Ecological Assessment For An Extension To The Marine Farms Of Kauauroa Bay Pelorus Sound

A Report For Kauauroa Consortium

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Introduction:
This is a general assessment of the Marine Ecology (macro-benthic flora and fauna) in the subtidal area of Kauauroa Bay.

The criteria for this assessment follows the "Guideline for ecological investigations of proposed marine farm areas" (DoC, 1995).
It is the intension of the applicants to complete a comprehensive baseline study for subsequent monitoring purposes. The baseline study will include infauna, subtidal and water column components.
This area has been the subject of two other site report which should be read in conjunction with this report:
Biological report on a proposed marine farm located in Kauauroa Bay, Pelorus Sound. By Davidson Environmental Research, Survey and Monitoring Report Number 224 - R. Davidson May 1999.
Proposal to extend existing marine farm licences in Kauauroa Bay, Pelorus Sound. NIWA Client Report: MUS00411 / 2
Russel Cole, Niki Alcock, Don Tindale September 1999

Methods Used for Macro benthos Assessment
An initial assessment of the epi-benthic fauna and substrate was conducted by SCUBA to evaluate possible sampling methodologies in December 1999.
The proposed site was surveyed on the 3rd, 21st January 2000 by dredge (benthic tow sledge) and on the 19th, 20th January 2000 by SCUBA.

Diver transects:
Sampling was carried out along 6 transects: 1 x 110m, 1 x 140m and 4 x 200 metre transects (transects were orientated in the "shore normal position" perpendicular to the shore line). These transects were placed between the existing marine farms (the approximate position of these transects are shown in figure 1).
At the start (MLW) and at 5 metre intervals along each of the transects depth and substrate type were recorded (see transect diagrams). All depths have been adjusted to chart datum. All distances from shore were measured from MLW. While all due care was taken the distances must however be treated as approximate for all data given.

Dredge sampling (Benthic sledge)
The purpose of this sampling was to assess the marco epi-benthic fauna of the seaward area of licences in Kauauroa Bay. The sledge has an opening of 500mm wide by 260mm high. The leading edge has been designed to cut 3mm below the substrate surface in sand-sandy mud substrates to comprehensively sample the epi-benthic fauna present.
Initial sampling was undertaken with 2mm x 2mm stainless steel mesh. However, the dredge failed to sample properly due to sinking in the soft substrate and filling, the substrate material clogged the fine mesh (2mm mesh would fill soon after contact with the substrate surface).
To rectify this problem the mesh size was changed to 5mm x 5mm stainless steel mesh, this allow tows of approximately 200m to be preformed without clogging.
The area seaward of the existing farms was randomly sampled, six tows being carried out within the proposed extension area on the eastern side of the bay and two within the western extension area.
A hand held GPS was used to identify the tow positions, while a radar was used to verify the

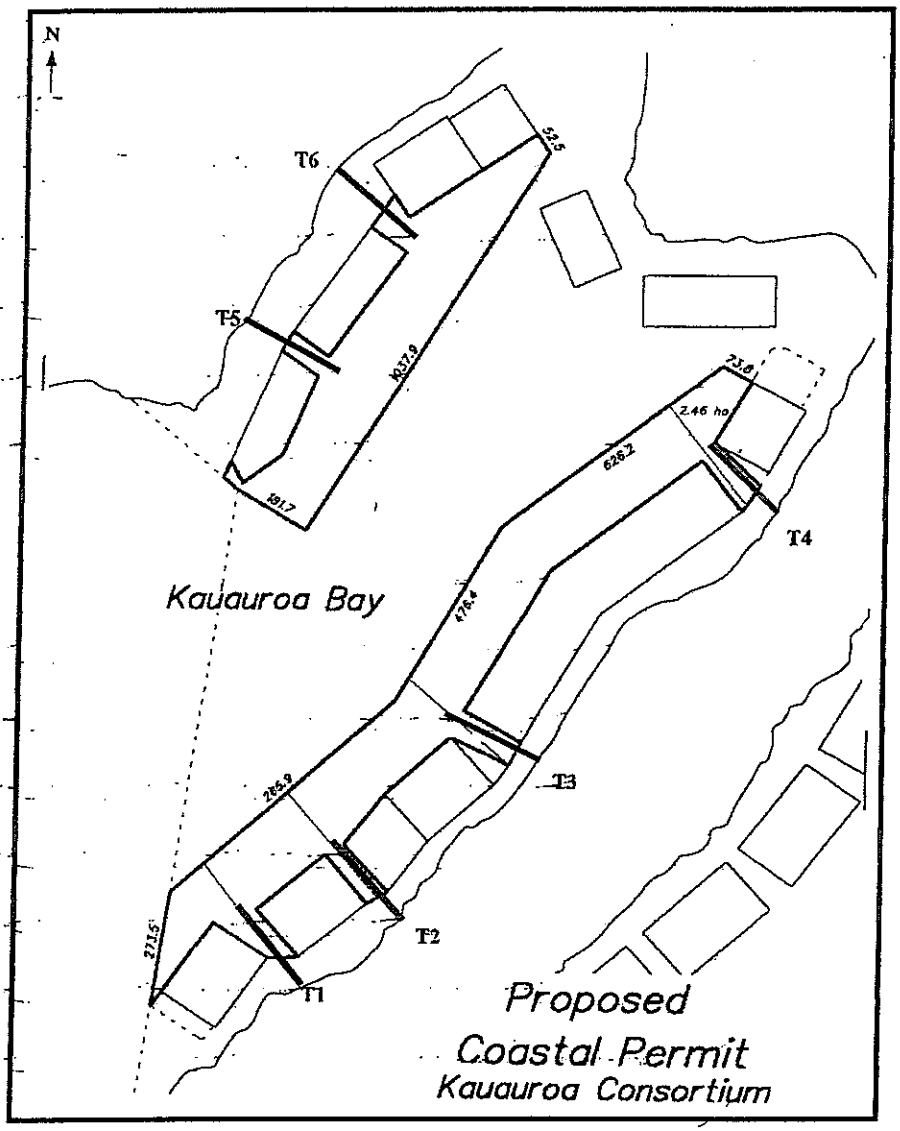


Figure 1

distance from shore. The dredge data can only be treaded as qualitative, as the tow lengths were variable (+/- 20 metres).

The following were the start points of the tows:

S 41°02.636'
E 173°58.844'
Bearing 057° ~ 200m

S 41°02.629'
E 173°58.856'
Bearing 135° ~ 200m

S 41°02.713'
E 173°58.731'
Bearing 128° ~ 200m

S 41°02.787'
E 173°58.653'
Bearing 180° ~ 200m

S 41°02.849'
E 173°58.508'
Bearing 215° ~ 200m S

S 41°02.980'
E 173°58.336'
Bearing 009° ~ 200m

S 41°02.340'
E 173°58.722'
Bearing 191° ~ 200m

S 41°02.523'
E 173°58.579'
Bearing 191° ~ 200m

Quantitative survey

Trigger species were countered in a two metre wide by 5 metre long strips, all the way along each transect. The presence, abundance and general distribution of all other species were noted.

Qualitative survey
In addition to the quantitative survey, a qualitative survey (i.e. random dive) of the inshore area, area of the marine farm and proposed extension was conducted.

- determine the presence of any "rare species"
- determine the presence of species with patchy distribution
- to verify that the transects are a true and accurate representation of the biotic patterns
- locate any reef structures or areas of hard substrate

Substrate Survey
The entire site was surveyed using a 3D sounder (Humming Bird 3D Wide Vista) placed on dual mode 3D and concurrent 2D mode. This was used to locate the existence of any reef structures or hard substrate. The sounder was "ground truthed" by diver to check depth and substrate type. In addition to this, a more powerful Furno FCV model 552 colour sounder was used to locate any anomalies in the offshore extension zone, while dredge tows were conducted.

