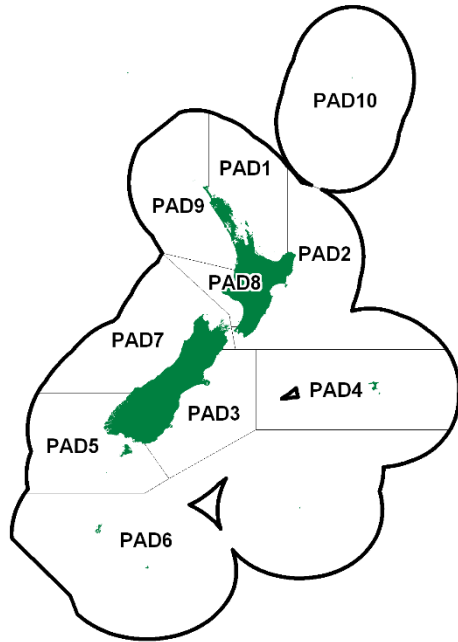


PADDLE CRABS (PAD)

(Ovalipes catharus)
Papaka



1. FISHERY SUMMARY

1.1 Commercial fisheries

Paddlecrabs were introduced into the QMS from 1 October 2002 with recreational and customary non-commercial allowances, TACCs and TACs summarised in Table 1.

Table 1: Recreational and Customary non-commercial allowances, TACCs and TACs for paddle crabs, by Fishstock.

Fishstock	Recreational Allowance	Customary non-Commercial Allowance	TACC	TAC
PAD 1	20	10	220	250
PAD 2	10	5	110	125
PAD 3	8	2	100	110
PAD 4	4	1	25	30
PAD 5	4	1	50	55
PAD 6	0	0	0	0
PAD 7	4	1	100	105
PAD 8	4	1	60	65
PAD 9	20	10	100	130
PAD 10	0	0	0	0

Commercial interest in paddle crabs was first realised in New Zealand in 1977–78 when good numbers of large crabs were caught off Westshore Beach, Napier in baited lift and set-pots. Annual catches have varied, mainly due to marketing problems, and estimates are likely to be conservative. Landings increased in the early fishery, from 775 kg in 1977 to 306 t in 1985, and 403 t in 1995–96 but have since generally decreased. Paddle crabs are known to be discarded from inshore trawl operations targeting species such as flatfish, and this may have resulted in under-reporting of catches. Crabs are marketed live, as whole cooked crabs, or as crab meat. Attempts were made to establish a soft-shelled crab industry in New Zealand in the late 1980s.

Bycatch is commonly taken during trawl, dredge and setnetting operations. Catch rates vary considerably with method, season and area, and there is no clear seasonal trend to paddle crab landings. It is likely that catches are related to the availability of fishers and/or market demands. Commercial landings from 1989–90 until the present are shown in Table 2, while Figure 1 shows the historical landings and TACC for the six main PAD stocks.

PADDLE CRABS (PAD)

Table 2: Reported landings (t) of paddle crabs by QMA and fishing year, from CLR and CELR_{landed} data from 1989–90 to present.

QMA	PAD 1		PAD 2		PAD 3		PAD 4		PAD 5	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1989–90	20	-	57	-	38	-	<1	-	<1	-
1990–91	34	-	37	-	26	-	0	-	6	-
1991–92	96	-	32	-	31	-	<1	-	<1	-
1992–93	175	-	14	-	36	-	0	-	<1	-
1993–94	277	-	18	-	46	-	0	-	<1	-
1994–95	237	-	6	-	36	-	<1	-	<1	-
1995–96	183	-	5	-	18	-	<1	-	1	-
1996–97	165	-	25	-	36	-	0	-	1	-
1997–98	158	-	126	-	18	-	<1	-	13	-
1998–99	195	-	197	-	21	-	<1	-	2	-
1999–00	265	-	21	-	27	-	1	-	14	-
2000–01	32	-	10	-	17	-	0	-	0	-
2001–02	221	-	34	-	22	-	0	-	2	-
2002–03	145	220	65	110	18	100	<1	25	<1	50
2003–04	239	220	46	110	20	100	0	25	0	50
2004–05	163	220	44	110	30	100	0	25	0	50
2005–06	109	220	49	110	11	100	0	25	<1	50
2006–07	53	220	21	110	13	100	0	25	3	50
2007–08	86	220	9	110	19	100	0	25	<1	50
2008–09	36	220	14	110	37	100	0	25	1	50
2009–10	35	220	17	110	37	100	0	25	<1	50
2010–11	49	220	18	110	47	100	0	25	<1	50
2011–12	12	220	41	110	47	100	<1	25	<1	50
2012–13	<1	220	36	110	39	100	<1	25	<1	50
2013–14	3	220	6	110	74	100	1	25	<1	50
2014–15	23	220	1	110	45	100	0	25	<1	50
2015–16	69	220	6	110	48	100	0	25	<1	50

