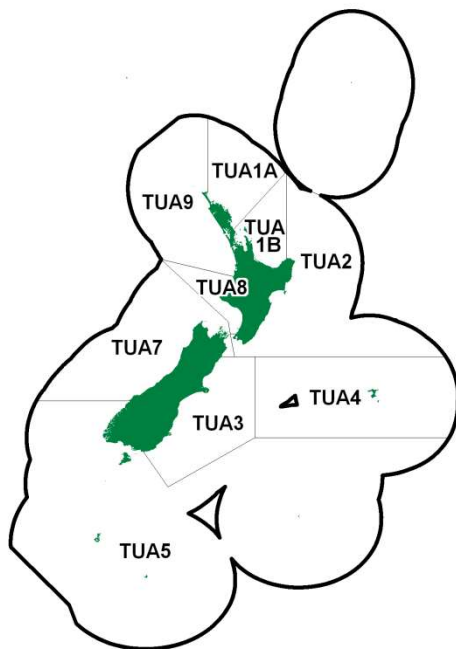


TUATUA (TUA)

(Paphies subtriangulata)

Tuatua



1. FISHERY SUMMARY

Tuatua (*Paphies subtriangulata*) were introduced into the QMS on 1 October 2005. The fishing year runs from 1 October to 30 September, and commercial catches are measured in greenweight. In October 2005 all TUA QMAs were allocated customary, recreational, and other sources of mortality allowances; and a TACC was introduced for TUA 9. A breakdown of each QMA TAC is listed in Table 1.

1.1 Commercial fisheries

QMA boundaries for tuatua were set the same as those established for FMAs, except for FMA 1 (the area between North Cape and Cape Runaway), which was divided into two QMAs, TUA 1A and TUA 1B, on either side of Te Arai Point (Pakiri Beach). The formerly specified historic commercial areas within TUA 1B (Papamoa domain to Maketu Beach, Bay of Plenty) and TUA 9 (i.e., Ninety Mile Beach, Hokianga Harbour to Maunganui Bluff, and specific areas between Maunganui Bluff to the North Head of the Kaipara Harbour) were revoked, and regulations were amended to remove the commercial daily catch limits for tuatua, which were no longer applicable. Commercial fishing was allowed to continue only in TUA 9 in the specified commercial area of the Kaipara Harbour entrance. A TACC of 43 t, which reflected the average of the reported landings taken from the Kaipara fishery between 1990–91 and 2003–04, was allocated to the TUA 9 stock in recognition that commercial tuatua fishing was constrained to the Kaipara Harbour entrance.

There is no minimum legal size (MLS) for tuatua, although fishers probably favour large individuals. Tuatua are available for harvest year-round, so there is no apparent seasonality in the fishery. Significant landings since 1989–90 have been reported from TUA 9 only (Table 2), and there have been no reported landings from TUA 5, TUA 6, and TUA 8. Landings from TUA 9 reached a peak of 192 t in 1997–98, and subsequently decreased, ranging from 4 to 76 t (average 32 t) between 1998–99 and 2003–04. This decline in commercial catches from the Kaipara bed is probably related to historic participants retiring from the fishery. The commercial effort had greatly reduced by 1992, post moratorium implementation, and catches were then influenced by the fact that commercial fishing is intermittent with only one or two fishers involved. No landings were reported from TUA 9 for 2004–05 to 2010–11. Since 2011–12 landings have fluctuated, exceeding 5 t in 2012–13 and 2015–16, but dropping to 0.6 t in 2016–17. There have been minimal landings reported since 2017–18.

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Table 1: Current Total allowable catches (TAC, t) allowances for customary fishing, recreational fishing, and other sources of mortality (t) and Total Allowable Commercial Catches (TACC, t) for tuatua.