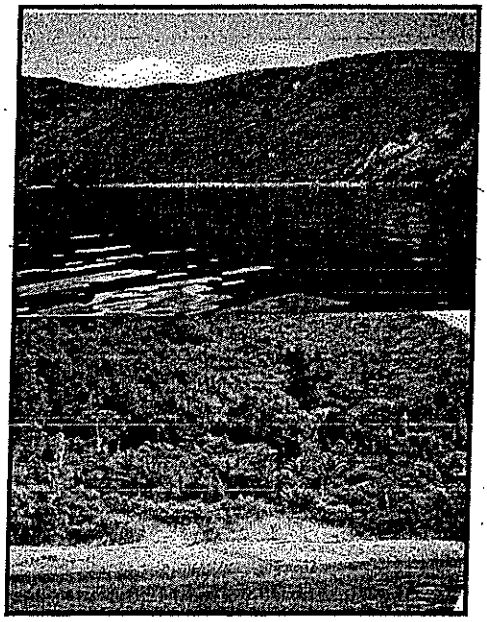
Video Survey
A video record was taken of selected transects.

Comparative Survey
The existing marine farm was randomly dived to ascertain the effects of marine farming in this area.

Conditions Encountered during Sampling
Visibility underwater was 3 to 5 metres in all areas, but in the soft substrate zone visibility decreased to zero on contact with the substrate surface.
Wind conditions were light during sampling.

Results and General Evaluation

General Evaluation and Substrate
The inshore land form is a mixture of cobble beaches and small bluffs. The hillsides above are a mixture of bush and coastal forest on the western side and head of the Kauauroa Bay, while regenerating scrub with wild pines are found on the eastern side of the bay.



Eastern area

Western area

Intertidal Platform
The intertidal platform is a combination of cobble and basement rock. The platform extends approximately 1.0 to 5 metres from MHW to MLW dependant upon the .

Sediment Description
The following is a combined assessment based upon the transects and random dives.

Sediment Type	Distance & Depth	Flora & Fauna
Basement rock Cobble/boulder	Basement rock restricted to 5m from MLW Cobble area ranges from 20m to 55m - majority of cobble area is within 40m	Neptune's necklace, blue mussel, cats eye, kina, flap jack,
Sand/silt /mud & Dead shell	from 20m to 90m from MLW	Brachiopod, scallop, blue cod, sea cucumber, spotty, triplefin, spiny star
Silt/Clay (mud)	50m from MLW seaward.	Cushion star, opal fish

Below the intertidal platform the substrate varies from a small boulder/cobble to cobble to sandy dead shell grading to silt/mud.

Reef System
No reef systems were found in the proximity of this site (in the seaward areas applied for).

Biota of the Inshore to 50 metres from MLW
The "inshore" area supports a diversity of species, a list of those species observed is combined with those of the soft sediments and is contained in the appendix.

Biota of the proposed marine farm extension 150 to 400 metres from MLW
The diversity and density of macro- epibenthic species in this area was found to be generally low in the area of the offshore extension when compared to the inshore area, warp area and between & below existing marine farms.

Trigger Levels
Both Qualitative and Quantitative surveys failed to find patches or beds of trigger level species within the proposed marine farm offshore extension area.

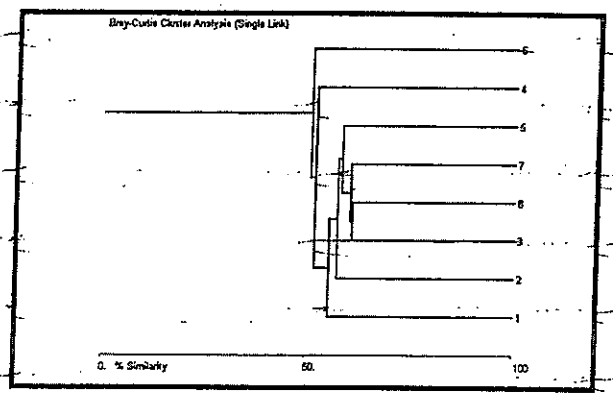
Horse mussels (*Atrina zelandica*) were observed in the area, the density was below the trigger level. The highest density of this species was observed on transect three at ~ 60m from MLW (a total of 4 were seen). The density of Horse mussels for transect three was 0.01m^2. The trigger level for this species is 0.2m^2.

Scallops (*Pecten novaezelandiae*) were observed at above trigger levels in the area between the existing farms on transects 3 & 4 in the area of sandy shell hash from 30m to 75m from MLW. The occurrence diminished further on (hard cobble) and offshore (silt/mud) than the density observed in this area. The density recorded upon these two transects were 0.13 (6/90m^2) and 0.25 (10/40m^2) respectively in the shell hash zone, however, total transect areas produced levels below trigger levels.

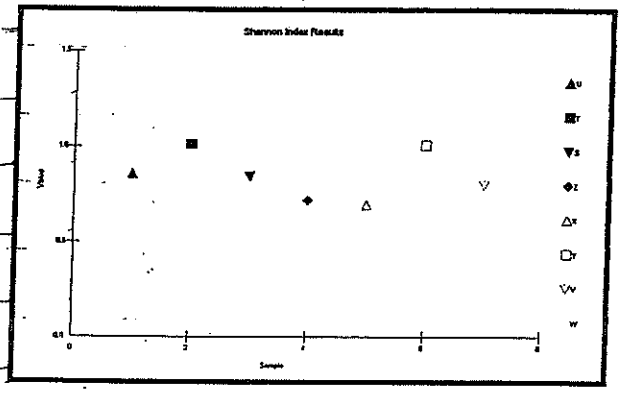
The Brachiopod (*Magaella sanguinea*) were found occupying a similar area as the scallops, the densities were counted at between 5 - 15m^2 (maxima), these densities are below DoC trigger levels (20m^2).

Fish feeding pits were found in the sandy shell hash zones. These were both within the inshore boundaries of the marine farms as well as in the areas between existing marine farms and in the warp area of the existing marine farms. These features are restricted to the sandy shell areas.

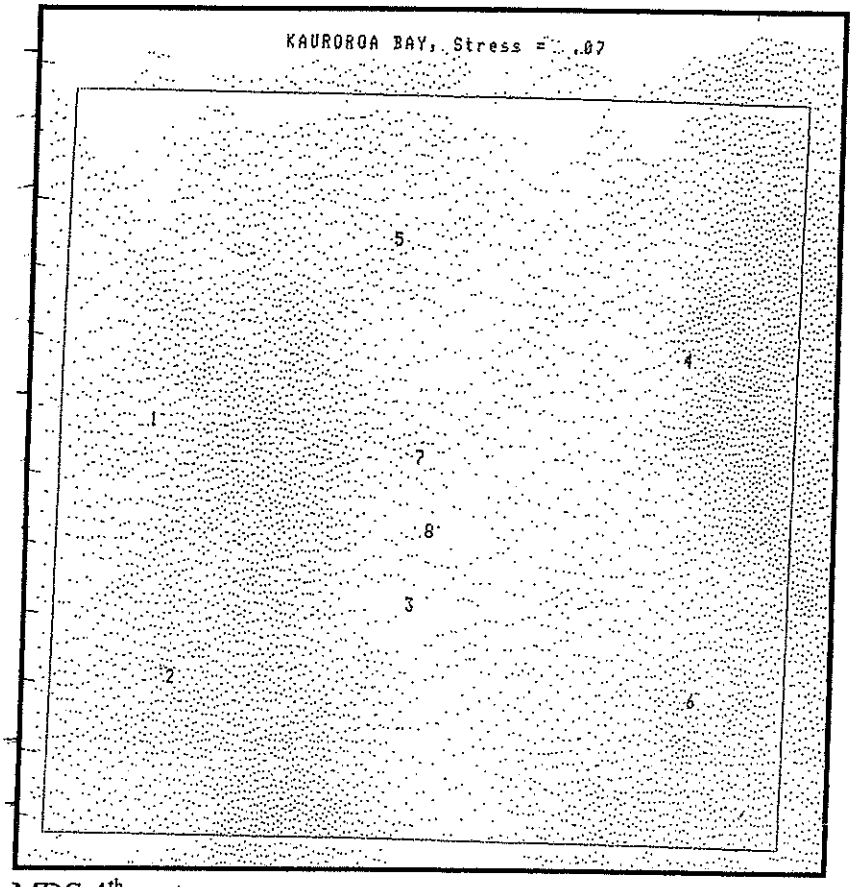
The tube worm (*Galeolaria hystrix*) is present on the site, however no mounds were located. The random dive failed to find any beds or clusters of this species greater than the densities found in the transects.