QMA	PAD 6		PAD 7		PAD 8		PAD 9		PAD 10	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1989–90	0	-	94	-	22	-	0	-	0	-
1990–91	0	-	68	-	12	-	0	-	0	-
1991–92	0	-	83	-	21	-	0	-	0	-
1992–93	0	-	59	-	24	-	0	-	0	-
1993–94	0	-	49	-	27	-	5	-	0	-
1994–95	0	-	71	-	46	-	<1	-	0	-
1995–96	55	-	82	-	58	-	<1	-	<1	-
1996–97	25	-	106	-	44	-	<1	-	1	-
1997–98	7	-	63	-	25	-	<1	-	<1	-
1998–99	10	-	59	-	34	-	0	-	1	-
1999–00	14	-	45	-	50	-	0	-	<1	-
2000–01	0	-	0	-	<1	-	0	-	0	-
2001–02	22	-	33	-	24	-	0	-	0	-
2002–03	<1	0	42	100	11	60	0	100	0	0
2003–04	0	0	50	100	17	60	<1	100	0	0
2004–05	0	0	40	100	14	60	1	100	0	0
2005–06	0	0	48	100	14	60	1	100	0	0
2006–07	0	0	32	100	11	60	<1	100	0	0
2007–08	0	0	47	100	7	60	0	100	0	0
2008–09	0	0	35	100	11	60	<1	100	0	0
2009–10	0	0	17	100	13	60	0	100	0	0
2010–11	0	0	11	100	14	60	0	100	0	0
2011–12	0	0	7	100	14	60	<1	100	0	0
2012–13	0	0	11	100	17	60	0	100	0	0
2013–14	0	0	4	100	13	60	0	100	0	0
2014–15	0	0	0	100	1	60	0	100	0	0
2015–16	0	0	0	100	4	60	<1	100	0	0

PADDLE CRABS (PAD)

QMA	Total		QMA	Total	
	Landings	TACC		Landings	TACC
1989-90	231	-	2002-03	281	765
1990-91	183	-	2003-04	372	765
1991-92	264	-	2004-05	292	765
1992-93	308	-	2005-06	232	765
1993-94	423	-	2006-07	132	765
1994-95	397	-	2007-08	168	765
1995-96	403	-	2008-09	134	765
1996-97	403	-	2009-10	120	765
1997-98	410	-	2010-11	140	765
1998-99	519	-	2011-12	121	765
1999-00	437	-	2012-13	103	765
2000-01	59	-	2013-14	101	765
2001-02	358	-	2014-15	71	765
			2015-16	127	765

