Final Report of Project Fiordland 2002-2003

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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

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).

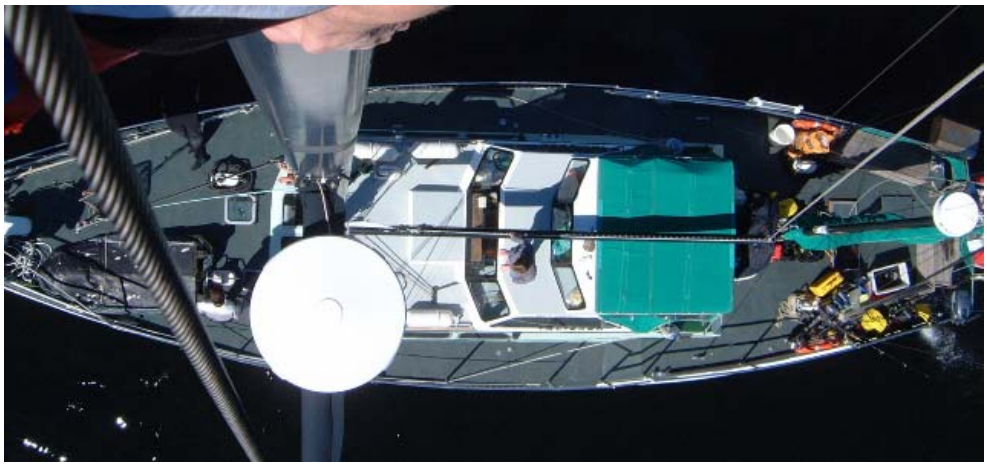
We would like to thank **Chris Paulin** (Museum of New Zealand Te Papa Tongarewa), **Dr. Miles Lamare** (University of Otago) and **Dr. Richard Grigg** (University of Hawaii) for their expert advice on Fiordland and Black Coral. We are also grateful for the support given to us by **Dr. Graham Stone**,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



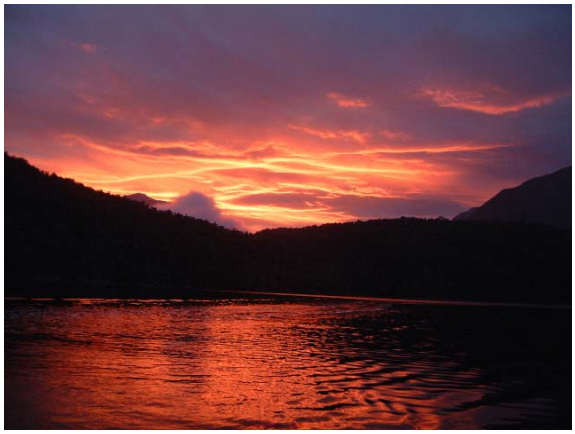
Talisker – our charter

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.

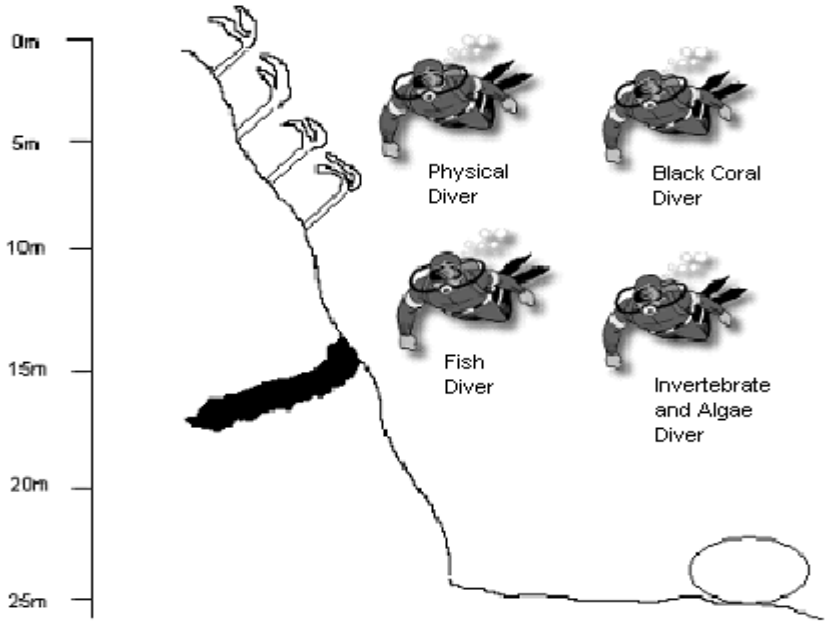
On each survey, a team of 4 divers was sent down to survey from the depth of 25m to the surface. The team of 4 consisted of:

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.

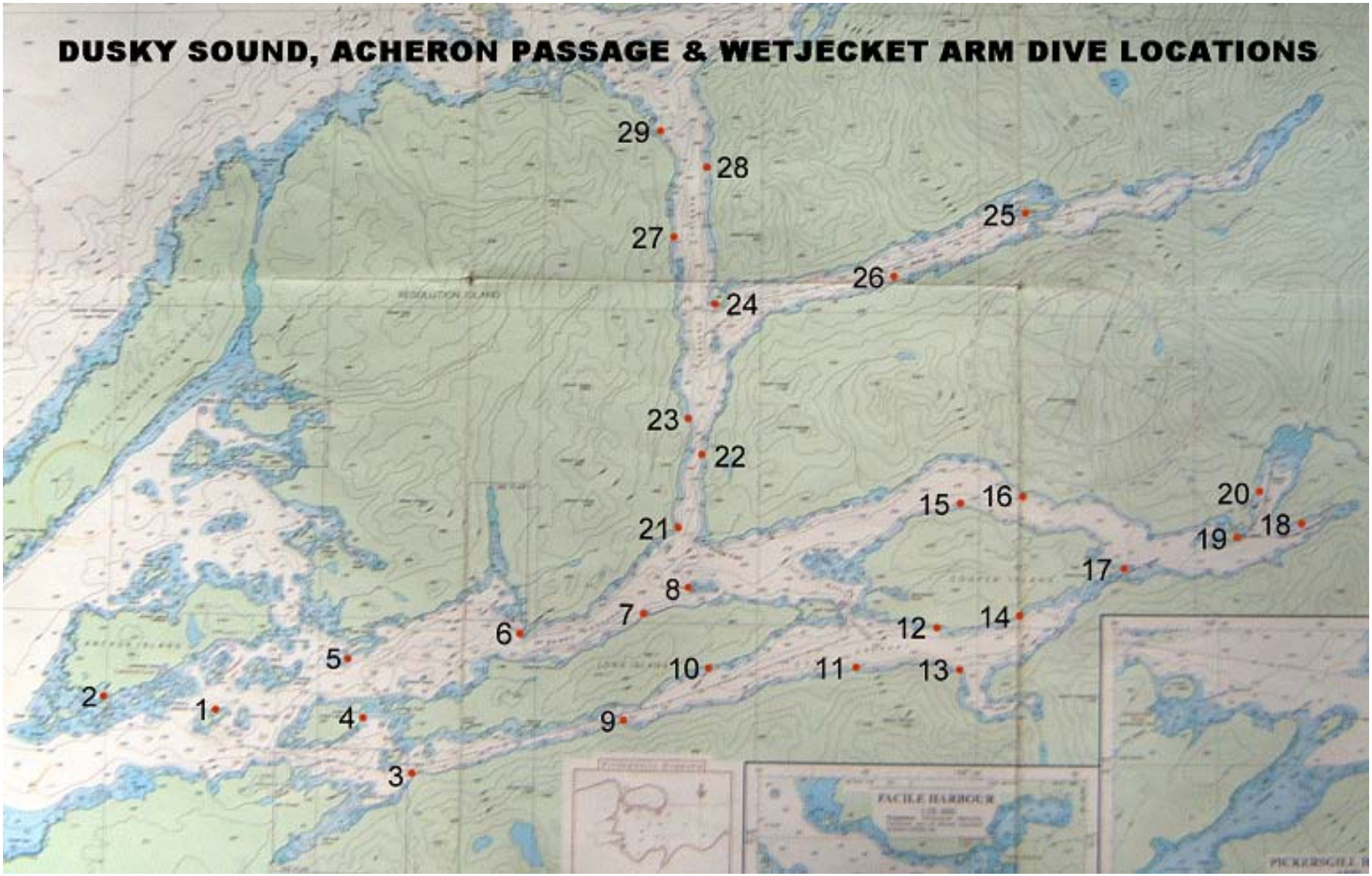


Fig 1.1: Project Fiordland survey sites.

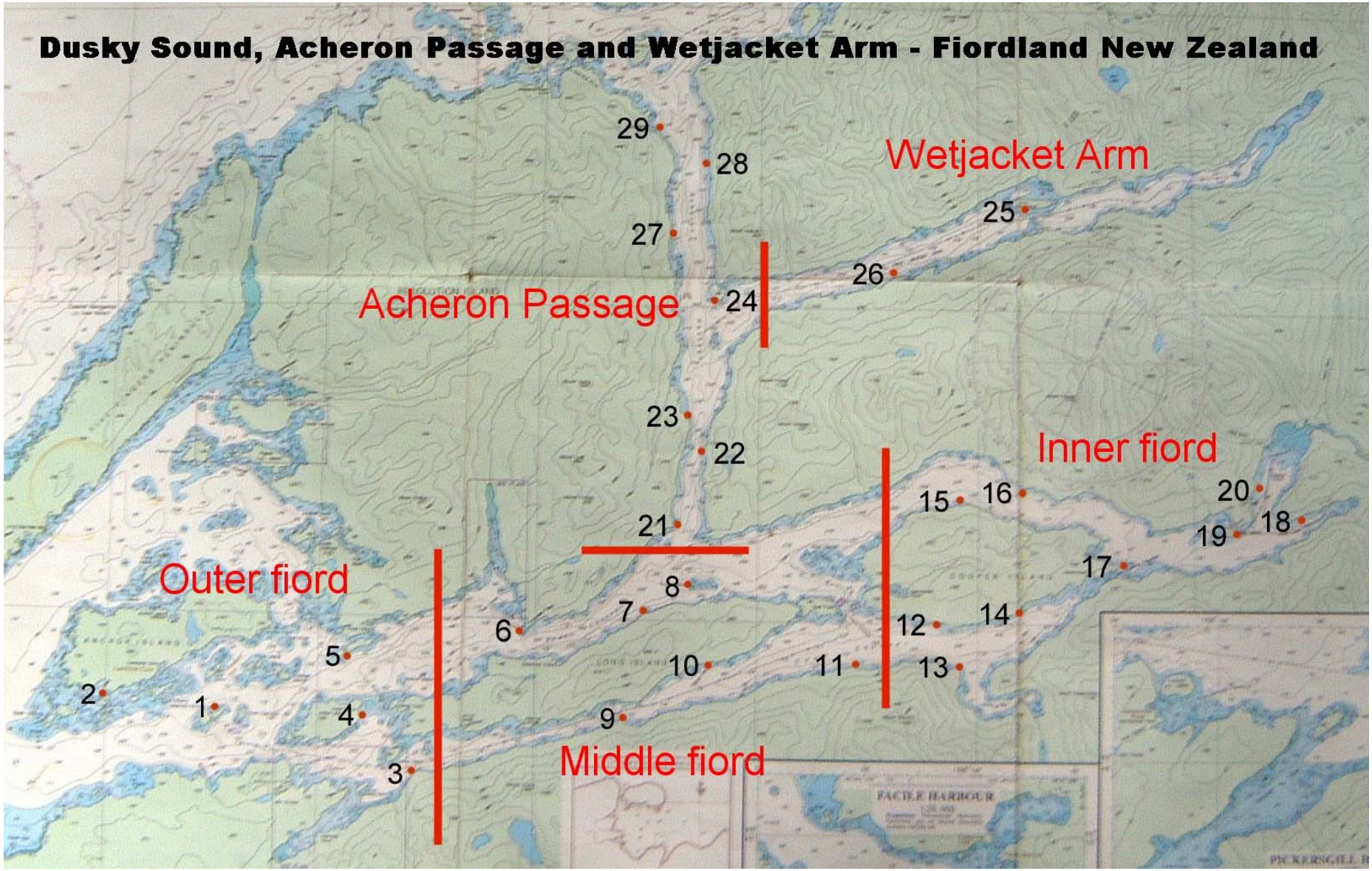


Fig 1.2: Project Fiordland Survey Regions

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.

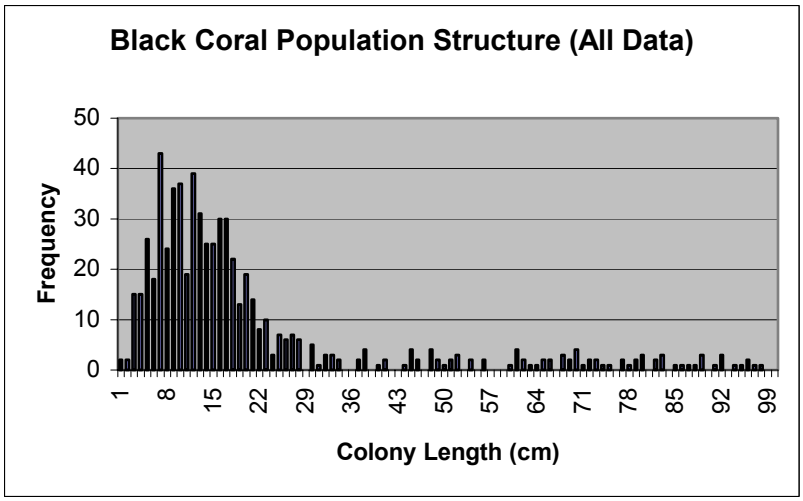
Methodology

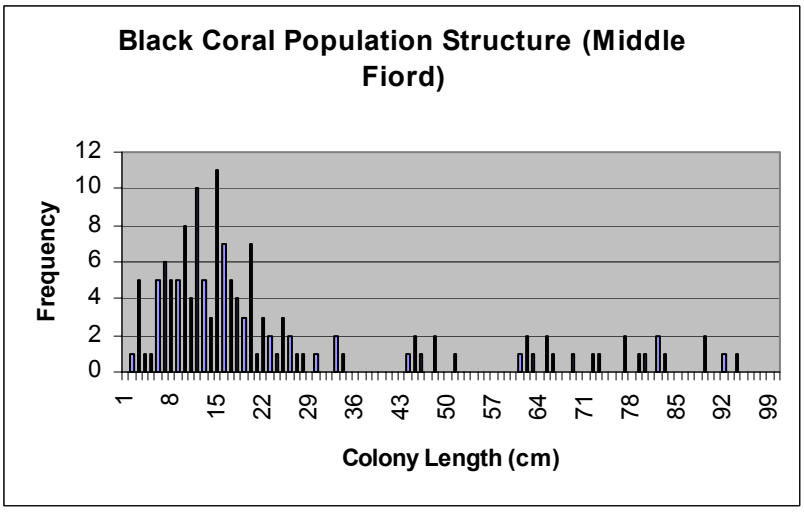
Black Coral (*Antipathes fiordensis*) surveys were conducted throughout Dusky Sound, the Acheron Passage and Wet Jacket Arm. The sites were chosen randomly but selected to be descriptive of different areas in the Fiords. SCUBA divers were sent to measure the colony lengths of all Black Coral colonies 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.





