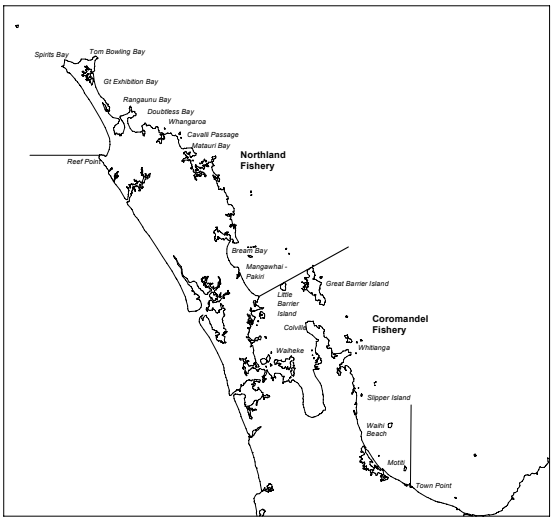
SCALLOPS NORTHLAND (SCA 1)

(*Pecten novaezelandiae*)
Kuakua, Tipa



1. FISHERY SUMMARY

1.1 Commercial fisheries

Scallops support regionally important commercial fisheries off the north-east coast of the North Island between Reef Point (Ahipara) and Cape Rodney, the limits of the Northland fishery. Fishing is conducted within discrete beds in Spirits Bay, Tom Bowling Bay, Great Exhibition Bay, Rangaunu Bay, Doubtless Bay, Stevenson's Island, the Cavalli Passage, Bream Bay, and the coast between Mangawhai and Pakiri Beach. All commercial fishing is by dredge, with fishers preferring self-tipping "box" dredges to the "ring bag" designs used in Challenger and Chatham Island fisheries.

The Northland commercial scallop season runs from 15 July to 14 February, and the minimum legal size (MLS) is 100 mm. Since 1980, landings have varied more than 10-fold from less than 150 t to over 1500 t (greenweight). The two lowest recorded landings were in 1999 and 2000.

Northland scallops were introduced into the QMS on 1 April 1997. The Northland TAC is 75 t, comprised of a TACC of 40 t, allowances of 7.5 t for recreational fisheries and 7.5 t for customary fisheries, and an allowance of 20 t for other sources of mortality. Northern scallop fisheries are managed under the QMS using individual transferable quotas (ITQ) that are proportions of the Total Allowable Commercial Catch (TACC). Catch limits and landings from the Northland fishery are shown in Table 1. Figure 1 shows the per-stock catch composition for the main SCA stocks, and also the historical landings and TACC for SCA1. Both northern scallop fisheries have been gazetted on the Second Schedule of the Fisheries Act 1996 which specifies that, for certain "highly variable" stocks, the Annual Catch Entitlement (ACE) can be increased within a fishing season. The TACC is not changed by this process and the ACE reverts to the "base" level of the TACC at the end of each season.

Table 1: Catch limits and landings (t meatweight or greenweight) from the Northland fishery since 1980. The Northland commercial scallop season runs from 15 July to 14 February, inclusive. Data before 1986 are from Fisheries Statistics Unit (FSU) forms. Landed catch figures come from Monthly Harvest Return (MHR) forms, Licensed Fish Receiver Return (LFRR) forms, and from the landed section of Catch Effort and Landing Return (CELR) forms, whereas estimated catch figures come from the effort section of CELRs and are pro-rated to sum to the total CELR greenweight. "Whangarei" includes beds south of Cape Brett, "Far North" includes beds from Cape Brett to North Cape, and "Spirits" includes beds to the west of North Cape. Catch limits for 1996 were specified on permits in meatweight, and, since 1997, were specified as a formal TACC in meatweight ("Green" assumes the gazetted meatweight recovery conversion factor of 12.5% and probably overestimates the actual greenweight taken in most years). In seasons starting in 1999 and 2000, voluntary catch limits were 40 and 30 t, respectively. *, split by area not available; –, no catch limits set, or no reported catch (Spirits).