Dendrogram



Species indices Shannon-Wiener



MDS 4th root.

Dredge data gave the above results.

Discussion

The survey reports by Davidson, Cole *et al* and the findings of this report are in concert in terms of recommendations for placement of proposed structures. This is despite the different methodologies employed (naturalist dredge 2mm mesh verse benthic sledge 5mm mesh). This tends to lend confidence to the findings of this report in terms species but not in species numbers. This maybe due to the differences in species numbers 36 from the NIWA tow data compared to 56 species sampled within this study. Within the NIWA towed samples there is a grouping, where as this study's MDS plot tends to show that there is no definite groupings. This would indicate more than one factor in operation changing the species assemblages. These difference may be due to depth and site specific differences in locations within the bay.

The greatest diversity of marco-epibenthic species was contained in the inshore area that extends no more than 55 metres from MLW. In comparison densities of epibenthic species within the soft substrate zone were low. This is a function of the "substrate community relationship" simplistically - spatial heterogeneity (the hard substrate being structurally more complex) affording greater opportunities in comparison to the soft substrate. However, this investigation has only been of the macro-epibenthic floral & fauna communities (those organisms on the substrate's surface). The infaunal community (those species living in the soft/motile substrates) were not sampled. This report should be considered as descriptive rather than an exhaustive summary on the species present in this area.

This site suitability has been appraised with mussel culture in mind. As such included below is a brief description of the impacts of mussel farming.

Mechanical effects of mussel culture

The presence of a marine farm will increase the sedimentation rate, by reducing the water movement "flow thru" structures (particles tending to settle out of the water column). This is further augmented (collection of "fines" below marine farms) by the accumulation of shell material on the substrate causing turbulence of near bottom water movement. This results in collection of fine material of both organic and inorganic material.

Biological Overview

The role of organic biodeposition due to mussel farming and mollucs presence has been the focus of serval overseas studies Mattsson & Linen (1983), Kautsky & Evans (1987), Jaramillo *et al* (1992), Carver & Mallet (1990), Haven & Morales- Alamo (1966), & several others, while these studies relate to other species, culture techniques and conditions general assumptions can be drawn that are relevant to mollusc culture:

- Biodeposition rates from molluscans can contribute significantly to sedimentation rates.
- Sediment changes (from mollusc) in terms of organic content and gain size can alter communities present.

However, New Zealand based studies on the effects of mollusc culture are perhaps more relevant in terms of species specific effects and environmental conditions, such as Grange & Cole (1997), Cole & Grange (1996), Forrest (1995), De Jong (1994), Forrest (1991), Gillespie (1989), Kaspar *et al* (1985), to name but a few. The range of possible impacts in relation to mussel culture is site specific. The determinant factors appear to be depth/current regime. In broad terms: a shallow site with little water movement will have a relatively concentrated

impact, while that of a deep high current area will have a low impact dispersed over a larger area. Having stated this, the most obvious impact due to mussel farming is shell drop. The impact of this is generally along the shore rather than towards the shore or offshore from the marine farm. Observations from farms located in 30 + metres of water depth in high current flow areas - shell fall was contained within 40 metres of the surface structures (pers. obs.).

The location of a marine farm as proposed will result in the accumulation of shell, faecal & pseudofaecal material from present marine farming methodologies. The shell material will be a combination of both live and dead material that seldom extends further than 20 metres, in water of this depth and current regime (pers. observation, and measured in this instance). This material will fall on to a silt/mud substrate increasing the percentage of organic material (and deceasing the Redox layer). Sessile species (non mobile) may become smothered, while mobile species are capable of moving. Considering these effect it is considered that marine farms should be located over a silt/mud substrate, rather than hard substrates (Gillespie 1989, Forrest 1995), which this seaward extension proposal conforms with.

Conclusion

The seaward site extension would be appropriate for the marine farms in this area considering the guidelines (DoC,1995) and the general ecology of the area.

The proposed extensions between the existing structures from MLW to approximately 150 metres are discouraged due to fish feeding pits and the existence of cobble substrate in areas 55m from MLW and the scallop density found on certain transects.

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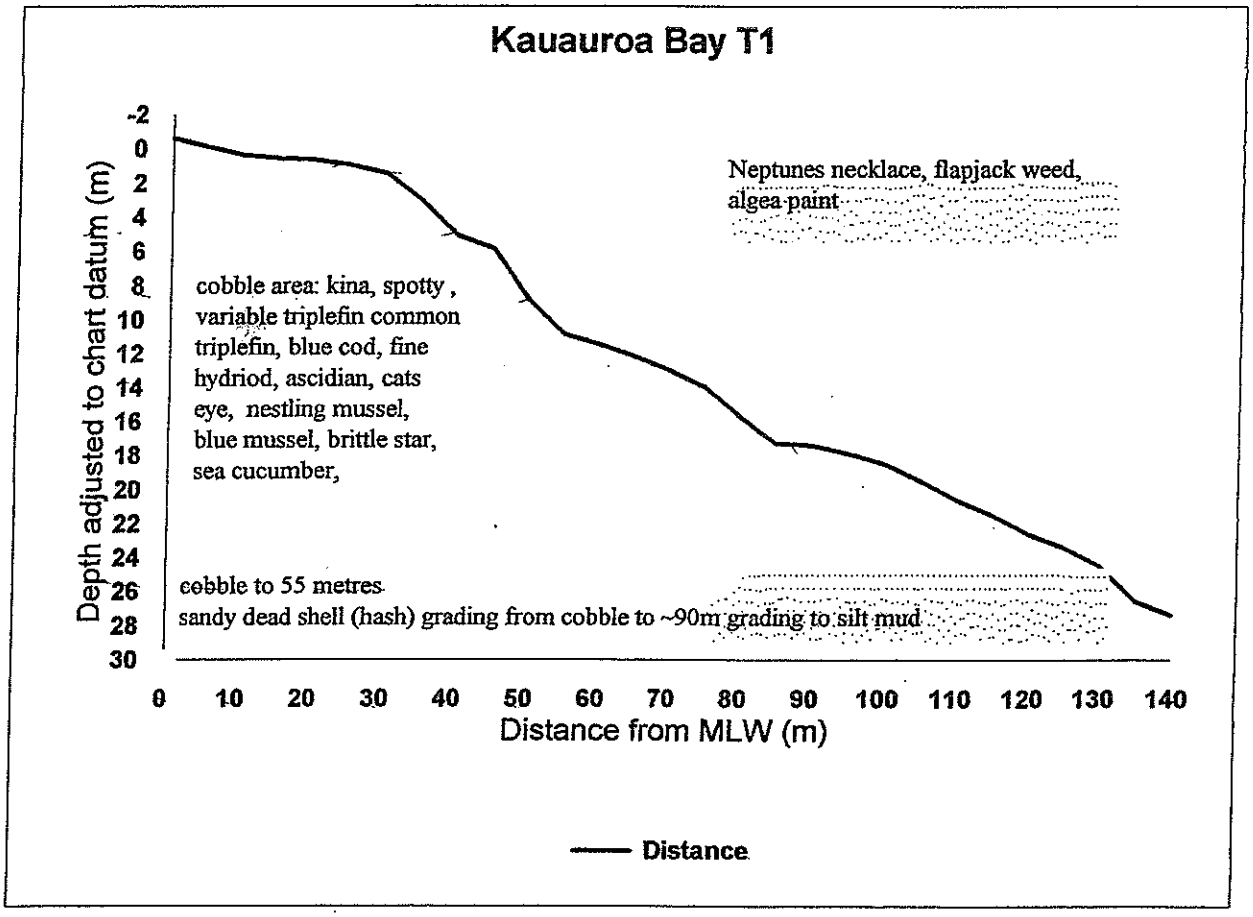