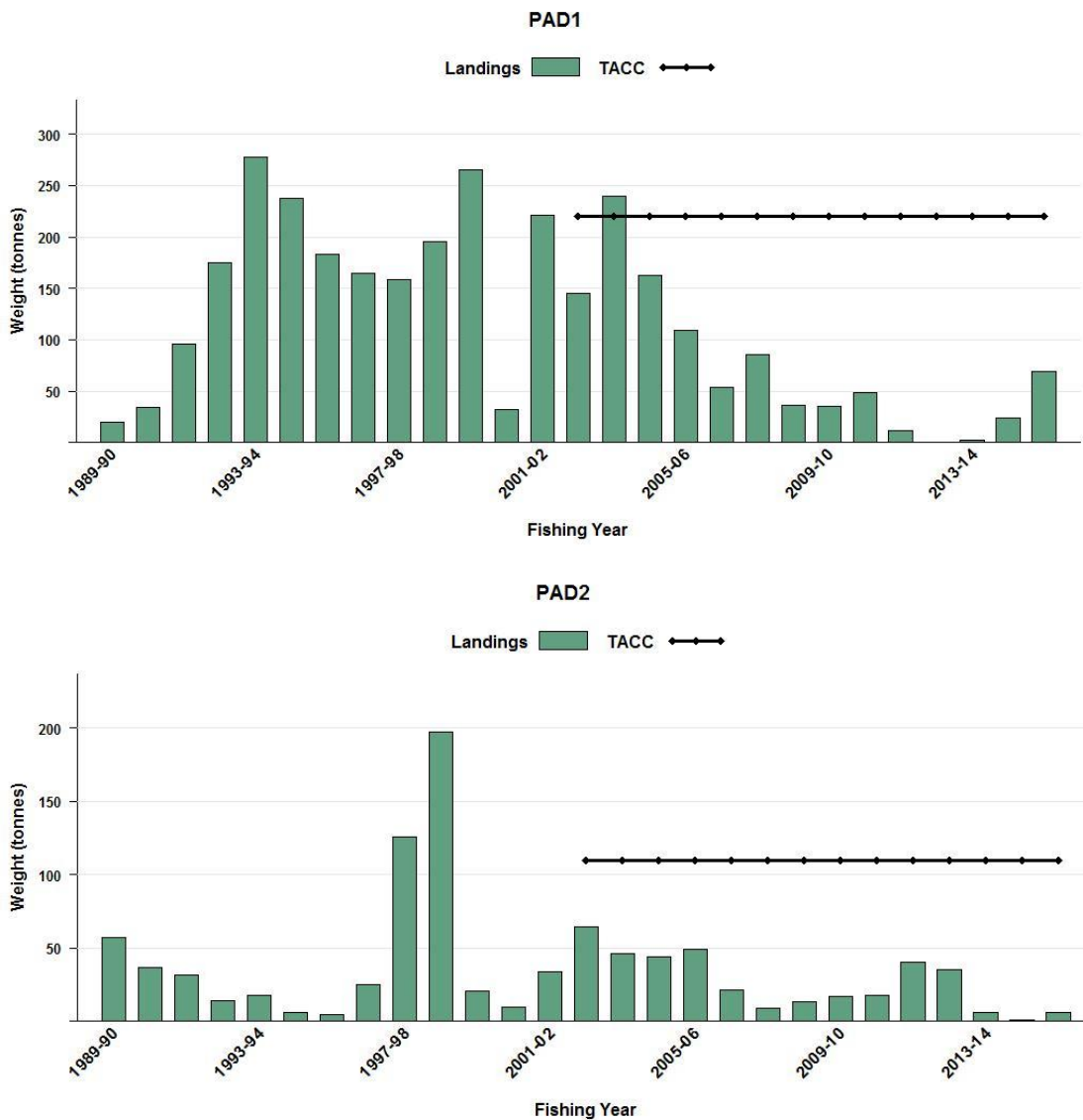


Figure 1 [Continued next page]: Reported commercial landings and TACCs for the six main PAD stocks. From top to bottom: PAD 1 (Auckland East), PAD 2 (Central East).