			Landings (t)						
	Catch limits (t)		MHR	LFRR	CELR		Estimated catch (t green)		
Season	Meat	"Green"	Meat	Meat	Meat	Green	Whangarei	Far North	Spirits
1980-81	–	–	–	–	–	238	*	*	*
1981-82	–	–	–	–	–	560	*	*	*
1982-83	–	–	–	–	–	790	*	*	*
1983-84	–	–	–	–	–	1 171	78	1 093	–
1984-85	–	–	–	–	–	541	183	358	–
1985-86	–	–	–	–	–	343	214	129	–
1986-87	–	–	–	114	–	675	583	92	–
1987-88	–	–	–	183	–	1 625	985	640	–
1988-89	–	–	–	171	–	1 121	1 071	50	–
1989-90	–	–	–	164	–	781	131	650	–
1990-91	–	–	–	115	–	519	341	178	–
1991-92	–	–	–	158	–	854	599	255	–
1992-93	–	–	–	135	–	741	447	294	–
1993-94	–	–	–	114	–	862	75	787	1
1994-95	–	–	–	205	–	1 634	429	1 064	142
1995-96	–	–	–	208	214	1 469	160	810	499
1996-97	188	1 504	–	129	132	954	55	387	512
1997-98	188	1 504	–	136	126	877	22	378	477
1998-99	106	848	–	31	32	233	0	102	130
1999-00	106	785	–	18	18	132	0	109	23
2000-01	60	444	–	17	17	128	0	88	40
2001-02	40	320	–	38	38	291	14	143	134
2002-03	40	320	33	40	40	296	42	145	109
2003-04	40	320	38	39	39	309	11	228	70
2004-05	40	320	40	40	40	319	206	77	37
2005-06	70	560	69	69	70	560	559	1	0
2006-07	70	560	53	53	51	405	404	1	0
2007-08	40	320	33	–	30	242	9	197	35

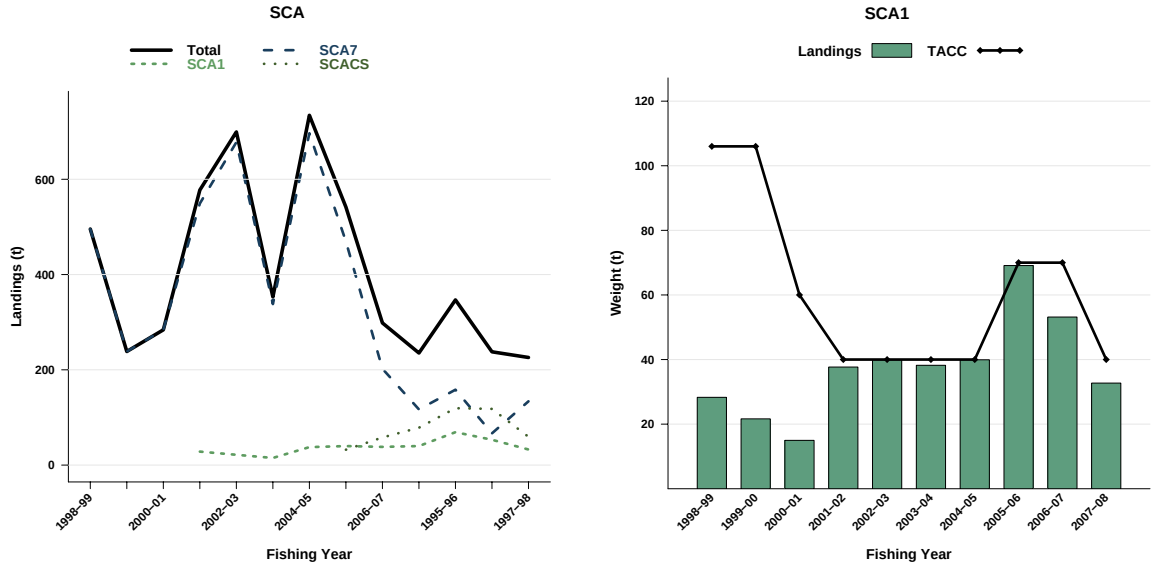


Figure 1: Left: Landings for the main SCA stocks and the sum total of these landings (solid line) throughout time. Right: Historical landings and TACC for SCA1 (Northland). Note that these figures do not show data prior to entry into the QMS.