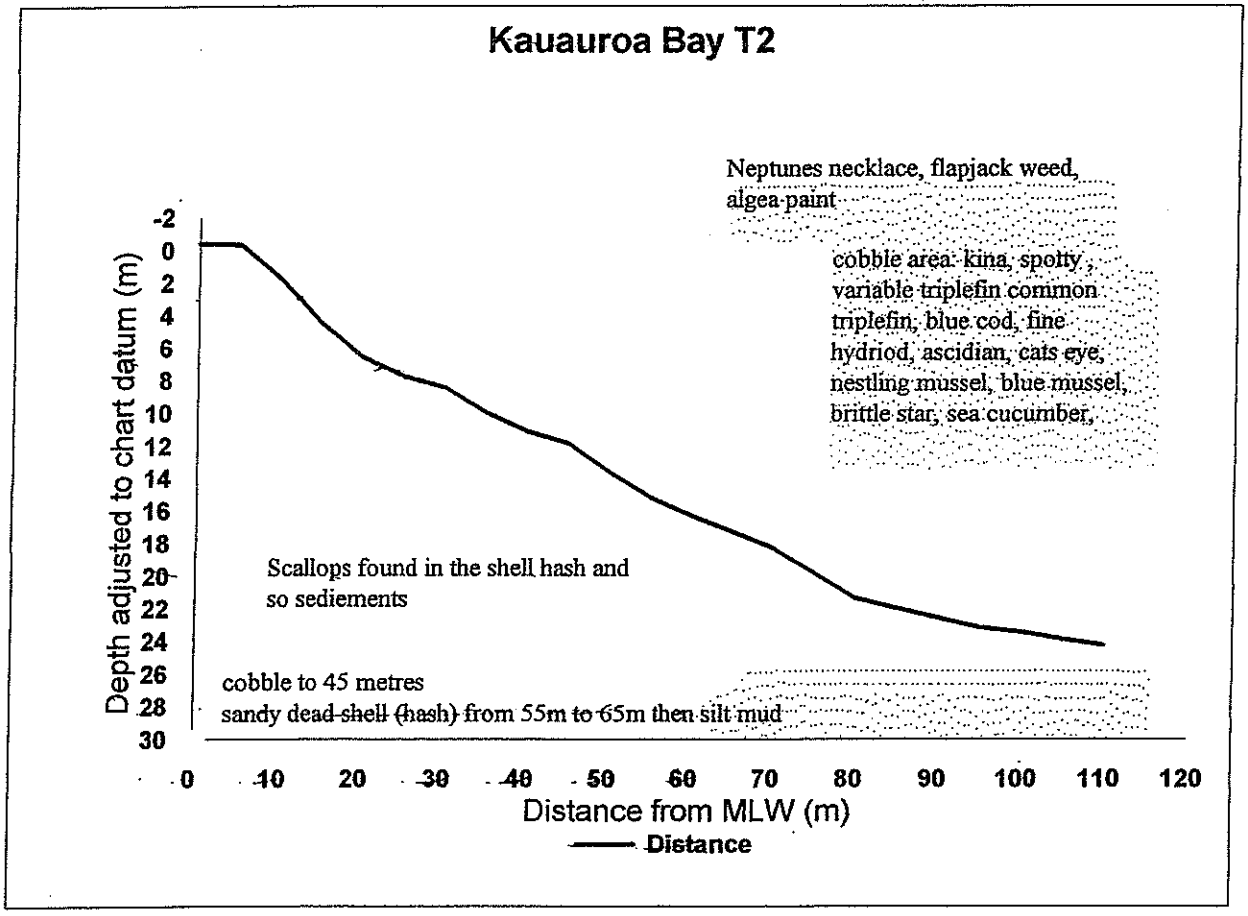

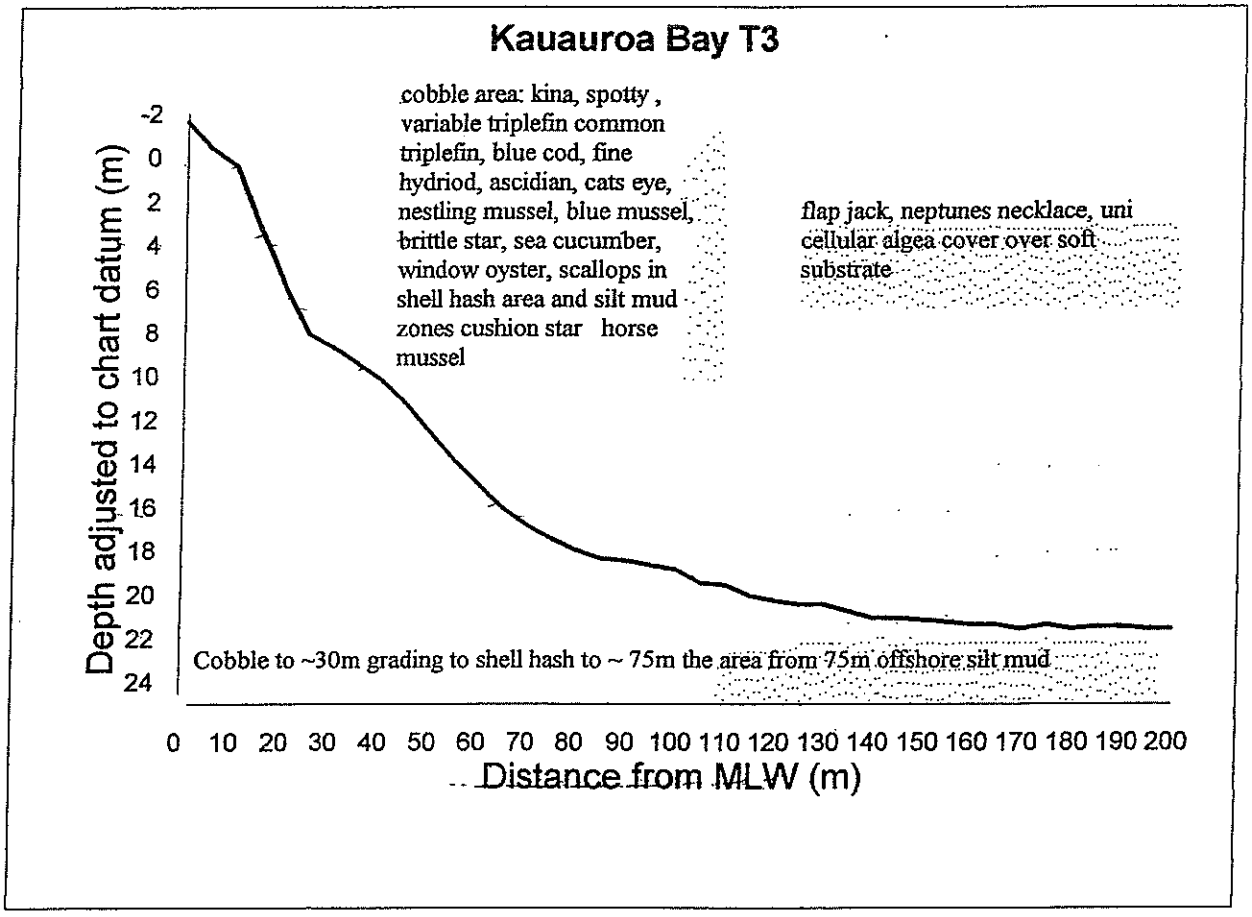

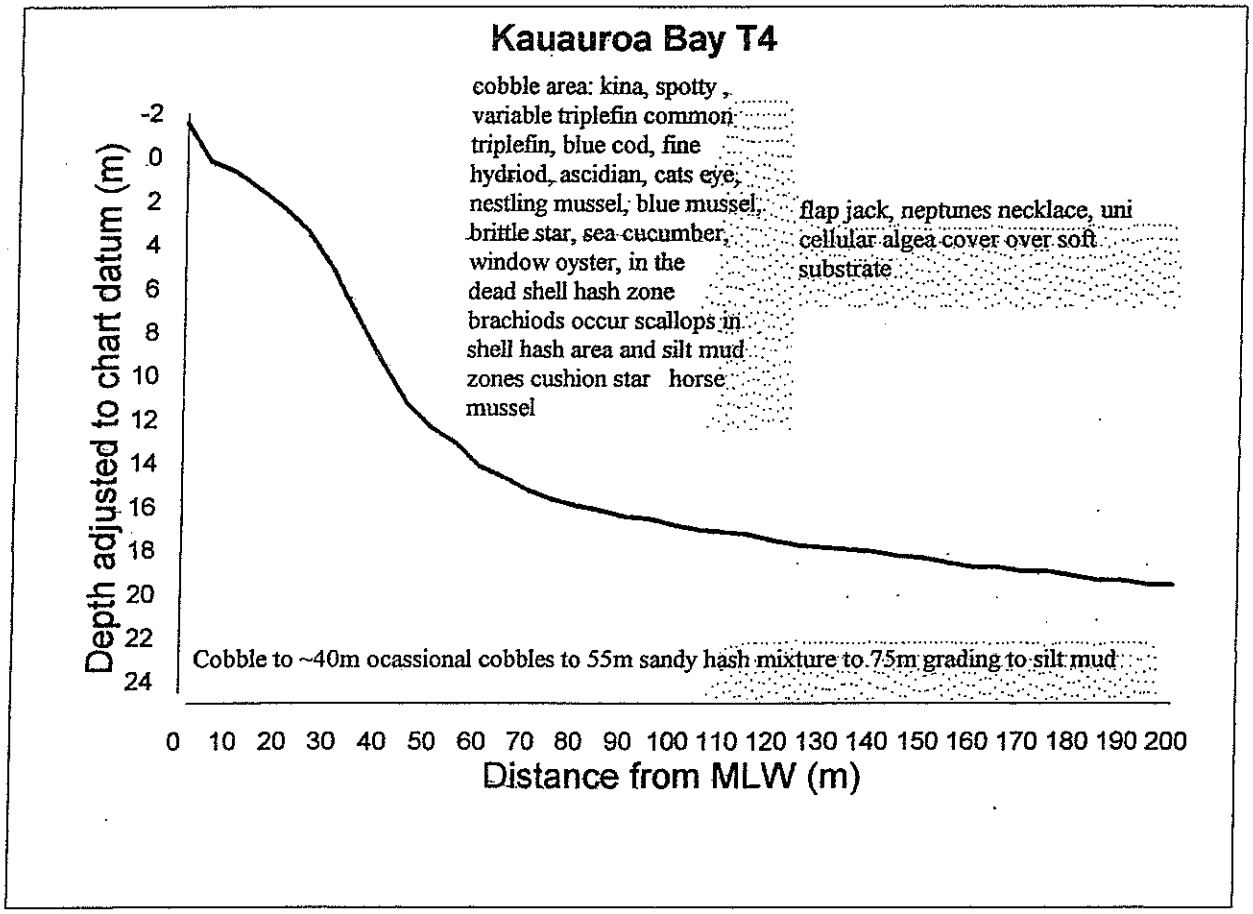

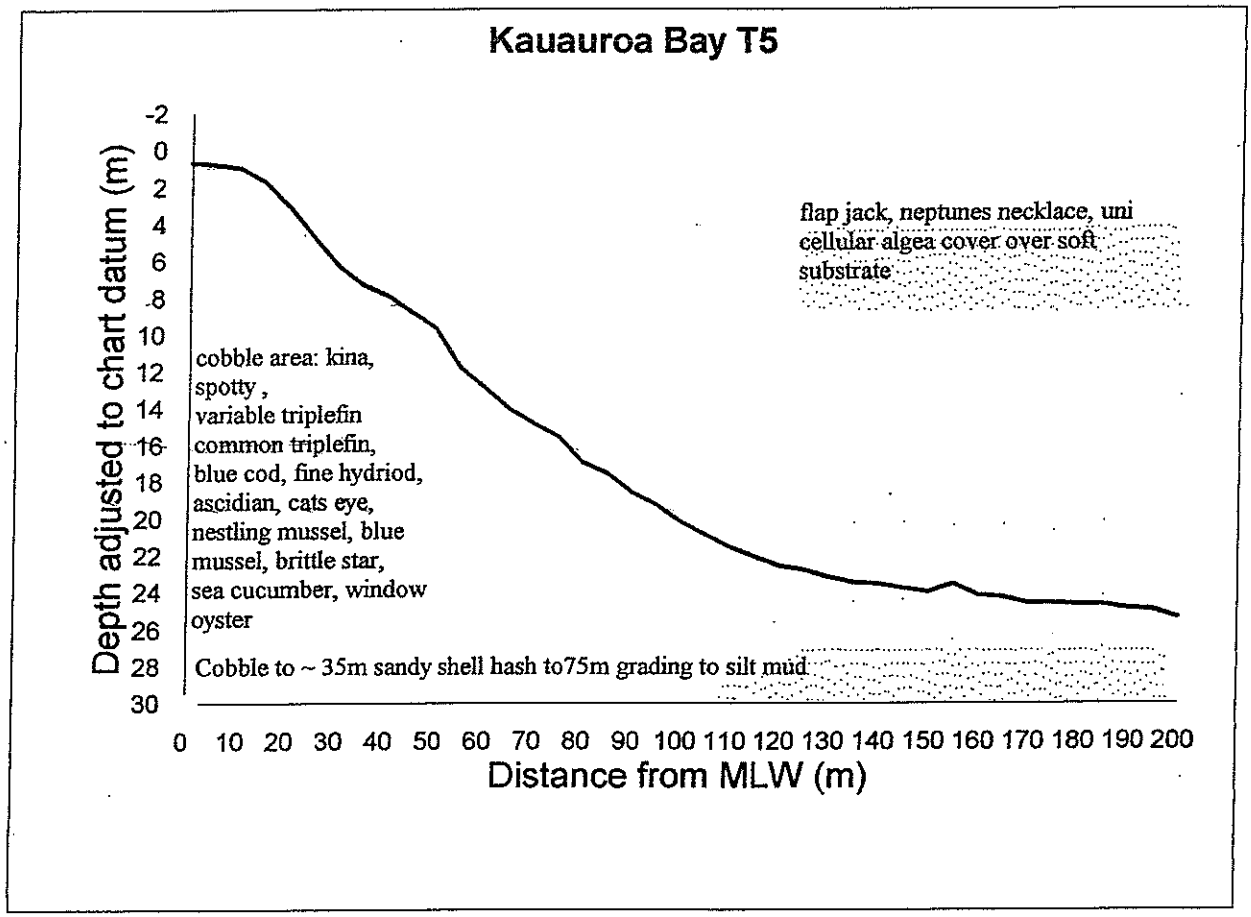

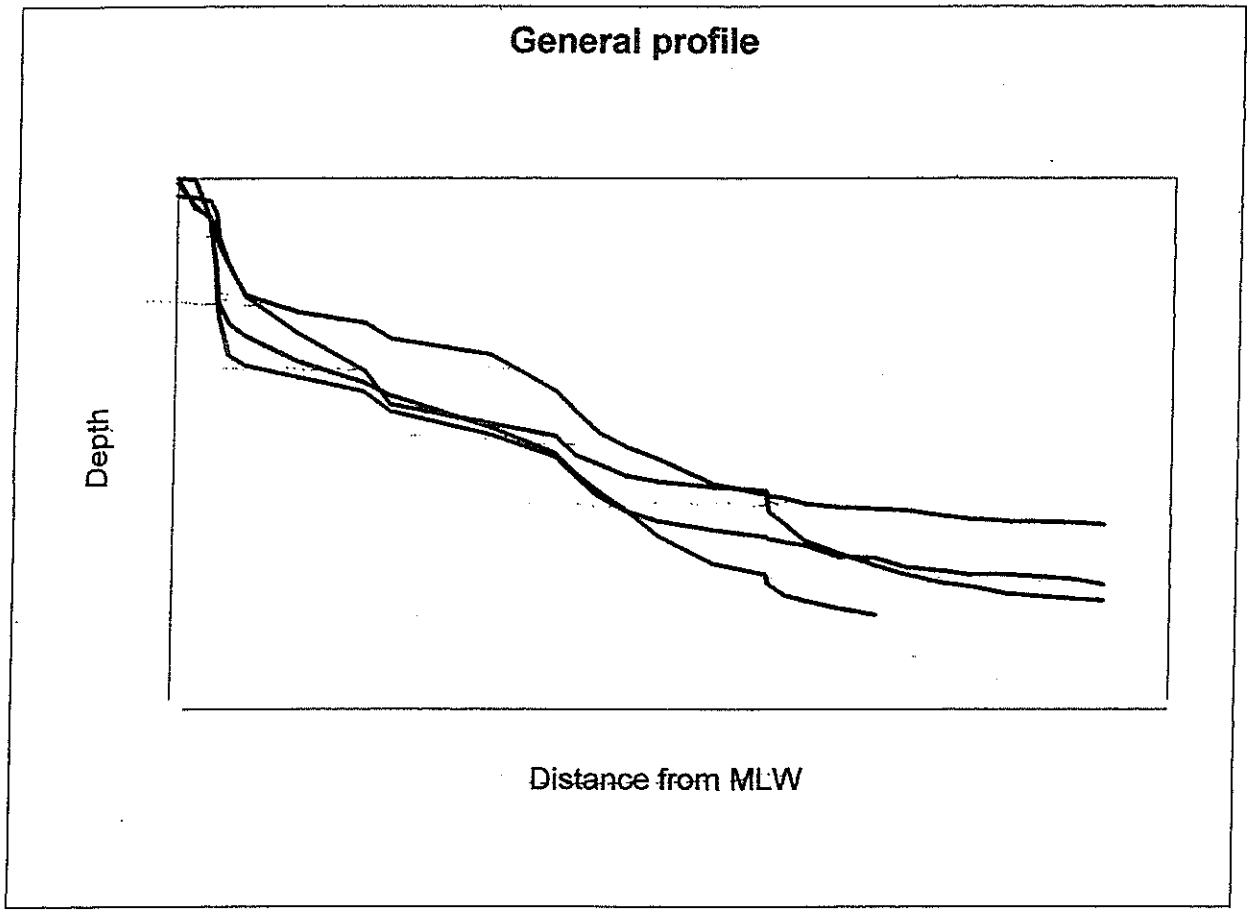

Species observed on Kauauroa Bay Transects 1- 6, spot dives and random inshore dives.

Species	Common Name	Maori Name	Habitat	Abundance
Algae				
Corallina sp.	coralline turf		Cobble	A
Lithothamnion sp.	Algae paint		Cobble	A
Rodymenia dichotoma	branching red wed		Shell hash	R
Porphyra sp.	Sheet red weed			
Gigartina sp.	red weed			
Callophyllis sp.	red weed			
Schizoseris sp.	red weed (branching blade)			
Medeiothamnion lyalli	red weed (fine tuff)			
Cladhymenia sp. (oblongiolia)	lobbed red weed			
Pterocladia lucida	agar weed			
Hormosira banksii	Neptunes necklace		Cobble	A
Cystophora torulosa	Zig zag weed			
Carpophyllum flexuosum	Flap jack		Cobble	O
