

# *Parvulastra vivipara*

## Tasmanian Live-bearing Seastar



Image by Mark Wapstra

TASMANIAN THREATENED SPECIES LISTING STATEMENT

**Common name:** Tasmanian Live-bearing Seastar

**Scientific name:** *Parvulastra vivipara* (Dartnall)

**Group:** Invertebrate, Echinodermata, Asteroidea, Valvatidae, Asterinidae

**Name history:** *Patiriella vivipara* Dartnall, 1969

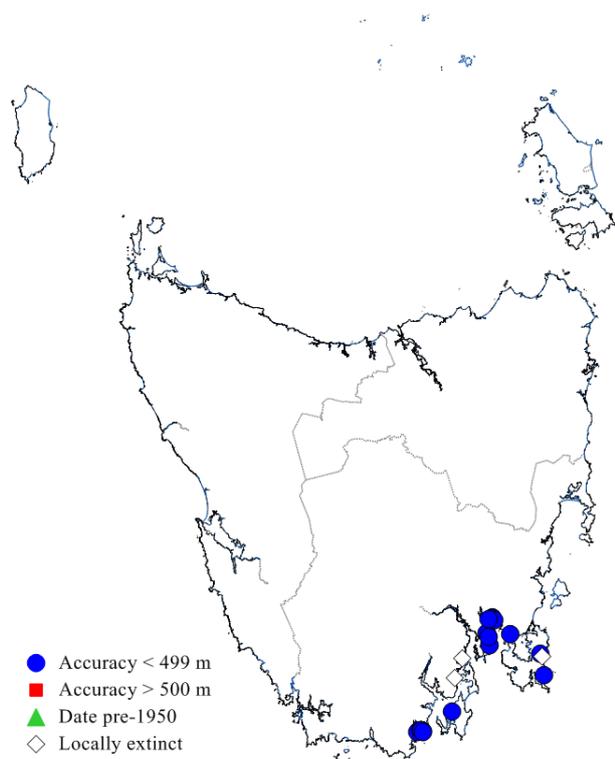
**Status:** *Threatened Species Protection Act 1995:* **vulnerable**

*Environment Protection and Biodiversity Conservation Act 1999:* **Vulnerable**

*IUCN Red List:* **Not listed**

**Distribution:** Endemic status: **Endemic**

Tasmanian NRM Regions: **South**



**Figure 1.** The distribution of the Tasmanian Live-bearing Seastar, showing NRM regions



**Plate 1.** Live specimen of the Tasmanian Live-bearing Seastar (image by Mark Wapstra)

#### SUMMARY

The Tasmanian Live-bearing Seastar is a small orange-yellow seastar, up to 15 mm across, with five arms and a rounded pentagonal shape. Endemic to Tasmania, the species is known only from waters between the high and low tide mark (littoral waters) in the State's southeast. The seastar is unusual in being one of very few seastars worldwide that brood their eggs then give birth to live young (viviparous). The main threats to the species are competition, displacement and possibly predation from introduced seastars such as the New Zealand Seastar and the Northern Pacific Seastar, and habitat modification. Many subpopulations of the species are close to populated areas and have been impacted by removal of habitat and run-off of pollutants. The objectives for management of the species include protection of known subpopulations, the location of any new subpopulations, and increasing understanding of the species' ecology and habitat requirements.

#### IDENTIFICATION AND ECOLOGY

The Tasmanian Live-bearing Seastar (*Parvulastra vivipara*) is a bluntly stellate seastar, up to 15 mm across (Plate 1). The species usually has five arms (although morphological variation is common with three, four or six arms occasionally being present) and is a rounded pentagonal shape. When alive, individuals are a consistent orange-yellow, slightly lighter on the actinal surface (Dartnall (1969).

The Tasmanian Live-bearing Seastar reaches sexual maturity (and a diameter of 5mm) at around 12 months. It is thought that the species may live 8 to 10 years (Prestedge 1998, 2001a). The species is capable of breeding throughout the year, with the peak reproductive season occurring from October to January. However, high numbers of juveniles have also been observed in June suggesting that there may also be a mid-year release period (Polanowski 1998, 2002). The Tasmanian Live-bearing Seastar is hermaphroditic, and undergoes self-fertilisation. Up to 5 young develop in the gonadal sac and when they reach 1-2 mm they rupture from the sac and emerge on the surface of the adult. The newborn seastars are tiny miniatures of the adult. This

type of reproduction means that the species cannot disperse widely, unlike species with a free-swimming larval stage (Bryant & Jackson 1999). This apparent inability to disperse into new habitat renders the species vulnerable to several threatening processes.