1.2 Recreational fisheries

There is an intense non-commercial (recreational and Maori) interest in scallops throughout the Coromandel and Northland fisheries. Non-commercial fishing for scallops occurs in suitable areas throughout the two fisheries, mostly in enclosed bays and harbours. Scallops are usually taken by diving using snorkel or SCUBA, although considerable amounts are also taken using small dredges. In some areas, especially in harbours, scallops can be taken by hand from the shallow subtidal and even the low intertidal zones (on spring tides), and, in storm events, scallops can be cast onto lee beaches in large numbers. To some extent, management of northern scallop fisheries has concentrated on spatial separation of commercial and amateur fisheries through the closure of harbours and enclosed waters to commercial dredging. However, areas of contention and conflict have existed in the past, some of which have been addressed using additional voluntary or regulated closures. Recreational regulations restrict the daily harvest (bag limit) to 20 per person, there is a minimum legal size of 100 mm shell length. Until 2006, the recreational scallop season ran from 15 July to 14 February, but in 2007 the season was changed to run from 1 September to 31 March.

Currently, there are no reliable estimates of non-commercial harvest of scallops from the Coromandel or Northland fisheries. Estimates of catch by recreational fishers from the two northern scallop fisheries have been made on four occasions as part of recreational fishing (telephone and diary) surveys (Table 2). The Marine Recreational Fisheries Technical Working Group (FTWG) reviewed these surveys and recommended "that the telephone-diary estimates be used only with the following qualifications: 1) they may be very inaccurate; 2) the 1996 and earlier surveys contain a methodological error; and 3) the 1999–2000 and 2000–01 estimates are implausibly high for many important fisheries."

Given the above concerns about the reliability of non-commercial harvest estimates, it is difficult to make comparisons between the levels of commercial and non-commercial harvest. However, recreational catch in 1993–94 from the area shared with the Northland commercial fishery was estimated as 40–60 t (Bradford 1997). Commercial landings from the Northland fishery in the most comparable period (July 1994 to February 1995 scallop season) were 1634 t, suggesting that, in that year, the recreational catch of scallops was probably 2–4% of total removals.

Table 2: Harvest estimates (number and greenweight) of scallops taken by recreational fishers in Coromandel and Northland (QMA 1) from the telephone-diary surveys conducted in 1993–94, 1996, 1999–2000, and 2000–01. The Marine Recreational Fisheries Technical Working Group considered that these estimates may be very inaccurate.

	Coromandel			QMA 1 (Northland)			
Year	No. of scallops	CV	Weight (t, green)	No. of scallops	CV	Weight (t, green)	Reference
1993–94	626 000	0.14	60.0–70.0	374 000	0.17	40.0–60.0	Bradford (1997)
1996	614 000	0.12	62.0	272 000	0.18	32.0	Bradford (1998)
1999–00	257 000	1.01	30.1	634 000	0.34	69.8	Boyd and Reilly (2002)
2000–01	472 000	0.47	55.3	820 000	0.31	90.3	Boyd *et al*. (2004)

1.3 Customary non-commercial fisheries

Scallops were undoubtedly used traditionally as food by Maori, although quantitative information on the level of customary non-commercial take is not available.

1.4 Illegal catch

There is no quantitative information on the level of illegal catch.

1.5 Other sources of mortality

Scallops encountered by box dredges in the Coromandel scallop fishery showed modest reductions in growth rate compared with scallops collected by divers, and their mortality was high (up to about 50% for larger size classes).

2. BIOLOGY

Pecten novaezelandiae is one of several species of "fan shell" bivalve molluscs found in New Zealand waters. Others include queen scallops and some smaller species of the genus *Chlamys*. *P. novaezelandiae* is endemic to New Zealand, but is very closely related to the Australian species *P. fumatus* and *P. modestus*. Scallops of various taxonomic groups are found in all oceans and support many fisheries world-wide. Most undergo large population fluctuations.