Carpophyllum maschalocarpum	Flap jack			
Colpomenia sinuosa	Air weed			
Undaria pinnatifida	Japanse weed invasive		On lines	C
	Algae uniceellular.		Soft substrate	A
Caulerpa germinata	Grape weed			

Porifera - Sponges

Species	Common Name	Maori Name	Habitat	Abundance
Callyspongia ramosa	Finger sponge (grey)	Kopuputai Roa		
Ancorina sp.	Grey sponge	Koopuputai Nui	Cobble	O
Cliona celata	Yellow encrusting sponge			
Lecettusa sp.	flask type sponge			
Polymastia fusca	Non discript encrusting			
Polymastia sp.	projected encrusting			
Hymeniacidon perlevis	Folded encrusting			
unidentified flask type sponge				

Coelenterates

Species	Common Name	Maori Name	Habitat	Abundance
Isactinia tenebrosa	Red waratah anemone	Kotare moana		
Corynactis haddoni	jewel anemone		Cobble	R
Phyctenactis tuberculosa	Wandering anemone	Humenga	Cobble	R
Actinothoe albocincta	White anemone		Line/Cobble	A/O
Clytia racemosa	Hydroid tree	Not seem		
Sertularia sp.	feather like hydroid			
Aglaophenia laxa ??	fine feather like hydroid			
Pennaria sp.	Feather hydroid		R	
Aurelia aurita	jellyfish	Petipeti	water colum	A

Tunicates - ascidians

Species	Common Name	Maori Name	Habitat	Abundance
Microcosmos kura	Warty sea-squirt	Kaeo Kura.	Cobble	O
Cnemidocarpa sp.	saddle ascidian		Cobble/shell	C
Didemnum candidum	cream ascidian			
Aplidium sp.	Black compound ascidian			

Brachiopoda

Species	Common Name	Maori Name	Habitat	Abundance
Magasella sanguinea	Lamp shell	Papa Kura	Dead Shell	C

Echinodermata

Species	Common Name	Maori Name	Habitat	Abundance
Evechinus chloroticus	Sea egg	Kina	Cobble/shell	A
Ophionereis fasciata	Mottle brittle star	Weki Huna	Soft substrate	R
Ophiopsammus maculata	Snake star	Weki	Cobble	O
Pateriella regularis	Cushion star	Kapu parahua	Cobble/soft	A

