-15	15-10	25-20	20-15	15-10	10-5	25-20	20-15	25-20	20-15	10-5	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	20-15	25-20	20-15	15-10	25-20	20-15	15-10
1																											
2																											
3																											
5	- 1									- 1			5										1		1		
6										1	1		3														
7	1										1		4										1		1	1	
- 8	1				1					2					1				1						1		
9	2		1							1			5	4			1						1		1	1	
10 11	- 1		- 1	1									1		1				1			1			- 1		
12													3						1	1						1	
13										10	1		3	3			1		1								
14										2			1	1							1				2		
15 16							-		-	3			-	6								1			2		
17							-			1			_	3				4				3	1				
18										1								1	2						1		
19				1						1				1					1								
20								1		1					1			1	1								
21 22				1						_				_	2	1		_ '	1						-		
23										1					1			1							1		
24																			1								
25								1																	1		
26 27				<u> </u>	-	<u> </u>	<u> </u>		1				1	<u> </u>		<u> </u>	<u> </u>	<u> </u>			<u> </u>	<u> </u>		<u> </u>	-		
28												1						1									
29																											
30											1											1					
31					\vdash					1																	
32 33				<u> </u>	 									<u> </u>		<u> </u>	1	 			 	 		 			
34					 	-	-										-	 			1	 		 			
35																											
36				\vdash	\vdash									\vdash													
37 38																						- 4					
39																											
40											1																
41										1																	
42																											
43 44																											
45					1																						
46																											
47																											
48 49	- 1																										
50																											
51																										1	
52 53																									1		
54	1					1																					
55																											
56 57																					1						
58																											
59																											
60 61																							1				
62																											
63																											
64					_						1															-	
65 66		\vdash			1	-	-										 	 			 	 		 			
67																											
68 69					-																					-	
70	1			<u> </u>	 	1	 		1	_			_	<u> </u>		<u> </u>	 	 	—	—	 	 	—	 		1	
71																							1				
72 73					_																	_				-	
74		\vdash			 	-	-										 	 			 			 			
75																					1						
76 77					_														_	_			_			-	
78				1	 	 	 			_			_	<u> </u>		<u> </u>	 	 	—	—	 	 	—	 			
79																											
80																											
81 82																											
83				1																			1				
84																						Ξ.					
85 86	1			<u> </u>	 									<u> </u>		<u> </u>	 	 			 	1		 			
86 87																											
88																											
89 90		-		-	-	-	-							-		-	 	 			 	 		 	 		
91					 	-	-										 	 			 	 		 			
92	1																										
93 94																											
94 95					 	-	-										 	 			 	 		 			
96										1																	
97 98																											
99																											
100																											
>1m	3	1		_ 1		_		3	_												2	2	1			2	
Totals	14	1	1	6	4	2	1	5	3	31	7	1	29	20	7	1	3	9	11	1	6	12	8	0	15	7	0



Appendix 2

Fish Data, dives 1-4

	es 1-4 T		1		Dive 1					Dive 2	2				Dive 3	3				Dive 4	1	
FAMILY	SPECIES	COMMON NAME / DES	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10		5-0	25-20	20-15			5-0	25-20	20-15	15-10		5-0
Scorpaenidae	Scorpaena papillosus	Dwarf scorpian fish			1	1																Ť
	Heliconlenus percoides	Sea perch						2					2	2		1			1			
Serranidae	Caesioperca lepidoptera	Butterfly perch				3		3	3	2	2		1	2		1	1	2	1			2
Serramane	Hypoplectrodes huntii	Red banded perch	1					1		2				_	1			-				
	Callanthias australis	Northern Splendid perch																				
	Callanthas allporti	Southern splendid perch																				_
Mullidae		Unidentified goatfish						1								1						
Scorpidae	Bathystethus cultratus	Grev knifefish	1																			
Chironemidae	Chironemus marmoratus	Hiwihiwi	1																		1	-
Aplodactylidae	Aplodactylus arctideus	Marblefish	1																			
ripiodactyridae	Aplodactylus etheridgii	Notch-head marblefish																				\vdash
Cheilodactylidae	Nemadactylus macrpterus	Tarakihi																				
Latridae	Latridopsis ciliaris	Blue moki																				\vdash
Latridae	Latris lineata	Trumpeter																				\vdash
Labridae	Bodianus unimaculatus	Red pigfish							1													\vdash
Labridac	Coris sandager	Sandager's wrasse																				
	Notolabrus celidotus	Spotty																				
	Notolabrus fucicola	Banded wrasse		1		1	1	2	2	1	2			1	1	2	1	1		1	1	1
	Notolabrus cinctus	Girdled wrasse	 	<u> </u>				-										- '	1	<u> </u>		
	Pseudolabrus miles	Scarlet wrasse		2	2			1	2	2								2	1	1		
Pinguipedidle	Parapercis colias	Blue cod	 	1				2							1			1	1	1		\vdash
Tripterygiidae	Forstervgion varium	Variable triplefin	 	<u> </u>				-	1									- '	<u> </u>	1		\vdash
Tripterygridae	Grahamina capito	Spotted triplefin	 															-		<u> </u>		\vdash
	Forsterygion lapillum	Common triplefin	 															-				\vdash
	Forsterygion flavonigrum	Yellow black triplefin								2	2			1	2	2		2	2	2	2	1
	Obliquichthys maryannae	Oblique-swimming triplefin	 	4	3	4	3			4			2	4	2			-			1	
	Forstervgion malcolmi	Mottled triplefin	 							_			-					1			<u> </u>	
	Karalepis stewarti	Scaly-headed triplefin	 															1				
	Ruanoho decemdigitatus	Long finned triplefin				1																_
	Notoclinops segmentatus	Blue eyed triplefin	 			2				2				1		2		-		1		
Mvxindae	Eptatretus cirrhatus	Hagfish																-		-		_
Scyliorhinidae	Cephalosyllium isabellum	Carpet shark																				_
Blenniidae	Parablennius laticlavius	Crested blenny													1							\vdash
Monacanthidae	Parika Scaber	Leatherjacket													_ '			-				_
Bothidae	Unidentified	Left eyed flounder	 	l									-	-		-		 				┢
9	Pempheris adspersus	Big Eye		-				1										 				\vdash
Squalidae	1 empheris auspersus	Dogfish	 	l				_ '					-	-		-		1				\vdash
2 2	Bovichtus variegatus	Thornfish	 	l									-	-		-		- '				\vdash
<u> </u>	Chelidonichthys kumn	Red gurnard	-	-				-										+	-	-		\vdash
	Chettaonichthys kumn	unidentified grouper	-					-										-	-	-		├─

*=lots of juveniles

Fish Data, dives 5-10

Fish Data, dives 5-1	0																													
			Dive 5					Dive 6					Dive 7					Dive 8					Dive 9					Dive 10		
COMMON NAME /	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Dwarf scorpian fish																														
Sea perch											2		1			1								1		1	1	2		
Butterfly perch	3	3	2	2		2	1	1		2			1			3	2						3	1	1	2	2	2	1	2
Red banded perch						1							1										1				1			
Northern Splendid perch																														
Southern splendid perch																														
Unidentified goatfish																											1			
Grey knifefish																														
Hiwihiwi																														
Marblefish																														
Notch-head marblefish	1																													
Tarakihi																2	1	1			1	1				1	1	1		
Blue moki		1																												
Trumpeter														\Box												1			1	
Red pigfish																														
Sandager's wrasse					1																						1			
Spotty		1													2			1						2	2				2	2
Banded wrasse	2	2	1	1				1	1												1		1	2	2	1		2	1	1
Girdled wrasse						1	1	1				1	1	1		2	2													
Scarlet wrasse	1	1	1	1	1	1		1		2	1	1	2	1	1	2	1	1			1		1	1	1		1			
Blue cod	2										1	1	1	T .		1					1	2	1	2					1	
Variable triplefin														T .																
Spotted triplefin																														
Common triplefin																														
Yellow black triplefin		2	1	1		1	2	2	2		2	1		2	1			1			1	1	1	1	2	2		2	2	
Oblique-swimming					3									T .									3	3			3		2	1
Mottled triplefin														1	1														2	1
Scaly-headed triplefin										1		1																		
Long finned triplefin																														
Blue eyed triplefin															1															
Hagfish	1																													
Carpet shark																														
Crested blenny																														
Leatherjacket		1											3													1	2			
Left eyed flounder																														
Big Eye															†														$\neg \neg$	
Dogfish						1																							$\neg \neg$	
Thornfish				1																									$\neg \neg$	
Red gurnard					1	1	1							\vdash	†														\dashv	
unidentified grouper															†														$\neg \neg$	
sea horse					 	†	†	†				 	 	H	\vdash													\vdash	\dashv	
																												-	-	

^{*=}lots of juveniles

Fish Data, dives 11-16

Fish Data, dives 11-1	6																													
			Dive 1					Dive 1					Dive 13					Dive 1					Dive 1					Dive 16		
COMMON NAME / DES	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Dwarf scorpian fish																														Ĺ
Sea perch						3										1	1				1		1			1				
Butterfly perch	3	2	2	2	2			1	2					3	2		3	3	3	3			1				1			1
Red banded perch						1	2	2																						
Northern Splendid perch																														
Southern splendid perch																														
Unidentified goatfish																														
Grey knifefish																														
Hiwihiwi																														
Marblefish																														
Notch-head marblefish																														
Tarakihi		1										1											1				1	1		
Blue moki																														
Trumpeter																												ı	\neg	
Red pigfish																														
Sandager's wrasse												1	1																	
Spotty	1		2	2	2				2	1		1			1			2	2			2	1	3	1		2		2	1
Banded wrasse		2	2	1	1													1				1		1				1		
Girdled wrasse	2	1		1			2								1		1	1				1	1							
Scarlet wrasse	1	1																				1		1			1			
Blue cod	1				1	2				1	2	3	3	2	2	2	2	2	2		1	2	1	1		1	1	1	1	
Variable triplefin																											1		1	
Spotted triplefin								1	2										2	2										
Common triplefin								2		2																				
Yellow black triplefin	2	2	2	1	1					3			4						2		2	1	2	2	2	2	2	2	2	1
Oblique-swimming						2	3				2					1	1	2	3											
Mottled triplefin	1		1	1	1																		1		1		1		1	2
Scaly-headed triplefin																														
Long finned triplefin																														
Blue eved triplefin																														
Hagfish																														
Carpet shark																														
Crested blenny													3																	
Leatherjacket															3		1													
Left eyed flounder																														
Big Eye																												-	-	
Dogfish						1																						-	\neg	
Thornfish																												-	\neg	
Red gurnard																												-	\dashv	
unidentified grouper																												-	-	
sea horse							1										†	†	 						 				\rightarrow	
		6:.																											-	