Fishstock	TAC	Customary	Recreational	Other Mortality	TACC
TUA 1A	84	40	40	4	0
TUA 1B	126	60	60	6	0
TUA 2	7	3	3	1	0
TUA 3	7	3	3	1	0
TUA 4	3	1	1	1	0
TUA 5	3	1	1	1	0
TUA 7	3	1	1	1	0
TUA 8	5	2	2	1	0
TUA 9	102	26	26	7	43

Table 2: Reported landings (t) of tuatua (*Paphies subtriangulata*) by Fishstock since 1989–90. Data up to 2003–04 taken from page 163 of MFish’s Initial Position Paper (IPP), dated 31 March 2005, data since from CELR and CLR (early CELR and CLR data erroneously record commercial landings from FMA 9 as FMA 1 because permit holders were not filling in the forms correctly). There have been no reported landings of tuatua in TUA 1B, TUA 2, TUA 5, TUA 6, and TUA 8.

Year	TUA 1	TUA 1A	TUA 3	TUA 4	TUA 7	TUA 9	Total	TACC
1989–90	0	-	0	0	0	69.015	69.015	-
1990–91	0	-	0	0	0.176	68.245	68.421	-
1991–92	0	-	0	0	1.667	82.002	83.669	-
1992–93	0	-	0	0	0.891	109.280	110.171	-
1993–94	0	-	0.042	0	0	177.165	177.207	-
1994–95	0	-	0	0	0	182.262	182.262	-
1995–96	0	-	0	0	0	100.016	100.016	-
1996–97	0	-	0.125	0	0.005	68.575	68.705	-
1997–98	0	-	0.184	0	0	192.262	192.446	-
1998–99	0	-	0	0	0	76.205	76.205	-
1999–00	0	-	0	0	0	44.450	44.450	-
2000–01	0	-	0	0	0	16.150	16.150	-
2001–02	0	-	0	0	0	4.900	4.900	-
2002–03	0	-	0	0	0	36.160	36.160	-
2003–04	0	-	0.054	0	0	34.336	34.390	-
2004–05	0	-	0	0	0	0	0	-
2005–06	-	0	0	0	0	0	0	43
2006–07	-	0	0	0	0	0	0	43
2007–08	-	0	0	0	0	0	0	43
2008–09	-	0	0	0	0	0	0	43
2009–10	-	0	0	0	0	0	0	43
2010–11	-	0	0	0	0	0	0	43
2011–12	-	0	0	0	0	4.881	4.881	43
2012–13	-	0	0	0	0	5.294	5.294	43
2013–14	-	0	0	0.02	0	0	0.02	43
2014–15	-	0.012	0	0	0	1.801	1.801	43
2015–16	-	0	0	0	0	5.939	5.939	43
2016–17	-	0	0	0	0	0.58	0.58	43
2017–18	-	0	0	0	0	0	0	43
2018–19	-	0	0.004	0	0	0	0.004	43
2019–20	-	0	0.001	0	0	0	0.001	43
2020–21	-	0	0	0	0	0	0	43

1.2 Recreational fisheries

Tuatua support an extensive recreational fishery, with harvesting occurring in all stocks wherever there are accessible beds, particularly in the upper North Island. Tuatua are harvested entirely by hand gathering, and there is no MLS (although large tuatua are preferred). There is a recreational daily catch limit of 150 tuatua per person, except in the Auckland - Coromandel region where the limit has been 50 per day per person since November 1999.

The harvest estimates provided by telephone-diary surveys between 1993 and 2001 are no longer considered reliable for various reasons but a more reliable National Panel Survey was conducted for the first time throughout the 2011–12 fishing year. The panel survey used face-to-face interviews of a random sample of 30 390 New Zealand households to recruit a panel of fishers and non-fishers for a full year. The panel members were contacted regularly about their fishing activities and harvest information collected in standardised phone interviews. The panel survey was repeated in 2017–18 (Wynne-Jones et al. 2019). Harvest estimates (in numbers of tuatua) are given in Table 3 (from Wynne-Jones et al. 2014 and Wynne-Jones et al. 2019).