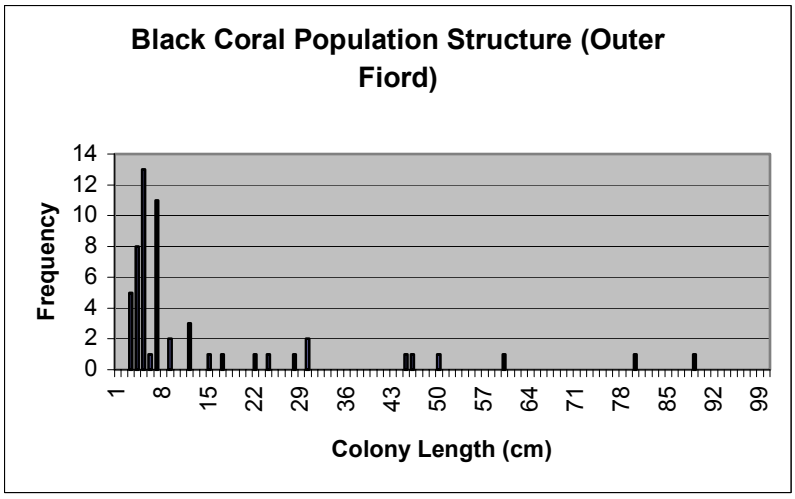
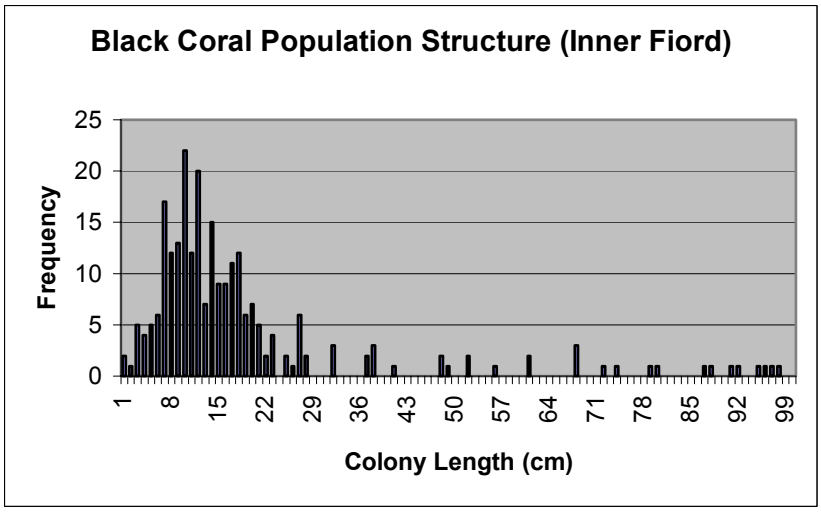
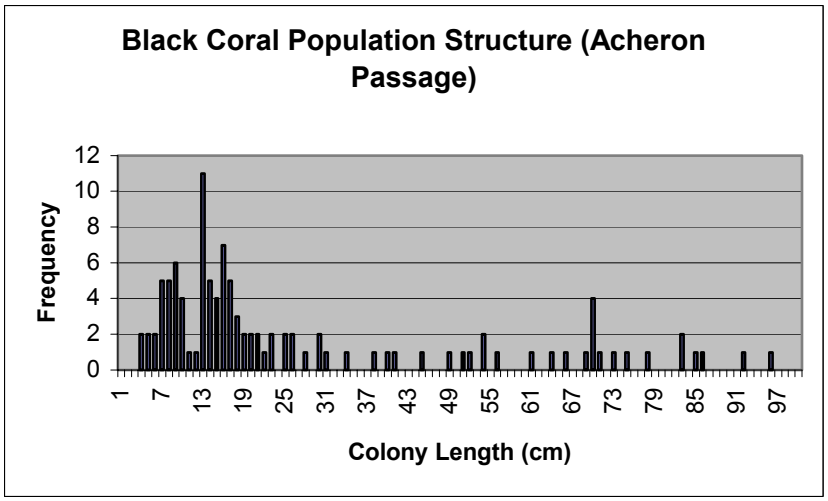


Figure 2: Population Structure of Black Coral Populations in different regions Dusky Sound, Acheron Passage and Wet Jacket Arm.





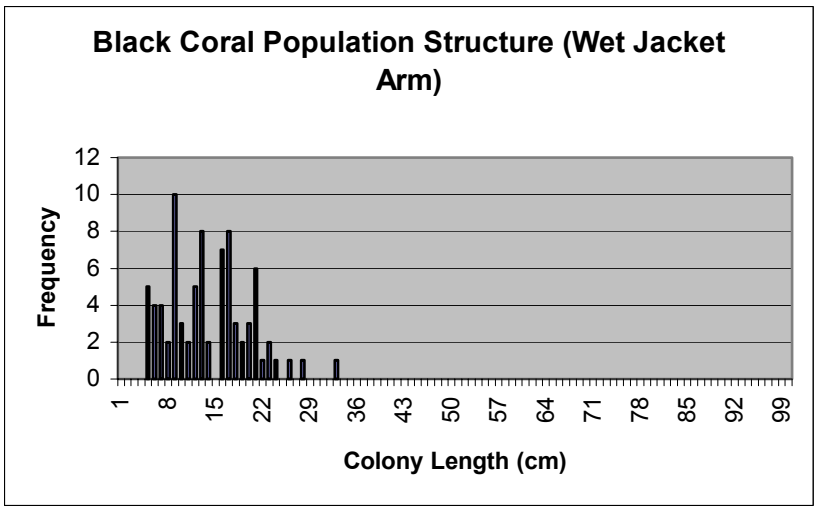


Figure 2 (cont.): Population Structure of Black Coral Populations in different regions Dusky Sound, Acheron Passage and Wet Jacket Arm.

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

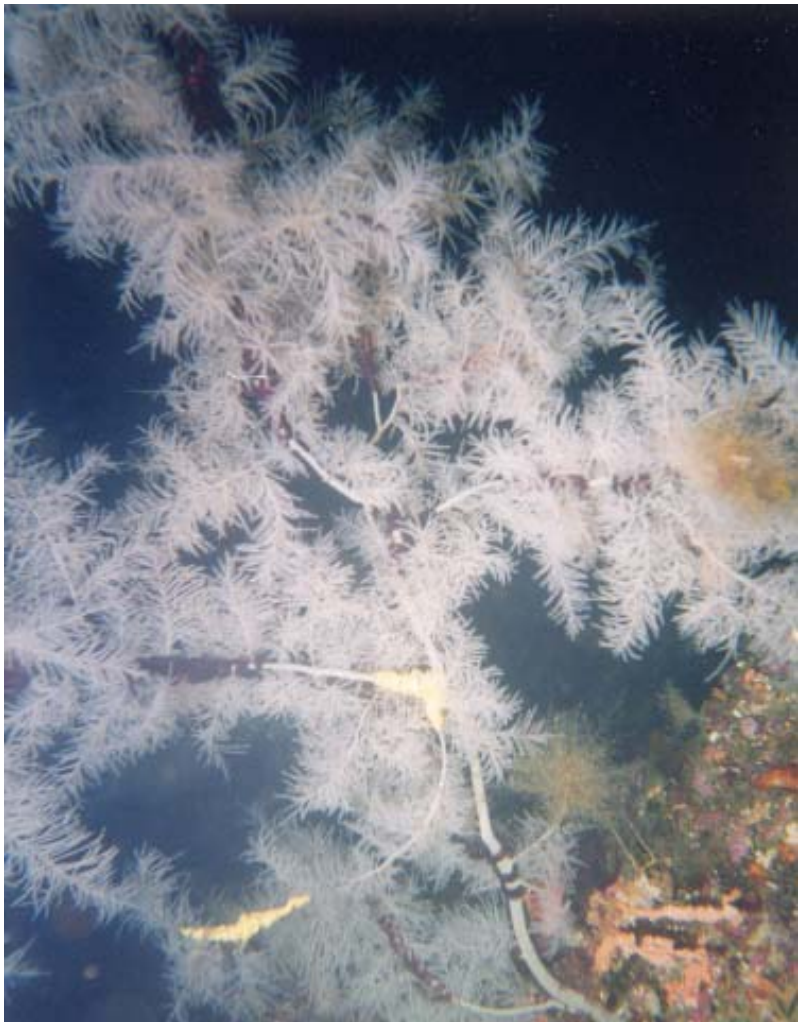
The results presented here indicate that longer Black Coral colonies (*Antipathes fiordensis*) are more frequent in the Outer and Middle Fiord Areas than in Inner Fiord Areas. This suggests the Middle and Outer Fiord Areas are more favorable for the growth of larger Black Coral Colonies.

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.

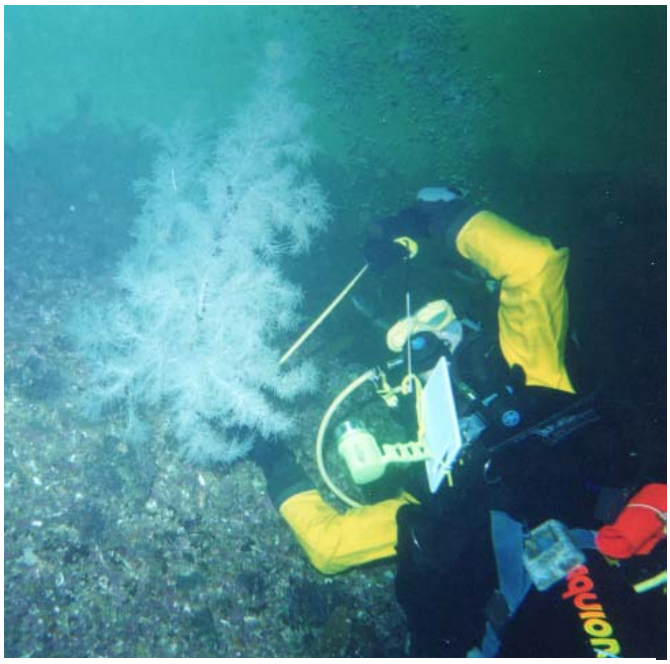
BLACK CORAL



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 $F_{3,23} = 1.75$, $p = 0.186$).

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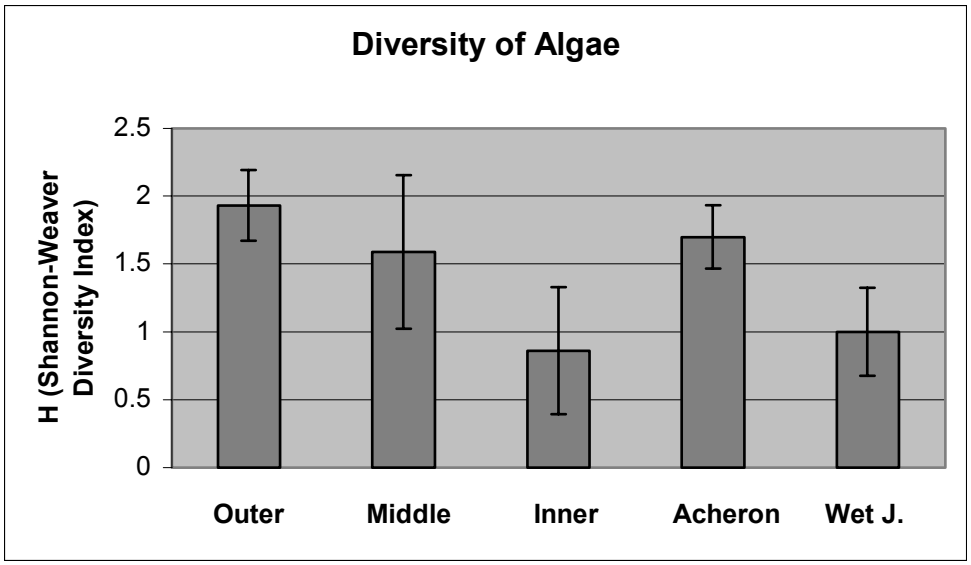
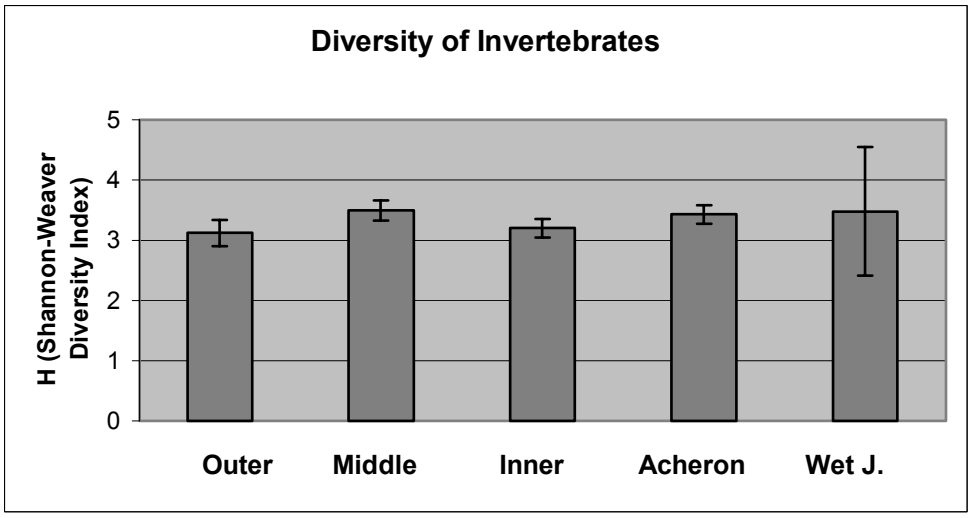
Dive number	Shannon Weaver Diversity Index (H)			Fiord Area
	Fish	Invert	Algae	
1	1.9338	3.2892	1.7362	Outer
2	2.4149	3.1496	2.1525	Outer
3	2.2660	3.2226	1.7251	Outer
4	2.4308	2.8289	2.1444	Outer
5	2.4582	3.1101	1.8996	Outer
6	2.0198	3.5356	1.5672	Middle
7	2.3992	3.5934	2.0788	Middle
8	1.9915	3.6920	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.