^{*=}lots of juveniles

Fish Data, dives 17-22

Fish Data, dives 17-22																														
			Dive 1					Dive 1					Dive 1					Dive 2					Dive 2					Dive 22		
COMMON NAME / DES	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Dwarf scorpian fish																														
Sea perch	1	1																			2					2	2	ı		i
Butterfly perch					1						1		1						1			2	4	2		4	4		3	3
Red banded perch																			1	3	1						1		1	
Northern Splendid perch																														
Southern splendid perch																														
Unidentified goatfish																														
Grey knifefish																														
Hiwihiwi																														
Marblefish																														
Notch-head marblefish																														
Tarakihi	1																						1	1		1	1	2	2	
Blue moki																												-	\neg	
Trumpeter																												-	\neg	
Red pigfish																														
Sandager's wrasse	1																											-	-	
Spotty	1		1	1	2			1	2	1		1	1	1	2	2	1			2			1		1			3	-	
Banded wrasse	1			1	1	1	1				1	1	1		1														-	
Girdled wrasse	1				1												2		3			4	3	4		3	4	4	3	3
Scarlet wrasse	1			1																	1	1		1		1		1	1	
Blue cod	1	1	1	1	1	1						1	1	1	1	1		1	1		1	1	1		1	1			1	
Variable triplefin	1		<u> </u>																											
Spotted triplefin	1																											-	-	1
Common triplefin	1																													
Yellow black triplefin	1	1	2	1		1	1	1	1		1	1	1						2			3	3	3		2	2	3		
Oblique-swimming triplefin	+ -		 				-	-									1		_			-		-				– †	-	
Mottled triplefin	1	1	1	1		1																								
Scaly-headed triplefin	1		<u> </u>																						1			1		
Long finned triplefin	1																													
Blue eyed triplefin	1																													
Hagfish	1																1											-	-	
Carpet shark	1																1											-	-	
Crested blenny	1																2				3	3	3		1			-	-	2
Leatherjacket	+		<u> </u>					4											1		-	- ŭ	Ŭ		- '			-		
Left eyed flounder	1		-														-		-						-					
Big Eye	1		 	1							1						 								1			-+		
Dogfish	-		 	 				_	 		1		 				 						 		 			-	\dashv	
Thornfish	-		 	 				_	 		- '		 				 						 		 			-	\dashv	
Red gurnard	1		 		-	-								\vdash		-	 	-	-	-		-			 			-	\dashv	
unidentified grouper	+ '		 		-	-								\vdash		-	 	-	-	-		-			 			-	\dashv	—
sea horse	-		+	-					-		-		-				1						-		+			\vdash	\dashv	
SCA HOISC																														

^{*=}lots of juveniles

Fish Data, dives 23-29

Fish Data, dives 23-29																																			
			Dive 2					Dive 2					Dive 2					Dive 2					Dive 2					Dive 2					Dive 29		
COMMON NAME / DES	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Dwarf scorpian fish																																1			ь_
Sea perch						2			1		1		1			1	1					2*				1					1	1	1		i
Butterfly perch	4	3	3			1	1 2	1			3	2				3	1				2	2				3	1	2	1	2	4		i		i
Red banded perch	2	1											1													1	1						i		i
Northern Splendid perch												1				1																	1		ı
Southern splendid perch																																	i		
Unidentified goatfish																																1			1
Grey knifefish																							3												3
Hiwihiwi																																	i		
Marblefish																																1			i
Notch-head marblefish																																			
Tarakihi											1	1										1	1			1							\Box	\Box	ī
Blue moki																																\Box			·
Trumpeter																												1	1						1
Red pigfish																																\Box	\Box	\neg	1
Sandager's wrasse																																			<u> </u>
Spotty								2	2	1				2				2	2		1	2*	1	1	2					1				1	· ·
Banded wrasse														1		1	1	2	1		1		1	1	1					1	1	1	1	1	1
Girdled wrasse					1				1				1									2*	2	1		1	1	2	2	1	2	1	2	1	· ·
Scarlet wrasse		2	1		2	2	2 2	:	1					2	1	1	1		1		1		1			1	1	1	1	1	1	2	1		
Blue cod								1		1	1					1					1	1*				1						1		1	<u> </u>
Variable triplefin																	1																		ī
Spotted triplefin																																			1
Common triplefin																																			í
Yellow black triplefin	3	3	3	2		1	1 2	1		1	2	2	1	2	1	1	1	1	1							1	1				1	1	1	1	í
Oblique-swimming triplefin					4	Į.				2															3									3	ī
Mottled triplefin			1		1	1	I							1					1																í
Scaly-headed triplefin																																			1
Long finned triplefin																																			í
Blue eyed triplefin																																			í
Hagfish																																-	\Box	-	1
Carpet shark			1			1	I																									-	\Box	-	1
Crested blenny																																\Box			·
Leatherjacket							1																												ı
Left eyed flounder							1																												ı
Big Eye																																-	-		·
Dogfish						1																												$\overline{}$	
Thornfish																																		$\overline{}$	
Red gurnard																																	\Box		
unidentified grouper													1																			-	-		·
sea horse							1							1																		$\overline{}$	\neg	\neg	$\overline{}$
	•	•——		•	•		•				•		•				•					•						•	•			-			

*=lots of juveniles

Invertebrate & Algal Data, dives 1-4

									Dive1					Dive 2					Dive 3					Dive 4		
Phylum	Class	Order	Family	Genus	Species	Common name/description	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Plants	Red Algae					Crustose coraline red algae	5	5	3	2		4	2	2	4				5	2		4		5	5	
				Arthocardia	wardii	Red ferny		1	2	3				3	2		1		5	5	4	1		1	2	
						Red strips																				
	Green Algae			Carpometria	costata	No float Laminaria		1	2	3			2	2	3							4	5	1	<u> </u>	
				Caluerpa	brownii	Green ferns		1	4	4			2	4	4					2		<u> </u>	5	4		<u></u>
				Carpophyllum	flexuosum	Flexable flapjack				2				2								<u> </u>				<u></u>
				Durvillaea	sp.	Tidal Laminaria				2												<u> </u>			<u> </u>	
				Codium	sp.	Green fingers						1	2	1	2			3	2	1		2	4	3	1	
				Zonaria	tuneriana	Shiny red/brown									2				2	2		<u> </u>			1	
				Macrocystis	pyrifera	Bladder kelp									2							<u> </u>		2	5	. 4
				Eklonia	radiata	Stiped selagin								2							4	<u> </u>	5	5	3	
						Sailors eyeballs																2	2	2	2	
				Ulva	sp.	Sea Lettuce																<u> </u>				
Desmospongia				Latruncalia	sp.	Golf ball sponge						1	1									<u> </u>				
						Tube sponge	1	1	1			2	2				1		1			1	1			
				Raspailia	sp.	Digitated sponge		1									1		1			<u> </u>			<u> </u>	
				Callyspongia	sp.	Fingerlike sponge											2	2	2	?		1		1		
				Axinella	tricalyciformis	Cuplike sponge	1	2	2	1		2	2	2			2	2	2							
				Thorecta	sp.	Orange tubelike sponge																<u> </u>				<u></u>
				Polymastia	croceus	Breadcrumb sponge																<u> </u>			<u> </u>	
						Grey encrusting	1	2	! 1													<u> </u>				<u></u>
						Orange Encrusting																<u> </u>				<u></u>
						Yellow encrusting	1								2		1	1	2	! 1		2	2	2	2	. 2
						White encrusting							2		2							<u> </u>				<u></u>
						Pruple encrusting																				
						Black and White encrusting																<u> </u>				<u></u>
						Yellow encrusting spikey																<u> </u>				<u></u>
						White encrusting spikey																<u> </u>				
						Blue encrusting spikey																<u> </u>			<u> </u>	
						Black sponge																<u> </u>			<u> </u>	
Worms						Spagetti worm			2	2												<u> </u>			<u> </u>	
						Tube worm	2	2	2	1			1									2	2	2	2	
				Protula	sp.	Tube worm	3	3	2	1			1	1			1	1	1			<u> </u>			<u> </u>	
						CTW																<u> </u>			<u> </u>	
				Saccoglossus	sp.	Acorn worm			1						1							1	2	2	1	1
						Peanut worm									2							<u> </u>			<u> </u>	
				Sabella	sp.	Feather duster worm												1	1			<u> </u>			<u> </u>	
Coelenterates				Errina	sp.	Red Coral	3	3									1	<u> </u>	1			<u> </u>		— —'	Ь	⊥
				Antipathes	fiordensis	Black Coral	1	1				2	2				2	2				<u> </u>		— —'	Ь	⊥
				Sarcophylum	sp.	Sea pens		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>						<u> </u>	ldot		ــــــ	<u> </u>
				Gorgoinia	sp.	Gorgonian		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>						<u> </u>	ldot		ــــــ	<u> </u>
						Hydroid	3	3	2				<u> </u>				2	2	2	2		2	2	2	2	. 2
					oi subarticulatus	Hydroid							<u> </u>				3	2	1			1	1	1	Ь	<u> </u>
				Sertularella	geodiae	Hydroid																			<u></u>	<u> </u>
						Stalked anemone														2	4	<u> </u>			<u> </u>	
				Edwardsia	sp.	Red anemone				1					1		2	2				<u> </u>		<u> </u>	<u> </u>	<u> </u>
				Mimteridium	cryptum	Many fingered anemone			1			1										<u> </u>			<u> </u>	
				Cerianthus	sp.	Tube anemone		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>						<u> </u>	ldot		ــــــ	<u> </u>
				Anthothoe	albocincta	Orange anemone		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>					4	<u> </u>	ldot		ــــــ	4
				Phlyctenactis	tuberculosa	Wandering anemone		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>						<u> </u>	ldot		ــــــ	<u> </u>
					· ·	Stoney coral																				
						Cup coral		<u> </u>	<u> </u>				<u> </u>	<u> </u>		<u> </u>						<u> </u>	ldot		ــــــ	
	Octocoral			Alcyonium	aurantiacum	Dead mans fingers																				
						Zooanothian																				
				Parazooanthus	s sp.	Zooanthids																				
						White zooanothian																				
	1		1			Like C. cosatata, hard white protrusions																				

