Figure 1. Davidson et al., Locations of Marlborough Sounds Significant Marine Areas

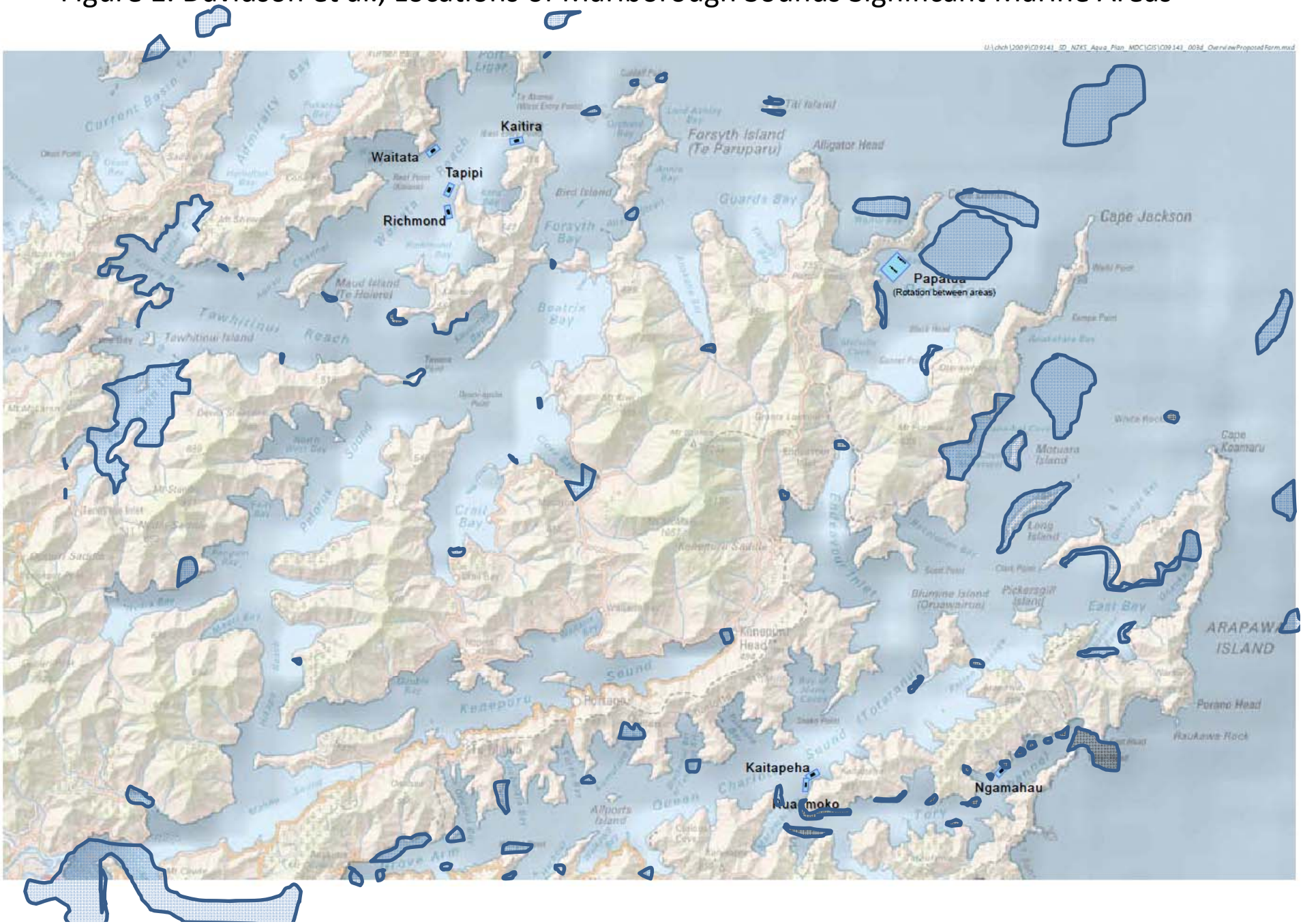

Figure 2. Davidson et al., Dive Locations to Identify Marlborough Sounds Significant Marine Areas – note red crosses often represent more than a single dive site location, i.e. they are tightly clustered.

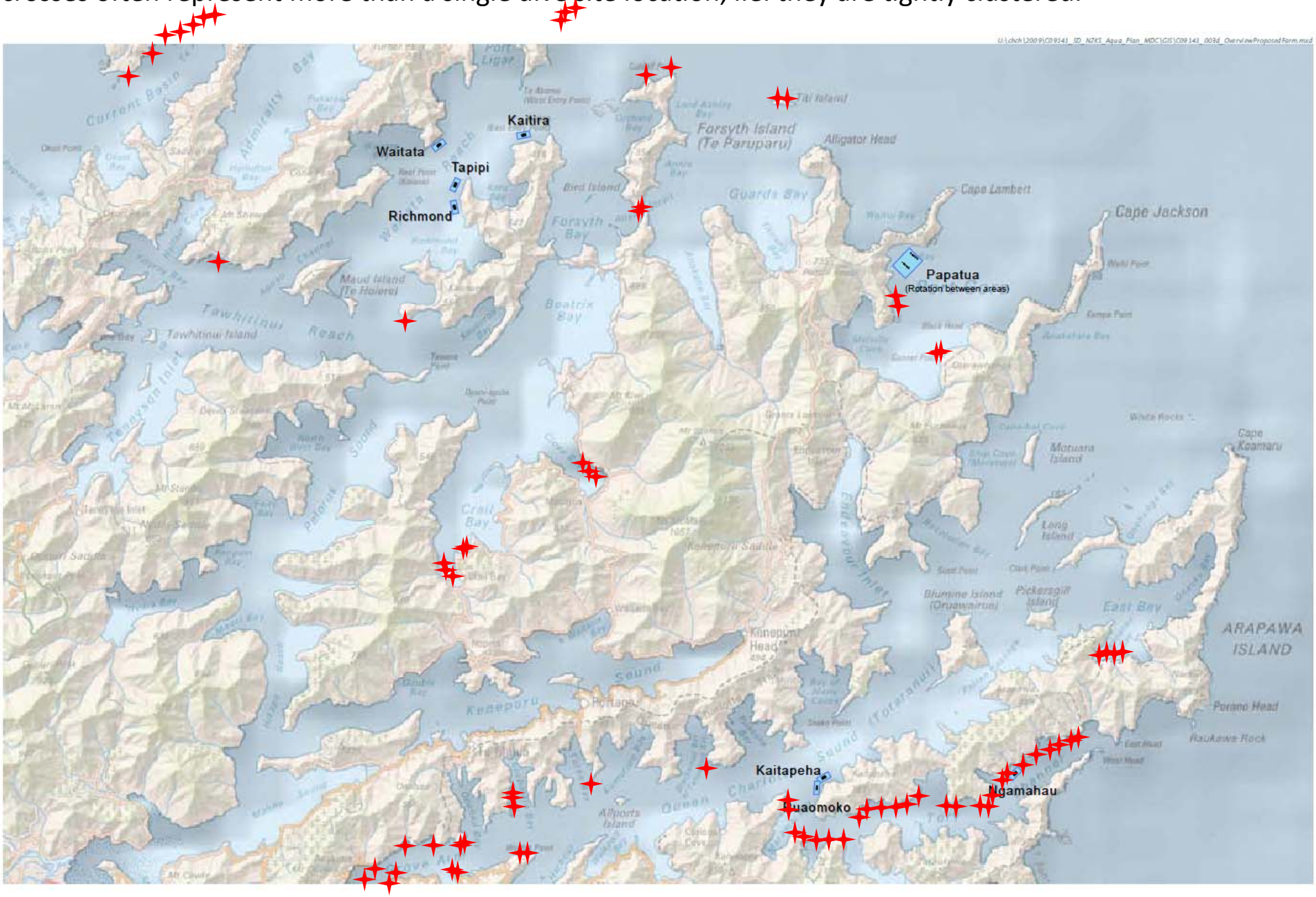

Figure 3. Davidson et al., Dive Locations Overlaid on Significant Marine Areas in the Marlborough Sounds

