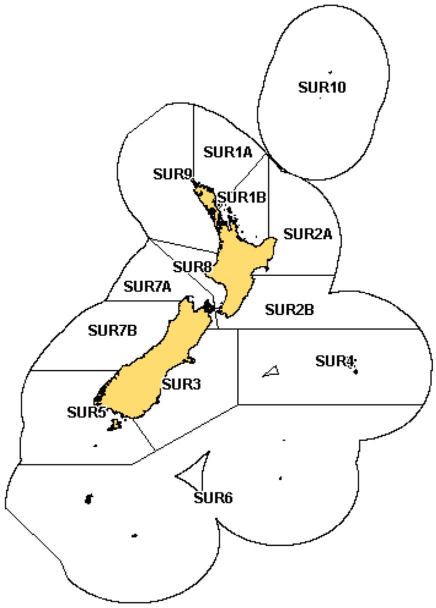
KINA (SUR)

(*Evechinus chloroticus*)



1. FISHERY SUMMARY

Kina was introduced into the Quota Management System from October 2002. Five Quota Management Areas based on the FMA's 3, 4, 5, 7A (Marlborough Sounds) and 7B (West Coast) were created, and the allowances, TACCs and TACs are summarized in Table 1.

Table 1: Recreational and Maori allowances, TACCs and TACs (t) for kina Fishstocks 3,4,5, and 7.

Fishstock	Recreational Allowance	Māori Customary Allowance	TACC	TAC
SUR 3	5	10	60	76
SUR 4	7	20	225	255
SUR 5	5	10	245	263
SUR 7A	20	80	135	238
SUR 7B	5	10	10	26

North Island Kina was introduced into the Quota Management System from October 2003. Six Quota Management Areas based on the FMA's 1A (Auckland – North), 1B (Auckland – South), 2A (Central (East –North)), 2B (Central (East – South)), 8, 9 and 10 were created, and the allowances, TACCs and TACs are summarised in Table 2.

Table 2: Recreational and Maori allowances, TACCs and TACs (t) for kina Fishstocks 1,2,8,9 and 10.

Fishstock	Recreational Allowance	Māori Customary Allowance	TACC	TAC
SUR 1A	65	65	40	172
SUR 1B	90	90	140	324
SUR 2A	60	60	80	204
SUR 2B	35	35	30	102
SUR 8	12	12	1	26
SUR 9	11	11	10	33
SUR 10	0	0	0	0

a) Commercial fisheries

Most kina are found in waters less than 10 m deep and are harvested by breath-hold diving, although about 10% of the total catch in 1998–99 was by taken by dredge in SUR 7. Some target dredging also occurs in SUR 1 and SUR 4. There is no minimum legal size for kina. Almost all of the roe harvested in this fishery is consumed on the domestic market. In 1988–89, competitive TACCs were established in the more important FMAs but not in east Northland (SUR 1) or at the Chatham Islands (SUR 4), both of which developed into productive fisheries in the 1990s (Table 3). Divers in SUR 1 have a daily catch limit of 300 kg/diver. On 1 October 1992 the Ministry of Fisheries placed a moratorium on the issue of

permits to commercially harvest kina. The kina fishery has evolved considerably since the imposition of the moratorium. Where present, the competitive TACCs have either been not caught or they are exceeded, both by wide margins. Much of the increase in catch observed in SUR 5 in the late 1980s can be attributed to an experimental fishery developed in SUR 5, between Puysegur Point and Breaksea Island. The short-lived Kina Development Programme harvested kina from Dusky Sound in 1993 under special permit.

(b) Recreational fisheries

Recreational catch was estimated in a national survey in 1996 (Fisher & Bradford, 1998; Bradford, 1998) and 2000 (Boyd & Reilly, 2004) (Table 4). There are no estimates of recreational catch from the Chatham Islands. In many instances, insufficient kina were caught to provide reliable estimates of the error associated with the estimates of total harvest. The recreational harvest estimates for 1996 are not considered reliable as estimates of total harvest but provide relative estimates between areas. The harvest estimates for 2000 are considered to be more reliable as absolute estimates with the exception SUR 2

(c) Customary fisheries

There is an important customary harvest of kina by Maori for food. Where data are available, only small catches of kina have been reported under the customary harvest provisions of the Fisheries Act 1996. In SUR 3, 5, and 7, all catches were less than 1 t per year (Table 5). These catch estimates are probably under-estimates as an unknown proportion of the kina harvested by Maori is caught outside taiapure or mataitai and not recorded as customary harvest (P. Grimshaw, Ngai Tahu Development Corporation, pers. comm.). No data are available for other regions of New Zealand (S. Kerins, Te Ohu Kai Moana, pers. comm.).