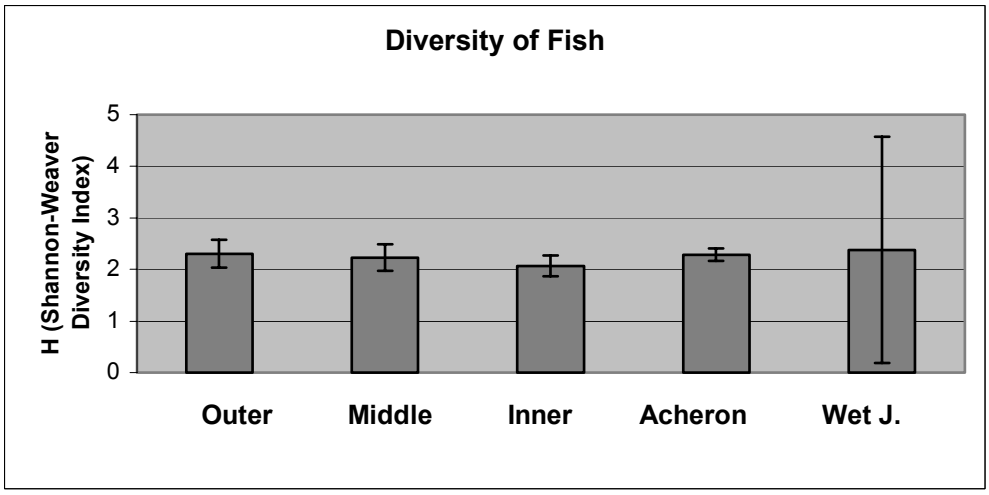


Figure 3.2: Shannon-Weaver Diversity Scores for Fish, Invertebrate and Algal species in different areas of the Fiord.

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

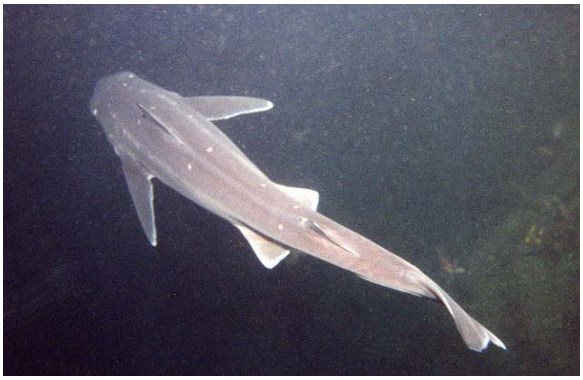
Commonly encountered Fish

FISH

Blue Cod – *Parapercis colias*

Banded Wrasse – *Notolabrus fucicola*

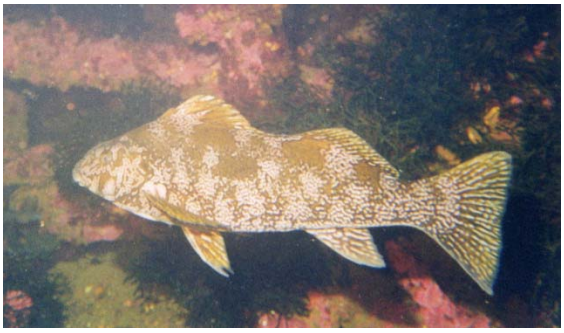
Scarlet Wrasse – *Pseudolabrus miles*



Dogfish, member of the Squalidae

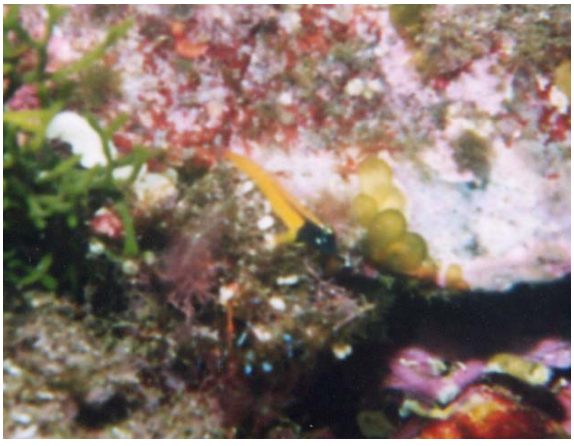
Carpet shark – *Cephalosyllium isabellum*

Seahorse – *Hippocampus abdominalis*

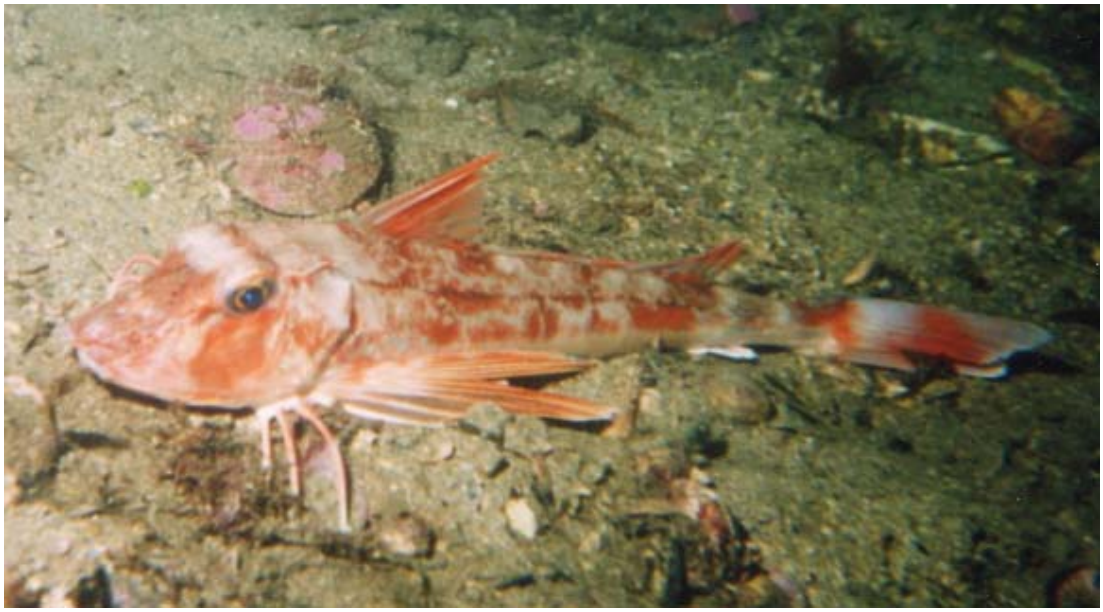


Marblefish – *Aplodactylus arctideus*

Mottled triple fin –
Forsterygion malcolmi



Yellow black triple fin –
Forsterygion flavonigrum

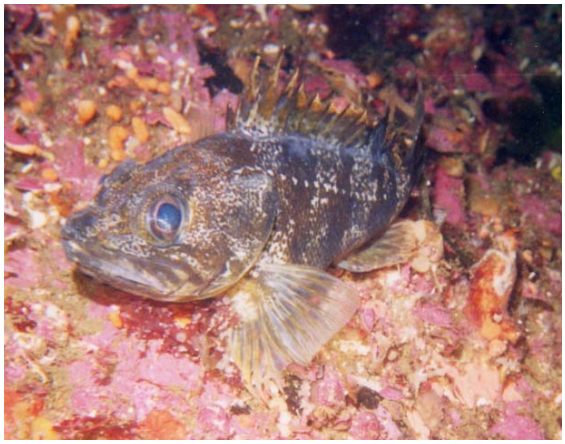


Red Gunnard – *Chelidonichthys kumn*

Leatherjacket – *Parika scaber*

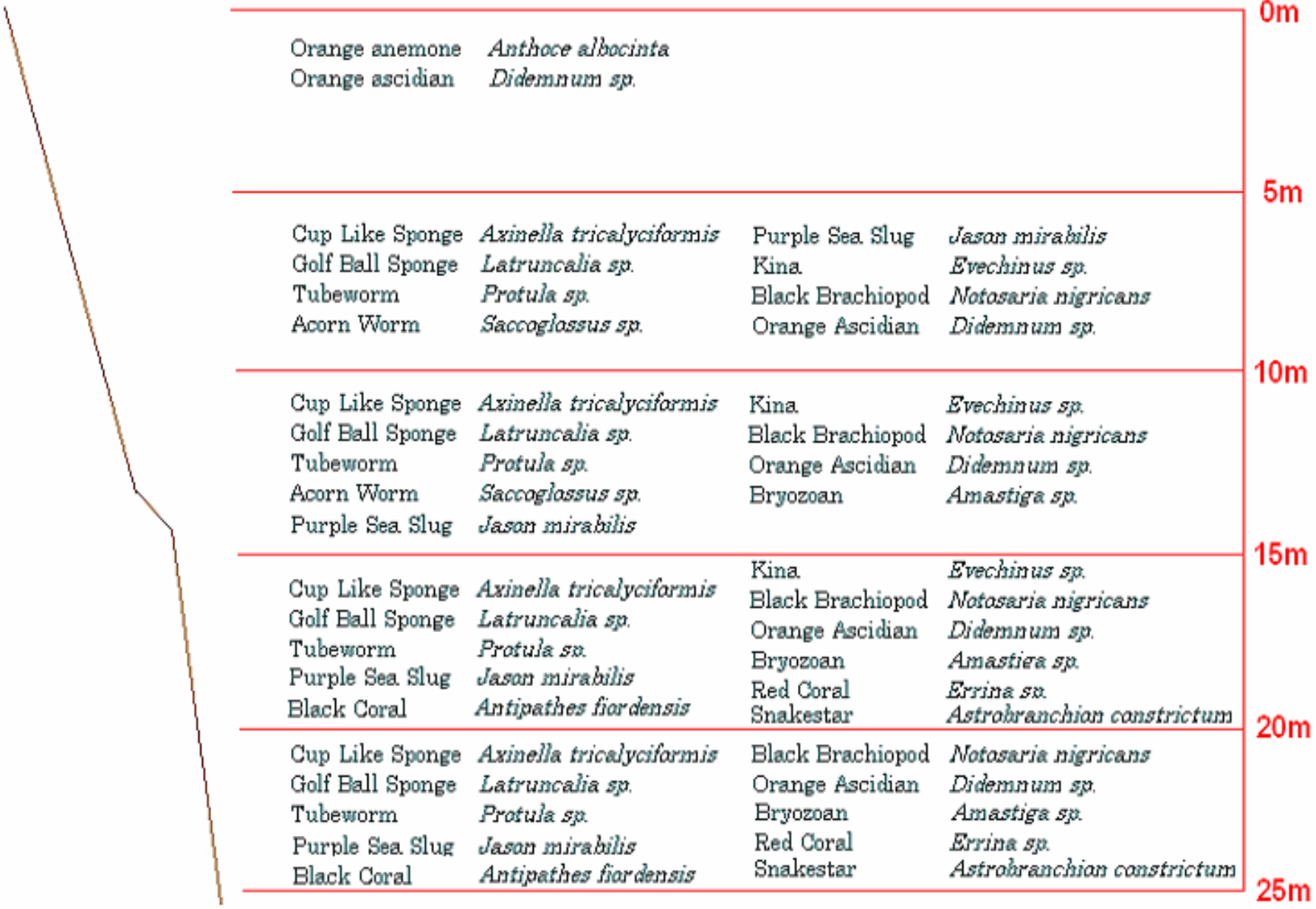
Blue Moki – *Latridopsis ciliaris*

Tarahiki – *Nemadactylus macrpterus*



Jock Stewart or Sea Perch – *Heliconlenus percoides*

Commonly encountered Invertebrates



0m

Orange anemone	*Anthoce albocinta*
Orange ascidian	*Didemnum sp.*

5m

Cup Like Sponge	*Axinella tricalyciformis*	Purple Sea Slug	*Jason mirabilis*
Golf Ball Sponge	*Latruncalia sp.*	Kina	*Evechinus sp.*
Tubeworm	*Protula sp.*	Black Brachiopod	*Notosaria nigricans*
Acorn Worm	*Saccoglossus sp.*	Orange Ascidian	*Didemnum sp.*

10m

Cup Like Sponge	*Axinella tricalyciformis*	Kina	*Evechinus sp.*
Golf Ball Sponge	*Latruncalia sp.*	Black Brachiopod	*Notosaria nigricans*
Tubeworm	*Protula sp.*	Orange Ascidian	*Didemnum sp.*
Acorn Worm	*Saccoglossus sp.*	Bryozoan	*Amastiga sp.*
Purple Sea Slug	*Jason mirabilis*		

15m

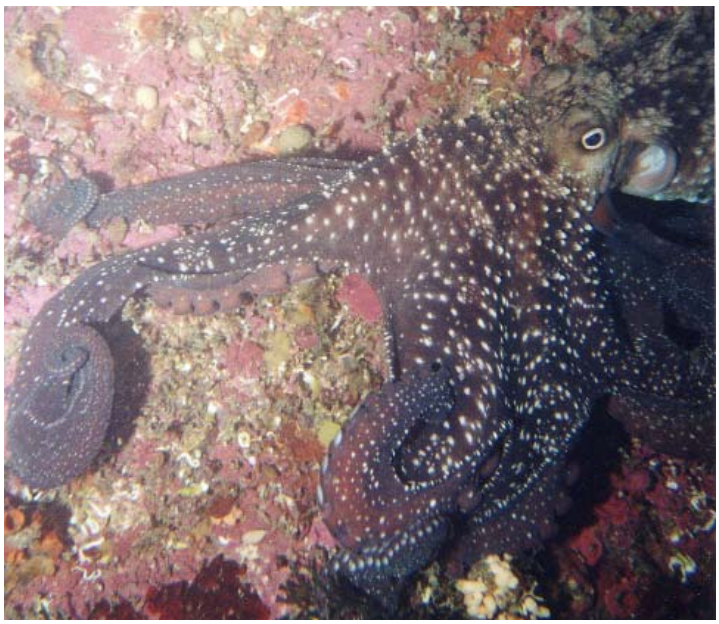
Cup Like Sponge	*Axinella tricalyciformis*	Kina	*Evechinus sp.*
Golf Ball Sponge	*Latruncalia sp.*	Black Brachiopod	*Notosaria nigricans*
Tubeworm	*Protula sp.*	Orange Ascidian	*Didemnum sp.*
Purple Sea Slug	*Jason mirabilis*	Bryozoan	*Amastiga sp.*
Black Coral	*Antipathes fiordensis*	Red Coral	*Errina sp.*
		Snakestar	*Astrobranchion constrictum*

20m

Cup Like Sponge	*Axinella tricalyciformis*	Black Brachiopod	*Notosaria nigricans*
Golf Ball Sponge	*Latruncalia sp.*	Orange Ascidian	*Didemnum sp.*
Tubeworm	*Protula sp.*	Bryozoan	*Amastiga sp.*
Purple Sea Slug	*Jason mirabilis*	Red Coral	*Errina sp.*
Black Coral	*Antipathes fiordensis*	Snakestar	*Astrobranchion constrictum*

25m

INVERTEBRATES



Octopus – *Octopus huttoni*

Crayfish – *Jasus edwardasi*

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

Golf-Ball sponge – *Latruncalia sp*.