Coscinasterias calamaria	Spiny star	Papatangaroa	Cob/soft/farm	A
Echinocardium cordatum	Heart urchin	Kina Pakira	Soft substrate	A
Sticopus mollis	Sea cucumber	Rori	Cob/soft/farm	A
Astrea roseus	Brittle star		Soft substrate	C

Mollusca
Gastropds

Species	Common Name	Maori Name	Habitat	Abundance
Cellana radians	Radiate limpet	Ngakihi	Cobble	C
Melagraphia aethiops	Spotted top shell	Maihi	Cobble	R
Cookia sulcata	Cooks Turban shell	Pupu Karikawa	Cobble	R
Turbo smaragdus	Cat's eye	Ataata	Cobble	C
Struthiolaria sp.	Ostrich foot	Totorere/Takai	Soft substrate	R
Poirieria zelandica	Spiny Murex	Pupu Tarataratea	Soft substrate	R
Amalda sp.	Olive shell	Tikoaka	Dredge	
Maricolpus rosesus	Turret Shell	Papatai	Cobble	R
Cryptoconchus popsus	Fleshy chiton		Cobble	R
Austrousus glans	Whelk		Cobble	R
Sypharochiton pelliserpentis	Snake skin Chiton	Papatua	Cobble	R

Bivalves

Species	Common Name	Maori Name	Habitat	Abundance
Atrin pectinata zelandica	Horse mussel	Hururoa	Soft/ shell	R
Aulacomya atra maoriana	Ribbed mussel	Pukanikani	Cobble	R
Mytilus sp.	Blue mussel	Toretore	Cobble	C
Perna canaliculus	Green mussel	Kuku	Cobble/farm	O/A
Modiolarca impacta	Nesting mussel	Kuku Mau Toka	Cobble	O
Pecten novaezelandiae	Scallop	Tipa/ Kuakua	shell/soft	O/R
Chlamys zelandiae	Fan Shell	Kopakopa	Cobble	R
Monia zelandica	Window oyster		Cobble	R
Nemocardium pulchellum	Strawberry cockle		dredge	
Neilo australis			dredge	
Nucula strangei	Nutshell		dredge	
Notocallistra multistriata			?	
Theora lubrica	Japanese Bivalve		?	
Leptomya retiaria			?	
Tellina charlottae			?	
Limaria orientalis	Japanese file shell		?	
Thracia vegrandis			?	

Octopus maorium	Octopus	Wheke	Cobble	R

Arthropoda - Crustacea

Species	Common Name	Maori Name	Habitat	Abundance
Pagurus novaezelandiae	Hermit crab	Papaka moke	Cobble/Shell	A
Paramithrax sp.	Masking crab	Papaka Huna	Farm	O
Chaemaesipho sp.	Barnacle		Cobble	A

Amphipoda

Species	Common Name	Maori Name	Habitat	Abundance

Annelida - Polychaeta

Species	Common Name	Maori Name	Habitat	Abundance
Branchiomma serratibranchis	Brown tube worm			
Galeolaria hystrix	Tube worm	no mounds observed	Cobble	C
Maldanidae sp.			Dredge	
Spiorbis sp.				
Pomatoceros sp.				
Amphitrite rubra	Bristle worm		Cobble	R

Fishes

Species	Common Name	Maori Name	Habitat	Abundance
Parapercis colias	Blue cod	Raawaru	Cobble	C
Notolabrus celidotus	Spotty	Paketi	Cobble	C
Forstergion lapillum	Common triplefin		Cobble	C
Forstergion varium	Variable triplefin		Cobble	C
Hemerocoetes monopterygius	Opalfish	Kohikohi	Soft/ shell	R
Parika scaber	Leatherjacket	Kokiri	Lines	O
Genyagnus monopterygius	Spotted Stargazer	Kourepoua	Cobble	R
Seriola grandis	Kingfish	Kahu	Lines	R

Species collected from dredge transects 1 - 8 Kauauroa Bay

Species	1	2	3	4	5	6	7	8
Unidentified flask type sponge				1				
Unidentified flat worm							1	
Nemocardium pulcheilum	48	24	85	5	7	3	9	21
Pecten novaezelandiae				1	1			
Austrofusus glans			5	1				
Notoplax violacea		1						
Neilo australis	11	41	7	6	1	13	10	19
Amalda mucronata		1	4			2	2	2
Struthiolaria papulosa						1		
Perna canaliculuis						1		
Mytilus sp.								2
Notocallista multistriata		2	3					
Leionucula strangei	4	50	3	28		23	7	17
Nucula hartvigiana						3		
Theora lubrica		12	2					1
Limaria orientalis		3						
Cuspidaria wellmani		1						
Tellina charlottae	1	2	1					
Alcithoe fusus			1	1				
Penion sulcatus					1			
Leptomya retiaria	2							
Poirieria zelandica	1		2					3
Delatalium scaphopoda						1		
Scaphopoda						1		
Magaella sanguinea		13						
Chaetopteridae			1		1			
Arabellidae	2							
Nepthyidae				1	2			1
Opheliidae	1	1						
Lumbrinereidae	1	1						
Maldanidae	1	1	1	1	1	1	2	
Onuphidae			1	1		1		1
Seruplidae						2		
Aphroditidae	1		1			1		
Terebellidae		3	3				1	
Capitellidae	1							
Heterothyone alba		1	6			2		
Echinocardium cordatum	14	6	22		6	1	5	32
Rynkartorpa uncinnata						1		
Stichopus mollis		1			1		3	
Ophiocentrus maculata	10	7	3		4		2	1
Amphiura correcta	31	27	31	7	32	1	38	26
Isopoda sp. A	1	1				2	1	
Isopoda sp. B						1		
Anthuridea sp.		1						
Petrolisthes novaezelandiae		1						
Nectocarcinus antaricus		2	1					
Thalassinidae sp					1			
Pontophilus sp.				1				
Pagurus sp.			1			4	1	
Periclimenes sp.		1						
Notomithrix minor	1	1						

Sipunculid						1		
Flat Fish Bothidae fam.			1					
Hippocampus abdominalis	1							
Haticarcinus sp	1							

Species	Common Name	Maori Name	Habitat	Abundance
Algae				
Corallina sp.	coralline turf		Cobble	A
Lithothamnion sp.	Algae paint		Cobble	A
Rodymenia dichotoma	branching red wed		Shell hash	R
Porphyra sp.	Sheet red weed			
Gigartina sp.	red weed			
Callophyllis sp.	red weed			
Schizoseris sp.	red weed (branching blade)			
Medeiothamnion lyalli	red weed (fine tuff)			
Cladhymenia sp. (oblongiolia)	lobbed red weed			
Pterocladia lucida	agar weed			
Hormosira banksii	Neptunes necklace		Cobble	A
Cystophora torulosa	Zig zag weed			
Carpophyllum flexuosum	Flap jack		Cobble	O
Carpophyllum maschalocarpum	Flap jack			
Colpomenia sinuosa	Air weed			
Undaria pinnatifida	Japanse weed invasive		On lines	C
	Algae uniceellular.		Soft substrate	A
Caulerpa germinata	Grape weed			

Porifera - Sponges

Species	Common Name	Maori Name	Habitat	Abundance
Callyspongia ramosa	Finger sponge (grey)	Kopuputai Roa		
Ancorina sp.	Grey sponge	Koopuputai Nui	Cobble	O
Cliona celata	Yellow encrusting sponge			
Lecettusa sp.	flask type sponge			
Polymastia fusca	Non discript encrusting			
Polymastia sp.	projected encrusting			
Hymeniacidon perlevis	Folded encrusting			
unidentified flask type sponge				