Table 3: Recreational harvest estimates for tuatua stocks from the national panel survey in 2011–12 (Wynne-Jones et al. 2014) and 2017–18 (Wynne-Jones et al. 2019). Mean weights were not available from boat ramp surveys to convert these estimates to weights.

Stock	Number of tuatua	CV
2011–12 (national panel survey)		
TUA 1A	297 826	0.45
TUA 1B	267 380	0.52
TUA 2	14 222	0.84
TUA 3	2 102	0.77
TUA 7	14 503	0.88
TUA 8	42 608	0.47
TUA 9	231 109	0.49
TUA total	869 751	0.26
2017–18 (national panel survey)		
TUA 1A	31 059	0.72
TUA 1B	249 308	0.57
TUA 2	9 205	0.78
TUA 3	11 439	0.71
TUA 5	10 629	1.00
TUA 7	3 020	1.01
TUA 8	29 998	0.72
TUA 9	219 744	0.40
TUA total	564 401	

1.3 Customary non-commercial fisheries

In common with many other intertidal shellfish, tuatua are an important customary species taken as kaimoana. Both oral tradition and the numerous middens of *P. triangulata* shells around the coastline clearly show that this fishery has been an important one to Maori for at least several hundred years.

Māori customary fishers utilise the provisions under both the recreational fishing regulations and the various customary regulations. Many tangata whenua harvest tuatua under their recreational allowance and these are not included in records of customary catch. Customary reporting requirements vary around the country. Customary fishing authorisations issued in the South Island and Stewart Island would be under the Fisheries (South Island Customary Fishing) Regulations 1999. Many rohe moana / areas of the coastline in the North Island and Chatham Islands are gazetted under the Fisheries (Kaimoana Customary Fishing) Regulations 1998 which require reporting on authorisations. In the areas not gazetted, customary fishing permits would be issued would be under the Fisheries (Amateur Fishing) Regulations 2013, where there is no requirement to report catch.

The information on Māori customary harvest under the provisions made for customary fishing can be limited (Table 4). These numbers are likely to be an underestimate of customary harvest as only the catch approved and harvested in kilograms and numbers are reported in the table.

Table 4: Fisheries New Zealand records of customary harvest of tuatua (approved and reported as weight (kg) and numbers), since 2001–02. – no data. [Continued on next page].

Fishing year	TUA 1A		TUA 1B	
	Weight (kg)	Numbers	Weight (kg)	Numbers
	Approved	Harvested	Approved	Harvested
2001–02	–	–	–	–
2002–03	–	–	–	–
2003–04	–	–	–	–
2004–05	–	–	–	–
2005–06	–	–	–	–
2006–07	–	–	–	–
2007–08	–	–	75	25
2008–09	–	–	346	285
2009–10	75	75	215	180
2010–11	100	100	50	30
2011–12	–	–	–	–
2012–13	–	–	–	–
2013–14	–	–	–	–
2014–15	–	–	–	–
2015–16	–	–	–	–
2016–17	–	–	35	35
2017–18	–	–	40	40
2018–19	–	–	80	80
2019–20	–	–	–	–
2020–21	–	–	–	–

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Table 4 [continued]

Fishing year	TUA 2				TUA 3			
	Weight (kg)		Numbers		Weight (kg)		Numbers	
	Approved	Harvested	Approved	Harvested	Approved	Harvested	Approved	Harvested
2001-02	-	-	-	-	-	-	60	60
2002-03	-	-	-	-	-	-	-	-
2003-04	-	-	300	265	-	-	-	-
2004-05	-	-	-	-	-	-	-	-
2005-06	-	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-	-
2007-08	-	-	-	-	-	-	-	-
2008-09	-	-	-	-	-	-	-	-
2009-10	-	-	-	-	-	-	-	-
2010-11	-	-	-	-	-	-	150	150
2011-12	-	-	-	-	-	-	-	-
2012-13	-	-	-	-	-	-	-	-
2013-14	-	-	-	-	-	-	-	-
2014-15	-	-	-	-	-	-	-	-
2015-16	-	-	-	-	-	-	-	-
2016-17	-	-	-	-	-	-	-	-
2017-18	-	-	-	-	-	-	-	-
2018-19	-	-	-	-	-	-	-	-
2019-20	-	-	-	-	-	-	-	-
2020-21	-	-	-	-	-	-	-	-