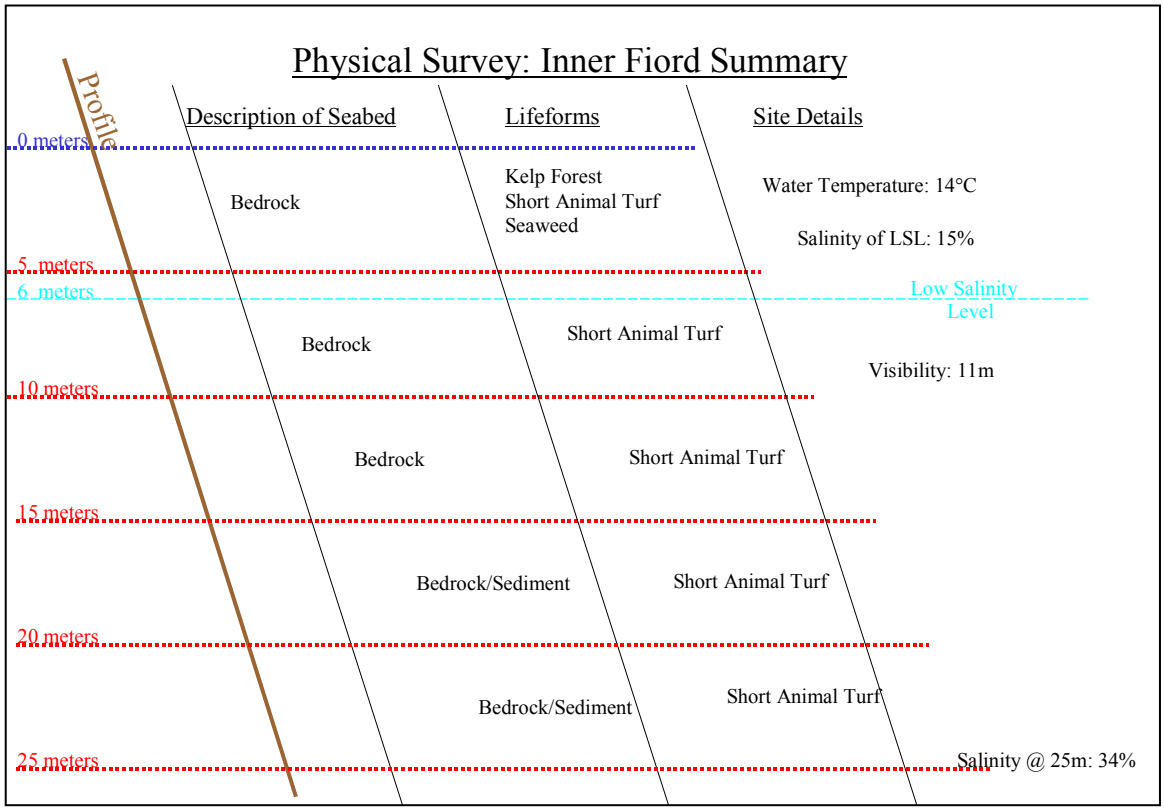
Crayfish – *J. edwardasi*

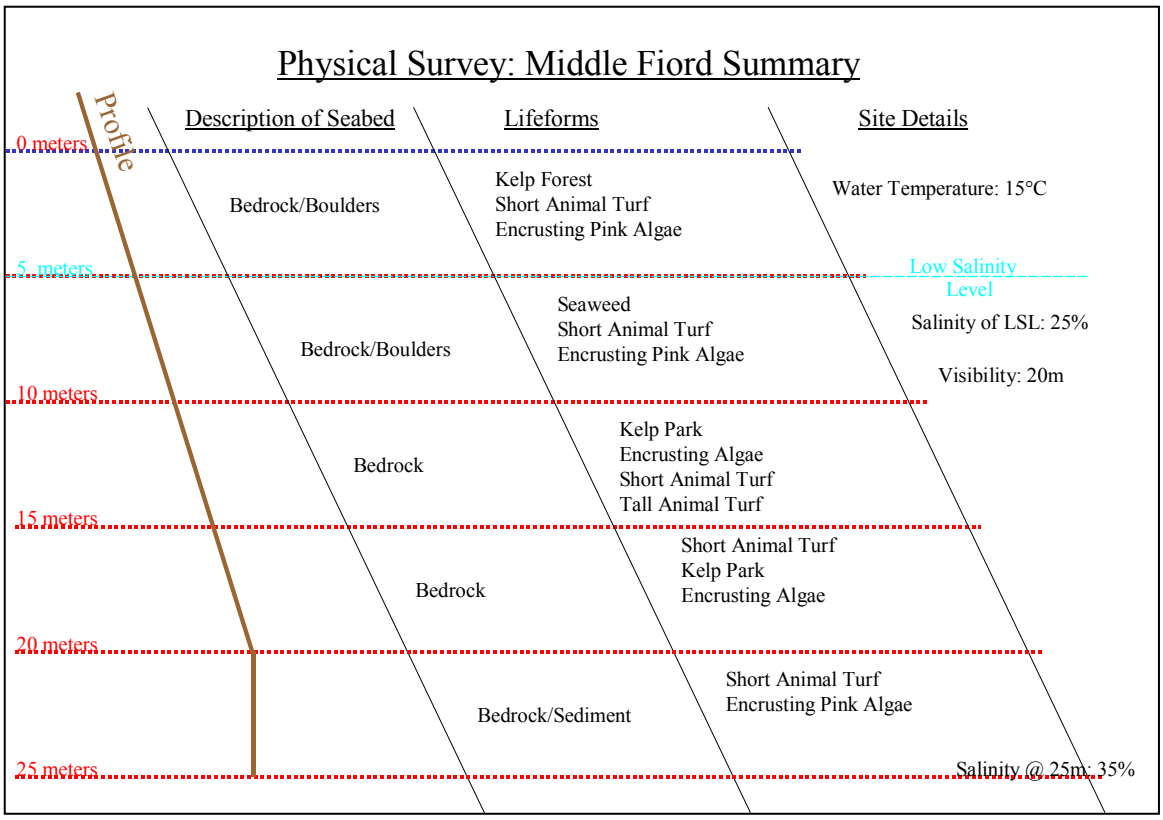
Commonly encountered Algae

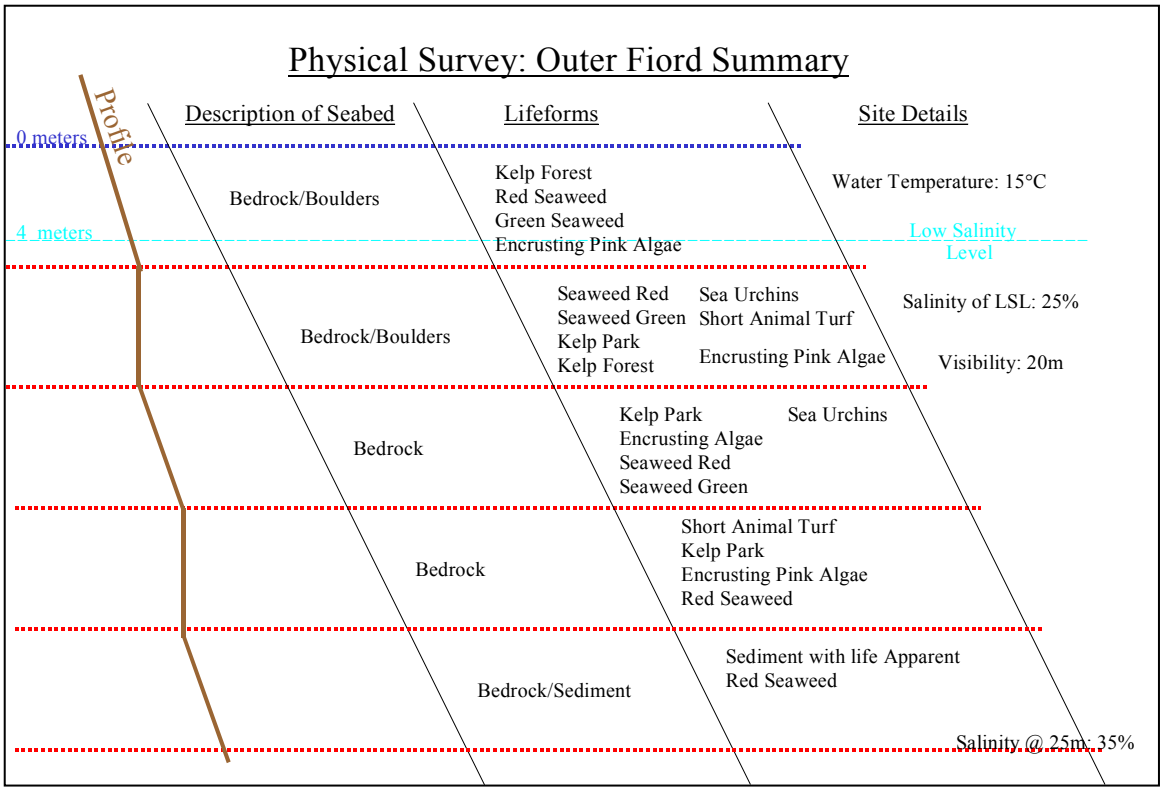
5. Physical Data Summary

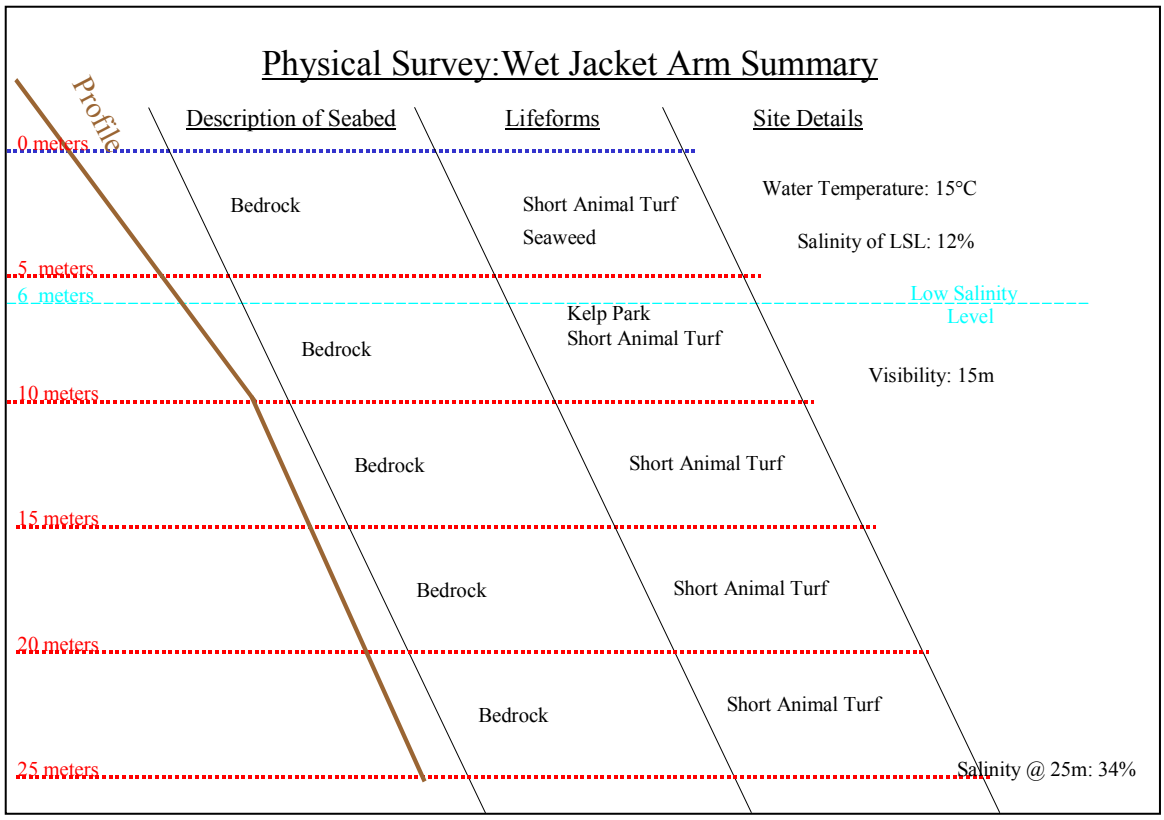
Physical Surveys

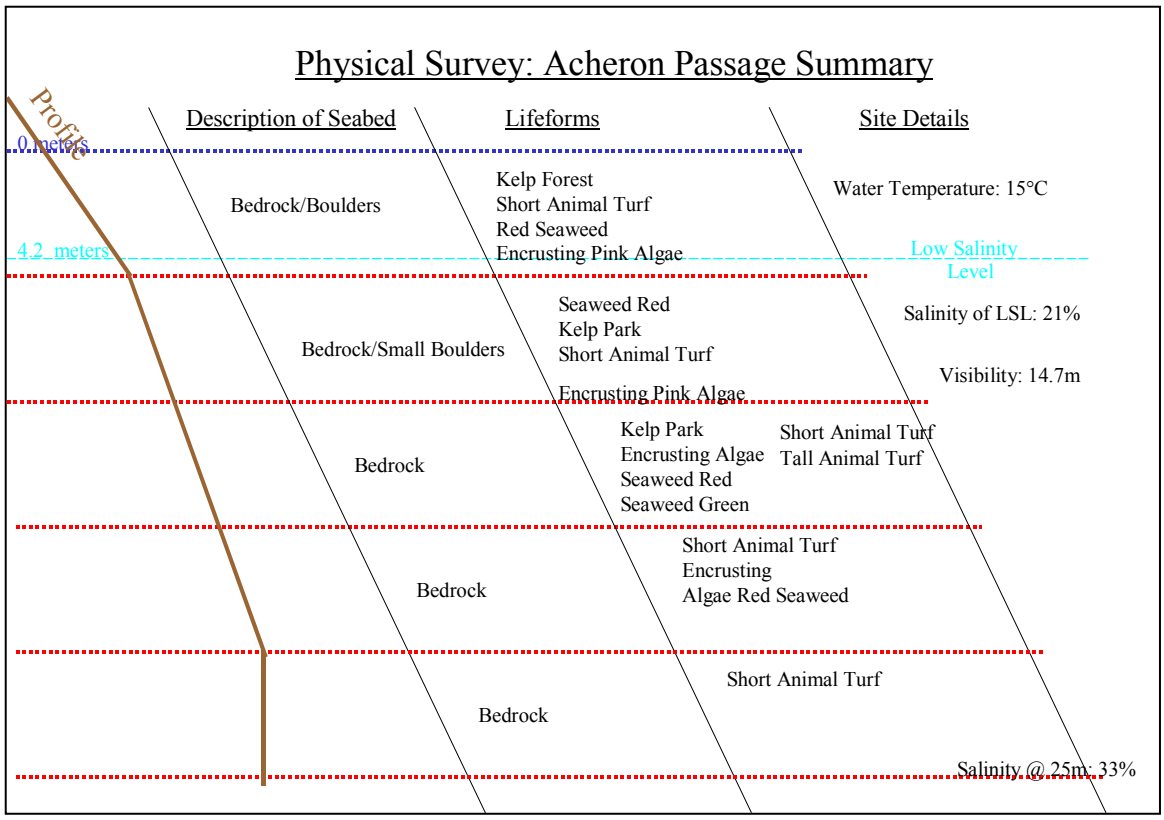
Below is a summary of the oceanographic data from the 5 regions of the Fiord. The physical survey sheet used to record the physical data can be found is shown in figure 5.1. Physical data for each individual survey site can be found in appendix 3. Description of the seabed, dominant life forms and conditions 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: Middle Fiord Summary
Profile
Description of Seabed
Lifeforms
Site Details
0 meters
Bedrock/Boulders
Kelp Forest
Short Animal Turf
Encrusting Pink Algae
Water Temperature: 15°C
5 meters
Low Salinity Level
Seaweed
Short Animal Turf
Encrusting Pink Algae
Salinity of LSL: 25%
Bedrock/Boulders
Visibility: 20m
10 meters
Kelp Park
Encrusting Algae
Short Animal Turf
Tall Animal Turf
Bedrock
15 meters
Short Animal Turf
Kelp Park
Encrusting Algae
Bedrock
20 meters
Short Animal Turf
Encrusting Pink Algae
Bedrock/Sediment
25 meters
Salinity @ 25m: 35%