Coelenterates

Species	Common Name	Maori Name	Habitat	Abundance
Isactinia tenebrosa	Red waratah anemone	Kotare moana		
Corynactis haddoni	jewel anemone		Cobble	R
Phyctenactis tuberculosa	Wandering anemone	Humenga	Cobble	R
Actinothoe albocincta	White anemone		Line/Cobble	A/O
Solanderia racemosa	Hydroid tree	Not seem		
Sertularia sp.	feather like hydroid			
Aglaophenia laxa ??	fine feather like hydroid			
Pennaria sp.	Feather hydroid		R	
Aurelia aurita	jellyfish	Petipeti	water colum	A

Tunicates - ascidians

Species	Common Name	Maori Name	Habitat	Abundance
Microcosmos kura	Warty sea-squirt	Kaeo Kura.	Cobble	O
Cnemidocarpa sp.	saddle ascidian		Cobble/shell	C
Didemnum candidum	cream ascidian			
Aplidium sp.	Black compound ascidian			

Brachiopoda

Species	Common Name	Maori Name	Habitat	Abundance
Magasella sanguinea	Lamp shell	Papa Kura	Dead Shell	C

Echinodermata

Species	Common Name	Maori Name	Habitat	Abundance
Evechinus chloroticus	Sea egg	Kina	Cobble/shell	A
Ophionereis fasciata	Mottle brittle star	Weki Huna	Soft substrate	R
Ophiopsammus maculata	Snake star	Weki	Cobble	O
Pateriella regularis	Cushion star	Kapu parahua	Cobble/soft	A
Coscinasterias calamaria	Spiny star	Papatangaroa	Cob/soft/farm	A

Echinocardium cordatum	Heart urchin	Kina Pakira	Soft substrate	A
Sticopus mollis	Sea cucumber	Rori	Cob/soft/farm	A
Astrea roseus	Brittle star		Soft substrate	C

Mollusca
Gastropds

Species	Common Name	Maori Name	Habitat	Abundance
Cellana radians	Radiate limpet	Ngakihi	Cobble	C
Melagraphia aethiops	Spotted top shell	Maihi	Cobble	R
Cookia sulcata	Cooks Turban shell	Pupu Karikawa	Cobble	R
Turbo smaragdus	Cat's eye	Ataata	Cobble	C
Struthiolaria sp.	Ostrich foot	Totorere/Takai	Soft substrate	R
Poirieria zelandica	Spiny Murex	Pupu Tarataratea	Soft substrate	R
Amalda sp.	Olive shell	Tikoaka	Dredge	
Maricolpus rosesus	Turret Shell	Papatai	Cobble	R
Cryptoconchus porosus	Fleshy chiton		Cobble	R
Austrousus glans	Whelk		Cobble	R
Sypharochiton pelliserpentis	Snake skin Chiton	Papatua	Cobble	R

Bivalves

Species	Common Name	Maori Name	Habitat	Abundance
Atrin pectinata zelandica	Horse mussel	Hururoa	Soft/ shell	R
Aulacomya atra maoriana	Ribbed mussel	Pukanikani	Cobble	R
Mytilus sp.	Blue mussel	Toretore	Cobble	C
Perna canaliculus	Green mussel	Kuku	Cobble/farm	O/A
Modiolarca impacta	Nesting mussel	Kuku Mau Toka	Cobble	O
Pecten novaezelandiae	Scallop	Tipa/ Kuakua	shell/soft	O/R
Chlamys zelandiae	Fan Shell	Kopakopa	Cobble	R
Monia zelandica	Window oyster		Cobble	R
Nemocardium pulchellum	Strawberry cockle		dredge	
Neilo australis			dredge	
Nucula strangei	Nutshell		dredge	
Notocallistra multistriata			?	
Theora lubrica	Japanese Bivalve		?	
Leptomya retiaria			?	
Tellina charlottae			?	
Limaria orientalis	Japanese file shell		?	
Thracia vegrandis			?	

Octopus maorium	Octopus	Wheke	Cobble	R

Arthropoda - Crustacea

Species	Common Name	Maori Name	Habitat	Abundance
Pagurus novaezelandiae	Hermit crab	Papaka moke	Cobble/Shell	A
Paramithrax sp.	Masking crab	Papaka Huna	Farm	O
Chaemaesipho sp.	Barnacle		Cobble	A

Amphipoda

Species	Common Name	Maori Name	Habitat	Abundance

Annelida - Polychaeta

Species	Common Name	Maori Name	Habitat	Abundance
Branchiomma serratibranchis	Brown tube worm			
Galeolaria hystrix	Tube worm	no mounds observed	Cobble	C
Maldanidae sp.			Dredge	
Spiorbis sp.				
Pomatoceros sp.				
Amphitrite rubra	Bristle worm		Cobble	R

Fishes.

Species	Common Name	Maori Name	Habitat	Abundance
Parapercis colias	Blue cod	Raawaru	Cobble	C
Notolabrus celidotus	Spotty	Paketi	Cobble	C
Forstergion lapillum	Common triplefin		Cobble	C
Forstergion varium	Variable triplefin		Cobble	C
Hemerocoetes monopterygius	Opalfish	Kohikohi	Soft/ shell	R
Parika scaber	Leatherjacket	Kokiri	Lines	O
Genyagnus monopterygius	Spotted Stargazer	Kourepoua	Cobble	R
Seriola grandis	Kingfish	Kahu	Lines	R

Species	1.	2	3	4	5	6	7	8
Unidentified flask type sponge				1				
Unidentified flat worm							1	
Nemocard	48	24	85	5	7	3	9	21
Pecten novaezelandiae				1	1			
Austrofusus glans			5	1				
Notoplax violacea		1						
Neilo aust	11	41	7	6	1	13	10	19
Amalda mucronata		1	4			2	2	2
Struthiolaria papulosa						1		
Perna canaliculuis						1		
Mytilus sp.								2
Notocallista multistria		2	3					
Leionucula	4	50	3	28		23	7	17
Nucula hartvigiana						3		
Theora lubrica		12	2					1
Limaria orientalis		3						
Cuspidaria wellmani		1						
Tellina ch	1	2	1					
Alcithoe fusus			1	1				
Penion sulcatus					1			
Leptomya	2							
Spirieria z	1		2					3
Dentalium scaphopoda						1		
Scaphopoda						1		
Magaella sanguinea		13						
Chaetopteridae			1		1			
Arabellida	2							
Nepthyidae				1	2			1
Opheliidae	1	1						
Lumbriner	1	1						
Maldanida	1	1	1	1	1	1	2	
Onuphidae			1	1		1		1
Seruplidae						2		
Aphroditid	1		1			1		
Terebellidae		3	3				1	
Capitellida	1							
Heterothyone alba		1	6			2		
Echinocar	14	6	22		6	1	5	32
Rynkartorpa uncinnata						1		
Stichopus mollis		1			1		3	
Ophiocent	10	7	3		4		2	1
Ophiura	31	27	31	7	32	1	38	26
Isopoda sp	1	1				2	1	
Isopoda sp. B						1		
Anthuridea sp.		1						
Petrolisthes novaeze		1						
Nectocarcinus antari		2	1					
Thalassinidae sp					1			
Pontophilus sp.				1				
Pagurus sp.			1			4	1	
Periclimenes sp.		1						
Notomithri	1	1						
Sipunculid						1		
Flat Fish Bothidae fam.			1					
Hippocam	1							