Invertebrate & A	nyai Data, i	uives 1-4 (C	OIIL.)					l									_	_							Ь	—
1									Dive1					Dive 2					Dive 3					Dive 4		
Phylum	Class	Order	Family	Genus	Species		25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
Molluscs				Astraea	heliotropium	Circular saw shell	1																	<u>'</u>	Ь	Ь
				Cominella	nassoides	Whelk													1					└ ──'	ــــــ	⊢
				Argobuccinum	sp.	Whelk			1						1									Щ'	Ь	_
						Turet shell			1															<u>'</u>	Ь	
				Chromadoris	aureomargianta	Nudibranch - white				2								1		2				1	Щ.	
				Chromadoris	conwayii	Nudibranch - blue and white																		<u>'</u>	Ь	
				Jason	mirabilis	Sea slug - purple																		<u> </u>	Щ.	
				Archidoris	wellingtonensis	Sea slug - warty																		<u> </u>		
						Sunflower seed nudibranch																		<u> </u>		
				Charonia	sp.	Trumpet								1										<u> </u>		<u> </u>
				Cookia	sulcata	Cook's Turban shell																		<u> </u>		
				Calliostoma	granti	Grant's maurea																1	1	1	<u> </u>	
				Mytilus	galloprovancialis	Blue mussels																		1		
		1		Atrina	zelandica	Horse mussels																				
				Talochlamys	gemmulata	Spiny scallop																				
				Maoricolpus	roseus	Cone shell																				
				Cryptoconchus	porosus	Butterfly chiton																		\neg		
						Chiton																		1		
				Octopus	huttoni	Octopus																				$\overline{}$
Crustaceans						Hermit crab	1					1						1				1		1	1	
				Jasus	edwardasi	Red crayfish			1			1											2			
Pycnogonids/Other				2	2	Sea Spider													1				_	1		-
Echinoderms				ļ .		Feather star																		\vdash		-
Lonnodonio						Brittlestar	3	2	2					1							1			$\vdash \vdash \vdash$	—	\vdash
				Coscinasterias	calamaria	11 arm starfish	3	2	1	1				1			1	1	2	1	1		1	\vdash		
				Pectinura	maculata	Snakestar	2		2	_		2							3	1				$\vdash \vdash \vdash$	—	\vdash
				Astrobranchion		Snakestar											2	2	,	_ '				\vdash	├	-
				Henricia																				-	\leftarrow	\vdash
				Pentagonaster	sp.	Normal orange star Common biscuitstar			- 1					- 1					2	2	2	- 1		2	1	_
																									←	\vdash
				Asterodon	sp.	Red starfish																		—	—	\vdash
				Patriella	regularis	Cushion star				-				-	0									$m{}$	—	⊢
				Evechinus	sp.	Kina				3														₩	Ь—	\vdash
				Pseudechinus		White urchin												_					_	ڵڝ	<u> </u>	\vdash
				Stichopus	mollis	Sea cucumber	_	_	1	1					2		1	2	1	1	1	2	2	2	2	<u> </u>
Bryazoans						Unidentified	2	2	2			2	3	3	3		3	3	3	3	3	2	2	2	2	<u> </u>
					novaezelandiae	Classic lace coral																		└ ──'	ــــــ	⊢
				Amastigia	sp.	Classic branching																		└ ─'	Ь—	⊢
				Crisia	sp.	Thin classic branching																		Щ'	Ь	_
																								<u> </u>	Щ.	
Ascidians						White encrusting (potentially young Diadenium)	2	3	1			2	2	2	1		4	4	3	3	2	3	3	3	3	<u> </u>
				Didemnum	sp.	Orange	1	1	1			2	2	2	1		2	2	2	2		3	3	3	3	<u> </u>
				Didemnum	candidum	common one found - white/orange																		<u> </u>		
		1				Wax ascidian																		\Box		
		1		Pseudodistoma	sp.	Red colonial ascidians																				
		1		Cnemidocarpa	bicornuta	Tube like sea squirt																				
				Oplidium	sp.	Black ascidian																				
Brachiopods				Notosaria	nigricans	Black brachiopod											1									
.,		1		Magasella	sanguinea	Scarlet brachiopod																				
		1		Liothyrella	zelandea	White brachiopod	 	 				\vdash						-	-	 			-	$\vdash \vdash \vdash$	\vdash	_

Invertebrate & Algal Data, dives 5-10

		l			Dive 5					Dive 6					Dive 7					Dive 8					Dive 9	1				Dive 10	1	
Genus	Species	Common name/description	25-20				5-0	25-20				5-0	25-20			10-5	5-0	25-20			10-5	5-0	25-20				5-0	25-20				5-0
000	ороснос	Crustose coraline red algae	20 20	20 .0	3	3	3	1	20 .0	2	. 5		5	4	3	2	0.0	5	4	3	3	0 0	5	20 .0	10 .0	3 3)	20 20	3	3	2	
Arthocardia	wardii	Red ferny		2	H	5		-	2	, -	5		Ŭ	_	3	4		Ŭ		2	3	- 1	J			1 -	,		Ŭ	- ĭ	-	
Hillocardia	warun	Red strips			1	J	1			1					J	3					2				1	-	+					
Carpometria	costata	No float Laminaria					1			1	1				3	3		2	3	2	2				1	1	1		- 1			
	brownii	Green ferns		1	1		2	1		-	2	1				1											+	1	2			-
			1	-	-		3	-		1						- '				2	- 1					-	1					\vdash
	flexuosum	Flexable flapjack	1	1	<u> </u>		1	1		1	1	1									4				1	1	1					├
	sp.	Tidal Laminaria	1	-	<u> </u>	2		1	- 1	4	,	1		2	2	2			2	2	- 1		- 1	-	-	, ,	,					├
	sp.	Green fingers		5		3	2	1		4	. 3	1							3	3	0			_		4	1	-				\vdash
	tuneriana	Shiny red/brown					1										.			1	3					-	-					⊢—
	pyrifera	Bladder kelp		<u>. </u>		_				<u> </u>	ļ.,						4		1	1	2						1					\vdash
Eklonia	radiata	Stiped selagin		1		3	5	1		4	. 1				2	2			2		2						1					\vdash
		Sailors eyeballs		1		1	ļ.,																									⊢
	sp.	Sea Lettuce					1									1					3	4										Ь
Latruncalia	sp.	Golf ball sponge		2	2			1	2	2	1				2	2			2	3											1	
		Tube sponge		3	3			2	2	2	!		3	2	2	2		2	2	2			4						2	2		
	sp.	Digitated sponge						2	2	2 2	1		1						2							2	2					
Callyspongia	sp.	Fingerlike sponge		1	1			1	2	2 1					2				1						2	2 2	?	3	2	2	1	
Axinella	tricalyciformis	Cuplike sponge		2	2	2	2	2						1	2	2			2	2	2								2	2		
Thorecta	sp.	Orange tubelike sponge																														
Polymastia	croceus	Breadcrumb sponge																														
		Grey encrusting																	2		1											
		Orange Encrusting								4				2							3		2	2	! 1	1 2	2					
		Yellow encrusting		1	1	1			1	3	i				2						3									2		
		White encrusting													1	1				2												
		Pruple encrusting																														
		Black and White encrusting																														
		Yellow encrusting spikey						1		2					2	2					3											
		White encrusting spikey																								1	1					
		Blue encrusting spikey														2										1						
		Black sponge																								1	1					
		Spagetti worm																		- 1						1	1					
		Tube worm			1			2	2) 1				2	2	1		2	2	2				9	. 2	,		2	2			-
Protula	Sp.	Tube worm	1	3	3	3		1	2	, '				2	1			-	2	2					-	\	+					_
rotara	ъρ.	CTW			-	J				1					_											+	1	1				-
Saccoglossus	60	Acorn worm			1																					+	+					
Saccogiossus	sp.	Peanut worm					1			1	2														1	1	1			1	- 1	
Sabella	Sp.	Feather duster worm		1	1		-	1		-		1													-	+	+	1		-		-
	sp.	Red Coral	1							1															-	1	1					\vdash
	fiordensis	Black Coral		2	2		-	2	2	,	-	1	2	2				2					2	- 1	1		+	2	2	2	- 1	-
			 	3	1 3	-	+			1	+	 					-			 				-	 '	+	+-	3	- 3		 '	
	sp.	Sea pens	1	 	 		1	 		1	1	<u> </u>	2					\vdash					- 4		1	1	1	-	-		1	
Gorgoinia	sp.	Gorgonian	1	_		_		1	_		-	1	2	_	-		_	_	_	_			1				+-	1 4	_	_	_	—
Cumple ates	aubartiaulatus	Hydroid	1	1 2	1 2	2	1	 	1 2	: 1	1 2	1	2	2	1			3	2	2				1 2	1 2	1	1	1 2	1 2	2	2	
Symplectoscyp.		Hydroid	1	1	 		1	1		1	1	1					_	-							1	+	+	1			\vdash	—
Sertularella	geodiae	Hydroid	-		<u> </u>	-	-		-	1	-	-					-	\vdash							-	1	1	+	-		-	Ь—
		Stalked anemone	<u> </u>	<u> </u>	├		1	Ļ.,		<u> </u>	1	<u> </u>						\vdash		 					 	1	1—	2	-			
	sp.	Red anemone	1	<u> </u>	<u> </u>		1	1		1	1	<u> </u>						\sqcup	1						1	₩.		1				├
	cryptum	Many fingered anemone	1	-	<u> </u>			1		1	<u> </u>	<u> </u>			<u> </u>			\sqcup							1	 	4	1			2	├
	sp.	Tube anemone		2		2	-	ļ			1	ļ		2	1											1	1		2			<u> </u>
	albocincta	Orange anemone	1	<u> </u>	<u> </u>		4	3		1		<u> </u>														<u> </u>						
Phlyctenactis	tuberculosa	Wandering anemone	1	<u> </u>	<u> </u>			<u> </u>		1		<u> </u>														<u> </u>						
		Stoney coral																														
		Cup coral																														
Alcyonium	aurantiacum	Dead mans fingers																														
		Zooanothian																1	1									2	3	1		
Parazooanthus	sp.	Zooanthids																														
	•	White zooanothian						2	2	1	1		1	2									2	1	1							
		1	1	1	1			1 -		<u> </u>		1														1	1	1				