Fishing year	TUA 4				TUA 9			
	Weight (kg)		Numbers		Weight (kg)		Numbers	
	Approved	Harvested	Approved	Harvested	Approved	Harvested	Approved	Harvested
2001-02	-	-	-	-	-	-	60	60
2002-03	-	-	-	-	-	-	-	-
2003-04	-	-	-	-	-	-	-	-
2004-05	-	-	-	-	-	-	-	-
2005-06	-	-	-	-	-	-	-	-
2006-07	-	-	-	-	-	-	-	-
2007-08	-	-	-	-	-	-	-	-
2008-09	-	-	-	-	-	-	-	-
2009-10	-	-	300	300	-	-	-	-
2010-11	-	-	-	-	-	-	-	-
2011-12	-	-	-	-	100	70	-	-
2012-13	-	-	-	-	-	-	-	-
2013-14	-	-	-	-	-	-	-	-
2014-15	-	-	100	100	-	-	-	-
2015-16	-	-	-	-	-	-	-	-
2016-17	-	-	100	100	-	-	-	-
2017-18	2	2	-	-	-	-	-	-
2018-19	-	-	-	-	-	-	-	-
2019-20	-	-	-	-	-	-	-	-
2020-21	-	-	-	-	-	-	-	-

1.4 Illegal catch

The illegal catch of tuatua is probably significant in some areas, with some recreational fishers exceeding their bag limit, but no quantitative information on the level of illegal catch is available.

1.5 Other sources of fishing-related mortality

No quantitative information on the level of other sources of mortality is available. Tuatua are generally sedentary and beds are susceptible to localised depletion, not only by harvesting pressure, but also by habitat disturbance and degradation. Incidental mortality of tuatua is likely in the Kaipara Harbour dredge fishery if tuatua are damaged during encounters with the dredge. Changes in bank stability could arise from dredging operations and might cause additional incidental mortality. However, the level of dredge-related mortality is unknown. As suspension feeders, tuatua may also be adversely affected by high sedimentation loads in the water column. In some areas, such as Ninety Mile Beach, Dargaville and Muriwai, vehicles driven along the beach pass directly over tuatua beds, increasing mortality either directly by damaging tuatua or indirectly by adversely modifying surface sand conditions leading to desiccation of tuatua.

2. BIOLOGY

Tuatua (*Paphies subtriangulata*) belong to the family Mesodesmatidae, a group of moderate to large wedge-shaped surf clams that include toheroa (*Paphies ventricosum*), deepwater tuatua (*Paphies*

donacina), and pipi (*Paphies australis*). *P. subtriangulata* is extensively distributed around New Zealand in localised abundant populations, but mainly occurs around the North Island, and at more scattered locations in the northern South Island, Stewart Island, and the Chatham Islands.

Tuatua are ecological markers of fine, clean, fluid sands on ocean beaches with moderate wave exposure. The densest beds are found in the zone from the low intertidal to the shallow subtidal (down to about 4 m depth). The tuatua is a suspension feeder with short siphons. It is usually wedged only a few centimetres into the sand, with the straight siphonal end often characteristically exposed and discoloured by a green or brown algal film. Individuals are often dragged about the surface and redistributed by swash and backwash before actively burrowing back into the sand.