Scallops are found in a variety of coastal and intertidal habitats, but particularly in semi-enclosed areas where circulating currents are thought to retain larvae. After the planktonic larval phase and a relatively mobile phase as very small juveniles, scallops are largely sessile and move actively mainly in response to predators. They may, however, be moved considerable distances by currents and storms and are sometimes thrown up in large numbers on beaches.

Scallops are functional hermaphrodites, and become sexually mature at a size of about 60–70 mm shell length. They are extremely fecund and may spawn several times each year. Fertilisation is external and larval development lasts for about 3 weeks. Initial settlement occurs when the larva attaches via a byssus thread to filamentous material or dead shells on or close to the seabed. The major settlement of spat in northern fisheries usually takes place in early January. After growth to about 5 mm, the byssus is detached and, after a highly mobile phase as a small juvenile, the young scallop takes up the relatively sedentary adult mode of life.

The very high fecundity of this species, and likely variability in the mortality of larvae and pre-recruits leads to great variability in annual recruitment. This, combined with variable mortality and growth of adults, leads to scallop populations being highly variable from one year to the next, especially in areas of rapid growth where the fishery may be supported by only one or two year classes. This variability is characteristic of scallop populations world-wide, and often occurs independently of fishing pressure.

Little detailed information is available on the growth and natural mortality of Northland scallops, although the few tag returns from Northland indicate that growth rates in Bream Bay are similar to those in the nearby Coromandel fishery (see the report for SCA CS). The very large average size of scallops in the northern parts of the Northland fishery and the consistent lack of small animals there suggests that growth rates may be very fast in the far north.

3. STOCKS AND AREAS

Little is known of the stock structure of New Zealand scallops. It is currently assumed for management that the Northland fishery is separate from the adjacent Coromandel fishery and from the various west coast harbours, Golden Bay, Tasman Bay, Marlborough Sounds, Stewart Island and Chatham Island fisheries.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

Catch rates are variable both within and among seasons, but the relationship between biomass and CPUE is complex and (declines in) CPUE cannot be used to estimate biomass within a season (Cryer 2001b). Effort data are, therefore, not presented.

4.2 Biomass estimates

Virgin biomass, B_0, and the biomass that will support the maximum sustainable yield, B_{MSY}, have not been estimated and are probably not appropriate reference points for a stock with highly variable recruitment and growth such as scallops.

There have been almost annual assessments of Northland scallops since 1992 (Table 3), in support of a CAY management strategy. Assessments are based on pre-season biomass surveys conducted by diving and/or dredging. Composite dive-dredge surveys were conducted annually from 1992 to 1997, except in 1993 when only divers were used. From 1998, surveys were conducted using dredges only. The Northland fishery was not surveyed in 1999, 2000, or 2004. Where dredges have been used, absolute biomass must be estimated using scalars (multipliers) to correct for the efficiency of the particular dredges used. Previously, these scalars were estimated by comparing dredge counts with diver counts in experimental areas (e.g., Cryer & Parkinson 1999). However, different vessels have been used in the five most recent surveys and no trials were conducted on the efficiency of the particular dredges used. Estimating start-of-season biomass and yield is, therefore, difficult and contains unmeasurable as well as measurable uncertainty. For some years, the highest recorded estimate of dredge efficiency has been used, but more recent surveys have had a range of corrections applied from no correction (the most conservative) to historical average across all studies (the least conservative).

Estimates for the Northland fishery calculated using historical average dredge efficiency (Table 3) suggest that the biomass in Bream Bay was substantially lower in 2007 than the record high levels observed in 2005 and 2006. The beds in Rangaunu Bay seem more consistent between years, although the 2007 biomass estimate was the highest on record. The biomass in Spirits/Tom Bowling Bays was higher in 2007 than 2006 but remains low compared with historical levels.