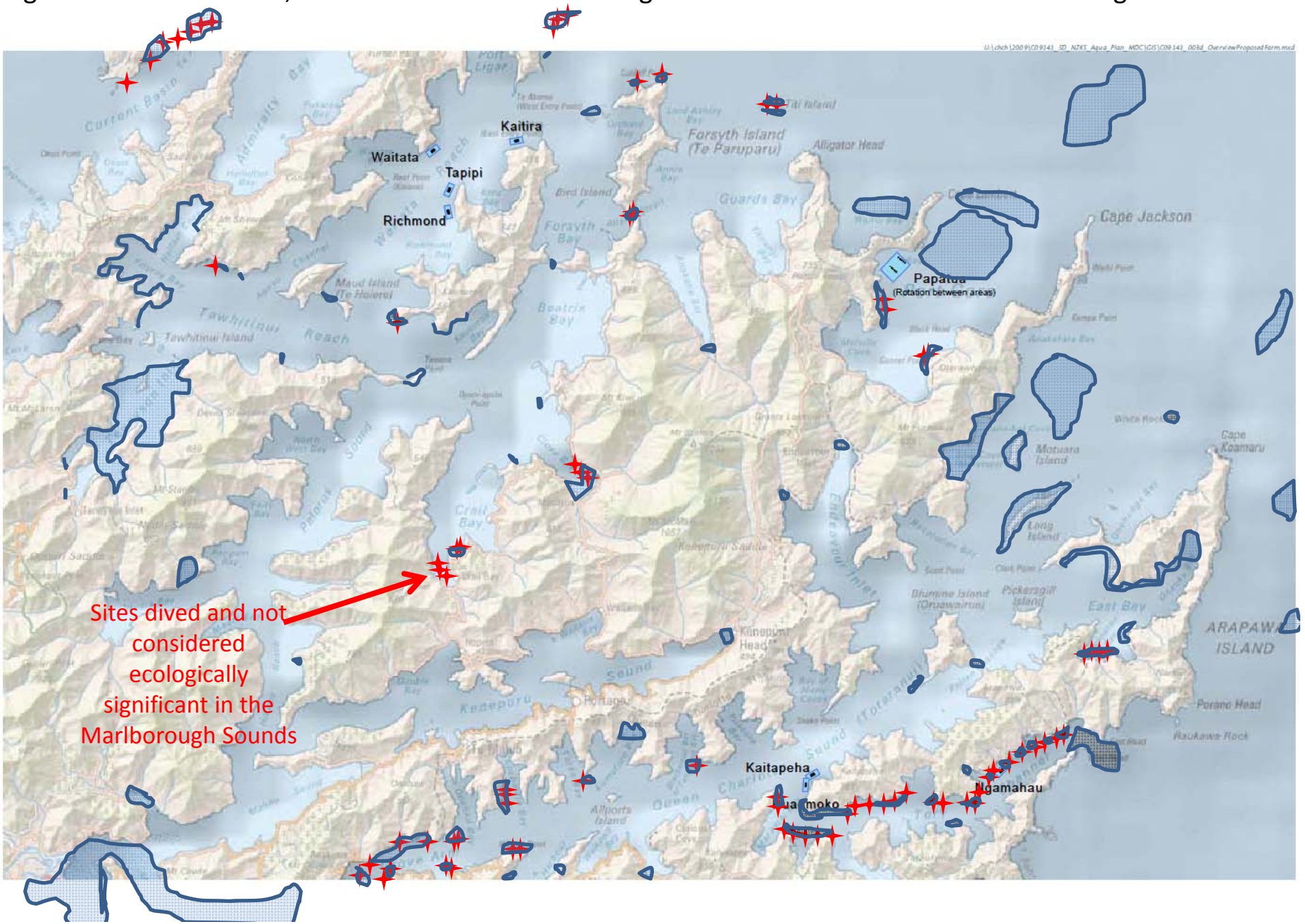

Figure 4. Davidson et al., Map Locations for Marlborough Sounds Significant Marine Areas

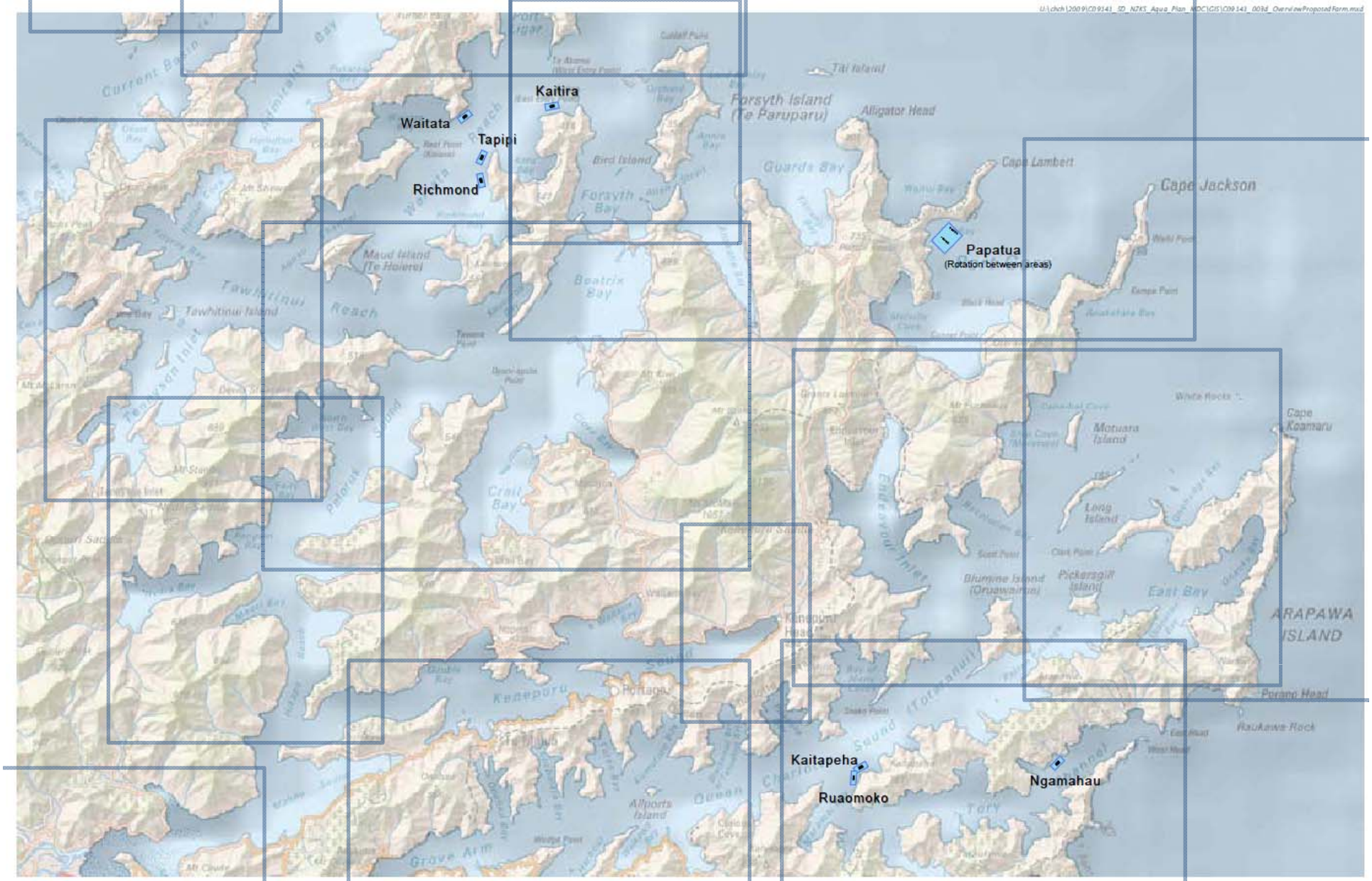

Figure 5. Davidson et al., Map Locations for Marlborough Sounds Significant Marine Areas