Table 3: Total reported catch (t greenweight) of kina (SUR) by FMA and fishing year by all methods and target species. The reported fishing year is the calendar year the fishing year ends. Data from 1989 and 1990 are combined from the FSU and CELR databases. – indicates no recorded catch. Data for the period 1983 to 1999 are from Andrew (2001), and have been groomed. Catch estimates for 2000 and 2001 are taken directly from MFish. * includes 133 t caught in Dusky Sound experimental fishery. Catches from SUR 6, 8, and 9 have been pooled because too few permit holders recorded catches in these FMAs to report them singly.

Year	SUR 1	SUR 1A	SUR 1B	SUR 2	SUR 2A	SUR 2B	SUR 3	SUR 4	SUR 5	SUR 6, 8, & 9	SUR 7	SUR 7A	SUR 7B	Total
1983	66.2	–	–	33.0	–	–	4.8	11.3	0.5	3.6	26.3	–	–	157
1984	81.4	–	–	180.3	–	–	14.4	4.0	0.9	0.3	55.1	–	–	342
1985	64.5	–	–	83.8	–	–	4.0	7.4	4.6	0.9	99.6	–	–	275
1986	72.0	–	–	139.1	–	–	6.2	52.7	0.2	2.0	86.6	–	–	360
1987	52.1	–	–	142.6	–	–	2.4	28.4	4.3	0.1	52.6	–	–	283
1988	22.1	–	–	154.1	–	–	1.7	76.5	2.3	–	175.6	–	–	432
1989	35.5	–	–	92.8	–	–	0.8	216.6	19.0	1.5	6.2	–	–	372
1990	10.0	–	–	282.4	–	–	4.1	190.0	13.4	6.5	41.5	–	–	548
1991	71.5	–	–	87.2	–	–	21.3	35.3	166.9	4.4	56.3	–	–	443
1992	78.7	–	–	37.3	–	–	15.8	192.9	272.2	5.0	114.4	–	–	717
1993	89.7	–	–	170.4	–	–	9.9	21.8	*530.3	–	210.2	–	–	1032
1994	150.7	–	–	176.7	–	–	8.8	55.3	327.2	2.3	98.2	–	–	820
1995	155.9	–	–	129.7	–	–	7.1	100.7	342.9	89.5	149.0	–	–	975
1996	174.5	–	–	41.2	–	–	6.0	99.5	446.4	0.1	142.2	–	–	910
1997	161.6	–	–	49.9	–	–	5.4	225.7	171.6	0.2	121.7	–	–	736
1998	134.8	–	–	36.5	–	–	3.8	303.1	91.2	1.4	144.7	–	–	716
1999	201.4	–	–	20.2	–	–	38.4	168.2	120.6	0.5	113.9	–	–	663
2000	297.4	–	–	14.5	–	–	50.4	396.5	106.3	0.1	87.9	–	–	956
2001	184.5	–	–	11.4	–	–	11.2	472.6	69.8	3.1	80.1	–	–	832
2001–02	237.0	–	–	3.0	–	–	5.2	368.0	184.9	–	31.7	–	–	829.7
2002–03	211.2	–	–	30.4	–	–	0.3	167.3	132.5	0.9	1.3	63.2	0	607.4
2003–04	1.7	26.9	111.0	0	14.5	4.6	0.3	114.8	199.1	3.8	0	85.4	0	562.3
2004-05	–	20.9	131.1	–	6.5	1.4	.5	91.7	350.4	.9	–	101.3	–	704.7
2005-06	–	41.0	138.6	–	22.1	0.2	<0.1	70.2	473.0	4.0	–	72.1	5.3	826.5

Table 4: Recreational harvest of kina for 1993–94 and 1996. CV's are indicated only for those samples with adequate sample sizes. Data compiled from Bradford (1996, 1998) and Fisher & Bradford (1998).