Table 3: Estimated recruited biomass (at the time of surveys) of scallops of 95 mm or more shell length in various component beds of the Northland scallop fishery since 1992, assuming historical average dredge efficiency. – indicates no survey in a given year. Estimates of biomass given for 1993 are probably negatively biased, especially for Rangaunu Bay (*), by the restriction of diving to depths under 30 m, and all estimates before 1996 are negatively biased by the lack of surveys in Spirits Bay (†). Totals also include biomass from less important beds at Mangawhai, Pakiri, around the Cavalli Passage, in Great Exhibition Bay, and Tom Bowling Bay when these were surveyed. Commercial landings in each year for comparison can be seen in Table 1, wherein "Far North" landings come from beds described here as "Whangaroa", "Doubtless", and "Rangaunu".

Year	Biomass (t)					
	Bream Bay	Whangaroa	Doubtless	Rangaunu	Spirits Bay	Total
1992	1 733	–	78	766	–	3 092 †
1993	569	172	77	170 *	–	1 094 *
1994	428	66	133	871	–	1 611 †
1995	363	239	103	941	–	1 984 †
1996	239	128	32	870	3 361	5 098
1997	580	117	50	1 038	1 513	3 974
1998	18	45	37	852	608	1 654
1999	–	–	–	–	–	–
2000	–	–	–	–	–	–
2001	110	8	0	721	604	1 451
2002	553	10	–	1 027	1 094	2 900
2003	86	33	3	667	836	1 554
2004	–	–	–	–	–	–
2005	2 945	–	–	719	861	4 676
2006	5 315	–	–	1 275	261	7 539
2007	795			1 391	432	2 694

Diver surveys of scallops were conducted in June 2006 and June–July 2007 at selected scallop beds in Northland and Coromandel recreational fishing areas (Williams 2008, Williams *et al*. 2007). For the four small beds (total area of 4.35 km^2) surveyed in the Northland fishery, start-of-season biomass of scallops over 100 mm shell length was estimated to be 49.7 t greenweight (CV of 23%) or 6.2 t meatweight in 2006, and 42 t greenweight (CV of 25%) or 5 t meatweight (CV of 29%) in 2007.

4.3 Estimation of Maximum Constant Yield (MCY)

MCY is not normally estimated for scallops and, given the highly variable nature of most wild scallop fisheries, is likely to be close to zero.

4.4 Estimation of Current Annual Yield (CAY)

Management of Northland scallops is based on a CAY approach. Since 1998, catch limits have been adjusted in line with estimated start-of-season recruited biomass and an estimate of CAY made using the version of the Baranov catch equation given by Cryer & Morrison (1997).

Cryer & Morrison (1997) modelled yield-per-recruit in the Coromandel fishery, but their model was modified to incorporate growth parameters more suited to the Northland fishery and estimate reference fishing mortality rates. For an assumed rate of natural mortality of M = 0.50, $F_{0.1}$ was estimated as 0.550 and F_{MAX} as 0.700. $F_{40\%}$ was not estimated. Yield estimates based on $F_{0.1}$ should probably be preferred as targets over that based on F_{MAX} (which is usually considered a limit reference point). The following modified version of the Baranov equation given by Cryer & Morrison (1997) should be used in their application:

$$CAY = \frac{F_{ref}}{F_{ref} + \frac{7M}{12}} * [1 - e^{-(F_{ref} + \frac{7M}{12})}] * B_{jul} \qquad (1)$$

where B_{JUL} is the estimate of recruited biomass in July. Natural mortality is assumed to act in tandem with fishing mortality for the first 7 months of the year, the length of the current Northland commercial scallop season. Because of the uncertainty over biomass estimates, growth, and mortality in a given year, and appropriate reference rates of fishing mortality, yield estimates must be treated with caution. CAY estimates are derived for one scenario: the 'average outlook', which includes incidental effects on adults but excludes putative habitat effects.