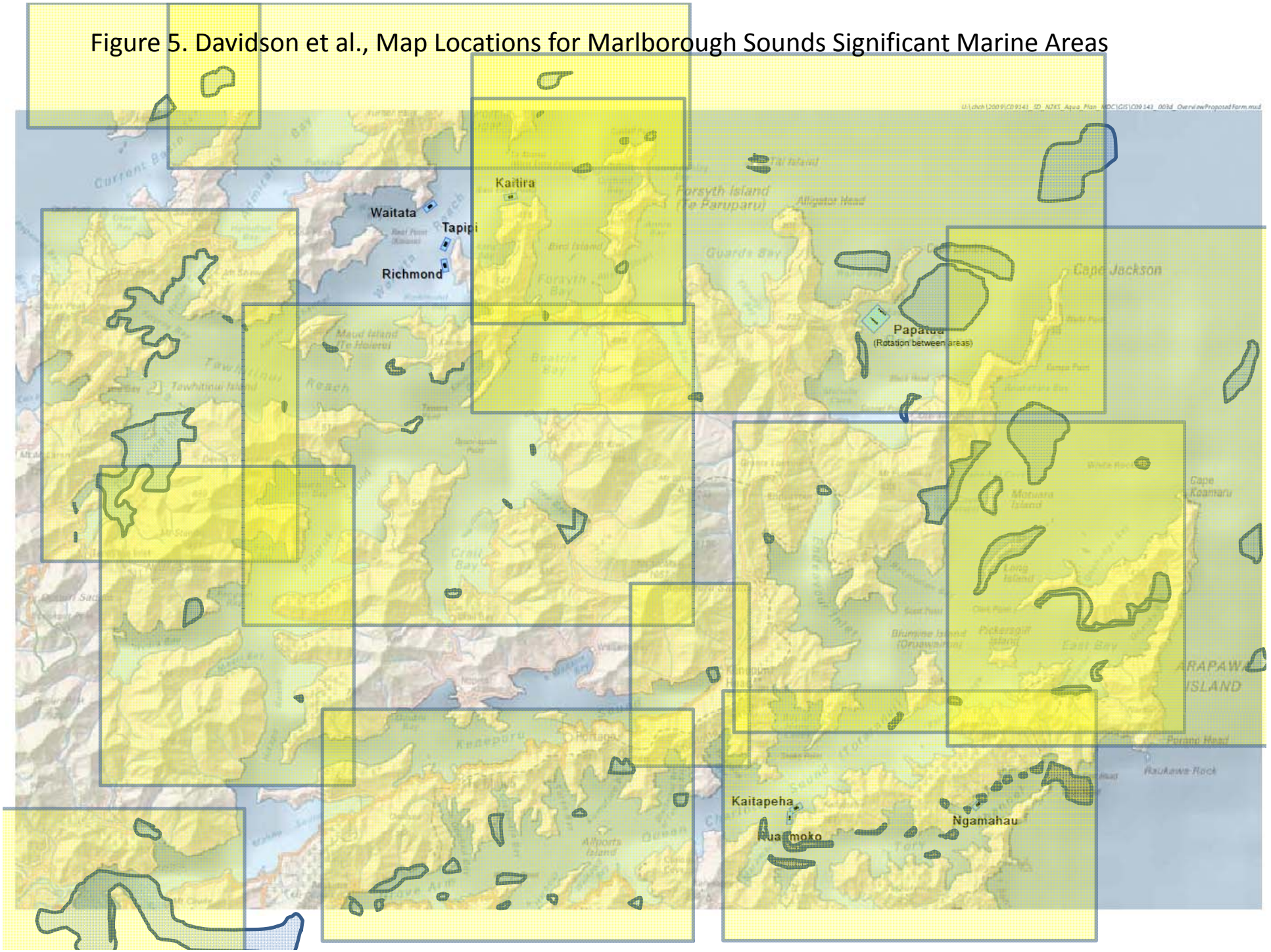

Figure 6. Locations of video clips recorded near and at proposed and existing salmon farms

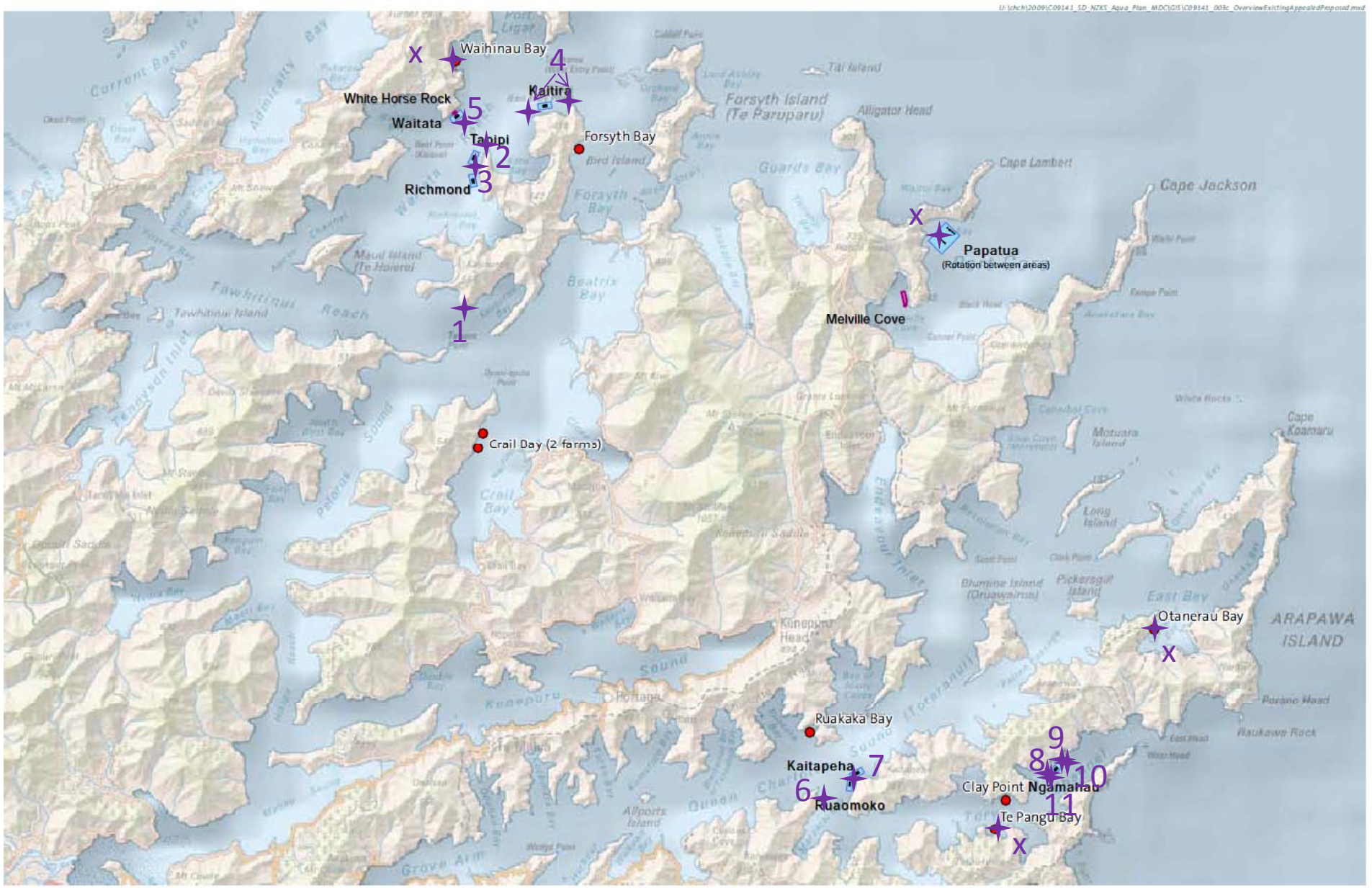

Figure 7. Deposition footprints for Papatua, Waitata, Kaitira and Taipipi.