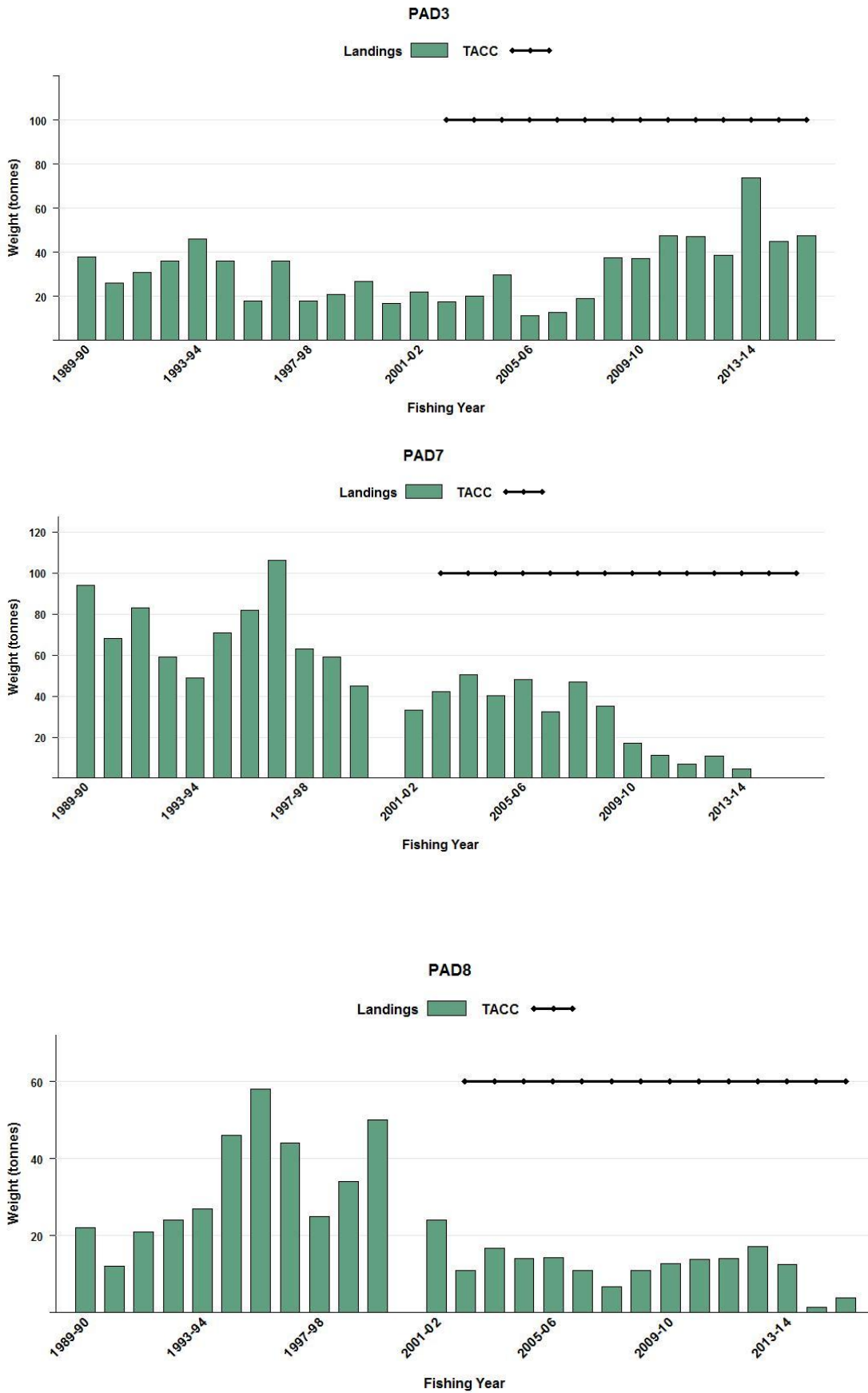


Figure 1 [Continued]: Reported commercial landings and TACCs for the six main PAD stocks. From top to bottom: PAD 3 (south East Coast), PAD 5 (Southland), PAD 7 (Challenger), and PAD 8 (Central Egmont).

PADDLE CRABS (PAD)

1.2 Recreational fisheries

Indicative data from the 1996 National Marine Recreational Fishing Survey show that paddle crabs are seldom caught by recreational fishers (NIWA unpublished). Paddle crabs are taken as a bycatch of beach and estuarine seining and in setnets throughout much of their geographical range.

1.3 Customary non-commercial fisheries

There is no quantitative information on the current level of customary non-commercial catch.