Physical Survey: Outer Fiord Summary
Profile
Description of Seabed
Lifeforms
Site Details
0 meters
Bedrock/Boulders
Kelp Forest
Red Seaweed
Green Seaweed
Encrusting Pink Algae
Water Temperature: 15°C
4 meters
Low Salinity Level
Seaweed Red
Seaweed Green
Kelp Park
Kelp Forest
Sea Urchins
Short Animal Turf
Encrusting Pink Algae
Salinity of LSL: 25%
Bedrock/Boulders
Visibility: 20m
Kelp Park
Encrusting Algae
Seaweed Red
Seaweed Green
Sea Urchins
Bedrock
Short Animal Turf
Kelp Park
Encrusting Pink Algae
Red Seaweed
Bedrock
Sediment with life Apparent
Red Seaweed
Bedrock/Sediment
Salinity @ 25m: 35%


Physical Survey:Wet Jacket Arm Summary
Profile
Description of Seabed
Lifeforms
Site Details
0 meters
5 meters
6 meters
10 meters
15 meters
20 meters
25 meters
Bedrock
Short Animal Turf
Seaweed
Water Temperature: 15°C
Salinity of LSL: 12%
Low Salinity Level
Kelp Park
Short Animal Turf
Bedrock
Visibility: 15m
Bedrock
Short Animal Turf
Bedrock
Short Animal Turf
Bedrock
Short Animal Turf
Salinity @ 25m: 34%


Physical Survey: Acheron Passage Summary
Profile
Description of Seabed
Lifeforms
Site Details
0 meters
4.2 meters
Bedrock/Boulders
Kelp Forest
Short Animal Turf
Red Seaweed
Encrusting Pink Algae
Water Temperature: 15°C
Low Salinity Level
Seaweed Red
Kelp Park
Short Animal Turf
Encrusting Pink Algae
Salinity of LSL: 21%
Bedrock/Small Boulders
Visibility: 14.7m
Kelp Park
Encrusting Algae
Seaweed Red
Seaweed Green
Short Animal Turf
Tall Animal Turf
Bedrock
Short Animal Turf
Encrusting
Algae Red Seaweed
Bedrock
Short Animal Turf
Bedrock
Salinity @ 25m: 33%

Physical survey

Site Details

Site name: Date:
GPS: _____S_____E
Description of location
Time in: Time out: Duration of dive:
Visibility: Sea temperature:
Time in relation of tides:
Conditions (currents, surge):
Salinity at bottom depth: Salinity of LSL:
Depth of LSL:

Description of Seabed (Performed in 5 meter depth increments)

Deepest depth: Shallowest depth: Gradient:

Type of seabed:

Bed rock___ Boulders___ Cobbles___ Sand____

Mixed Ground___ Mud___ Other_____
(Underline dominant type)

Life forms (Performed in 5 meter depth increments)
(Mark abundance R-rare <5% cover, O-occasional 5-50%, C-common >50%)

Animal Turf on Rocks	Tall	Short
Animal Bed (note animals)		
Sediment with life apparent (tubes, burrows etc.)		
Barren sediment		

Kelp forest	
Kelp park	
Encrusting Pink Algae	
Mixed Seaweeds	

Anything unusual or noteworthy about the seabed or marine life?
(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.

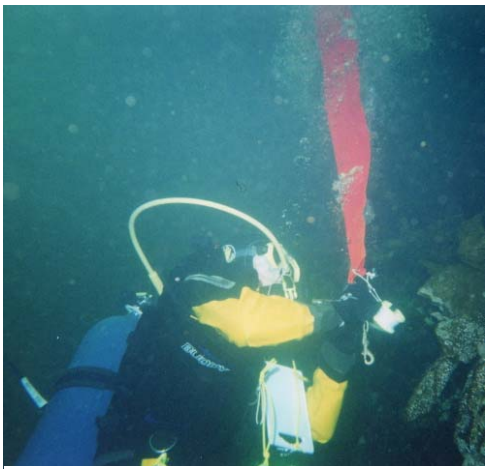
Three of the team members attended a two-day boat-handling course and further to this one member completed a course in basic engine mechanics.

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

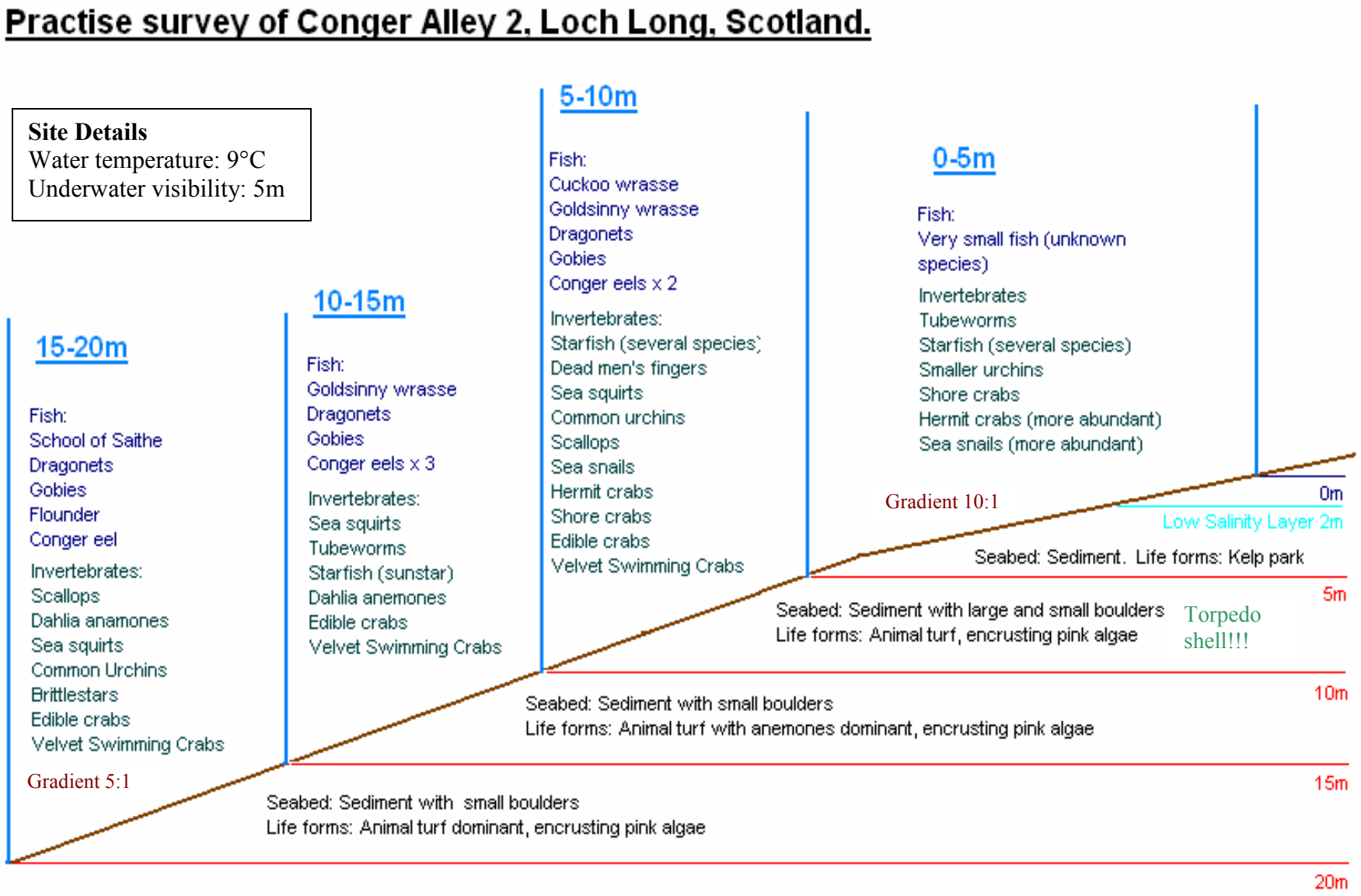


Fig 6: Pre-Expedition Practice survey of a site in Loch Long

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 25m	**Actual time** 15 min		
Max. allowable time 20 min	**Pressure Group** 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.

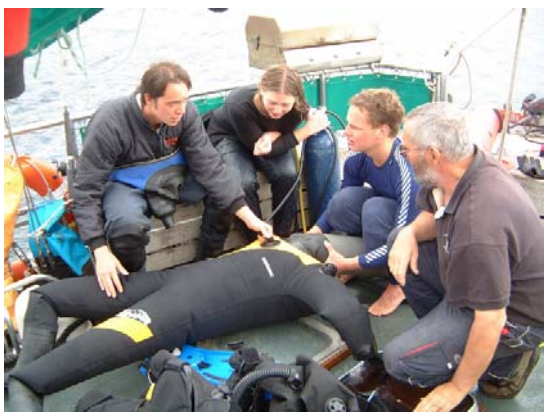
Diving in the fiords proved very simple, with negligible currents in the majority of dives and very good visibility beneath the Low Salinity Layer. Indeed there was more light penetrating through the LSL than we had expected, and conditions were favorable compared to the sites we had dived in Scotland. 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	2,000
Davis Expedition Fund	5,600
James Rennie Bequest	900
The Carnegie Trust for the Universities of Scotland	2,000
Carnegie Vacation Scholarship awarded to Don Asprey	630
Royal Geographical Society (with the Institute of British Geographers)	
Rio Tinto plc.	1,000
The British Sub-Aqua Club Jubilee Trust	1,000
PADI Project Aware	417.39
The Explorers Club (New York)	664.59
Fund-raising Cousteau Creates night	519.71
RBS interest to account	25.71
Personal Contributions	3,000
GRAND TOTAL OF INCOME	**17,757.40**

SUMMARY OF EXPENDITURE

PRE EXPEDITION

Insurance	564.52
Transport (flights & coach)	7715.18
Boat Charter	6452.38
Administration	
Application fees	20
Phonebill	5.15
Training (rental, fills, courses)	368
Equipment	
Books	45
Tools	6.95
Dive equipment	291.54
Medical kit	59.82
Photographic & Batteries	72
Fund-raising events (club & flyers)	290
Other	69.25
SUB-TOTAL	**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.



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Appendix 1

Black Coral Data, dives 1-11

	Dive 1		Dive 2	Dive 3		Dive 4		Dive 5		Dive 6			Dive 7		Dive 8		Dive 9			Dive 10			Dive 11		
Depth (m)	25-20	20-15	25-20	25-20	20-15	25-20	20-15	20-15	15-10	25-20	20-15	15-10	25-20	20-15	25-20	20-15	25-20	20-15	15-10	25-20	20-15	15-10	25-20	20-15	15-10
Size (cm)																									
1																									
2													1												
3					5								1	1					2						1
4					8																				1
5					13														1						
6								1		1			1		1				1						1
7					10			1		1								1		2	1		1		
8											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												1	1		2					1					
14										1		1	1												
15								1		3	1	1		1			1	1				1			1
16										1	1	1					1						1	1	1
17								1		2							1					1	1		
18										1	1						2								
19												1													2
20										1	1		1	1								2			1
21										1															
22								1		1	1		1												
23										1					1										
24									1		1														
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73										1															
74																									
75																									
76																									
77												1					1								
78																									
79													1												
80								1					1												
81																									
82													1	1											
83													1												
84																									
85																									
86																									
87																									
88																									
89	1											1					1								
90																									
91																									
92										1															
93																									
94																1									
95																									
96																									
97																									
98																									
99																									
100																									
>1m	1		1	3				4															2		
Totals	2	0	4	3	36	0	0	17	3	25	16	10	19	9	5	1	9	7	4	7	4	10	6	1	11

Black Coral Data, dives 12-20

	Dive 12	Dive 13				Dive 14			Dive 15		Dive 16				Dive 17			Dive 18		Dive 19			Dive 20		
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		1						
2											1														
3																			1		3		1		
4						1									1							1		1	
5	1	1				1	1														1				
6		2									1											1	1	1	
7		1		1		2	2				4	1								2			2	2	
8		1	1			2	2						3			1								2	
9		3							1		1	1			1					1			1	4	
10		3	2		2	6	3	1					1					1						3	
11	1	4	1	1	2																		1	2	
12		5	2	1		2	4	1		1								1	1		1			1	
13		1	1			1						1	1						1	1					
14		2	1	4		2	2	1	1		1							1							
15			1			1	2	1	2		1				1										
16	1	1				2	2		1														2		
17		4				1		3	1							1								1	
18		4				1	1		1						3								1	1	
19			1			1										1	1					1		1	
20		4				2				1															
21	1		1						1														1	1	
22			2																						
23		1	1						1														1		
24																									
25															1							1			
26						1																			
27		1													1	1		1			1		1		
28				1											1										
29																									
30																									
31																									
32																			1			1	1		
33																									
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																		1							
57																									
58																									
59																									
60																									
61																		1				1			
62																									
63																									
64																									
65																									
66																									
67																									
68														1	1						1				
69																									
70																									
71																									
72		1																							
73																									
74												1													
75																									
76																									
77																									
78																									
79			1																						
80																		1							
81																									
82																									
83																									
84																									
85																									
86																									
87															1										
88												1													
89																									
90																									
91														1											
92													1												
93																									
94																									
95				1																					
96																								1	
97																					1				
98			1																						
99																									
100																									
>1m		1	1										3									1	1		
Totals	4	40	17	9	4	26	19	7	12	3	9	6	10	2	11	4	3	8	5	4	8	7	14	21	3