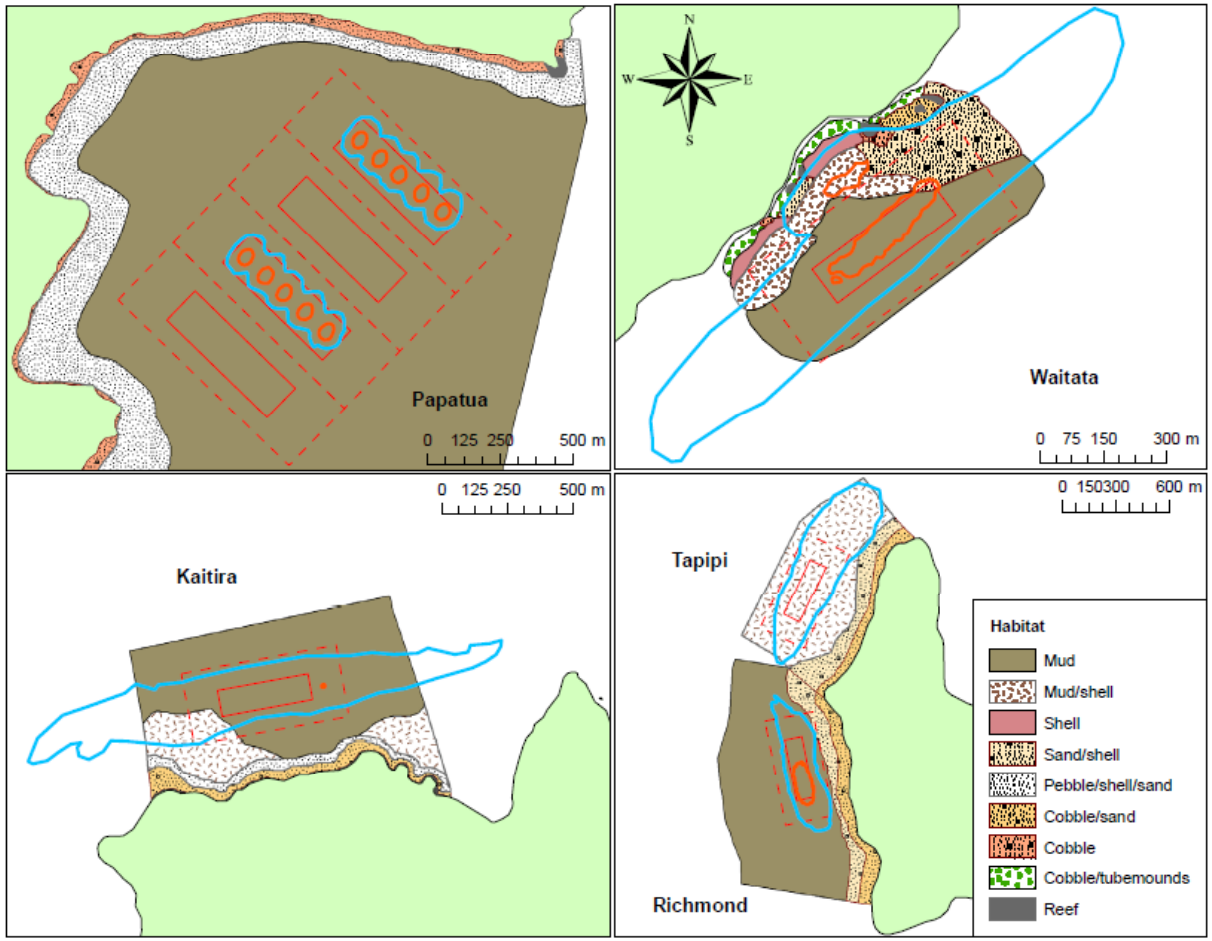

Figure 14. Summary maps of the benthic substrata and habitats observed at the NZ King Salmon Plan Change Sites at Papatua in Port Gore, and Waitata, Kaitira, Tapipi and Richmond in Pelorus Sound. Blue ellipses represent the 0.5 kg m^{-2} yr^{-1} depositional level predicted for the maximum conceivable feed loading (MCFL) at each site; the level at which soft sediment infaunal communities begin to show signs of enrichment (ES >3). Red ellipses represent the 10 kg m^{-2} yr^{-1} deposition level predicted for the MCFL; the level at which peak enrichment is reached (ES 5). NB. The Waitata depositional footprint includes that of the proposed inshore WHR (White Horse Rock) salmon farm currently under consideration in the Environment Court. No areas were predicted to be affected by a depositional flux of 10 kg m^{-2} yr^{-1} at the Tapipi Site.