Embryogenesis is asynchronous, with progeny at different stages of development in the gonads. The end-point of brooding is variable in the Tasmanian Live-bearing Seastar, with juveniles emerging from the parent at sizes ranging between 1.5 and 5.0 mm diameter. At birth the juveniles are up to 25-30% of the parent's diameter. Birth involves distension of the gonopore, with a marked separation of the ossicles and softening of the connective tissue around the pore. The juveniles are considerably larger than the ova and depend on extraembryonic nutrition to support their growth. Once the mouth opens, the juveniles prey on their intragonadal siblings. Cannibalism accounts for much of the post-metamorphic mortality.

The Tasmanian Live-bearing Seastar feeds at night and on dull, overcast days (Prestedge 1998). It is an extra-oral (outside of the mouth) feeder on micro-algal films coating the surface of submerged rocks and can evert (push out) its remarkably voluminous cardiac stomach to a diameter larger than that of its body. Individuals often have their stomach fully everted and in contact with the substratum, indicating that digestion is likely to take place outside the body (Polanowski 2002).

#### Survey techniques

The Tasmanian Live-bearing Seastar is usually surveyed at low tide, by observers walking the littoral zone and searching for the species by visual assessment of the substrate. Lifting rocks by hand (where possible) to search for the species is also undertaken (DPIW 2006a; Prestedge 1998). Polanowski (2002) recommended surveying at night or on overcast days, due to the seastars becoming more visible as they emerged out of hiding onto the top of rocks to feed.

## Taxonomic issues

The Tasmanian Live-bearing Seastar was first described in the genus *Patiriella* (Dartnall 1969) but the southern Australian multi-armed species were recognised as possibly requiring a new genus (Dartnall et al. 2003), which was demonstrated in a taxonomic study by Waters et al. (2004), who suggested that four species previously included in *Patiriella* belong to a monophyletic clade. This group share a consistent morphology characterised by subpentagonal form, longitudinal series of abactinal plates on rays, oblique series of actinal plates, granuliform and digitiform spinelets, a few papulae space, and superambulacral and superactinal plates, and the clade warrants generic rank, which was formally recognised by O’Loughlin & Waters (2004) with the erection of *Parvulastra*.

## Confusing species

The Tasmanian Live-bearing Seastar is similar to other species that may co-occur. In the field, colour of live individuals may be used to separate some species. The Tasmanian Live-bearing Seastar is consistently orange-yellow, *Patiriella exigua* has a blue-green actinal surface, and *Patiriella regularis* has an off-white actinal surface (Dartnall 1969). Reproductive characteristics may be used to separate several similar species (Dartnall 1969) but this requires microscopical examination.

## DISTRIBUTION AND HABITAT

The Tasmanian Live-bearing Seastar is endemic to Tasmania (Table 1, Figure 1). It is only known from littoral waters (area between the high and low tide mark) in the State’s southeast (Prestedge 2001a).

The Tasmanian Live-bearing Seastar is known reliably from 13 locations (Prestedge 2001a), however, the subpopulations at two, or possibly three, of these locations are believed to be extinct (Prestedge 2001a; Rowland 2001). It is believed that the colony at Woodbridge was introduced there in late 1995. The distribution of the Tasmanian Live-bearing Seastar is severely fragmented as all known subpopulations are relatively small and isolated. The sites are separated by distances that exceed

the presumed dispersal capacity of the species (Prestedge 2001a). The likelihood of the current distribution of the Tasmanian Live-bearing Seastar being the actual distribution is reasonably high.

The Tasmanian Live-bearing Seastar lives in rocky areas in the upper intertidal zone, usually under rocks or in crevices (Plates 2 & 3). They appear to have a water depth limit, being found from just below the high water mark to a depth of approximately 1.2 m at high water (Prestedge 2001a). The species prefers gently sloping, sheltered shores, characterised by rocks often no more than 20 to 30 cm high. Some small colonies seem to be habitat specific, with some preferring dolerite and others sandstone.