Average outlook, including incidental effects on adults

The recruited biomass of scallops 100 mm in shell length or greater at the start of the 2007 season in the Northland fishery was predicted to be 1637 t (greenweight) and 208 t (meatweight) (Williams 2007) CAY was calculated using these biomass estimates and the reference fishing mortality rate $F_{0.1}$ as follows:

For $F_{0.1}$ (0.550), CAY = 0.6535 × 0.5690 × 1637 (208) = 609 t (green) or 77 t (meat)

These estimates of CAY would have a CV at least as large as that of the estimate of start-of-season recruited biomass (50–51%) are sensitive to assumptions about dredge efficiency, growth, and expected recovery of meatweight from greenweight, and relate to the surveyed beds only. The sensitivity of these yield estimates to excluding areas of low density has not been calculated, but excluding stations with scallop density less than 0.02 m^{-2} and 0.04 m^{-2} reduced the fishery-wide time of survey biomass estimate by 95 and 100%, respectively. It should be noted that these low-density exclusions were calculated before correcting for average historical dredge efficiency, so these estimates are conservative. However, even if corrections for dredge efficiency were applied and no exclusions were made, the density of scallops 100 mm or more was low in all areas of the fishery surveyed. The level of risk to the putative Northland scallop stock of fishing at the estimated CAY level cannot be determined.

4.5 Other yield estimates and stock assessment results

The estimation of Provisional Yield (PY) is no longer accepted as appropriate, and assessments since 1998 have used a CAY approach.

5. STATUS OF THE STOCKS

Estimates of current biomass for the Northland fishery are available (from a 2007 survey) but there are no estimates of reference biomass with which to compare them. A substantial increase in biomass was observed between 2003 and 2006, which resulted in the 2006 biomass estimate being the highest recorded for Northland. In 2005 and 2006, estimates of biomass were considerably higher than those in 2003 for some beds (notably Bream Bay), but similar or lower in others. There appeared to have been a "shift" in biomass away from the Far North and towards Bream Bay and Mangawhai/Pakiri

Beach. This was the "reverse" of the shift towards the Far North that occurred in the early 1990s. However, the 2007 survey results suggest the biomass in Bream Bay and Mangawhai/Pakiri has declined markedly since 2006, and, consequently, the overall fishery biomass is far lower in 2007 than in recent years.

Substantial uncertainty stemming from assumptions about dredge efficiency during the surveys, rates of growth and natural mortality between survey and season, and predicting the average recovery of meatweight from greenweight remain in these stock assessments. Future research should be aimed at reducing this uncertainty, and could include a modelling study of dredge efficiency using existing data, and more field studies of scallop growth and mortality. Managing the fisheries based on the number of recruited scallops at the start of the season as opposed to recruited biomass (the current approach) could remove the uncertainty associated with converting estimated numbers of scallops to estimated meatweight.

We do not understand the processes that have resulted in such large fluctuations in scallop abundance. To get sustainable yield from such a variable stock it is necessary to alter the catch every year. Recent management of Northland scallops has been based on a Current Annual Yield (CAY) approach using $F_{0.1}$ as an appropriate reference point, which is considered both appropriate and conservative. Annual pre-season research (dredge) surveys are required to estimate recruited biomass and for stock assessment to estimate CAY. Commercial catch limits are adjusted following a review of the survey results and stock assessment, and after consultation with fishery stakeholders.

Yield estimates, TACC, ACE, and reported landings for the 2007–08 fishing year are summarised in Table 4.

Table 4: Yield estimates, TACC, ACE, and reported landings, for the 2007–08 fishing year, for scallops SCA 1.

			2006	2007			2008
Fishstock	QMA	MCY	CAY ($F_{0.1}$)	CAY ($F_{0.1}$)	TACC	ACE	Landings
SCA 1	Northland	N/A	366	77	40	40	29

6. FOR FURTHER INFORMATION

Boyd RO., Gowing L., Reilly JL. 2004. 2000-2001 national marine recreational fishing survey: diary results and harvest estimates. Final Research Report for Ministry of Fisheries project REC2000/03. 81p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Boyd RO., Reilly JL. 2002. 1999/2000 National marine recreational fishing survey: harvest estimates. Final Research Report for Ministry of Fisheries project REC98/03. 28 p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Bradford E. 1997. Estimated recreational catches from Ministry of Fisheries North region marine recreational fishing surveys, 1993-94.

Bradford E. 1998. Harvest estimates from the 1996 national marine recreational fishing surveys.