Figure 8. Deposition footprints for Ngamahau, Kaitapeha and Ruaomoko

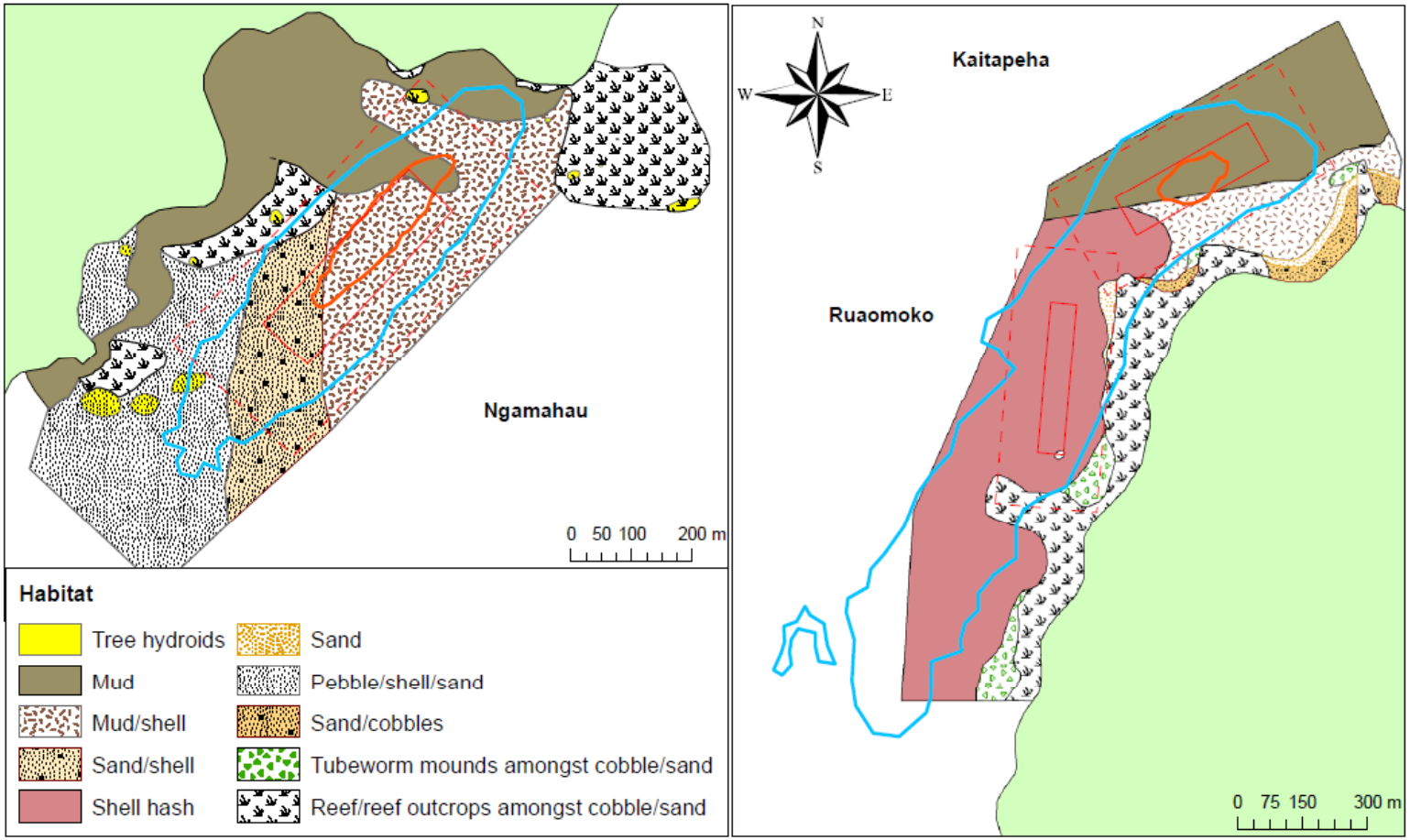

Figure 15. Summary maps of the benthic substrata and habitats encountered at the proposed NZ King Salmon Plan Change sites within Queen Charlotte Sound. Blue ellipses represent the 0.5 kg m^{-2} yr^{-1} depositional level predicted for the maximum conceivable feed loading (MCFL) at each site; the level at which soft sediment infaunal communities begin to show signs of enrichment (ES >3). Red (Bold) ellipses represent the 10 kg m^{-2} yr^{-1} deposition level predicted for the MCFL; the level at which peak enrichment is reached (ES 5 – See Section 4.1.2). Red solid box is the cage area boundary, and the large red box (dotted line) is the proposed NZ King Salmon Plan Change site boundary.

Table 1. Impacts on dominant substrata, ecologically important habitats or values from proposed farms

Table 4. Summary of the dominant substrata (in reducing order of area), ecologically important habitats or values found within and adjacent to the proposed Sites, and the distances to these habitats, upstream, in the middle and downstream of the cage area boundaries. Refer to Appendices 5-12 for full Site descriptions.

Site	**Dominant substrata**	**Ecologically important habitats and / or values above trigger levels (Department of Conservation 1995,** Table 2**)**	**Distance (m) from Cage Area Boundaries (Upstream, Middle, Downstream)**
Richmond	Mud, Sand/shell	Scallops (0.6 m^{-2})	0, 0, 0
		Inshore cobble/reef habitat	182, 179, 134
Kaitira	Mud, Mud/shell	Inshore cobble/reef habitat	203, 220, 275
Tapipi	Mud/shell	Inshore reef habitat	265, 302, 329
Papatua	Mud	Inshore cobble/reef habitat	306, 491, 306
Waitata	Mud, Sand/shell, Mud/shell	Inshore reef habitat	192, 181, 255
		Tubeworm mounds	225, 198, 162
Ngamahau	Mud/shell, Sand/shell, Mud	Inshore reef habitat	176, 50, 165
		Patches of hydroids and biogenic clumps	107, 91, 135
Kaitapeha	Mud, Mud/shell, Shell hash	Deep boulder/cobble and reef habitat	200, 96, 87
		Tubeworm mounds and biogenic clumps	143, 97,-
Ruaomoko	Shell hash, Cobble/reef, Sand	Deep boulder/cobble and reef habitat	95, 76, 0
		Tubeworm mounds and biogenic clumps	-,65,-

Figure 9. Unidentified species found in large numbers on the shell hash/sand/mud substrates at Ruaomoko.

Figure 10. Benthic enrichment under marine farms.

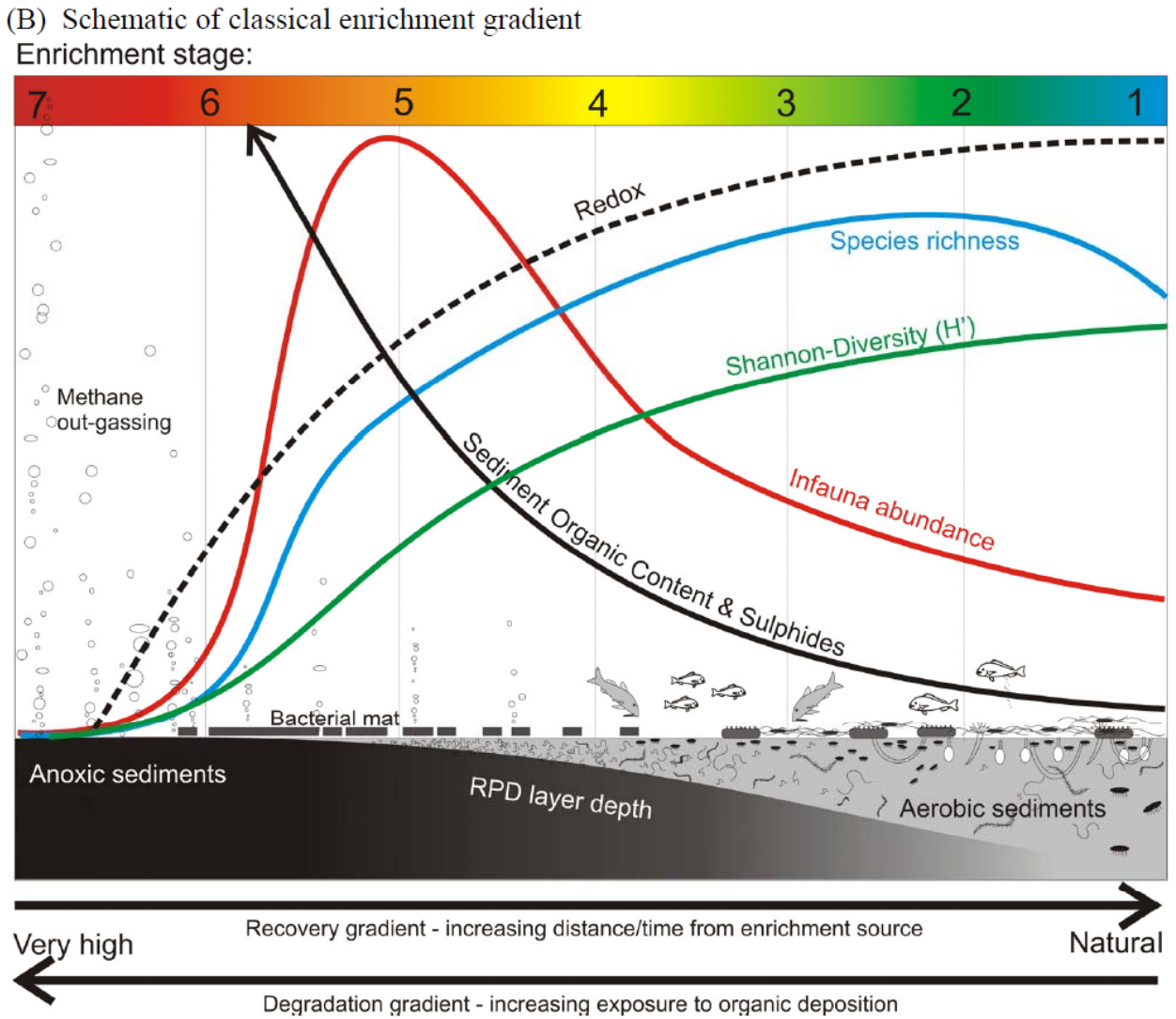

Figure 8. (B) stylised depiction of changes in infaunal abundance, species richness (number of taxa), sediment organic content and sulphide and redox levels along an enrichment gradient, defined by Enrichment Stage (ES) 1-7.