Tuatua have separate sexes (1:1 sex ratio) and reproduce by broadcast spawning, synchronously releasing eggs and sperm into the water column for external fertilisation. In north-eastern New Zealand, two main spawning periods have been documented, one between September and November, the other between February and April. Spawning events have been observed *in situ* at high water on a number of occasions, with only a small proportion of the population participating in each event. These spawning events were synchronous with pipi spawning in the same area.

Planktonic larval development takes about two to three weeks, so larvae have the potential to disperse widely if conditions allow. Larval settlement is thought to occur high in the intertidal, but spat and juveniles are highly mobile, moving around with the tidal flow before reburying themselves rapidly. Tuatua appear to migrate down the beach to occupy the lower intertidal and shallow subtidal as they grow larger. Growth appears to be rapid but variable, with tuatua reaching 40–70 mm shell length in about 3 years. Maximal length is variable among areas, ranging from about 50 to 80 mm, and the maximum age is probably about 5 or more years. Highly variable recruitment has been observed on the northwest coast of the North Island, and this is likely to occur in other areas. As in other surf clams, natural mortality is likely to be high.

A length-weight relationship has been estimated for tuatua sampled from East Auckland, and a southern population (probably Dunedin) where weight (in g) = $a(\text{length (in mm)})^b$, where $a = 0.2 \times 10^{-3}$ and $b = 2.927$. Data source: D. Allen unpublished data. Because the samples were from one northern and one southern population, the estimated relationship may not be representative of other populations.

3. STOCKS AND AREAS

Little is known of the stock structure of tuatua. There have been no biological studies directly relevant to the identification of separate stocks of *P. subtriangulata* around New Zealand, although “stocks” are likely to be linked by larval dispersal. For management purposes stock boundaries are based on FMAs, with the exception of TUA 1, which was divided into TUA 1A and TUA 1B on either side of Te Arai Point because there are likely to be significant differences in the state and use of the tuatua beds between the Northland and Hauraki Gulf / Bay of Plenty areas, and the respective alignment of recreational and customary fishing interests to those management areas. The circulation patterns that maintain the separation of the surf zone habitat to form a self-contained ecosystem also retain planktonic larvae of surf clams probably isolating surf clams genetically as well as ecologically.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

There are no estimates of fishery parameters or abundance for any tuatua fishstock.

4.2 Biomass estimates

There is no time series of biomass surveys for tuatua either in the bed in the Kaipara Harbour entrance where commercial harvesting by dredge occurs now, or anywhere else that would indicate whether tuatua populations are changing in response to past and current levels of harvesting.

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4.3 Yield estimates and projections

MCY has not been estimated for *P. subtriangulata*. *CAY* has not been estimated for *P. subtriangulata*.

5. STATUS OF THE STOCKS

There are no estimates of biomass or sustainable yields of tuatua for any tuatua stock and the status of all stocks is unknown. Because natural mortality is high and recruitment is variable, the biomass of tuatua is likely to be highly variable.

- TUA - *Paphies subtriangulata*

Stock Status	
Year of Most Recent Assessment	No formal assessment conducted for any of the stocks
Assessment Runs Presented	Recruited biomass (shells \geq 50mm)
Reference Points	Target: Undefined Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: Undefined
Status in relation to Target	Unknown
Status in relation to Limits	Unknown
Status in relation to Overfishing	-

Historical Stock Status Trajectory and Current Status
-

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Unknown
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	Landings are less than a quarter of the TACC and have generally been declining since 2002–03.

Projections and Prognosis	
Stock Projections or Prognosis	-
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Unknown Hard Limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Unknown

Assessment Methodology and Evaluation	
Assessment Type	-
Assessment Method	-
Assessment Dates	- Next assessment: Unknown
Overall assessment quality rank	
Main data inputs (rank)	
Data not used (rank)	
Changes to Model Structure and Assumptions	-
Major Sources of Uncertainty	-

Qualifying Comments

Landings are thought to have been declining in recent times because of economic rather than biological reasons.

Fishery Interactions

Interactions with other species are currently being characterised.

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