Invertebrate	etsClenIA &	dives 5-10 (cont.)		1				1	1	1							1				1				1		1	1			$\overline{}$	
vertebrate	a Aiyai Dala,	Lives 5-10 (COIII.)	1	<u> </u>	Dive 5	<u> </u>			<u> </u>	Dive 6					Dive 7		Ч-		_	Dive 8					Dive 9		<u> </u>			ive 10		
Genus	Species	Common name/description	25-20				5-0	25-20				5-0	25-20			10-5	5-0	25-20			10-5	5-0	25-20				5-0	25-20	20-15		10-5	5-0
Astraea	heliotropium	Circular saw shell	25-20	20-13	13-10	10-3	3-0	25-20	20-13	13-10	10-5	3-0	25-20	20-13	13-10	10-5	3-0	25-20	20-13	13-10	10-3	3-0	25-20	20-13	13-10	10-3	3-0	25-20	20-13	2	10-5	3-0
Cominella	nassoides	Whelk																												3		
Argobuccinum		Whelk																			2					2	1					
Argobaccinam	<i>υρ.</i>	Turet shell																								1	1				+	
Chromadoris	aureomargianta	Nudibranch - white				1																					 				-	
Chromadoris	conwayii	Nudibranch - White Nudibranch - blue and white				_ '																									-	
Jason	mirabilis	Sea slug - purple				1	1	1		1										1	1											
Archidoris	wellingtonensis	Sea slug - purple Sea slug - warty				_ '			1	_ '																					-	
Archidoris	weilingtonensis	Sunflower seed nudibranch																													-	
Charonia	SD.	Trumpet		1																	2				- 1		<u> </u>				\rightarrow	
Cookia	sp. sulcata	Cook's Turban shell	1												- 1												1			2	\longrightarrow	
Calliostoma	granti	Grant's maurea		1						- 1				- 1													<u> </u>				\rightarrow	
Mytilus	galloprovancialis		1				2			-				- 1													1				\longrightarrow	
Atrina	• -	Blue mussels	 	 	 	-			 		-	\vdash				-	1		-				-		 		 		-			
	zelandica	Horse mussels	1	 					-		1						\vdash								-		<u> </u>	-	-		\dashv	
Talochlamys	gemmulata	Spiny scallop	 	 	 	-			 		-	\vdash				-	1		-				-		 		 		 		\longrightarrow	
Maoricolpus	roseus	Cone shell	1	 					-		1						\vdash								-		<u> </u>	-	-		\dashv	
Cryptoconchus	porosus	Butterfly chiton	1	1																- 4	2						1					
0.4		Chiton		1																							<u> </u>				\longrightarrow	
Octopus	huttoni	Octopus	1	1	- 4	- 4																					1				- 1	
		Hermit crab		1	1	- 1																						_				
Jasus	edwardasi	Red crayfish																													\longrightarrow	
?	?	Sea Spider											- 1														-					
		Feather star	<u> </u>	<u> </u>				1																								
		Brittlestar			_	_						_				_					_											
Coscinasterias		11 arm starfish		1		1			٠.			3				1					2						-	_				
Pectinura	maculata	Snakestar	<u> </u>	_		1		1	1				1	1				1							١.,			2	2	1		
Astrobranchion		Snakestar	<u> </u>	- 2	2				_				1	1									1		1	1						
Henricia	sp.	Normal orange star	<u> </u>	_		_		1	2	1															1	2				1		
Pentagonaster		Common biscuitstar	<u> </u>	3	3	2																			1	1						
Asterodon	sp.	Red starfish	<u> </u>	<u> </u>																												
Patriella	regularis	Cushion star																														
Evechinus	sp.	Kina									2										2										2	
Pseudechinus		White urchin		<u> </u>	_	_																						_				
Stichopus	mollis	Sea cucumber		2	2	2	2	_	2	1					1	1			1	1	2				1	2	<u> </u>	2	1	1		
<u></u>		Unidentified	1	2	2	2		2	2	1	1					<u> </u>							1	0	4	5	0	4	3	3	3	0
	novaezelandiae	Classic lace coral						2	1	1			2	2	3	2		2	3	1			1	_	2		<u> </u>	2	2	1		
Amastigia	sp.	Classic branching	1	<u> </u>				1	2	2			2	1	1			2	2	2			2	2	1	<u> </u>	<u> </u>					
Crisia	sp.	Thin classic branching	1	<u> </u>										1									4	2	2	2	0	5	4	4	3	0
		White encrusting		ļ																							<u> </u>					
		(potentially young Diadenium)		3	3	3	4	2	2	1			2	2	3	2											<u> </u>					
Didemnum	sp.	Orange		3	3	3	4		2	1			1	2	3	3		2		2			4	4	3	2	<u> </u>	3	2	2	2	
Didemnum	candidum	common one found - white/orange												2	2			2	1	3	1						<u> </u>					
		Wax ascidian	1	<u> </u>											1					2					2	2	<u> </u>		2	2		
Pseudodistoma		Red colonial ascidians																														
Cnemidocarpa		Tube like sea squirt							1					2	3				2	2	1			1	1	2						
Oplidium	sp.	Black ascidian																														
Notosaria	nigricans	Black brachiopod		2	2	2	1	3	2				2	2	1			2	1						1				2	2	T	
Magasella	sanguinea	Scarlet brachiopod						2	2				3	2				1	2	2					2				1	3		
Liothyrella	zelandea	White brachiopod						2	2				2	1				2	2	1					2				3	2	\neg	
Lioury i cild	20,0,,,000	·	1	1	1	1		- 5	2								H										!	2	- ŭ		-+	
		Brachiopod	<u> </u>	1				5																								

Invertebrate & Algal Data, dives 11-16

			05.55		Dive 11			05.05		0 ive 12			05.0-		live 13			05.0-		Dive 14			05.0-		ive 15			05.01		ive 16		1 = 6
Genus	Species	Common name/description	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
		Crustose coraline red algae	3	3	3	2						3								2	2		4	2	2	1					2	
Arthocardia	wardii	Red ferny								1	1	1	4	4	4	4									2	4					3	3
		Red strips																														
Carpometria	costata	No float Laminaria		1										1	1									2	4	2						
Caluerpa	brownii	Green ferns		2	2																											
Carpophyllum	flexuosum	Flexable flapjack																														
Durvillaea	sp.	Tidal Laminaria																														
Codium	sp.	Green fingers																						1	1	1						
Zonaria	tuneriana	Shiny red/brown																											2	2		
Macrocystis	pyrifera	Bladder kelp																							1	2						
Eklonia	radiata	Stiped selagin																								2						
		Sailors eyeballs																	1	1												
Ulva	sp.	Sea Lettuce										3					3				2	4										2
Latruncalia	sp.	Golf ball sponge				1				1								1	1	1				1							t —	1
		Tube sponge		2	2			1	2	1	1												2	1	1	1					—	_
Raspailia	Sp.	Digitated sponge	1 -	† – –	 	1		2	1	1	2		1	1	1	1		2	2	1	1					t		1	1	ব	. 3	
Callyspongia	sp.	Fingerlike sponge	٦	2	2	1			<u> </u>	<u> </u>			_		<u> </u>	1				1	1				1	1		- '	<u> </u>		۳	
Axinella	tricalyciformis	Cuplike sponge	+ -	2		-	—	2	2	2	_		3	2	2	 		-	 	-	-				1	 	-	 	-	-	-	+-
Thorecta	sp.	Orange tubelike sponge	+										3	- 3		1			1	- 1					- '	-		1			-	
Polymastia	sp. croceus	Breadcrumb sponge	1	1	1	-	-				-					1			1	2	2					-	-	1			-	-
Polymastia	croceus	Grey encrusting	1	1																											\vdash	\vdash
			-															2	2	2	2				- 4	-	-				-	-
		Orange Encrusting	1	-																											₩	₩
		Yellow encrusting																													↓	↓
		White encrusting																													<u> </u>	ь
		Pruple encrusting																													2	
		Black and White encrusting																														
		Yellow encrusting spikey						2	2	2	2		2	2	2										1	2	2	1	2	1		<u> </u>
		White encrusting spikey																													2	
		Blue encrusting spikey																														
		Black sponge								1	1																					
		Spagetti worm						2	3	3	3																			2		
		Tube worm	2	2	2			2	2	2	2	3		4	4	4	4	2	2	2	2	3	2	2	1	1				3	. 3	
Protula	sp.	Tube worm						1	1																			2	2	3	3	,
		CTW																							3	2						
Saccoglossus	Sp.	Acorn worm																							1	2						
		Peanut worm			1	1																										
Sabella	sp.	Feather duster worm																	2	2	2											
Errina	sp.	Red Coral																	_	_	_										—	—
Antipathes	fiordensis	Black Coral	3	3 3	3 2	1		1	1				3	3	3	2		3	3	3			1	2	1	1		2	2	2	1	
Sarcophylum	sp.	Sea pens	1	1	_														Ť					_		<u> </u>			_		<u> </u>	_
Gorgoinia	sp.	Gorgonian	2)																											 	
Oorgonna	<i>3μ.</i>	Hydroid	2	, 2	2	2							2	2	2								1	1	1	1					 	
Symplectoscy	oi subarticulatus	Hydroid	 	-	-													2	2	2	2				_						 	
Sertularella	geodiae	Hydroid	1					3	3	3	3	3	2	2	2			2	2	2	2						-	1	1	3	3	_
oci luiai ciid	godulac		2	,	1	 	-	1	1	1					-	1										1	-	- '	- '		⊢∸	-
Edwardaia	•	Stalked anemone		1	_	-	-	-	-	- '	-					 			 				-			 	-	 			+	+
Edwardsia	sp.	Red anemone	+	1	1	2			-							 		-	-							<u> </u>		-	-		├	├
Mimteridium	cryptum	Many fingered anemone	1				-	_	-	-		_										-				1	-				\vdash	Н—
Cerianthus	sp.	Tube anemone	1	1 2	1	-	<u> </u>	2	1	1	-	_				-			-							-		-			₩	₩
Anthothoe	albocincta	Orange anemone	1	1	1							2														<u> </u>	<u> </u>				Ь—	Ь—
Phlyctenactis	tuberculosa	Wandering anemone	1																							ļ					Ь—	Ь—
		Stoney coral	1																							ļ					↓	
		Cup coral																													Ь	
Alcyonium	aurantiacum	Dead mans fingers																												3	3	
-		Zooanothian	2	2 3	3 1																											
Parazooanthus	s sp.	Zooanthids																														
		White zooanothian																							1	1						

Invertebrate	& Alnal Data	dives 11-16 (cont.)														1										1					-	\neg
invertebrate	a Aiyai Data, i	dives 11-16 (cont.)			Dive 11				_	ive 12					ive 13					ive 14					Dive 15	<u> </u>				ive 16		
Genus	Species	Common name/description	25.20		15-10		5.0	25.20				5.0	25.20				5.0	25.20				5.0	25.20				5-0	25.20				5-0
Astraea	heliotropium	Circular saw shell	25-20	20-13	10-10	10-5	5-0	25-20	20-13	13-10	10-5	5-0	25-20	20-15	13-10	10-5	5-0	25-20	20-13	13-10	10-5	5-0	25-20	20-15	13-10	10-5	3-0	25-20	20-15	13-10	10-5	3-0
Cominella	nassoides	Whelk			2																										-	
Argobuccinum		Whelk			3												- 4					2				1					\rightarrow	
Argobuccinum	sp.	Turet shell															-					3		- 1		- 1					-	
Oh di-																										-						
		Nudibranch - white																								1					\rightarrow	
	conwayii mirabilis	Nudibranch - blue and white																								-						
Jason		Sea slug - purple																		- 1						1					\rightarrow	
Archidoris	wellingtonensis	Sea slug - warty																													-	
		Sunflower seed nudibranch																													\longrightarrow	
Charonia	sp.	Trumpet			_																											
Cookia	sulcata	Cook's Turban shell			2					L.,																L.,				1		
Calliostoma	granti	Grant's maurea								1	1														1	1						
Mytilus		Blue mussels																														
Atrina	zelandica	Horse mussels																								ļ				2	2	
Talochlamys	gemmulata	Spiny scallop																		L.,	L					└						
Maoricolpus	roseus	Cone shell							1	1			3	3	3	2				3	3											
Cryptoconchus	porosus	Butterfly chiton																			1	1				<u> </u>						
		Chiton							2	2	2																					
Octopus	huttoni	Octopus																														
		Hermit crab				1																				1				1		
Jasus	edwardasi	Red crayfish	2						2	2	1																					
?	?	Sea Spider																														
		Feather star																														
		Brittlestar																														
Coscinasterias	calamaria	11 arm starfish				1		1	1	3	3	3						1	2	2	2									2	2	
Pectinura	maculata	Snakestar	2	2	1															2	2									1	1	
Astrobranchion	constrictum	Snakestar											2	2	2													1	1	1	1	
Henricia	sp.	Normal orange star			1																2	3	1	1				1	1	2	2	2
Pentagonaster	pulchellus	Common biscuitstar						2	2	2	2		2	2									1					2	2	2	2	
Asterodon	sp.	Red starfish																														
Patriella	regularis	Cushion star													2	2	2				2	2				1		1	1		2	
Evechinus	sp.	Kina				2		2	2											2	2					1				2	2	
Pseudechinus	huttoni	White urchin						2					2					2										1				
Stichopus	mollis	Sea cucumber	2	1	1			1	1	1	1		2	2	2	2	2	2	2	2	2		1	1	1	1		2	2	2	2	
		Unidentified	4	3	3	3																										
Hippellozooia	novaezelandiae	Classic lace coral	2	2	1			4	4	4	4							2	2	2	2				2							
Amastigia	sp.	Classic branching						2	2	2			2	2	1			2	2	2	2							3	3	3	3	
Crisia	sp.	Thin classic branching	5	4	4	3		2	2	2	2																					
		White encrusting																													\neg	
		(potentially young Diadenium)																3	3	3	3	3						1	1			
Didemnum	Sp.	Orange	3	2	2	2																									=	_
Didemnum	candidum	common one found - white/orange						2	2	1	1	2	3	3	3	3	3	4	4	4	4	4	3	3	3	2	1	2	2	3	3	2
		Wax ascidian		2	2																		Ť	Ì		1		i				
Pseudodistoma	3 SD.	Red colonial ascidians													4	4	4				4	5				i i				3		
Cnemidocarpa		Tube like sea squirt						2	2	2	2				1			1	1	1		Ŭ		2	2	2	1		1	1	1	
Oplidium	sp.	Black ascidian																	<u> </u>	•					<u> </u>	-	i i				\rightarrow	
Notosaria	nigricans	Black brachiopod		2	2			4	4	4	4	4			4	4		3	3	3	3					1		3	3	3	3	
					2			- 4	4	4	- 4	-			-	- 4		2	2	- 3	- 3					-	2	1	1	2	- 3	
Magasella	sanguinea	Scarlet brachiopod		1	3		-		1	1						\vdash	_									1		1	1			
Liothyrella	zelandea	White brachiopod		3	2			3	2	2	2															└						
1		Brachiopod	2						1																1	1	l					