Black Coral Data, dives 21-29

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

			Dive 1					Dive 2					Dive 3					Dive 4				
FAMILY	**SPECIES**	**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
Scorpaenidae	*Scorpaena papillosus*	Dwarf scorpian fish			1	1																
	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
	Hypoplectrodes huntii	Red banded perch						1		2	1				1							
	Callanthias australis	Northern Splendid perch																				
	Callanthas allporti	Southern splendid perch																				
Mullidae		Unidentified goatfish						1								1						
Scorpidae	*Bathystethus cultratus*	Grey knifefish																				
Chironemidae	*Chironemus marmoratus*	Hiwihiwi																			1	
Aplodactylidae	*Aplodactylus arctideus*	Marblefish																				
	Aplodactylus etheridgii	Notch-head marblefish																				
Cheilodactylidae	*Nemadactylus macrpterus*	Tarakihi																				
Latridae	*Latridopsis ciliaris*	Blue moki																				
Latridae	*Latris lineata*	Trumpeter																				
Labridae	*Bodianus unimaculatus*	Red pigfish							1													
	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																	1			
	Pseudolabrus miles	Scarlet wrasse		2	2			1	2	2								2	1	1		
Pinguipedidle	*Parapercis colias*	Blue cod		1				2							1			1	1	1		
Tripterygiidae	*Forsterygion varium*	Variable triplefin							1											1		
	Grahamina capito	Spotted triplefin																				
	Forsterygion lapillum	Common triplefin																				
	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	4	4	2	4	2						1	
	Forsterygion malcolmi	Mottled triplefin																				
	Karalepis stewarti	Scaly-headed triplefin																				
	Ruanoho decemdigitatus	Long finned triplefin				1																
	Notoclinops segmentatus	Blue eyed triplefin				2				2				1		2				1		
Myxindae	*Eptatretus cirrhatus*	Hagfish																				
Scyliorhinidae	*Cephalosyllium isabellum*	Carpet shark																				
Blenniidae	*Parablennius laticlavius*	Crested blenny													1							
Monacanthidae	*Parika Scaber*	Leatherjacket																				
Bothidae	*Unidentified*	Left eyed flounder																				
?	*Pempheris adspersus*	Big Eye						1														
Squalidae		Dogfish																1				
?	*Bovichtus variegatus*	Thornfish																				
	Chelidonichthys kumn	Red gurnard																				
		unidentified grouper																				
	Hippocampus abdominalis	sea horse																				

*=lots of juveniles

Fish Data, dives 5-10

	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																										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			1					1	2	1	2					1	
Variable triplefin																														
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																		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																														
Dogfish						1																								
Thornfish				1																										
Red gurnard																														
unidentified grouper																														
sea horse																														

*=lots of juveniles

Fish Data, dives 11-16

	Dive 11					Dive 12					Dive 13					Dive 14					Dive 15					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																														
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																														
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 eyed triplefin																														
Hagfish																														
Carpet shark																														
Crested blenny													3																	
Leatherjacket															3		1													
Left eyed flounder																														
Big Eye																														
Dogfish						1																								
Thornfish																														
Red gurnard																														
unidentified grouper																														
sea horse																														

*=lots of juveniles

Fish Data, dives 17-22

	Dive 17					Dive 18					Dive 19					Dive 20					Dive 21					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			
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																														
Trumpeter																														
Red pigfish																														
Sandager's wrasse																														
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	
Blue cod	1	1	1	1	1	1						1	1	1	1	1		1	1		1	1	1		1	1			1	1
Variable triplefin																														
Spotted triplefin																														1
Common triplefin																														
Yellow black triplefin	1	1	2	1		1	1	1	1		1	1	1						2			3	3	3		2	2	3		
Oblique-swimming triplefin																														
Mottled triplefin		1	1	1		1																								
Scaly-headed triplefin																									1			1		
Long finned triplefin																														1
Blue eyed triplefin																														
Hagfish																														
Carpet shark																														
Crested blenny																	2				3	3	3		1					2
Leatherjacket								4											1											
Left eyed flounder																														
Big Eye																														
Dogfish											1																			
Thornfish																														
Red gurnard	1																													
unidentified grouper																														
sea horse																														

*=lots of juveniles

Fish Data, dives 23-29

	Dive 23					Dive 24					Dive 25					Dive 26						Dive 27					Dive 28					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			
Sea perch						2			1		1		1			1	1					1	2*				1					1	1			
Butterfly perch	4	3	3			1	2	1			3	2				3	1					2	2				3	1	2	1	2	4				
Red banded perch	2	1											1														1	1								
Northern Splendid perch												1				1																				
Southern splendid perch																																				
Unidentified goatfish																																				
Grey knifefish																								3												3
Hiwihiwi																																				
Marblefish																																				
Notch-head marblefish																																				
Tarakihi											1	1											1	1			1									
Blue moki																																				
Trumpeter																									1	1									
Red pigfish																																				
Sandager's wrasse																																				
Spotty								2	2	1				2				2	2			1	2*	1	1	2					1				1	1
Banded wrasse														1		1	1	2	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	1
Scarlet wrasse		2	1		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	
Variable triplefin																	1																			
Spotted triplefin																																				
Common triplefin																																				
Yellow black triplefin	3	3	3	2		1	2	1		1	2	2	1	2	1	1	1	1	1								1	1			1	1	1	1	
Oblique-swimming triplefin					4					2																3								3	
Mottled triplefin			1		1	1								1					1																
Scaly-headed triplefin																																				
Long finned triplefin																																				
Blue eyed triplefin																																				
Hagfish																																				
Carpet shark			1			1																														
Crested blenny																																				
Leatherjacket																																				
Left eyed flounder							1																													
Big Eye																																				
Dogfish						1																														
Thornfish																																				
Red gurnard																																				
unidentified grouper													1																							
sea horse														1																						

*=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		
				Caluerpa	*brownii*	Green ferns		1	4	4			2	4	4					2			5	4		
				Carpophyllum	*flexuosum*	Flexable flapjack				2				2												
				Durvillaea	*sp.*	Tidal Laminaria				2																
				Codium	*sp.*	Green fingers						1	2	1	2			3	2	1		2	4	3	1	
				Zonaria	*tuneriana*	Shiny red/brown									2				2	2					1	
				Macrocystis	*pyrifera*	Bladder kelp									2									2	5	4
				Eklonia	*radiata*	Stiped selagin								2							4		5	5	3	
						Sailors eyeballs																2	2	2	2	
				Ulva	*sp.*	Sea Lettuce																				
Desmospongia				*Latruncalia*	*sp.*	Golf ball sponge						1	1													
						Tube sponge	1	1	1			2	2				1		1			1	1			
				Raspailia	*sp.*	Digitated sponge		1									1		1							
				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																				
				Polymastia	*croceus*	Breadcrumb sponge																				
						Grey encrusting	1	2	1																	
						Orange Encrusting																				
						Yellow encrusting	1								2		1	1	2	1		2	2	2	2	2
						White encrusting							2		2											
						Pruple encrusting																				
						Black and White encrusting																				
						Yellow encrusting spikey																				
						White encrusting spikey																				
						Blue encrusting spikey																				
						Black sponge																				
Worms						Spagetti worm			2	2																
						Tube worm	2	2	2	1			1									2	2	2	2	
				Protula	*sp.*	Tube worm	3	3	2	1			1	1			1	1	1							
						CTW																				
				Saccoglossus	*sp.*	Acorn worm			1						1							1	2	2	1	1
						Peanut worm									2											
				Sabella	*sp.*	Feather duster worm												1	1							
Coelenterates				*Errina*	*sp.*	Red Coral	3	3									1		1							
				Antipathes	*fiordensis*	Black Coral	1	1				2	2				2	2								
				Sarcophylum	*sp.*	Sea pens																				
				Gorgoinia	*sp.*	Gorgonian																				
						Hydroid	3	3	2								2	2	2	2		2	2	2	2	2
				Symplectoscyp	*subarticulatus*	Hydroid											3	2	1			1	1	1		
				Sertularella	*geodiae*	Hydroid																				
						Stalked anemone														2	4					
				Edwardsia	*sp.*	Red anemone				1					1		2	2								
				Mimteridium	*cryptum*	Many fingered anemone			1			1														
				Cerianthus	*sp.*	Tube anemone																				
				Anthothoe	*albocincta*	Orange anemone															4					4
				Phlyctenactis	*tuberculosa*	Wandering anemone																				
						Stoney coral																				
						Cup coral																				
	Octocoral			*Alcyonium*	*aurantiacum*	Dead mans fingers																				
						Zooanothian																				
				Parazooanthus	*sp.*	Zooanthids																				
						White zooanothian																				
						Like *C. cosatata,* hard white protrusions																				

Invertebrate & Algal Data, dives 1-4 (cont.)

							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
Molluscs				*Astraea*	*heliotropium*	Circular saw shell	1																			
				Cominella	*nassoides*	Whelk													1							
				Argobuccinum	*sp.*	Whelk			1						1											
						Turet shell			1																	
				Chromadoris	*aureomargianta*	Nudibranch - white				2								1		2				1		
				Chromadoris	*conwayii*	Nudibranch - blue and white																				
				Jason	*mirabilis*	Sea slug - purple																				
				Archidoris	*wellingtonensis*	Sea slug - warty																				
						Sunflower seed nudibranch																				
				Charonia	*sp.*	Trumpet								1												
				Cookia	*sulcata*	Cook's Turban shell																				
				Calliostoma	*granti*	Grant's maurea																1	1	1		
				Mytilus	*galloprovancialis*	Blue mussels																				
				Atrina	*zelandica*	Horse mussels																				
				Talochlamys	*gemmulata*	Spiny scallop																				
				Maoricolpus	*roseus*	Cone shell																				
				Cryptoconchus	*porosus*	Butterfly chiton																				
						Chiton																				
				Octopus	*huttoni*	Octopus																				
Crustaceans						Hermit crab	1					1						1				1		1	1	
				Jasus	*edwardasi*	Red crayfish			1			1											2			
Pycnogonids/Other				*?*	*?*	Sea Spider													1					1		
Echinoderms						Feather star																				
						Brittlestar	3	2	2					1							1					
				Coscinasterias	*calamaria*	11 arm starfish	3	2	1	1				1			1	1	2	1	1		1			
				Pectinura	*maculata*	Snakestar	2		2			2							3	1						
				Astrobranchion	*constrictum*	Snakestar											2	2								
				Henricia	*sp.*	Normal orange star																				
				Pentagonaster	*pulchellus*	Common biscuitstar			1					1					2	2	2	1		2	1	
				Asterodon	*sp.*	Red starfish																				
				Patriella	*regularis*	Cushion star																				
				Evechinus	*sp.*	Kina				3				2	2											
				Pseudechinus	*huttoni*	White urchin																				
				Stichopus	*mollis*	Sea cucumber			1	1					2		1	2	1	1	1	2	2	2	2	2
Bryazoans						Unidentified	2	2	2			2	3	3	3		3	3	3	3	3	2	2	2	2	2
				Hippellozooia	*novaezelandiae*	Classic lace coral																				
				Amastigia	*sp.*	Classic branching																				
				Crisia	*sp.*	Thin classic branching																				
Ascidians						White encrusting (potentially young Diadenium)	2	3	1			2	2	2	1		4	4	3	3	2	3	3	3	3	3
				Didemnum	*sp.*	Orange	1	1	1			2	2	2	1		2	2	2	2		3	3	3	3	3
				Didemnum	*candidum*	common one found - white/orange																				
						Wax ascidian																				
				Pseudodistoma	*sp.*	Red colonial ascidians																				
				Cnemidocarpa	*bicornuta*	Tube like sea squirt																				
				Oplidium	*sp.*	Black ascidian																				
Brachiopods				*Notosaria*	*nigricans*	Black brachiopod											1									
				Magasella	*sanguinea*	Scarlet brachiopod																				
				Liothyrella	*zelandea*	White brachiopod																				
						Brachiopod																		2	2	2

Invertebrate & Algal Data, dives 5-10

			Dive 5					Dive 6					Dive 7					Dive 8					Dive 9					Dive 10				
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	3	1	2	2	5		5	4	3	2		5	4	3	3		5	3	3	2		3	3	3	2	
Arthocardia	*wardii*	Red ferny		2		5			2		5				3	4				2	3	1				2						
		Red strips														3					2											
Carpometria	*costata*	No float Laminaria													3	3		2	3	2	2			2	1				1			
Caluerpa	*brownii*	Green ferns		4			3				2					1									3				2			
Carpophyllum	*flexuosum*	Flexable flapjack																		2	4											
Durvillaea	*sp.*	Tidal Laminaria																			1											
Codium	*sp.*	Green fingers		5		3			1	4	3			2	2	2			3	3			1	1	2	2						
Zonaria	*tuneriana*	Shiny red/brown					1													1	3											
Macrocystis	*pyrifera*	Bladder kelp															4		1	1	2											
Eklonia	*radiata*	Stiped selagin		1		3	5			4	1				2	2			2		2											
		Sailors eyeballs		1		1																										
Ulva	*sp.*	Sea Lettuce					1									1					3	4										
Latruncalia	*sp.*	Golf ball sponge		2	2			1	2		1				2	2			2	3											1	
		Tube sponge		3	3			2	2	2			3	2	2	2		2	2	2			4						2	2		
Raspailia	*sp.*	Digitated sponge						2	2	2			1						2							2						
Callyspongia	*sp.*	Fingerlike sponge		1	1			1	2	1					2				1						2	2		3	2	2	1	
Axinella	*tricalyciformis*	Cuplike sponge		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	2						
		Yellow encrusting		1	1	1			1	3					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																														
		Blue encrusting spikey														2																
		Black sponge																														
		Spagetti worm																		1												
		Tube worm						2	2	1				2	2	1		2	2	2				3	2	3		2	2				
Protula	*sp.*	Tube worm		3	3	3		1	2					2	1				2	2												
		CTW																														
Saccoglossus	*sp.*	Acorn worm																														
		Peanut worm									2																			1	1	
Sabella	*sp.*	Feather duster worm																														
Errina	*sp.*	Red Coral																														
Antipathes	*fiordensis*	Black Coral		3	3			2	2				2	2				2					2	1	1	1		3	3	2	1	
Sarcophylum	*sp.*	Sea pens																														
Gorgoinia	*sp.*	Gorgonian											2										1					2				
		Hydroid		2	2	2			2	1	2		2	2	1			3	2	2				2	2	1		2	2	2	2	
Symplectoscyp	*subarticulatus*	Hydroid		1																												
Sertularella	*geodiae*	Hydroid																														
		Stalked anemone																										2				
Edwardsia	*sp.*	Red anemone						1											1													
Mimteridium	*cryptum*	Many fingered anemone						1																		1					2	
Cerianthus	*sp.*	Tube anemone		2		2					1			2	1														2			
Anthothoe	*albocincta*	Orange anemone					4	3																								
Phlyctenactis	*tuberculosa*	Wandering anemone																														
		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							

Invertebrate & Algal Data, dives 5-10 (cont.)