1.4 Illegal catch

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

1.5 Other sources of mortality

There is no quantitative information available on other sources of mortality, although unknown quantities of paddle crabs have been discarded from commercial fishing operations such as the inshore trawl, setnet and dredge fisheries.

2. BIOLOGY

The paddle crab is found off sandy beaches, and in harbours and estuaries throughout mainland New Zealand, the Chatham Islands, and east and south Australia. They are abundant from the intertidal zone to at least 10 m depth, although they do occur in much deeper water. Paddle crabs are mainly active in early evening or at night, when they move into the shallow intertidal zone to feed.

Paddle crabs are versatile and opportunistic predators. They feed mainly on either molluscs or crustaceans, but also on polychaetes, several fish species, cumaceans, and occasionally on algae. A high proportion of the molluscs eaten are *Paphies* species. These include: tuatua (*P. subtriangulata*); pipi (*P. australis*); and toheroa (*P. ventricosa*). The burrowing ghost shrimp *Callinassa filholi*, isopods and amphipods are important crustacean prey items. Cannibalism is common, particularly on small crabs and during the winter moulting season.

Anecdotal information suggests there has been a significant increase in paddle crab numbers since the 1970s. Concern has been expressed as to the impact of an increased number of paddle crabs on bivalve shellfish stocks in coastal waters. Feeding studies have shown that although paddle crabs do eat large adult toheroa and other shellfish, they more usually eat bivalve shellfish spat which are found in abundance.

Mating generally occurs during winter and spring (May to November) in sheltered inshore waters. Female paddle crabs can only mate when they are soft-shelled. Male crabs protect and carry pre-moult females to ensure copulation. Female crabs are thought to migrate to deeper water to spawn over the warmer months (September to March). After spawning the eggs are incubated until they hatch. *Ovalipes catharus* has an extended larval life characterised by eight zoea stages and a (crab-like) megalopa. The larvae are thought to live offshore in deeper water, migrating inshore in the megalopa stage to settle from January to May.

Two spawning mechanisms have been observed in *O. catharus*. In Wellington, Tasman Bay, and Canterbury, spawning does not appear to be synchronised and females may spawn several times during the season (non-synchronous spawning). In Blueskin Bay, Otago, paddle crabs are group-synchronous, with one clutch of eggs developing to maturity over winter, and spawned from September to February.

Annual fecundity is determined by the number of eggs per brood (brood fecundity) and the number of broods per year. Both these parameters are size dependent and highly variable. Brood fecundity estimates vary considerably geographically from between 82 000–638 000 in Wellington waters, to 100 000–1 200 000 in Canterbury waters, and 931 000–2 122 807 in Otago waters. The number of broods per year also varies geographically from 1.2–3.3 in Wellington waters, to 1.2–2.2 in Canterbury waters, and 1 brood per year in Otago waters (group synchronous spawning).

O. catharus is a relatively large and fast growing species of *Ovalipes*. In Canterbury waters, paddle crabs reach a maximum size of 130 mm carapace width (CW - males only) after 13 postlarval moults and 3 to 4 years after settlement. Other studies have reported maximum sizes up to 150 mm CW. In Wellington

waters, crabs of approximately 100 mm carapace width, of either sex, would be at least 3 years old, while larger crabs could be 4 or 5 years old.

The differences in growth rate, size at first maturity, and fecundity (particularly the number of broods) appear to be largely environmentally regulated. At lower temperatures and higher latitudes, paddle crabs grow slower, mature at a larger size, have a shorter breeding season, and produce fewer broods per year.

Estimates of biological parameters relevant to stock assessment are presented in Table 3.

Table 3: Estimates of biological parameters.