Year	Area	Number of kina (x 1,000)	CV (%)	Catch (t)*
1993–94	East Northland	109	60	27.1
1993–94	Hauraki Gulf	14	–	3.5
1993–94	Bay of Plenty	648	49	160.9
1993–94	SUR 1	801	41	198.9
1993–94	SUR 9	30	72	7.4
1996	SUR 1	316	24	78.5
1996	SUR 2	61	–	15.1
1996	SUR 3	12	–	3.0
1996	SUR 5	20	–	5.0
1996	SUR 7	2	–	0.5
1996	SUR 8	43	–	10.7
1996	SUR 9	30	–	7.4
2000	SUR 1	1 793	35	445.2
2000	SUR 2	1 026	57	254.7
2000	SUR 3	8	58	2.0
2000	SUR 5	70	101	17.4
2000	SUR 7	2	101	0.5
2000	SUR 8	85	85	21.1
2000	SUR 9	82	67	20.4

- Catches in numbers have been converted to catch in tonnes by assuming an average whole weight of 248.3 g per kina. In the absence of size-specific catch statistics, a parsimonious conversion assumes kina are caught in equal proportion across a size range of 60 to 110 mm TD. The lower size in this range is approximately the size-at-maturity (see Barker, 2001) and the upper size is close to maximum harvested size. Weight-at-size was calculated using a test diameter-weight relationship ($W = (6.27x10^{-4})TD^{2.88}$) derived for kina of 60–110 mm TD from Dusky Sound (n = 1063, unpublished data). The estimates of total catch in tonnes should be considered as indicative only.

Table 5: Reported customary catch by FMA for SUR 3, 5, and 7. Data as numbers caught supplied by Ngai Tahu Development Corporation. Catch in kg was estimated using the same conversion rules as described in Table 2.

Year	SUR	Count	Weight (kg)
1998–99	3	100	25
	5	1522	433
	7	0	0
1999–00	3	0	0
	5	1631	405
	7	0	0

(d) Illegal catch

Current levels of illegal harvest are not known.

(e) Other sources of mortality

Although there is no minimum legal size for kina, some incidental mortality is likely because roe quality (recovery rate and colour) is commonly assessed by opening 'test' kina underwater. These animals are not subsequently landed. There are no estimates of the magnitude to this incidental mortality.

2. BIOLOGY

The biology and ecology of kina has been extensively studied; this literature has most recently been reviewed by Barker (2001). *Evechinus chloroticus* is found throughout New Zealand the sub Antarctic Islands. Kina has an annual reproductive cycle which culminates in spawning between November and March (Dix, 1970; Walker 1982; McShane et al., 1994, 1996; Lamare & Stewart, 1997; Lamare, 1998). Size at maturity appears to vary considerably and may be as small as 30 mm and as large as 75 mm TD (Dix, 1970; Barker et al., 1998). In Dusky Sound, kina are reproductively mature at 50–60 mm T.D. (McShane et al., 1996). Within these seemingly consistent patterns in the seasonality of the reproductive cycle there are many differences in the gonad size at small spatial scales.

Settlement is likely to be sporadic among years and appears to differ among locations and habitats (Dix, 1972; Walker, 1995). Few small kina were observed in any of the surveys in Dusky Sound (McShane et al., 1993). These results suggest that the productivity of stocks in Fiordland may be low and that recruitment over-fishing is a real possibility. Overall, there is very little knowledge of the processes that limit the settlement and recruitment of kina.

There is relatively little information available on the interactions between kina, its predators and competitors. Although a wide range of fish and invertebrates eat kina, there is limited evidence that these species control or limit populations of kina in Fiordland. Recent work in a marine reserve, where large predators such as reef fishes and crayfish are abundant, indicates that predators can control numbers of kina surviving the transition from crevice-bound to open substratum grazing (Cole & Keuskamp, 1998; Babcock et al., 1999). Babcock et al. (1999) have drawn a direct link between the increases in snapper and crayfish populations and the long-term decline in kina populations in the Leigh Marine Reserve. There is however, no evidence that high kina densities limit rock lobster populations (Andrew & MacDiarmid, 1991). It is likely, however, that changes in the abundance of kina, and the consequent changes in habitat representation, are part of a complex set of interacting processes, including but not exclusively, increased predation.

Kina compete with a range of invertebrate herbivores, including paua. There is no published evidence that high densities of kina limit paua populations in Fiordland. McShane (1997) reported that paua are abundant in Dusky Sound, and in Chalky and Preservation Inlets, but are rare in the fjords.

Lamare and Mladenov (2000) estimate that kina grow 8–10 mm in their first year of life. Growth rates will vary considerably depending on local conditions but kina may take 8–9 years to reach 100 mm TD, and very large individuals may reach ages of 20+ years (McShane & Anderson, 1997; Lamare & Mladenov, 2000).