Invertebrate & Algal Data, dives 17-22

					Dive 17					Dive 18					ive 19					ive 20					Dive 2					ive 22		
Genus	Species	Common name/description	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0
		Crustose coraline red algae							2	2	2		2	1				2	2	2	1		3	3	9	3		3	3	3		
Arthocardia	wardii	Red ferny	2	2	2 3	3	3																			3	4			4	4	٢
		Red strips																														
Carpometria	costata	No float Laminaria	2	2	2	2																				1						1
Caluerpa	brownii	Green ferns																						2	2	2					4	,
Carpophyllum	flexuosum	Flexable flapjack																														
Durvillaea	sp.	Tidal Laminaria																														
Codium	sp.	Green fingers	3	3	3	3									2	1								2	1			2	2	2	2	4
Zonaria	tuneriana	Shiny red/brown	1	1																			1	1	1	1		1	1	1	1	
Macrocystis	pyrifera	Bladder kelp																														
Eklonia	radiata	Stiped selagin																					2	2	2			2	2			-
		Sailors eyeballs																							_				1	1	1	
JIva	sp.	Sea Lettuce					1																1							-		†
atruncalia	sp.	Golf ball sponge					,								1								2	2	2	2			2	2	2	,
atranoana	ор.	Tube sponge						1	2	2	1												1	1	1	1					_	+-
Raspailia	sp.	Digitated sponge	 	 	 			1	1	1	 								1	1	1		1	1	<u> </u>	1						+-
Callyspongia	sp.	Fingerlike sponge	1	1	1	1		3	2	1	1		1	1						2	1		<u> </u>			 					1	+-
Axinella	tricalyciformis	Cuplike sponge	 	 	 	_			-	-	 		 '	-				\vdash			<u> </u>		2	2	-	1 2	+	2	2	2	2	,—
Thorecta	sp.	Orange tubelike sponge	 	 	 	_			-	-	 		\vdash					\vdash			-				-	 	+	1 1				+-
Polymastia	croceus	Breadcrumb sponge	 	1	 	-					1							H + 1	_						-	-	-		-		-	+-
-OlyIIIasiia	croceus	Grey encrusting		1							1																					+-
		Orange Encrusting	2		2																											+-
				- 4	2						1			- 1	2	4	- 1			- 1						1		1				+-
		Yellow encrusting												1	3	- 1	1			1				_	_	_						₩
		White encrusting																					1	1	1	1		_				₩
		Pruple encrusting																										_				₩
		Black and White encrusting													_	_			_		_										١.	.—
		Yellow encrusting spikey												1	2	2	- 2		2	2	3					<u>. </u>		1	1	1	1	₩
		White encrusting spikey																					1	1	1	1						↓
		Blue encrusting spikey																														↓
		Black sponge																					1									\bot
		Spagetti worm																							3	4	3	3	3	3	3	ــــــــــــــــــــــــــــــــــــــ
		Tube worm	3	3	3	3	3	1	1	2	1							1	1	1	1			2	2	2		3	3	3	3	i
Protula	sp.	Tube worm											1	2	3	1								2	2	2		2	2	2	2	
		CTW			1																											<u> </u>
Saccoglossus	sp.	Acorn worm													1																	
		Peanut worm																														
Sabella	sp.	Feather duster worm		2	2																											1
Errina	sp.	Red Coral																														
Antipathes	fiordensis	Black Coral	3	3	3 2			2	1				1	1	1				1				3	3	2	1		2	1	1	1	1
Sarcophylum	sp.	Sea pens																														
Gorgoinia	sp.	Gorgonian																														
		Hydroid																	1	1				2	3	3		3	3	3	3	š
Symplectoscy	oi subarticulatus	Hydroid											1	1	1																	
Sertularella	geodiae	Hydroid																														1
	-	Stalked anemone																İ														
Edwardsia	sp.	Red anemone							1	1										1	2											
Mimteridium	cryptum	Many fingered anemone																														
Cerianthus	sp.	Tube anemone	1	1	1						1									1				2	2	2		2	2	2	2	4
Anthothoe	albocincta	Orange anemone	t -	t	t -				1		t													<u> </u>	_	T -		t				T
Phlyctenactis	tuberculosa	Wandering anemone	1	1	1				<u> </u>		1															1		1				t
, 0.0		Stoney coral	1	1	1	1			1	1	1															1					1	+-
		Cup coral	1	1	1	1			1	1	1															1					1	+-
Alcyonium	aurantiacum	Dead mans fingers	2	 -	, ,	_			1	-	 		\vdash	1				\vdash		1	-		2	2	-	1 2	+	2	2	2	2	,—
noy Official	aarannacum	Zooanothian		+		-			<u> </u>		1			-				H + 1	_	- '			1	- 4	1	1	-					+-
				1	1	1					1	1			1						1					1 '	1				1	1
Jorganous Marie																												1				
Parazooanthus	s sp.	Zooanthids White zooanothian						4	2	2	- 1		- 1	2	2	- 1		1	2	2								4	1	4	1	-

mvertebrate	e & Algai Data, o	dives 17-22 (cont.)																														
					Dive 17					ive 18					ive 19					ive 20					ive 21					ve 22		
Genus	Species	Common name/description	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15	15-10	10-5	5-0	25-20	20-15 1	5-10	10-5	5-0
Astraea	heliotropium	Circular saw shell									1					1																
Cominella	nassoides	Whelk														2					1											
Argobuccinum	sp.	Whelk					1			2	3										1											
		Turet shell														2					1											
Chromadoris	aureomargianta	Nudibranch - white																														
Chromadoris	conwavii	Nudibranch - blue and white																														
Jason	mirabilis	Sea slug - purple																										1	1	1	1	
Archidoris		Sea slug - warty																														
	<u> </u>	Sunflower seed nudibranch																													\neg	
Charonia	sp.	Trumpet																														
Cookia	sulcata	Cook's Turban shell																											2	2	2	
Calliostoma	granti	Grant's maurea																													- 1	
Mytilus		Blue mussels													2	2															-+	
Atrina	zelandica	Horse mussels	2	2	2	2					1															1				- +	-+	_
Talochlamys	gemmulata	Spiny scallop	1	1	1	1			\vdash		 		\vdash						\vdash		\vdash				-	-	—	\vdash	+	\rightarrow	\rightarrow	
Maoricolpus	roseus	Cone shell	2	,	2	2			\vdash		 		\vdash						\vdash		\vdash				- 1	-	—	\vdash	+	2	- 2	
Cryptoconchus		Butterfly chiton							1		1		1		1				1								-	1				—
Cryptoconcnus		Chiton	1							- 1				- 1	2	- 1			1	- 1										-+	\rightarrow	
0-4			-						1		-															- 1	-					
Octopus	huttoni	Octopus	-						1		- 1																-		- 4			
		Hermit crab	1								<u> </u>																		- '	-	\rightarrow	
Jasus		Red crayfish	1																												_	
?	?	Sea Spider	1						_																		ļ				_1	
		Feather star	1						_															1			ļ	1	1			
		Brittlestar							_				1	1	_	_			1	1										_		
Coscinasterias		11 arm starfish			3	3								1	2	2									_				2	2	2	
Pectinura		Snakestar	<u> </u>	1	1	1		1	1				1	1					1					2	2	2		2	2	2	2	2
Astrobranchion		Snakestar	2	2	2 2																		3	3	2	1		2	1	1	1	
Henricia	sp.	Normal orange star	2	2	2 2	3	3								1	1			2									2	2	2	2	2
Pentagonaster	pulchellus	Common biscuitstar	2	2	2 2	2					1			2	1	2				3	2				1	1		2	2	2	2	
Asterodon	sp.	Red starfish			2	3	3			1	1				2	2				2												
Patriella	regularis	Cushion star								1	1			1	1				1	1			1	1				2	2		2	2
Evechinus	sp.	Kina					1			1	1				1	1				1	1					2	2				3	3
Pseudechinus	huttoni	White urchin						1	1	2	1		1					1	2	1												
Stichopus	mollis	Sea cucumber	2	2	2 2	2			1	1	1		1	2	1	1	1	1	1	2	1		2	2	2	2		2	2	2	2	
		Unidentified																														
Hippellozooia	novaezelandiae	Classic lace coral			2	2				1	1		1	2	2	1		1	1	2								2	2	2	2	
Amastigia	sp.	Classic branching													1								4	4	4	4		3	3	3	3	
Crisia	sp.	Thin classic branching																						2	2	2		1	1			
		White encrusting																														
		(potentially young Diadenium)											1	1	1																	
Didemnum	sp.	Orange																					2	2	2	2						
Didemnum	candidum	common one found - white/orange	3	3	3	3				3	2		2	2	2			2	2	2	2		4	4	4	4		3	3	3	3	
		Wax ascidian	1		T					1	† – –			1	2	2				2	1										\rightarrow	
Pseudodistoma		Red colonial ascidians	2	2	2	3	3		1	2				1	1	2	2			1	2							2	2	3	4	-4
Cnemidocarpa		Tube like sea squirt	2	2	2 2	2	Ĭ	1	2	- 2	2		1	2	2	2	2		1	1	1		2	2	2	2		2	2	2	- 2	
Oplidium	Sp.	Black ascidian	+						+ -		 		 '						- '		H				1	1	—	-	1	1		
			2	2	2	2				2	1		- 1	2	- 1	1			2				4	1	4	- 4		2	3	3	-	
Notosaria	nigricans	Black brachiopod	1 2	1	, 3	2			1				 							_	\vdash		4	4	_	- 4	-	3	0	U		
Magasella	•	Scarlet brachiopod	2	2	2	2				2			1	1	2	2			1	2					2	2			2	2	- 2	
Liothyrella	zelandea	White brachiopod	1							1			1	2	1	2		2	1													
		Brachiopod	1		1				1 7		1						I -									_	I		T	T	T	