			Dive 5					Dive 6					Dive 7					Dive 8					Dive 9					Dive 10				
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
Astraea	*heliotropium*	Circular saw shell																			1					1			2	2		
Cominella	*nassoides*	Whelk																												3		
Argobuccinum	*sp.*	Whelk																			2					2						
		Turet shell																								1						
Chromadoris	*aureomargianta*	Nudibranch - white				1																										
Chromadoris	*conwayii*	Nudibranch - blue and white																														
Jason	*mirabilis*	Sea slug - purple				1	1	1		1										1	1											
Archidoris	*wellingtonensis*	Sea slug - warty							1																							
		Sunflower seed nudibranch																														
Charonia	*sp.*	Trumpet																			2				1							
Cookia	*sulcata*	Cook's Turban shell													1															2		
Calliostoma	*granti*	Grant's maurea								1				1																		
Mytilus	*galloprovancialis*	Blue mussels					3																									
Atrina	*zelandica*	Horse mussels																														
Talochlamys	*gemmulata*	Spiny scallop																														
Maoricolpus	*roseus*	Cone shell																														
Cryptoconchus	*porosus*	Butterfly chiton																														
		Chiton																		1	2											
Octopus	*huttoni*	Octopus																														
		Hermit crab		1	1	1																									1	
Jasus	*edwardasi*	Red crayfish			2																							2				
?	*?*	Sea Spider											1																			
		Feather star						1																								
		Brittlestar																														
Coscinasterias	*calamaria*	11 arm starfish		1		1						3				1					2										1	
Pectinura	*maculata*	Snakestar				1		1	1				1	1				1										2	2	1		
Astrobranchion	*constrictum*	Snakestar		2	2								1	1									1		1	1						
Henricia	*sp.*	Normal orange star						1	2	1															1	2				1		
Pentagonaster	*pulchellus*	Common biscuitstar		3	3	2																			1	1						
Asterodon	*sp.*	Red starfish																														
Patriella	*regularis*	Cushion star																														
Evechinus	*sp.*	Kina									2										2										2	
Pseudechinus	*huttoni*	White urchin																														
Stichopus	*mollis*	Sea cucumber		2	2	2	2		2	1					1	1			1	1	2				1	2		2	1	1		
		Unidentified		2	2	2		2	2	1	1												1	0	4	5	0	4	3	3	3	0
Hippellozooia	*novaezelandiae*	Classic lace coral						2	1	1			2	2	3	2		2	3	1			1		2			2	2	1		
Amastigia	*sp.*	Classic branching						1	2	2			2	1	1			2	2	2			2	2	1							
Crisia	*sp.*	Thin classic branching												1									4	2	2	2	0	5	4	4	3	0
		White encrusting																														
		(potentially young Diadenium)		3	3	3	4	2	2	1			2	2	3	2																
Didemnum	*sp.*	Orange		3	3	3	4		2	1			1	2	3	3		2		2			4	4	3	2		3	2	2	2	
Didemnum	*candidum*	common one found - white/orange												2	2			2	1	3	1											
		Wax ascidian													1					2						2	2		2	2		
Pseudodistoma	*sp.*	Red colonial ascidians																														
Cnemidocarpa	*bicornuta*	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		
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		
		Brachiopod						5	3																			2				

Invertebrate & Algal Data, dives 11-16

			Dive 11					Dive 12					Dive 13					Dive 14					Dive 15					Dive 16				
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																												
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								
		Tube sponge		2	2			1	2	1	1												2	1	1	1						
Raspailia	*sp.*	Digitated sponge						2	1	1	2		1	1	1			2	2									1	1	3	3	
Callyspongia	*sp.*	Fingerlike sponge	3	2	2	1																			1							
Axinella	*tricalyciformis*	Cuplike sponge		2	2			2	2	2			3	3	3										1							
Thorecta	*sp.*	Orange tubelike sponge																		1												
Polymastia	*croceus*	Breadcrumb sponge																		2	2											
		Grey encrusting																														
		Orange Encrusting																2	2	2	2				1							
		Yellow encrusting			2																											
		White encrusting																														
		Pruple encrusting																													2	
		Black and White encrusting																														
		Yellow encrusting spikey						2	2	2	2		2	2	2										1	2	2	1	2	1		
		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	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	2	1		1	1				3	3	3	2		3	3	3			1	2	1	1		2	2	2	1	
Sarcophylum	*sp.*	Sea pens																														
Gorgoinia	*sp.*	Gorgonian	2																													
		Hydroid	2	2	2	2							2	2	2								1	1	1	1						
Symplectoscyp	*subarticulatus*	Hydroid																2	2	2	2											
Sertularella	*geodiae*	Hydroid						3	3	3	3	3	2	2	2			2	2	2	2							1	1	3	3	
		Stalked anemone	2					1	1	1																						
Edwardsia	*sp.*	Red anemone																														
Mimteridium	*cryptum*	Many fingered anemone				2																										
Cerianthus	*sp.*	Tube anemone		2				2	1	1																						
Anthothoe	*albocincta*	Orange anemone										2																				
Phlyctenactis	*tuberculosa*	Wandering anemone																														
		Stoney coral																														
		Cup coral																														
Alcyonium	*aurantiacum*	Dead mans fingers																												3	3	
		Zooanothian	2	3	1																											
Parazooanthus	*sp.*	Zooanthids																														
		White zooanothian																							1	1						

Invertebrate & Algal Data, dives 11-16 (cont.)

			Dive 11					Dive 12					Dive 13					Dive 14					Dive 15					Dive 16				
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
Astraea	*heliotropium*	Circular saw shell		2	2																											
Cominella	*nassoides*	Whelk			3																											
Argobuccinum	*sp.*	Whelk															4					3										2
		Turet shell																						1		1						
Chromadoris	*aureomargianta*	Nudibranch - white																														
Chromadoris	*conwayii*	Nudibranch - blue and white																														
Jason	*mirabilis*	Sea slug - purple																														
Archidoris	*wellingtonensis*	Sea slug - warty																		1												
		Sunflower seed nudibranch																														
Charonia	*sp.*	Trumpet																														
Cookia	*sulcata*	Cook's Turban shell			2																									1		
Calliostoma	*granti*	Grant's maurea								1	1														1	1						
Mytilus	*galloprovancialis*	Blue mussels																														
Atrina	*zelandica*	Horse mussels																												2	2	
Talochlamys	*gemmulata*	Spiny scallop																														
Maoricolpus	*roseus*	Cone shell							1	1			3	3	3	2				3	3											
Cryptoconchus	*porosus*	Butterfly chiton																			1	1										
		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																														
		(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																					1						
Pseudodistoma	*sp.*	Red colonial ascidians													4	4	4				4	5								3	3	
Cnemidocarpa	*bicornuta*	Tube like sea squirt						2	2	2	2				1			1	1	1				2	2	2	1		1	1	1	
Oplidium	*sp.*	Black ascidian																														
Notosaria	*nigricans*	Black brachiopod		2	2			4	4	4	4	4			4	4		3	3	3	3							3	3	3	3	
Magasella	*sanguinea*	Scarlet brachiopod		1	3			1	1	1								2	2	2	2					1	2	1	1	2	1	
Liothyrella	*zelandea*	White brachiopod		3	2			3	2	2	2																					
		Brachiopod	2																													

Invertebrate & Algal Data, dives 17-22

			Dive 17					Dive 18					Dive 19					Dive 20					Dive 21					Dive 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	3	3		3	3	3		
Arthocardia	*wardii*	Red ferny	2	2	3	3	3																			3	4			4	4	
		Red strips																														
Carpometria	*costata*	No float Laminaria	2	2	2	2																				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	
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	
Ulva	*sp.*	Sea Lettuce					1																1									
Latruncalia	*sp.*	Golf ball sponge													1								2	2	2	2			2	2	2	
		Tube sponge						1	2	2													1	1	1	1						
Raspailia	*sp.*	Digitated sponge						1	1	1									1	1	1		1	1		1						
Callyspongia	*sp.*	Fingerlike sponge						3	2	1			1	1						2	1											
Axinella	*tricalyciformis*	Cuplike sponge																					2	2	2	2		2	2	2	2	
Thorecta	*sp.*	Orange tubelike sponge																														
Polymastia	*croceus*	Breadcrumb sponge																							2	2						
		Grey encrusting																														
		Orange Encrusting	2	2	2																											
		Yellow encrusting												1	3	1	1			1												
		White encrusting																					1	1	1	1						
		Pruple encrusting																														
		Black and White encrusting																														
		Yellow encrusting spikey												1	2	2	2		2	2	3							1	1	1	1	
		White encrusting spikey																					1	1	1	1						
		Blue encrusting spikey																														
		Black sponge																					1									
		Spagetti worm																							3	4	3	3	3	3	3	
		Tube worm	3	3	3	3	3	1	1	2	1							1	1	1	1			2	2	2		3	3	3	3	
Protula	*sp.*	Tube worm											1	2	3	1								2	2	2		2	2	2	2	
		CTW			1																											
Saccoglossus	*sp.*	Acorn worm													1																	
		Peanut worm																														
Sabella	*sp.*	Feather duster worm		2																												
Errina	*sp.*	Red Coral																														
Antipathes	*fiordensis*	Black Coral	3	3	2			2	1				1	1	1				1				3	3	2	1		2	1	1	1	
Sarcophylum	*sp.*	Sea pens																														
Gorgoinia	*sp.*	Gorgonian																														
		Hydroid																	1	1				2	3	3		3	3	3	3	
Symplectoscyp	*subarticulatus*	Hydroid											1	1	1																	
Sertularella	*geodiae*	Hydroid																														
		Stalked anemone																														
Edwardsia	*sp.*	Red anemone							1	1										1	2											
Mimteridium	*cryptum*	Many fingered anemone																														
Cerianthus	*sp.*	Tube anemone																		1				2	2	2		2	2	2	2	
Anthothoe	*albocincta*	Orange anemone							1																							
Phlyctenactis	*tuberculosa*	Wandering anemone																														
		Stoney coral																														
		Cup coral																														
Alcyonium	*aurantiacum*	Dead mans fingers	2	2	2				1					1						1			2	2	2	2		2	2	2	2	
		Zooanothian																					1	1	1	1						
Parazooanthus	*sp.*	Zooanthids																														
		White zooanothian						1	3	2	1		1	2	2	1		1	2	2								1	1	1	1	

Invertebrate & Algal Data, dives 17-22 (cont.)

			Dive 17					Dive 18					Dive 19					Dive 20					Dive 21					Dive 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
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	*conwayii*	Nudibranch - blue and white																														
Jason	*mirabilis*	Sea slug - purple																										1	1	1	1	
Archidoris	*wellingtonensis*	Sea slug - warty																														
		Sunflower seed nudibranch																														
Charonia	*sp.*	Trumpet																														
Cookia	*sulcata*	Cook's Turban shell																											2	2	2	
Calliostoma	*granti*	Grant's maurea																														
Mytilus	*galloprovancialis*	Blue mussels													2	2																
Atrina	*zelandica*	Horse mussels	2	2	2	2																										
Talochlamys	*gemmulata*	Spiny scallop	1	1	1	1																										
Maoricolpus	*roseus*	Cone shell	2	2	2	2																			1					2	2	
Cryptoconchus	*porosus*	Butterfly chiton													1				1													
		Chiton								1				1	2	1			1	1												
Octopus	*huttoni*	Octopus																								1					1	
		Hermit crab									1																		1			
Jasus	*edwardasi*	Red crayfish																														
?	*?*	Sea Spider																													1	
		Feather star																					1					1	1			
		Brittlestar											1	1					1	1												
Coscinasterias	*calamaria*	11 arm starfish			3	3								1	2	2													2	2	2	
Pectinura	*maculata*	Snakestar		1	1	1		1	1				1	1					1					2	2	2		2	2	2	2	2
Astrobranchion	*constrictum*	Snakestar	2	2	2																		3	3	2	1		2	1	1	1	
Henricia	*sp.*	Normal orange star	2	2	2	3	3								1	1			2									2	2	2	2	2
Pentagonaster	*pulchellus*	Common biscuitstar	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			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				1	2	2				2	1											
Pseudodistoma	*sp.*	Red colonial ascidians	2	2	2	3	3			2	2			1	1	2	2			1	2							2	2	3	4	4
Cnemidocarpa	*bicornuta*	Tube like sea squirt	2	2	2	2		1	2	2	2		1	2	2	2	2		1	1	1		2	2	2	2		2	2	2	2	
Oplidium	*sp.*	Black ascidian																							1	1			1	1		
Notosaria	*nigricans*	Black brachiopod	3	3	3	3				2			1	2	1	1			2				4	4	4	4		3	3	3	3	
Magasella	*sanguinea*	Scarlet brachiopod	2	2	2	2				2	1		1	1	2	2			1	2					2	2			2	2	2	
Liothyrella	*zelandea*	White brachiopod								1			1	2	1	2		2	1													
		Brachiopod																														