Table 2. Measured near-bottom current speeds.

Table 10. Summary of physical properties relevant to the sites dispersive potential, along with total affected areas (for TEP, CLA and RUA, these are actual observed footprints, for proposed sites this is total predicted area). The 'ES 5 limit' column gives kt's of feed (per year) at which the level of depositional flux is predicted to result in ES 5 benthic effects. RIFL = recommended initial feed level, PSFL = predicted sustainable feed level, MCFL = maximum conceivable feed level. BCF = beneath cage floor.

		Flow type	Site depth	Near-bottom current speed		Max dist.#	ES5 limit	Area ‡	RIFL		PSFL		MCFL	
				Ave	Max					Area		Area		Area
Site	**# cages**		m	cm/s	cm/s	m	kt/yr	ha	**kt/yr**	ha	**kt/yr**	ha	**kt/yr**	ha
CLA		HF	30-40	19.1	79.0	344	-	13.2	**-**		**~4**		**-**	
TEP		HF	27-31	19.4	63.2	145	-	9.6	**-**		**~4**		**-**	
OTA		LF	37-39	3.5	13.5	na	-	na	**-**		**~2**		**-**	
RUA		LF	34-35	3.5	14.2	194	-	6.8	**-**		**~2**		**-**	
FOR		LF	30-32	3.2	10.9	na	-	na	**-**		**1.5-2**		**-**	
WAI		LF	28-30	9.1	29.7	na	-	na	**-**		**2-2.5**		**-**	
KAI	8	HF	~60	19.6	57.2	761	6	23.2	**3**	19	**4**↓	20	**6**˜	23.2
RIC	8	HF	32-40	15.7	56.3	247	2	9.8	**1.5**	9	**2**	10	**4**	12
TAP	8	HF	~62	15.7	43.8	524	5	21.0	**3**	18	**4**↓	20	**5**	21
WAT	8	HF	~63	17.6	126.7	589	6	28.3	**3**	21	**4**↓	24	**6**†	28
WHR+	*4*	*HF*	*22-28*	*10.1*	*44.3*	-	*2*	*9.2*	***1.5***	*~8*	***2***	*9.2*	***3***	*10.9*
WAT + WHR+	12	"	-	-	-		5	20.6	**4**(3:1)	25	**5.3**(4:1.3)	28	**8**(6:2)	32
NGA	8	HF	23-35	21.1	66.2	268	2	10.7	**1.5**	9	**2.5**	12	**4**	14.6

Figure 11. Hydrodynamic modelling of the Marlborough Sounds.

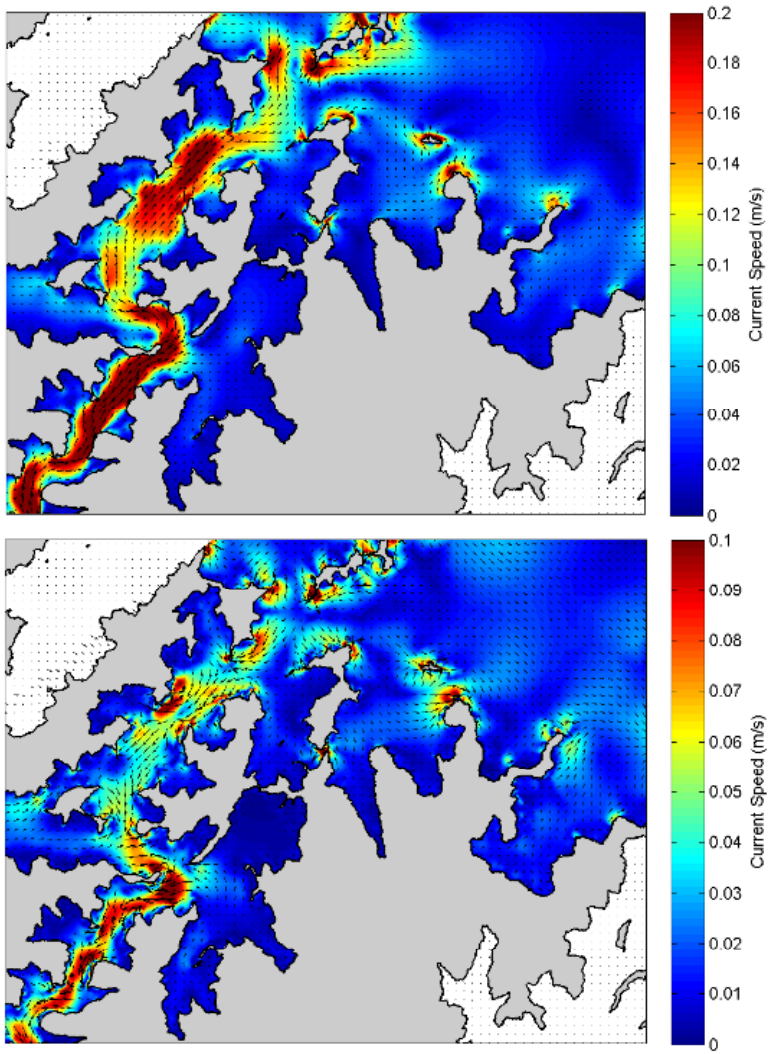

Figure 13. Mean current direction and speeds (mean over the period 24 July to 21 August 2008) in outer Pelorus Sound at the surface (top panel) and seabed (bottom panel), The results demonstrate a weak estuarine circulation over a period of moderate rainfall and river flows. The arrows show direction of (net) flow, whilst the colours and associated colour scale show net current speed (in $m.s^{-1}$; with a lower scale used show bottom water currents).

Figure 12.Clay Point predicted vs observed deposition.