Invertebrate & Algal Data, dives 23-29

Arthocardia wardii Carpometria costata Caluerpa brownii Carpophyllum flexuosun Durvillaea sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Ulva sp. Latruncalia sp. Raspailia sp. Callyspongia sp.	iata ivinii iosum iriana fera ata	Common name/description Crustose coraline red algae Red ferry Red strips No float Laminaria Green ferns Flexable flapjack Tidal Laminaria Green fingers Shiny redibrown Bladder kelp Sliped selagin Salors eyeballs Sea Lettuce Goff ball sponge Trube sponge Digitated sponge Flingerlike sponge Cuplike sponge Cuplike sponge Green tubelike sponge Green cursting Green Encrusting Orange Encrusting Orange Encrusting	25-20 3 2 2 1 2 1 3 3 2	20-15 3 2 2 1 2 1 2 3	15-10 3 4 2 2 1 1	2	5-0	25-20	20-15 2 2 1 1	15-10 2 2 3 3 2 1 3 3	10-5 2 3 3 3 3 3	5-0	25-20 4	20-15	15-10	10-5	5-0	25-20	20-15 4 2	15-10 3 3	10-5 3 4 2 2	5-0	25-20 20	3	-10 10- 2 2 2 5 1	5 5-0 3 2 4	3	20-15	15-10 3 2	10-5 3 3	5-0	25-20	20-15	15-10 3 3 5 5	10-5 3 3 4	5-0
Carpometria costata Caluerpa brownii Carpophyllum flexuosun Durvillaea sp. Codium sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Ulva sp. Latruncalia sp. Cadlyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saecogiossus sp. Sabelia sp. Sarcophylum sp. Sarcophylum sp. Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui	iata ivinii iosum iriana fera ata	Red ferry Red strips No float Laminaria Green ferrs Flexable flapjack Tidal Laminaria Green fingers Siriny red/brown Bladder kelp Stiped selagin Sailors eyeballs Sea Lettuce Goff ball sponge Tube sponge Digitated sponge Flingerlike sponge Cupilike sponge Orange tubelike sponge Grey encousting Grey genousting Grey genousting Orange tubelike sponge Grey encousting Orange functioning	2 2 1 1 3 3	2 2 1 1 2 3	3 4 2	2	3	2	2 2 1	2 3 3 1 1 3 3	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3		4	2	1	2		3	2	3	3		2	3	2 2 5	3 2 4 1	3	3	2	3 3		4	2	5	4	
Carpometria costata Caluerpa brownii Carpophyllum flexuosun Durvillaea sp. Codium sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Ulva sp. Latruncalia sp. Cadlyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saecogiossus sp. Sabelia sp. Sarcophylum sp. Sarcophylum sp. Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui	iata ivinii iosum iriana fera ata	Red ferry Red strips No float Laminaria Green ferrs Flexable flapjack Tidal Laminaria Green fingers Siriny red/brown Bladder kelp Stiped selagin Sailors eyeballs Sea Lettuce Goff ball sponge Tube sponge Digitated sponge Flingerlike sponge Cupilike sponge Orange tubelike sponge Grey encousting Grey genousting Grey genousting Orange tubelike sponge Grey encousting Orange functioning	2 1 1	2 1 2 1 2 2 3 3 2	2	2	3		1	3 3 3	3 3				1	2			2	3	2 2		2	3	5	4			2	2			2	5	4	
Caluerpa brownii Carpophyllum fiexuosun Durvillaea sp. Codium sp. Latrucalia sp. Callysinopia sp. Callysinopia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Sarcophylum sp. Gorgoinia sp. Corponia sp. Symplectoscypi subarticui	vnii vosum vriana fera ata	No foat Laminaria Green ferns Flexable flapjack Tidal Laminaria Green fingers Shiny redibrown Bladder kelp Sliped selagin Salors eyeballs Sea Lettuce Gof ball sponge Tube sponge Oligitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Grey encrusting Orange Grey encrusting	2 1 1	2 1 2 1 2 2 3 3 2			3		1	2	2 2				1						2		2	3	5	4			2	2			2	5	4	
Caluerpa brownii Carpophyllum fiexuosun Durvillaea sp. Codium sp. Latrucalia sp. Callysinopia sp. Callysinopia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Sarcophylum sp. Gorgoinia sp. Corponia sp. Symplectoscypi subarticui	vnii vosum vriana fera ata	No foat Laminaria Green ferns Flexable flapjack Tidal Laminaria Green fingers Shiny redibrown Bladder kelp Sliped selagin Salors eyeballs Sea Lettuce Gof ball sponge Tube sponge Oligitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Grey encrusting Orange Grey encrusting	2 1 1	2 1 2 1 2 3			3		1	2	2 2				1						2		2	3	5	4			2	2			2	5	4	
Caluerpa brownii Carpophyllum fiexuosun Durvillaea sp. Codium sp. Latrucalia sp. Callysinopia sp. Callysinopia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Sarcophylum sp. Gorgoinia sp. Corponia sp. Symplectoscypi subarticui	vnii vosum vriana fera ata	Green ferns Flexable flasplack Tidal Laminaria Green fingers Shiny red/brown Bladder kelp Stiped selagin Sailors eyeballs Sea Lettuce Goff ball sponge Tube sponge Upglated sponge Fingerlike sponge Cupilies sponge Grey encousting Grey encousting Grey gencousting Grey gencousting Grey gencousting	2 1	2 1 2 1 2 3	2 1 1 2	1 2 2	3		1	2	2 2				1						2		2	3	5	4			2	2			2	3	4	
Durvillaea sp. Codium sp. Codium sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Ulva sp. Latruncalia sp. Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gorgoinia sp. Symplectoscypi subarticui	eriana fera ata aty ilyciformis	Tidal Laminaria Green Ingers Shiny red/brown Bladder kelp Stiped selagin Saltors eyeballs Sea Lettuce Goff ball sponge Tube sponge Ugitated sponge Fingerlike sporge Cupilike sponge Orange tubelike sponge Grey encrusting Grey gencrusting Orange tubelike sponge Grey encrusting Orange functions	2 1	2 1 2 1 2 3	2 1 1 2	1 2 2	3		1	2	2 2				1						_				-1	1							2	3		
Durvillaea sp. Codium sp. Codium sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Ulva sp. Latruncalia sp. Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gorgoinia sp. Symplectoscypi subarticui	eriana fera ata aty ilyciformis	Green fingers Shiny redibrown Bladder kelp Stiped selagin Salors geballs Salors geballs Sea Lettuce Golf ball sponge Tube sponge Digitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Enclusting	2 1	2 1 2 1 2 3	1 2 3	1 2	3		1	2	2 2				1						2		1	1									2	3	_	
Codium sp. Zonaria tuneriana Macrocystis pyrifera Eklonia radiata Uliva sp. Latruncalia sp. Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saecogiossus sp. Sabelia sp. Errina sp. Sarcophylum sp. Gorgoinia sp.	fera ata ata	Green fingers Shiny redibrown Bladder kelp Stiped selagin Salors geballs Salors geballs Sea Lettuce Golf ball sponge Tube sponge Digitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Enclusting	2 1	2 1 1 2 1 2 3	1 2 3	1 2	3		1	2	2 2				1	-															1 1		2	3	_	
Zonaria tuneriana Macrocystis pyrifera Eklonia radiata VUva sp. Latruncalia sp. Callyspongia sp. Axinelia tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gorgoinia sp. Gorgoinia sp. Symplectoscypi subarticui	fera ata ata	Shiny red/brown Badder kelp Sliped selagin Saliors eyeballs Sea Lettuce Gof ball sponge Tube sponge Digitated sponge Fingerlike sponge Cupilike sponge Ourplike sponge Breadcrumb sponge Breadcrumb sponge Grey encrusting Orange Uncelling	1 2 1 1 3 3 2 2	2 1 2 2 2	1 2 3	1 2	3									1					2		1	2	2	1	2	2	3			1		\rightarrow		
Macrocystis pyrifera Ektonia radiata Ulva sp. Latruncalia sp. Raspailia sp. Callyspongia sp. Axinelia tricalycifo Thorecta sp. Protula sp. Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gargohia sp. Symplectoscypi subarticui	fera ata ata	Bladder kelp Stilped selagin Sailors eyeballs Sea Lettuce Goff ball sponge Tube sponge Tube sponge Fingerlike sponge Cupilies sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange tubelike sponge Orange tubelike sponge Orange forcisting	3	2 1 2 3	1 2 3	1 2	3																													
Eklonia radiata Ulva sp. Latruncalia sp. Raspailia sp. Callyspongia sp. Akinelia tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui	ata alyciformis	Stiped selagin Salors eyebalis Sea Lettuce Goff ball sponge Tube sponge Digitated sponge Fingerlike sponge Cuplike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Enclusting	33	2 2 3	1 2 3	1 2	3														2				2	5 5	5									
Ulva sp. Latruncalia sp. Raspailia sp. Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gorgoinia sp. Symplectoscypi subarticui	llyciformis	Salors eyeballs Sea Lettuce Goff ball sponge Tube sponge Oligitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange tubelike sponge	3	1 2 3	2	2	3														2															
Raspailia sp. Raspailia sp. Callyspongia sp. Callyspongia sp. Callyspongia sp. Tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabelia sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Sea Lettuce Gof ball sponge Tube sponge Digitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Encusting Orange Encusting	3	3	2	2	3																													
Raspailia sp. Raspailia sp. Callyspongia sp. Callyspongia sp. Callyspongia sp. Tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabelia sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Tube sponge Digitated sponge Fingerlike sporge Cuplike sponge Orange tubelike sponge Greadcrumb sponge Grey encrusting Orange functions	3	3	3	2					1																									
Raspailia sp. Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Gorgoinia sp. Symplectoscypi subarticui		Tube sponge Digitated sponge Fingerlike sporge Cuplike sponge Orange tubelike sponge Greadcrumb sponge Grey encrusting Orange functions	2	3	3			1					1								1	2	1	2	2	2	2	3	2	2		1	1	2	3	
Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Digitated sponge Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Encrusting	2	2	3			1	1				2	1	1						1						2	2	2				3	2		
Callyspongia sp. Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Fingerlike sponge Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Encrusting	2	2		3									2	2					2							2	2					1		
Axinella tricalycifo Thorecta sp. Polymastia croceus Protula sp. Saccogiossus sp. Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Cuplike sponge Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Encrusting	2	2				1	1	1			1	2	2					1	2	1		1				2	1				2	2		
Thorecta sp. Polymastia croceus Protula sp. Saccogiossus sp. Sabella sp. Errina sp. Antipathes flordensis Sacrophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Orange tubelike sponge Breadcrumb sponge Grey encrusting Orange Encrusting			2	2		1	1												1			1	1		2	2	1				2	2		
Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui	eus	Breadcrumb sponge Grey encrusting Orange Encrusting																											T -				\Box			
Protula sp. Saccoglossus sp. Sabella sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Grey encrusting Orange Encrusting																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui																																				
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Yellow encrusting																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui																		1	1	1	1							1								
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		White encrusting																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Pruple encrusting																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Black and White encrusting																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Yellow encrusting spikey	1	1	1	1													1	2	1			1	1	1		2	2	2						
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		White encrusting spikey																																		
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Blue encrusting spikey																		1	2	- 1			1				1	1			\vdash			
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Black sponge	1	1	1																															
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Spagetti worm	3	3	3	3																														
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Tube worm	3	3	3	3			1	2	2 2		3	2	2	2				1	1		2	2			1	1	1			1	2	2	1	
Saccogiossus sp. Sabeila sp. Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Tube worm	2	2	2	2												4	3	3	3															
Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		CTW												2	4	2																				
Sabella sp. Errina sp. Antipathes flordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Acorn worm											1							2	5				2	2			2				2	2	2	
Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Peanut worm																																		
Errina sp. Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Feather duster worm																		1	1		1					1	1							
Antipathes fiordensis Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui		Red Coral	3	3																																
Sarcophylum sp. Gorgoinia sp. Symplectoscypi subarticui	lensis	Black Coral	2	1	1			2	1				2	2	1			1	1	1			1				2	2	1			1				
Gorgoinia sp. Symplectoscypi subarticui		Sea pens																																		
Symplectoscypi subarticui		Gorgonian																																		
		Hydroid	3	3	3	3		2	1	1			2	2	1			1	1				3	3	2		1	1	2			2	2			
Sertularella geodiae	articulatus	Hydroid																																		
		Hydroid	2	2	2	2																														
		Stalked anemone																																		
Edwardsia sp.		Red anemone								1	ı			1	1											1		$\overline{}$				1	1			
Mimteridium cryptum		Many fingered anemone																											T -				\Box			
Cerianthus sp.	tum	Tube anemone	2	2	2	2				1																1		$\overline{}$					\vdash			
Anthothoe albocincts	tum	Orange anemone	1 7		<u> </u>					1	1		1	1	1							t				1		$\overline{}$			\vdash		\Box			
Phlyctenactis tuberculo		Wandering anemone	1 1							1	t -		t i	t i	<u> </u>							- t						\vdash		2	H		\vdash	-		
	cincta	Stoney coral	1 1						1	1	1		1	1	1									\dashv		-1		\vdash	\vdash	_	\vdash		\vdash	-		
	cincta		1 1							1	t -			1	1							- t						\vdash			\vdash		\vdash	-		
Alcyonium aurantiac	cincta		2	2	2	2		2	1	1	1		1	1	,						-+				-	+	1	1	-		\vdash		${m o}$	-+		\vdash
, cum auranuac	ecincta erculosa	Cup coral			-				- '	 	+		1	1	2		\vdash	- 1	1	2	- 				_		 	2	1		\vdash		\vdash	\longrightarrow		\vdash
Parazooanthus sp.	cincta	Cup coral Dead mans fingers								 	+		- '	 '	-		\vdash	-		-					_		1		+-"		\vdash	1	\vdash	\longrightarrow		\vdash
uruzovaninus sp.	ecincta erculosa	Cup coral Dead mans fingers Zooanothian			•																											-		\longrightarrow		\leftarrow
	ecincta erculosa	Cup coral Dead mans fingers	1	1	1	- 1									-					-	-+			_	_	-		$\vdash \vdash$			1 1					