Fishstock	Estimate		Source		
<u>1. Natural mortality (females only)</u>					
(Percentage mortality at each instar stage)					
Instar	Tasman Bay (QMA 7)	Canterbury (QMA 3)			
8	15.3	15.0	Osborne (1987)		
9	31.2	30.0			
10 (68–75 mm CW)	78.1	39.1			
11	30.7	38.9			
12	55.6	18.2			
13 (> 100 mm CW)	100	100			
<u>2. $\log_{10}(\text{weight}) = a + b * \log_{10}(\text{CW})$ (carapace width)</u>					
	Females		Males		
Canterbury (QMA 3)	a	b	a	b	Davidson & Marsden (1987)
	-3.32	2.79	-3.46	2.89	

3. STOCKS AND AREAS

It is not known whether biologically distinct stocks occur, although this seems unlikely given that the species is found throughout New Zealand waters, and from tagging experiments, appears to be highly migratory. There is probably also widespread larval dispersal as larvae spend two months offshore in deeper water (to at least 700 m). Genetically distinct populations may occur in isolated areas such as the Chatham Islands.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

None are available at present.

4.2 Biomass estimates

No estimates of current or virgin biomass are available. The landings, CPUE, and area data are considered too unreliable or incomplete to allow modelling.

4.3 Yield estimates and projections

MCY cannot be estimated.

CAY cannot be estimated because of the lack of current biomass estimates.

5. STATUS OF THE STOCKS

Estimates of current and reference biomass are not available. Landings have fluctuated significantly in most QMAs, mainly due to market variations. Paddle crabs are abundant throughout most of their range and the fishery is probably only lightly exploited.

PADDLE CRABS (PAD)

6. FOR FURTHER INFORMATION

- Armstrong, J H (1985) Aspects of the biology of the swimming crab, *Ovalipes catharus* (White, 1843) in the Otago region. Unpublished MSc thesis, University of Otago, Dunedin.
- Clark, M R (1978) Aspects of the population biology of the swimming crab *Ovalipes catharus* (White, 1843) (Crustacea; Decapoda; Portunidae) in the Plimmerton Area, Wellington. Unpublished BSc (Hons). Zoology Department, Victoria University, Wellington. 115 p.
- Davidson, R J (1987) Natural food and predatory activity of the paddle crab, *Ovalipes catharus*. Unpublished MSc thesis. Zoology Department, University of Canterbury, Christchurch, New Zealand. 110 p.
- Davidson, R J; Marsden, I D (1987) Size relationships and relative growth of the New Zealand swimming crab *Ovalipes catharus* (White, 1983). *Journal of Crustacean Biology* 7: 308–317.
- Haddon, M (1988) Impact of paddle crabs on shellfish. *Catch* 15: 9–11.
- Kung, H T (1973) Some aspects of the biology of the swimming crab *Ovalipes catharus* (White, 1843) in Paremata Harbour, New Zealand. Unpublished MSc thesis, Victoria University, Wellington.
- McLay, C L (1988) Brachyura and crab-like Anomura of New Zealand. Leigh Laboratory Bulletin No: 22, University of Auckland. 463 p.
- NZFIB (1996) The New Zealand seafood industry economic review 1994–1996. New Zealand Fishing Industry Board, Wellington. 65 p.
- Osborne, T A (1987) Life history and population biology of the paddle crab, *Ovalipes catharus*. Unpublished PhD thesis. Zoology Department, University of Canterbury, Christchurch, New Zealand. 156 p.
- Stead, D (1983) Paddle crab investigations. *Catch* 10: 14–15.
- Stead, D (1984) Crab fishery expansion possible. *Catch* 11: 13–14.
- Stevens, D W (1999) A summary of biology and commercial landings and a stock assessment of paddle crabs *Ovalipes catharus* White, 1843 (Crustacea, Portunidae) in New Zealand waters. New Zealand Fisheries Assessment Research Document 1999/18. 26 p. (Unpublished document held by NIWA library, Wellington.)
- Wear, R G (1988a) Paddle crab fishery has potential in New Zealand. *Catch* 15: 11 p.
- Wear, R G (1988b) Paddle crabs eat small shellfish. *Catch* 15: 12–13.
- Wear, R G; Haddon, M (1987) Natural diet of the crab *Ovalipes catharus* (Crustacea, Portunidae) around central and northern New Zealand. *Marine Ecology (Progress series)* 35: 39–49.