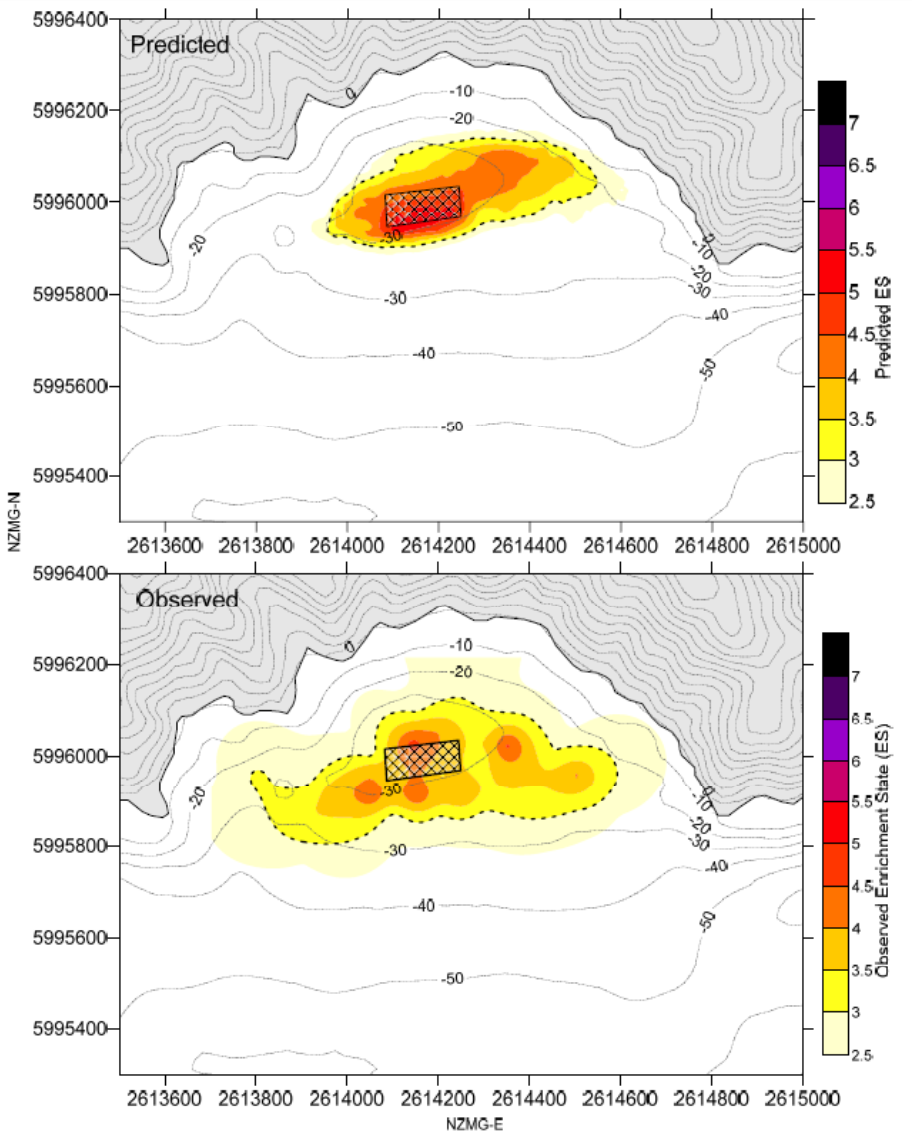

Figure 3.4. Predicted and observed (measured) benthic environmental footprints beneath the Clay Point salmon farm (in April 2011). Enrichment Stage (ES) measured by proxy from sulphide, redox and odour measurements of sediments sampled on grids of 65 grabs and validated by collecting a full suite of environmental variables (AFDW, sediment grain size, infauna) for 18 of the sites representing a cross-section of conditions.

Figure 13. Te Pangu predicted vs observed deposition.

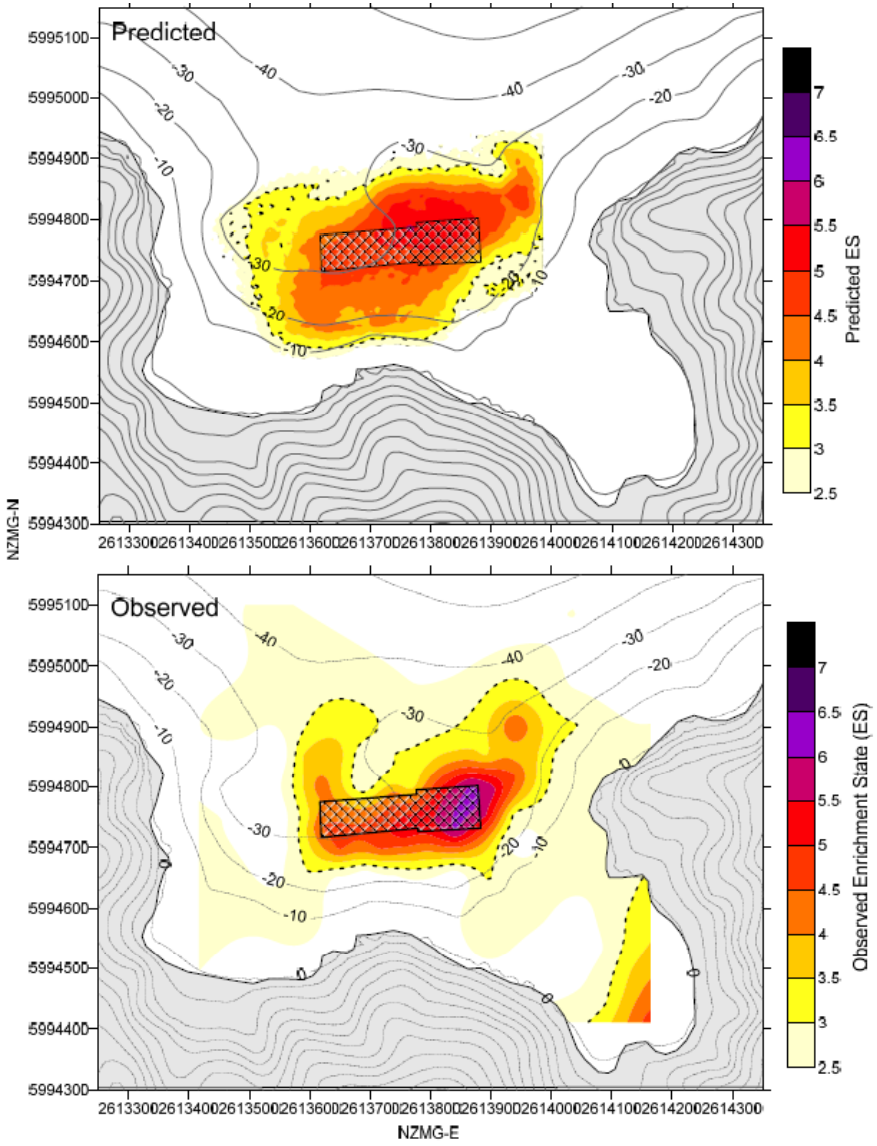

Figure 3.5. Predicted and observed (measured) benthic environmental footprints beneath the Te Pangu salmon farm (in April 2011). Enrichment Stage (ES) measured by proxy from sulphide, redox and odour measurements of sediments sampled on grids of 83 grabs and validated by collecting a full suite of environmental variables (AFDW, sediment grain size, infauna) for 19 of the sites representing a cross-section of conditions.

Figure 12. Ruakaka predicted vs observed deposition.