Invertebrate & Algal Data, dives 23-29

			Dive 23					Dive 24					Dive25					Dive 26					Dive 27					Dive 28					Dive 29				
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	25-20	20-15	15-10	10-5	5-0
		Crustose coraline red algae	3	3	3			2	2	2	3		4	2	4	4		3	4	3	3		3	3	2	3		3	3	3	3		4	3	3	3	
Arthocardia	*wardii*	Red ferny			4	4				3	3				3	2			2	3	4				2	2				2	3			2	3	3	
		Red strips							2	1																											
Carpometria	*costata*	No float Laminaria	2	2	2	2			1	3	3										2																
Caluerpa	*brownii*	Green ferns																			2		2	3	5	4				2	2			5	4	
Carpophyllum	*flexuosum*	Flexable flapjack																			2			1	1	1										
Durvillaea	*sp.*	Tidal Laminaria																																		
Codium	*sp.*	Green fingers	2	2	2	2			1	2	2				1	1					2		1	2	2	1		2	2	3			1	2	3		
Zonaria	*tuneriana*	Shiny red/brown	1	1	1	1																															
Macrocystis	*pyrifera*	Bladder kelp																			2				2	5	5										
Eklonia	*radiata*	Stiped selagin	2	2																	2																
		Sailors eyeballs	1	1	1	1																															
Ulva	*sp.*	Sea Lettuce					3				1																										
Latruncalia	*sp.*	Golf ball sponge		2	2	2		1					1								1	2	1	2	2	2		2	3	2	2		1	1	2	3	
		Tube sponge						1	1				2	1	1						1							2	2	2				3	2		
Raspailia	*sp.*	Digitated sponge	3	3	3	3									2	2					2								2	2				1		
Callyspongia	*sp.*	Fingerlike sponge						1	1	1			1	2	2					1	2	1		1					2	1				2	2		
Axinella	*tricalyciformis*	Cuplike sponge	2	2	2	2		1	1												1			1	1			2	2	1				2	2	
Thorecta	*sp.*	Orange tubelike sponge																																			
Polymastia	*croceus*	Breadcrumb sponge																																			
		Grey encrusting																																			
		Orange Encrusting																																			
		Yellow encrusting																1	1	1	1								1								
		White encrusting																																			
		Pruple encrusting																																			
		Black and White encrusting																																			
		Yellow encrusting spikey	1	1	1	1													1	2	1			1	1	1			2	2	2						
		White encrusting spikey																																			
		Blue encrusting spikey																		1	2				1					1	1						
		Black sponge	1	1	1																																
		Spagetti worm	3	3	3	3																															
		Tube worm	3	3	3	3			1	2	2		3	2	2	2				1	1		2	2				1	1	1			1	2	2	1	
Protula	*sp.*	Tube worm	2	2	2	2												4	3	3	3																
		CTW												2	4	2																					
Saccoglossus	*sp.*	Acorn worm											1							2	5				2	2				2				2	2	2	
		Peanut worm																																			
Sabella	*sp.*	Feather duster worm																		1	1		1						1	1						
Errina	*sp.*	Red Coral	3	3																																	
Antipathes	*fiordensis*	Black Coral	2	1	1			2	1				2	2	1			1	1	1			1					2	2	1			1				
Sarcophylum	*sp.*	Sea pens																																			
Gorgoinia	*sp.*	Gorgonian																																			
		Hydroid	3	3	3	3		2	1	1			2	2	1			1	1				3	3	2			1	1	2			2	2			
Symplectoscyp	*subarticulatus*	Hydroid																																			
Sertularella	*geodiae*	Hydroid	2	2	2	2																															
		Stalked anemone																																			
Edwardsia	*sp.*	Red anemone								1				1	1																			1	1			
Mimteridium	*cryptum*	Many fingered anemone																																			
Cerianthus	*sp.*	Tube anemone	2	2	2	2																															
Anthothoe	*albocincta*	Orange anemone											1	1	1																						
Phlyctenactis	*tuberculosa*	Wandering anemone																													2						
		Stoney coral													1																						
		Cup coral												1	1																						
Alcyonium	*aurantiacum*	Dead mans fingers	2	2	2	2		2	1				1	1	2													1	1								
		Zooanothian											1	1	2			1	1	2									2	1							
Parazooanthus	*sp.*	Zooanthids																																	1		
		White zooanothian	1	1	1	1																													1	2	

Invertebrate & Algal Data, dives 23-29 (cont.)

			Dive 23					Dive 24					Dive25					Dive 26					Dive 27					Dive 28					Dive 29				
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	25-20	20-15	15-10	10-5	5-0
Astraea	*heliotropium*	Circular saw shell									1	1	1																								
Cominella	*nassoides*	Whelk									1									1																	
Argobuccinum	*sp.*	Whelk																																			
		Turet shell											1							1																	
Chromadoris	*aureomargianta*	Nudibranch - white											2																								
Chromadoris	*conwayii*	Nudibranch - blue and white																																			
Jason	*mirabilis*	Sea slug - purple																		1	2							1					1				
Archidoris	*wellingtonensis*	Sea slug - warty																																			
		Sunflower seed nudibranch			1																																
Charonia	*sp.*	Trumpet											2							1																	
Cookia	*sulcata*	Cook's Turban shell		2	2	2		1					1						1		1			1		1		1							1		
Calliostoma	*granti*	Grant's maurea	1	1	1								1																								
Mytilus	*galloprovancialis*	Blue mussels							1	1	1									1																	
Atrina	*zelandica*	Horse mussels																	1				1	1									1				
Talochlamys	*gemmulata*	Spiny scallop																															1				
Maoricolpus	*roseus*	Cone shell		2	2	2																															
Cryptoconchus	*porosus*	Butterfly chiton				1									1				1	1	1																
		Chiton																		1														1	1		
Octopus	*huttoni*	Octopus																												1	1	1					
		Hermit crab						1																													
Jasus	*edwardasi*	Red crayfish																										1						2	2	
?	*?*	Sea Spider						1	1	1																1								2		
		Feather star	1	1																																
		Brittlestar						2	2	1													2						1							
Coscinasterias	*calamaria*	11 arm starfish	2	2	2	2															1		2			1									
Pectinura	*maculata*	Snakestar	2	2	2	2	2	1	1				2							1			2					1	2	2						
Astrobranchion	*constrictum*	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	*pulchellus*	Common biscuitstar		2	2	2		1		1			2		1	1			1	1			1		1	1			1							
Asterodon	*sp.*	Red starfish																		1									1							
Patriella	*regularis*	Cushion star	2	2		2	2												1				1		1	1								1		
Evechinus	*sp.*	Kina				3	3													1	1				1			1	2				2	2		
Pseudechinus	*huttoni*	White urchin																																			
Stichopus	*mollis*	Sea cucumber	2	2	2	2							2	1	1	1		2	1	1	2		1	1	2	2		1	1	1			1	1	2	2	
		Unidentified																																			
Hippellozooia	*novaezelandiae*	Classic lace coral	2	2	2	2		2	2	2	1		3	3	3	2		2	2	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			1	2	3	2		3	1	1			2	2	2	1		1	2	2		
Crisia	*sp.*	Thin classic branching	1	1											1								3	1				2	1	2	2			1	1		
		White encrusting																																			
		(potentially young Diadenium)																																			
Didemnum	*sp.*	Orange																																			
Didemnum	*candidum*	common one found - white/orange	3	3	3	3		2	2	3	2		4	4	5	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							
Pseudodistoma	*sp.*	Red colonial ascidians	2	2	3	4	4	2	1	1	2			1	2	2			1	1				2	1				1	1	1		1				
Cnemidocarpa	*bicornuta*	Tube like sea squirt	2	2	2	2		1	1	2	3		3	2	1	2			1	2	1		2	3	4	3		1	2	2	2						
Oplidium	*sp.*	Black ascidian		1	1										3	2				1	1			2	2	2			1	1	1				1	1	
Notosaria	*nigricans*	Black brachiopod	3	3	3	3		1	1					1						1	1		1						1	1			1				
Magasella	*sanguinea*	Scarlet brachiopod	2	2	2	2			1				2	2	3	2				2	2		1	1				2	2	2			2	2	2		
Liothyrella	*zelandea*	White brachiopod												1						1	1		1						2	2			1				
		Brachiopod																																			

Appendix 3

Physical data, Outer Fiord dives 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	
		166 32 623e	166 3193e	166 37 294e	166 36 491e	166 35 528e	
Conditions		Calm Slight Current	Slight swell	Calm	Slight Swell	Slight Swell	Average
Salinity @ 25m		35%	36%	35%	35%	35%	35%
Salinity of LSL		25%	25%	25%	25%	25%	25%
Depth of LSL		2.3	5.8	4.2	5.2	3.4	4
Visibility		20	20	20	20	15	20
Description 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	Small Boulders	
	15-20	Bedrock	Small Boulders	Bedrock	B'rock/Sediment	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	c	c	c	c	c	100
	Short Animal Turf	o					13
	Sea Urchins	c					20
	Seaweed Red	o	o	c		o	60
	Seaweed Green	o		o	o	o	53
	Encrusting Pink Algae			c			20
5-10	Seaweed Red	o	c	c		o	67
	Seaweed Green	o	o	r			33
	Kelp Park				c	o	33
	Kelp Forest	o	o				27
	Sea Urchins	c	r				27
	Short Animal Turf		o	c	c	o	67
	Encrusting Pink Algae			o		o	27
10-15	Kelp Park	o	o			r	33
	Encrusting Algae	o	r	o			33
	Seaweed Red	o	c	o			47
	Seaweed Green	o	o				27
	Sea Urchins		r	c			27
	Short Animal Turf		r	o		o	33
15-20	Short Animal Turf			o		r	20
	Tall Animal Turf	o					13
	Black Coral	o					13
	Animal Bed	Brittle Stars					0
	Kelp Park		o		o		27
	Seaweed Red		r	r		r	20
	Encrusting Algae		r	o	o	r	40
	Sediment, Life Apparent				o		13
20-25	Sediment, Life Apparent		c			o	33
	Short Animal Turf			r			7
	Seaweed Green				r		7
	Seaweed Red			r	o		20
	Encrusting Pink Algae			r			7
	Kelp Park				o		13

Physical data Middle Fiord dives 6-11

		Dive 6	Dive 7	Dive 8	Dive 9	Dive 10	Dive 11	
GPS		45 45 133s 166 39 945e	45 44 884s 166 42 412e	45 44 379s 166 43 503e	25 46 571s 166 41 954e	46 45 696s 166 47 951e	43 45 689s 166 47 104e	
Conditions		Calm	Calm	Calm	Calm	Slight Swell	Swell, slight current	Average
Salinity @ 25m		35%	35%	35%	36%	35%	36%	35%
Salinity of LSL		26%	25%	26%	25%	25%	25%	25%
Depth of LSL		6	4	3.5	5.9	5.5	5.6	5
Visibility		20	20	15	15	20	15	18
Description 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
								% Presence
0-5	Kelp Forest	c	c	c				50
	Short Animal Turf		o			c	c	44
	Seaweed	c						17
	Encrusting Pink Algae		c			c	c	50
5-10	Seaweed				c		o	28
	Kelp Park				c			17
	Kelp Forest			c				17
	Short Animal Turf	o	c			c	c	61
	Tall Animal Turf		o					11
	Encrusting Pink Algae	o	c			c		44
10-15	Kelp Park			c	c			33
	Encrusting Algae		c			c		33
	Seaweed						o	11
	Short Animal Turf		c	o	c	c	c	78
	Tall Animal Turf		o	o				22
	Black Coral				o			11
15-20	Short Animal Turf	c	c	c	c	o	c	94
	Tall Animal Turf		o					11
	Black Coral			o		r		17
	Kelp Park				o			11
	Seaweed						o	11
	Encrusting Algae	c	c	o		c		61
20-25	Sediment, Life Apparent							0
	Short Animal Turf	c	c	o				44
	Tall Animal Turf		o					11
	Encrusting Pink Algae	c	c	o			c	61
	Black Coral			o	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 @ 25m		32%	34%	35%	35%
Salinity of LSL		20%	21%	21%	10%
Depth of LSL		6.2	5.2	6.2	6
Visibility		10	10	15	10
Water Temperature		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				c
	Short Animal Turf	c	o	c	
	Tall Animal Turf		o		
	Seaweed				o
	Encrusting Pink Algae		o		
	Sediment with Life Apparent				
5-10	Seaweed Red	r			
	Short Animal Turf	c	o	c	o
	Tall Animal Turf		o		o
	Sediment with Life Apparent				
10-15	Short Animal Turf	c	c	o	c
	Tall Animal Turf				
	Animal Bed				
15-20	Short Animal Turf	c	o	o	c
	Tall Animal Turf				
	Sediment with Life Apparent				
20-25	Sediment with Life Apparent				
	Short Animal Turf	o	o	o	o

Physical data - Inner Fiord dives 16-20

		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 LSL		5.8	5.2	6	7.3	5.8	6
Visibility		15	15	10	8	7	11
Water Temperature		14	14				14
Description 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	c					22
	Short Animal Turf					c	41
	Tall Animal Turf						7
	Seaweed	c			r		22
	Encrusting Pink Algae					o	15
	Sediment, Life Apparent		c				11
5-10	Seaweed Red						4
	Short Animal Turf	c					48
	Tall Animal Turf						15
	Sediment, Life Apparent		c				11
10-15	Short Animal Turf	c				o	59
	Tall Animal Turf		c				11
	Animal Bed					o	7
15-20	Short Animal Turf	o	o			o	59
	Tall Animal Turf		o				7
	Sediment, Life Apparent	o	o				15
20-25	Sediment, Life Apparent	o	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	
Conditions		Calm	Calm, Slight Current	Calm, Strong Current	Calm	Calm	Calm	Calm	Average
Salinity @ 25m		35	35	35	34	33	32	32	33.71
Salinity of LSL		24	24	24	12	22	20	26	21.71
Depth of LSL		6.8	5.3	6.4	4	2	2	3	4.21
Temperature					15	15	15	15	15.00
Visibility		8	10	10	15	15	25	20	14.71
Description of Seabed									
	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	
	20-25	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	
Profile									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				c	c		c	43
	Kelp Park	o					c		24
	Short Animal Turf				c	c	c	c	57
	Seaweed Red	o	o	o			c	c	57
	Seaweed Green		o	o					19
	Encrusting Pink Algae	c	o						24
5-10	Seaweed Red	o	o	r			c	c	52
	Seaweed Green	o	r						14
	Kelp Park	o	o		c	o	c	c	71
	Short Animal Turf	c	c	c	c	o	c	c	95
	Encrusting Pink Algae	c		c					29
10-15	Kelp Park	c	o				o	o	43
	Encrusting Algae		c	c				o	38
	Seaweed Red	o		r	o				24
	Seaweed Green	o			o		o	c	43
	Short Animal Turf	o		c	o		c	c	62
	Tall Animal Turf	o			o			o	29
15-20	Short Animal Turf	o	c	c	o	o	c		71
	Tall Animal Turf				o	o			19
	Animal Bed							c	14
	Kelp Park							o	10
	Seaweed Red			r	r		o	c	33
	Encrusting Algae	o	o			o		c	43
	Sediment, Life Apparent				o				10
20-25	Short Animal Turf	o	o	c	o	o	o	c	76
	Encrusting Pink Algae					o			10
	Animal Bed							c	14

Physical data Wetjacket Arm dives 25 & 26

		Dive 25	Dive 26	
GPS		45 38 363s 166 51 068e	45 39 009s 166 49 314e	
Conditions		Calm	Calm	Average
Salinity @ 25m		34%	34%	34%
Salinity of LSL		12	11	12%
Depth of LSL		6		6.00
Temperature		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	c	o	83
	Seaweed	o	c	83
5-10				
	Kelp Park		o	33
	Kelp Forest			0
	Short Animal Turf	o	o	67
10-15				
	Short Animal Turf	o	c	83
15-20				
	Short Animal Turf	o	o	67
20-25				
	Short Animal Turf	o	o	67