Invertebrate & A	Algal Data	dives 23-29 (cont.)																																	$\neg \neg$	$\overline{}$	
	aga: Data,			D	ive 23					Dive 24					Dive25				<u> </u>	Dive 20	3				Dive 27					ive 28					Dive 29		
Genus	Species	Common name/description	25-20				5-0	25-20				5-0	25-20				5-0	25-20				5-0	25-20				5-0	25-20				5-0	25-20			10-5	5-0
		Circular saw shell									1	1	1				+			1	1																
		Whelk									1						1			1															-		
Argobuccinum sp.		Whelk																																			
,		Turet shell											1							1																	
Chromadoris aure		Nudibranch - white											2																								
Chromadoris conv		Nudibranch - blue and white																																			
Jason mira		Sea slug - purple																		1	2							1					1				
		Sea slug - warty																																			
		Sunflower seed nudibranch			1																																
Charonia sp.		Trumpet											2							1																	
Cookia sulca		Cook's Turban shell		2	2	2		1					1						1		1			1		1		1							- 1		
Calliostoma gran		Grant's maurea	1	1	1	_							1																								
		Blue mussels							1	1	1		1				1		1	1	1		1		1										-	-	
		Horse mussels	1 1										1				1		1	1	1		1	1									1		-	-	
		Spiny scallop	1 1										1				1		†	t	t –		†	<u> </u>	†								1		\rightarrow	-	
Maoricolpus rose		Cone shell	1 1	2	2	2							1				1		1		1		1		1										-	-	
Cryptoconchus poro		Butterfly chiton	1 1		_	1									1		1		1	1	1														-	-	
		Chiton	1 1																	1														1	1	-	
Octopus hutto		Octopus	1 1																											1	1	1			i T	-	
		Hermit crab						1									1																		-		
Jasus edwa		Red crayfish	1 1																									1							2	- 2	
? ?		Sea Spider	1 1					1	1	1																1									2		
		Feather star	1	1																															T	-	
		Brittlestar	1 1					2	2	1		1					1						2						1						\rightarrow	-	
Coscinasterias calar		11 arm starfish	2	2	2	2			_												1		2			1									-	-	
Pectinura maci	culata	Snakestar	2	2	2	2	2	1	1				2				1			1			2					1	2	2					-		
Astrobranchion cons		Snakestar	2	1	1	_							_										1					1	1					1	1	- 1	
Henricia sp.		Normal orange star	1	1	1	1		1	1	2	1												2			1								1	1	-	
Pentagonaster pulci		Common biscuitstar		2	2	2		1		1			2		1	1	1		1	1			1		1	1			1								
Asterodon sp.		Red starfish																		1									1								
Patriella regu		Cushion star	2	2		2	2												1				1		1	1									- 1		
Evechinus sp.		Kina	1 1			3	3													1	1		İ		1			1	2					2	2	-	
Pseudechinus hutto		White urchin															1																		-		
Stichopus molli		Sea cucumber	2	2	2	2							2	1	1	1	1	2	1	1	2		1	1	2	2		1	1	1			1	1	2	2	
		Unidentified																																			
Hippellozooia nova	aezelandiae	Classic lace coral	2	2	2	2		2	2	2	1		3	3	3	3 2	2	2	2	3	3 2		2	3	1			3	3	2	2		3	3	2	3	
Amastigia sp.		Classic branching	3	3	3	3		1		1				2	3	3		1	2	3	3 2		3	1	1			2	2	2	1		1	2	2		
Crisia sp.		Thin classic branching	1	1		Ť							1	<u> </u>	Ť		1		T -	Ť	1 -		3	1	i i			2	1	2	2			1	1	-	
		White encrusting																																			
		(potentially young Diadenium)	1 1										1				1		1		1		1		1										-	-	
Didemnum sp.		Orange	1 1										1				1		1		1		1		1										-	-	
		common one found - white/orange	3	3	3	3		2	2	3	2		4	4	5	5 2	2	4	4	4	4		4	4	3	3		3	2	2	2		2	3	3	4	
		Wax ascidian	4	4	4	4				1					1					1									1	1				\Box	-		
Pseudodistoma sp.		Red colonial ascidians	2	2	3	4	4	2	1	1	2			1	2	2	2		1	1				2	1				1	1	1		1				
Cnemidocarpa bicor		Tube like sea squirt	2	2	2	2		1	1	2	3		3	2	1	2	2		1	2	1		2	3	4	3		1	2	2	2						
Oplidium sp.		Black ascidian	1 1	1	1				İ				i i		3	3 2	2			1	1		1 -	2	2	2			1	1	1				1	1	
	ricans	Black brachiopod	3	3	3	3		1	1					1						1	1		1						1	1			1		-	\neg	
		Scarlet brachiopod	2	2	2	2			1			†	2	2	2	1 -			t -	-	2		1	1	t -			2	· ·	2			2	2	2	-	
Liothyrella zelar		White brachiopod	- 4						<u> </u>	1		1		4	- 3	1 -	1-	-	1	-	4		1	 '	1		\vdash		2	2		\vdash	4			-	
Liuuryrella zelar			+									1	 	1		1	+	 	 	 	1 1		 	-	 	1	\vdash					\vdash	- 1	₩		\longrightarrow	
		Brachiopod																																لـــــــا			



Appendix 3

.		4 -					
Physical	data, Outer Fiord div	es 1-5 Dive 1	Dive 2	Dive 3	Dive 4	Dive 5	
GPS		45 46 596s	45 46 379s	45 47 473s	45 46 309s	45 45 689s	
010		166 32 623e	166 3193e	166 37 294e	166 36 491e	166 35 528e	
Condition	I S	Calm Slight Current		Calm	Slight Swell	Slight Swell	Average
Salinity @		35%	36%	35%	35%	35%	35%
Salinity of		25%	25%	25%	25%	25%	25%
Depth of		2.3	5.8	4.2	5.2	3.4	4
Visibility		20	20	20	20	15	20
	n of Seabed						
	0-5	Bedrock/Boulders	B'rock/L Boulders	Bedrock	Bedrock	Boulders	
	5-10	Boulders	B'rock/L Boulders	Bedrock	Bedrock	B'rock/Boulders/S'ment	•
	10-15	Bedrock/Boulders	Small Boulders	Bedrock	B'rock/Sediment		
	15-20	Bedrock	Small Boulders	Bedrock		B'rock/Large Boulders	
	20-25		Sediment	Bedrock	Bedrock	Sediment	
Profile							Average
	0-5	1	1	1	1	4	2
	5-10	3	1	1	1	1	1
	10-15	2	4	1	2	3	2
	15-20	1	1	1	3	1	1
	20-25	1	4	1	1	4	2
							% Presence
0-5	Kelp Forest	С	С	С	С	С	100
	Short Animal Turf	0					13
	Sea Urchins	С					20
	Seaweed Red	0	0	С		0	60
	Seaweed Green	0	· ·	0	0	0	53
	Encrusting Pink Algae			С	Ü	Ü	20
	Enorability i intrigat	,		Ü			20
5-10	Seaweed Red	0	С	С		0	67
	Seaweed Green	0	0	r			33
	Kelp Park	-	-	·	С	0	33
	Kelp Forest	0	0		· ·	· ·	27
	Sea Urchins	С	r				27
	Short Animal Turf		0	С	С	0	67
	Encrusting Pink Algae	9		0		0	27
	3.1						
10-15	Kelp Park	0	0			r	33
	Encrusting Algae	0	r	0			33
	Seaweed Red	0	С	0			47
	Seaweed Green	0	0				27
	Sea Urchins		r	С			27
	Short Animal Turf		r	0		0	33
15-20	Short Animal Turf			0		r	20
	Tall Animal Turf	0					13
	Black Coral	0					13
	Animal Bed	Brittle Stars					0
	Kelp Park		0		0		27
	Seaweed Red		r	r		r	20
	Encrusting Algae		r	0	0	r	40
	Sediment, Life Appare	ent	•	J	0	·	13
	- sament, Eno Appare				Ŭ		
20-25	Sediment, Life Appare	ent	С			0	33
	Short Animal Turf	•	-	r		-	7
	Seaweed Green				r		7
	Seaweed Red			r	0		20
	Encrusting Pink Algae	z		r	· ·		7
	Kelp Park	-		'	0		13
	I. Sip i dir.				J		10