Bull MF. 1991a. New Zealand. pp. 853–859 in Shumway S.E. (Ed) Scallops: biology, ecology and aquaculture. Developments in Aquaculture & Fisheries Science, 21. Elsevier. Amsterdam. 1095p.

Cryer M. 1994. Estimating CAY for northern commercial scallop fisheries: a technique based on estimates of biomass and catch from the Whitianga bed. New Zealand Fisheries Assessment Research Document 1994/18. 21p.

Cryer M. 2001a. Coromandel scallop stock assessment for 1999. New Zealand Fisheries Assessment Report 2001/9. 18p.

Cryer M. 2002. Northland and Coromandel scallop stock assessments for 2001. New Zealand Fisheries Assessment Report 2002/60. 21p.

Cryer M., Morrison M. 1997. Yield per recruit in northern commercial scallop fisheries: inferences from an individual-based population model and experimental estimates of incidental impacts on growth and survival. Final Report to Ministry of Fisheries on Project AKSC03. 67p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Cryer M., Parkinson DM. 1999. Dredge surveys and sampling of commercial landings in the Northland and Coromandel scallop fisheries, May 1998. NIWA Technical Report 69. 63p.

Cryer M., Parkinson DM. 2001. Dredge surveys of scallops in the Northland and Coromandel scallop fisheries, April–May 2001. Working Document for Ministry of Fisheries Shellfish Fishery Assessment Working Group Meeting June 2001. 40p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Cryer M., Parkinson DM. 2002. Dredge surveys of scallops in the Northland and Coromandel scallop fisheries, 2001. New Zealand Fisheries Assessment Report 2002/61. 25p.

Cryer M., Parkinson DM. 2004. Dredge survey and stock assessment for the Northland scallop fishery, 2003. Final Research Report to Ministry of Fisheries on Project SCA2002/02. 34p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Cryer M., Parkinson DM. 2006. Biomass surveys and stock assessments for the Coromandel and Northland scallop fisheries, 2005. New Zealand Fisheries Assessment Report. 2006/34. 54p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Morrison M. 1998. Population dynamics of the scallop, *Pecten novaezelandiae*, in the Hauraki Gulf. Unpublished PhD thesis, University of Auckland, Auckland, New Zealand. 157p.

Williams JR. 2005. Reproductive ecology of the scallop, *Pecten novaezelandiae*. Unpublished PhD thesis, University of Auckland, Auckland, New Zealand. 134p.

Williams JR. 2007. Biomass surveys and stock assessments for the Coromandel and Northland scallop fisheries, 2007. New Zealand Fisheries Assessment Report 2008/35. 41p

Williams JR. 2008. Abundance of scallops (*Pecten novaezelandiae*) in Northland and Coromandel recreational fishing areas, 2007. Final draft New Zealand Fisheries Assessment Report for Ministry of Fisheries project SCA2006/03. 23p. (Unpublished report held by Ministry of Fisheries, Wellington.)

Williams JR., Babcock RC. 2004a. Patterns of reproduction and spawning behaviour for scallops, *Pecten novaezelandiae*, in northeastern New Zealand. Journal of Shellfish Research 23: 318.

Williams JR., Babcock RC. 2004b. Comparison of multiple techniques to evaluate reproductive variability in a marine bivalve: application to the scallop *Pecten novaezelandiae*. Marine and Freshwater Research *55*: 457–468.

Williams JR., Babcock RC. 2005. Assessment of size at maturity and gonad index methods for the scallop *Pecten novaezelandiae*. New Zealand Journal of Marine and Freshwater Research 39: 851–864.

Williams JR., Tuck ID., Carbines GD. 2007. Abundance of scallops (*Pecten novaezelandiae*) in Northland and Coromandel recreational fishing areas, 2006. New Zealand Fisheries Assessment Report 2008/34

Williams JR., Tuck ID., Parkinson DM. 2006b. Biomass surveys and stock assessments for the Coromandel and Northland scallop fisheries, 2006. New Zealand Fisheries Assessment Report 2007/24.