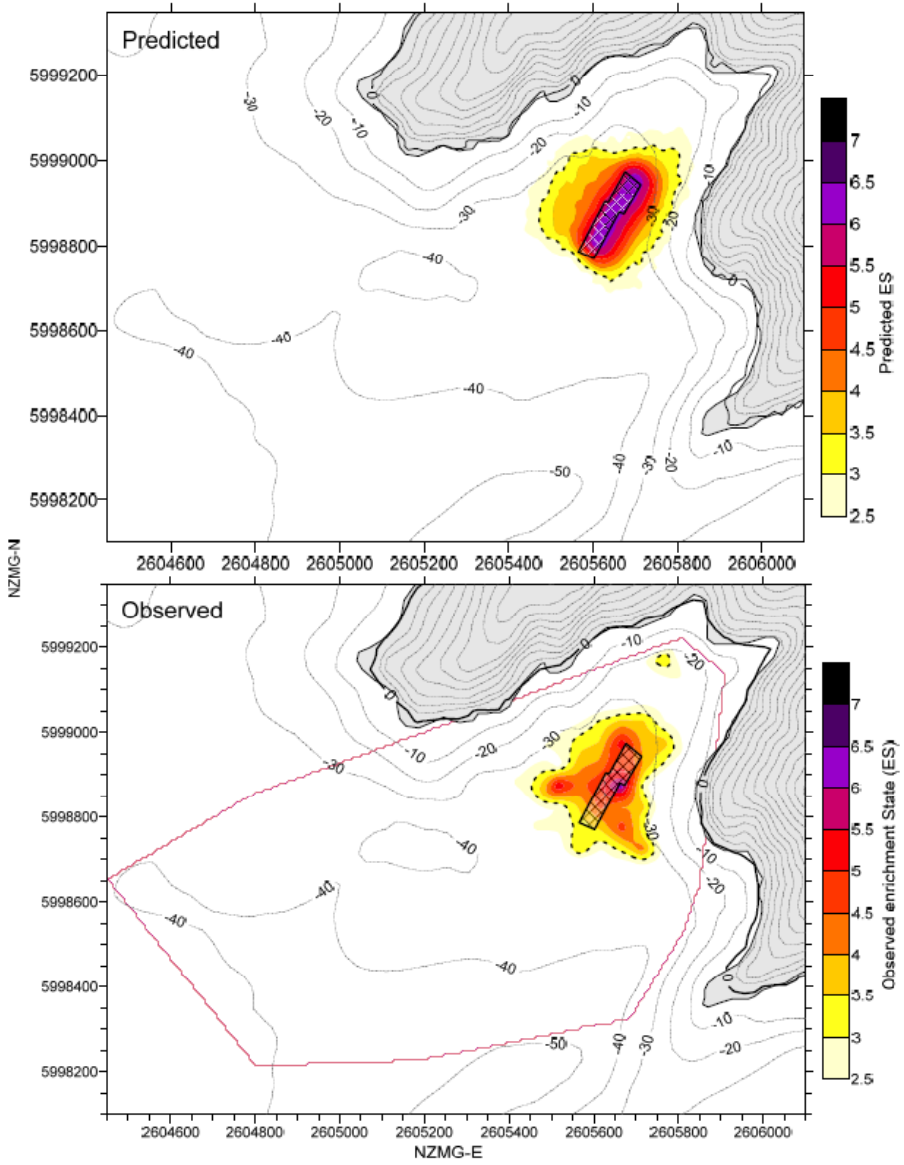

Figure 3.6. Predicted and observed (measured) benthic environmental footprints beneath the Ruakaka salmon farm (in April 2011). Enrichment Stage (ES) measured by proxy from sulphide, redox and odour measurements of sediments sampled on grids of 90 grabs and validated by collecting a full suite of environmental variables (AFDW, sediment grain size, infauna) for 18 of the sites representing a cross-section of conditions.

Table 3. Predicted vs observed deposition distances.

Table 3.4. Dimensions of measured footprints associated with CLA, RUA and TEP farms. Predicted footprints based on 2010 site configurations.

Footprint boundary			**CLA**		**RUA**		**TEP**	
			Pred.	**Obsv.**	**Pred.**	**Obsv.**	**Pred.**	**Obsv.**
≥ ES 2.5	Area (ha)	Total	12.3	32.0	10.6	9.4	15.7	26.3
	Distance (m)	Ave.	142	249	111	105	135	192
		Max.	*367*	*435*	*160*	*165*	*176*	*356*
		Min.	*58*	*104*	*29*	*50*	*91*	*58*
≥ ES 3	Area (ha)	Total	9.4	13.2	7.43	6.8	11.3	9.6
	Distance (m)	Ave.	111	155	82	81	102	95
		Max.	*291*	*344*	*130*	*145*	*149*	*194*
		Min.	*40*	*62*	*20*	*15*	*31*	*38*
≥ ES 5	Area	Total	0.5	0	2.1	0.5	1.0	1.2

Figure 15. Observed vs predicted flux.

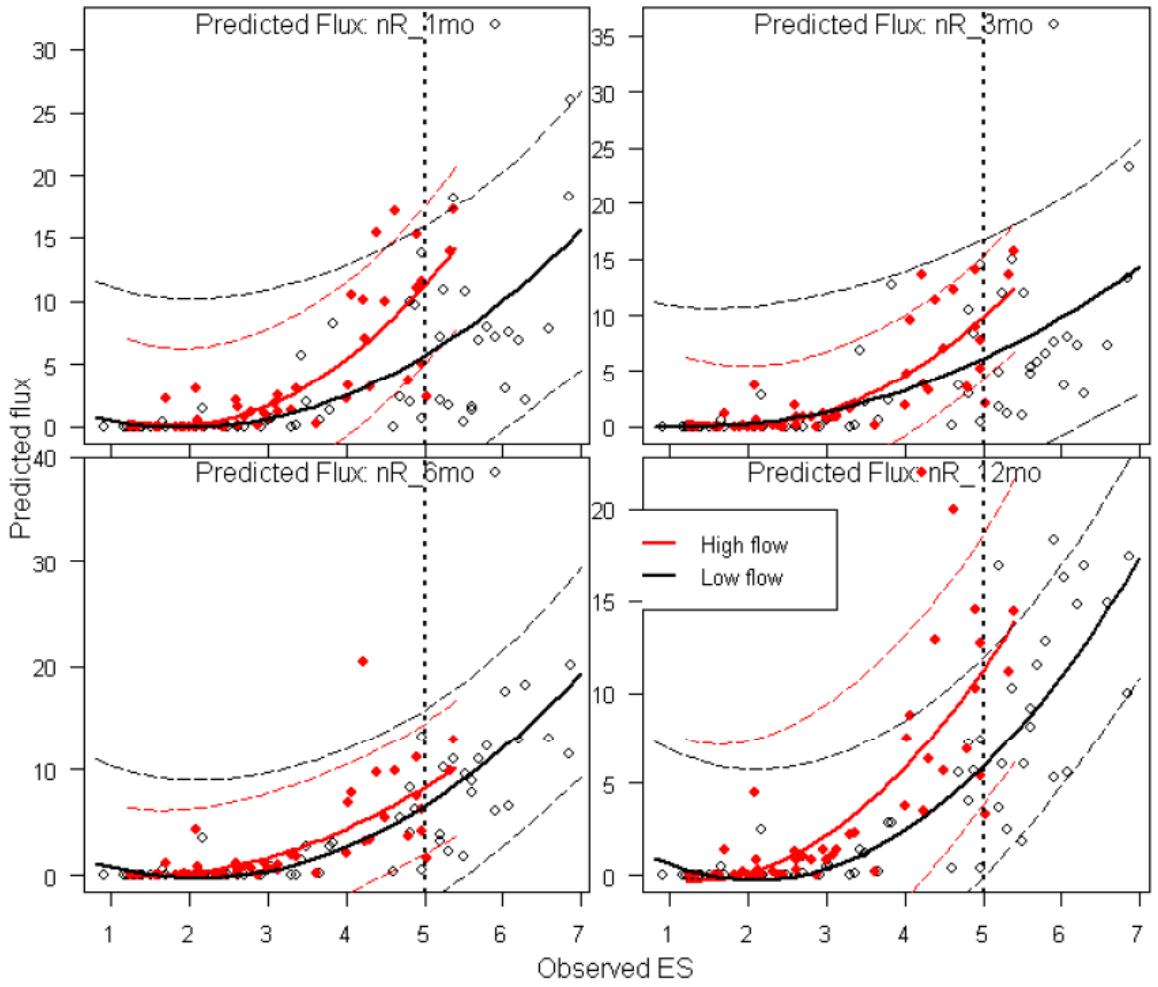

Figure 11. Relationship between Predicted flux (kg m^{-2} yr^{-1} - without resuspension), and Observed ES for the 1, 3, 6 and 12 month average feed scenarios at high-flow (solid red diamonds) and low-flow (open black diamonds) sites. Dashed vertical line indicates position of observed ES 5. Regression lines are second order polynomials with adjusted r-squared values of between 0.52 and 0.67. Dashed curved regression lines are 95% confidence intervals for each.