3. STOCKS AND AREAS

There appear to be few genetic differences in kina populations from Leigh (North Auckland) and Stewart Island (Mladenov et al., 1997) which suggests that there is at least some mixing among populations. There is no direct evidence that populations of kina at the Chatham Islands differ genetically from those on the mainland, nor is there evidence that ‘populations’ of kina at the Chatham Islands are dependent on dispersal of larvae from the mainland

4. STOCK ASSESSMENT

Although there is a wealth of information on the biology and ecology of this species (see Barker, 2001 for reviews), there is relatively little that can be used to assess the status of exploited stocks. There have been no assessments of sustainable yield nor are there estimates of biomass or trends in relative abundance for any Fishstock (Annala, 1995).

(a) Estimates of fishery parameters and abundance

Andrew (2001) reported catch rates from both dive and dredge fisheries but cautioned the interpretation of catch rate information of sedentary invertebrates, like kina, gathered at broad spatial scales.

Indices of relative abundance using timed swims have been reported for Ariel Reef in SUR 2 (Anderson & Stewart 1993), Chatham Islands (Schiel et al., 1995; Naylor & Andrew, 2002), and D’Urville Island and Arapawa Island in SUR 7 (McShane et al., 1994). Numerous surveys of kina have been done over the last 30 years in fished areas, mostly by university-based researchers (e.g., Dix, 1970; Choat & Schiel, 1982; Schiel et al., 1995; Cole & Keuskamp, 1998; Babcock et al., 1999; Wing et al., 2001). Andrew and Naylor (2002) reported a range of densities for kina around Chatham Island at $0.17/m^2$ (northwest Chatham Island) to $1.6/m^2$ (south east Chatham Island). These were generally lower than estimates made in the mid 1990's by Schiel et al. (1995) ($0.2/m^2$ to $6/m^2$). By contrast, lower kina densities of around $0.1/m^2$ were reported by McShane et al. (1994) for both Arapawa and D'Urville Island. Dix (1970) reported much higher mean relatively high densities of kina ranging from $2.2/m^2$ in Queen Charlotte Sound to $6/m^2$ at Kaikoura.

(b) Biomass estimates

McShane & Naylor (1993) reported biomass estimates of 2500 and 500 t respectively for D'Urville and Arapawa Islands (SUR 7), presumably based on an expansion of density estimates reported in McShane et al. (1994) by an area estimate, however, the methods are not detailed.

Biomass has been estimated for Dusky Sound and Chalky Inlet (SUR 5) prior to Dusky Sound being opened as an experimental fishery in May 1993 (McShane & Naylor, 1991, 1993). Productivity and biomass was to be estimated by depletion methods but this was unsuccessful because only 133 t of the projected 1000 t was caught (McShane et al., 1994b) and this catch was insufficient to cause a measurable change in the estimated biomass of kina.

(d) Estimation of Maximum Constant Yield (MCY)

MCY has not been estimated for any SUR fishstock. Within SUR 5, MCY estimate of sustainable yield within Dusky Sound and Chalky Inlet was reported in Annala (1995). This estimate used Method 1 of Annala (1995) for new fisheries based on surveys done by McShane & Naylor (1991, 1993) and an estimate of a reference fishing mortality derived from McShane et al. (1994a). The estimated annual sustainable yield of 275 t for these two areas has never been harvested because they are closed to commercial fishing except under special permit.

(e) Estimation of Current Annual Yield (CAY)

CAY has not been estimated for any SUR fishstock.

5. STATUS OF THE STOCKS

For all Fishstocks it is not known if current catch levels or proposed TACCs are sustainable, or if they are at levels which will allow the stocks to move towards a size that will support sustainable yields.

Table 6: Summary of TACCs (t), and reported landings (t) of kina for the most recent fishing year.

Fishstock	QMA		2005-06 Actual TACC (t)	2005-06 Reported landings (t)
SUR 1A	Auckland (East - North)	1	40	41.0
SUR 1B	Auckland (East - South)	1	140	138.6
SUR 2A	Central (East - North)	2	80	22.1
SUR 2B	Central (East - South)	2	30	0.2
SUR 3	South-east (Coast)	3	21	<0.1
SUR 4	South-east (Chatham),	4	225	70.2
SUR 5	Southland	5	455	473.0
SUR 6, 8 & 9	Sub-Antarctic, Central (West), Auckland (West)	6, 8 & 9	No TACC, 1 & 10	4.0
SUR 7A	Challenger (North)	7	135	72.1
SUR 7B	Challenger (South)	7	10	5.3
Total				826.5

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