Physical data Middle Fiord dives 6-11

i ilysical (uata Miladie i loid dives d		Divo 7	Divo 0	Divo 0	Divo 40	Divo 44	
GPS		Dive 6 45 45 133s 166 39 945e		Dive 8 45 44 379s 166 43 503e	Dive 9 25 46 571s 166 41 954e	Dive 10 46 45 696s 166 47 951e	Dive 11 43 45 689s 166 47 104e	
Conditions	.	Calm	Calm	Calm	Calm	Slight Swell	Swell, slight current	Average
	•	35%	35%	35%	36%	35%	36%	35%
Salinity @								
Salinity of		26%	25%	26%	25%	25%	25%	25%
Depth of L	.SL I	6	4	3.5	5.9	5.5	5.6	5
Visibility	1	20	20	15	15	20	15	18
Description	n of Seabed							
	0-5	Bedrock	Bedrock	Bedrock	B'rock/Boulders	Bedrock	Bedrock	
	5-10	B'rock/Sand	Bedrock	Sediment	Boulders	B'rock/Boulders	Bedrock	
	10-15	Bedrock	Bedrock	Bedrock	B'rock/Boulders	Bedrock	Bedrock	
	15-20	Bedrock	Bedrock	Bedrock	Bedrock	B'rock/Boulders	Bedrock	
	20-25	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
Profile								Average
	0-5	2	3	1	1	1	3	2
	5-10	2	3	1	2	2	2	2
	10-15	1	1	4	2	2	1	2
	15-20	1	1	3	3	3	2	2
	20-25	1	1	3	1	1	1	1
0.5	Kala Essat							% Presence
0-5	Kelp Forest	С	С	С				50
	Short Animal Turf		0			С	С	44
	Seaweed	С						17
	Encrusting Pink Algae		С			С	С	50
5-10	Seaweed				С		0	28
	Kelp Park				С			17
	Kelp Forest			С				17
	Short Animal Turf	0	С			С	С	61
	Tall Animal Turf		0					11
	Encrusting Pink Algae	0	С			С		44
10-15	Kelp Park			С	С			33
	Encrusting Algae		С			С		33
	Seaweed						0	11
	Short Animal Turf		С	0	С	С	С	78
	Tall Animal Turf		0	0				22
	Black Coral				0			11
15-20	Short Animal Turf	С	С	С	С	0	С	94
	Tall Animal Turf		0					11
	Black Coral			0		r		17
	Kelp Park				0			11
	Seaweed						0	11
	Encrusting Algae	С	С	О		С	·	61
	Enorabling 7 agab	Ü	Ü	Ü		Ü		0.
20-25	Sediment, Life Apparent							0
	Short Animal Turf	С	С	0				44
	Tall Animal Turf		0					11
	Encrusting Pink Algae	С	С	0			С	61
	Black Coral			О	r		r	22

Physical data - Inner Fiord dives 12-15

,		Dive 12	Dive 13	Dive 14	Dive 15
GPS		45 45 026s	45 45 657s	45 44 772s	
•		166 48 962e	166 49 675e	166 51 000e	
Conditions		Calm, heavy rain o'nig	Slight Swell	Calm	Slight Current
Salinity @ 2	25m	32%	34%	35%	35%
Salinity of L		20%	21%	21%	10%
Depth of LS	L	6.2	5.2	6.2	6
Visibility		10	10	15	10
Water Temp	perature	14.7			15
Description	of Seabed				
	0-5	Bedrock	Bedrock	Bedrock	B'rock/Sediment
	5-10	Bedrock	Bedrock	Bedrock	Bedrock
	10-15	Bedrock	Bedrock	Bedrock	Bedrock
	15-20	Bedrock	Bedrock	Bedrock	B'rock/Sediment
	20-25	Bedrock	B'rock/Boulders	Bedrock	Bedrock
Profile					
	0-5	2	1	1	2
	5-10	2	3	1	2
	10-15	1	1	1	2
	15-20	1	3	1	3
	20-25	1	4	1	2
0-5	Kelp Forest				С
	Short Animal Turf	С	0	С	
	Tall Animal Turf		0		
	Seaweed				0
	Encrusting Pink Algae		0		
	Sediment with Life Apparent				
5-10	Seaweed Red	r			
	Short Animal Turf	С	0	С	0
	Tall Animal Turf		0		0
	Sediment with Life Apparent				
10-15	Short Animal Turf	С	С	0	С
	Tall Animal Turf				
	Animal Bed				
15-20	Short Animal Turf	С	0	0	С
	Tall Animal Turf				
	Sediment with Life Apparent				
20-25	Sediment with Life Apparent				
	Short Animal Turf	0	0	О	0

Physical data - Inner Fiord dives 16-20

i ilysica	i data - iiiilei i iora di	Dive 16	Dive 17	Dive 18	Dive 19	Dive 20	
GPS		45 43 047s	45 44 046s	45 43 101s	45 43 531s	45 42 970s	
		166 57 903e	166 53 236e	166 58 136e	166 55 974e	166 56 402e	
Conditions		Calm	Calm	Calm, heavy rain	Calm, heavy rain	Calm, heavy rain	Average
Salinity @	25m	34%	34%	35%	33%	36%	34%
Salinity of	LSL	19%	16%	2%	6%	20%	15%
Depth of L	SL	5.8	5.2	6	7.3	5.8	6
Visibility		15	15	10	8	7	11
Water Ten	perature	14	14				14
Description	n of Seabed						
	0-5	Bedrock	B'rock/ Boulders	Bedrock	Bedrock	Bedrock	
	5-10	Bedrock	B'rock/ Sediment	Bedrock	Bedrock	Bedrock	
	10-15	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
	15-20	B'rock/Sediment	Bedrock	Bedrock	Bedrock	Bedrock	
	20-25	Sediment	B'rock/Sediment	Bedrock	Bedrock	Bedrock	
Profile							Average
	0-5	1	3	2	3	2	2
	5-10	2	3	2	3	3	2
	10-15	1	1	3	2	2	2
	15-20	3	3	1	1	2	2
	20-25	4	3	1	1	1	2
							% Presence
0-5	Kelp Forest	С					22
	Short Animal Turf					С	41
	Tall Animal Turf						7
	Seaweed	С			r		22
	Encrusting Pink Algae					0	15
	Sediment, Life Apparent		С				11
5-10	Seaweed Red						4
	Short Animal Turf	С					48
	Tall Animal Turf						15
	Sediment, Life Apparent		С				11
10-15	Short Animal Turf	С				0	59
	Tall Animal Turf		С				11
	Animal Bed					0	7
15-20	Short Animal Turf	0	0			0	59
	Tall Animal Turf		0				7
	Sediment, Life Apparent	0	0				15
20-25	Sediment, Life Apparent	0	o				15
	Short Animal Turf					r	33

Physical data Acheron Passage dives 21-24 & 28-29

		Dive 21	Dive 22	Dive 23	Dive 24	Dive 27	Dive 28	Dive 29	
GPS		43 43 185s		45 42 711s	45 39 914s	45 38 291s	45 37 263s	45 37 503s	
		166 43 148e		166 43 678e	166 44 074e	166 43 586e	166 43 724e	166 43 016e	
Conditio	ns	Calm	Calm, Slight Current	Calm, Strong Current	Calm	Calm	Calm	Calm	Average
Salinity	@ 25m	35	35	35	34	33	32	32	33.71
Salinity	-	24	24	24	12	22	20	26	21.71
Depth of		6.8	5.3	6.4	4	2	2	3	4.21
Tempera					15	15	15	15	15.00
Visibility	1	8	10	10	15	15	25	20	14.71
	tion of Seabed	ŭ							
Dooonp	0-5	B'rock/Small Boulders	Bedrock	Bedrock/Boulders	Bedrock	Bedrock	Bedrock	Bedrock	
	5-10	Small Boulders	B'rock/Boulders	Bedrock	Bedrock	Bedrock	Bedrock	B'rock/Sediment	
	10-15	B'rock/L Boulders	B'rock/Sediment	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
	15-20	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
Drofilo	20-25	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
Profile	10.5	_			_	_			Average
	0-5	3	4	4	3	3	1	4	3
	5-10	2	3	1	3	3	1	4	2
	10-15	2	3	1	1	3	1	4	2
	15-20	2	2	1	3	3	1	3	2
	20-25	1	1	1	1	4	1	1	1
									% Presence
0-5	Kelp Forest				С	С		С	43
	Kelp Park	0					С		24
	Short Animal Turf				С	С	С	С	57
	Seaweed Red	0	0	0			С	С	57
	Seaweed Green		0	0					19
	Encrusting Pink Algae	С	0						24
5-10	Seaweed Red	0	0	r			С	С	52
	Seaweed Green	0	r						14
	Kelp Park	0	0		С	О	С	С	71
	Short Animal Turf	С	С	С	С	0	С	С	95
	Encrusting Pink Algae	C		C					29
10-15	Kelp Park	С	0	-			0	0	43
	Encrusting Algae	ŭ	С	С			ŭ	0	38
	Seaweed Red	0	· ·	г	0			Ü	24
	Seaweed Green	0		'	0		0	С	43
	Short Animal Turf			_					62
		0		С	0		С	С	
	Tall Animal Turf	0			0			0	29
15-20	Short Animal Turf	0	С	С	О	0	С		71
	Tall Animal Turf				0	0			19
	Animal Bed							С	14
	Kelp Park							0	10
	Seaweed Red			r	r		0	С	33
	Encrusting Algae	0	0			0		С	43
	Sediment, Life Apparent				0				10
20-25	Short Animal Turf	0	0	С	0	0	0	С	76
	Encrusting Pink Algae					0			10
	LITCHUSTING FILIK ATUAE					U			10

Physical data Wetjacket Arm dives 25 & 26 Dive 25 Dive 26

_	-	Dive 25	Dive 26	
GPS		45 38 363s	45 39 009s	
•		166 51 068e	166 49 314e	
Conditions		Calm	Calm	Average
Salinity @		34%	34%	34%
Salinity of I		12	11	12%
Depth of L		6		6.00
Temperatu	re	15	15	15.00
Visibility		15	15	15.00
Description	of Seabed			
	0-5	Bedrock	Bedrock	
	5-10	Bedrock	Bedrock	
	10-15	Bedrock	Bedrock	
	15-20	Bedrock	Bedrock	
	20-25	Bedrock	Bedrock	
Profile				Average
	0-5	3	2	3
	5-10	3	2	3
	10-15	2	2	2
	15-20	2	2	2
	20-25	2	2	2
				% Presence
0-5				
	Short Animal Turf	С	0	83
	Seaweed	0	С	83
5-10				
	Kelp Park		0	33
	Kelp Forest			0
	Short Animal Turf	0	0	67
10-15				
	Short Animal Turf	0	С	83
15-20	lon and Automat To 6			07
00.05	Short Animal Turf	0	0	67
20-25	Chart Animal Tort	_	_	67
	Short Animal Turf	0	0	67