**Plate 2.** Habitat of the Tasmanian Live-bearing Seastar at Bambra Reef, Roches Beach, near Lauderdale (image by Mark Wapstra)



**Plate 3.** Habitat of the Tasmanian Live-bearing Seastar west of Lumeah Point, Pipeclay Lagoon, near Cremorne (image by Mark Wapstra)

**Table 1.** Population summary for the Tasmanian Live-bearing Seastar

	Location	Tenure	NRM region*	1:25 000 mapsheet	Year first seen	Extent of subpopulation (ha)	Abundance
1	Pitt Water	Pitt Water Nature Reserve	South	Carlton	1966	Unknown	Several thousand, but large declines since initial surveys of 1970's and 1980's.
2	Lewisham (Pitt Water)	?	South	Carlton	1952	Part of site 1?	4?
3	Bambra Reef, Roches Beach (Frederick Henry Bay)	?	South	Carlton	1963	450 m <sup>2</sup>	1983=400 1998=100 2001=17,505
4	Mays Point (South Arm)	Public Reserve	South	Carlton	2002	15 m <sup>2</sup>	2002=13
5	Primrose Sands (Susan Bay) (Frederick Henry Bay)	Public Reserve	South	Carlton	2001	25 m <sup>2</sup>	2002=1,885
6	Pipeclay Lagoon (South Arm)	?	South	Cremorne	1998	180 m <sup>2</sup>	2000=1,180
7	Tessellated Pavement (Tasman Peninsula)	Tessellated Pavement State Reserve	South	Taranna	1968	150 m <sup>2</sup>	1998 = 1500 2000=6,858
8	Fossil Island, Eaglehawk Neck (Tasman Peninsula)	Tasman National Park	South	Taranna	1953	Unknown	No estimate available (extinct?)
9	Fortescue Bay (Tasman Peninsula)	Tasman National Park	South	Hippolyte	1990	20 m <sup>2</sup>	1995=50 2000=20 2002=109
10	Grundys Point, Lunawanna, Bruny Island (D'Entrecasteaux Channel)	Public Reserve	South	Partridge	1988	34 m <sup>2</sup>	2000=904
11	Southport Lagoon	Southport Lagoon Conservation Area	South	Leprena?	2006	Not indicated (DPIW 2006a)	Several hundred
12	Peppermint Bay, Woodbridge (D'Entrecasteaux Channel)	?	South	Cygnet	1995	150 m <sup>2</sup>	2001=510 Introduced
13	Oyster Cove (D'Entrecasteaux Channel)	?	South	Barnes Bay?	1952	Unknown	Extinct
14	Howden, Powder Jetty (D'Entrecasteaux Channel)	?	South	Blackmans Bay	?	Unknown	Probably never existed
15	Tinderbox (D'Entrecasteaux Channel)	?	South	Blackmans Bay	?	Unknown	Possibly never existed

\*NRM region = Natural Resource Management region

## POPULATION PARAMETERS

The Tasmanian Live-bearing Seastar is known from 13 isolated subpopulations, which vary in abundance from less than 20 individuals to several thousands (Table 1). Rowland (2001) estimated the population size of the Tasmanian Live-bearing Seastar (excluding the Pitt Water subpopulation) to be approximately 27,000 individuals. Estimates have been made for the Pitt Water population on the basis of existing data and the total length of inhabited shoreline, giving an estimate of 326,000 individuals in the Pitt Water subpopulation.

Field observations and survey of the Tasmanian Live-bearing Seastar between 1975 and 1998 indicated a large decline in many subpopulations (see Table 1). In particular the largest known subpopulation, which occurs at Pitt Water, had undergone a major decline in numbers. Several large colonies had almost disappeared from the southwestern shore of the upper Pitt Water area, and the remaining subpopulations had decreased (Prestedge 1998). However, Prestedge (2001a) published an updated paper stating that there has been an increase in the number of colonies and in subpopulation numbers since 1990 and suggested that perhaps the species experiences a boom–bust cycle.

The extent of occurrence of the Tasmanian Live-bearing Seastar has been estimated at 2600 km<sup>2</sup>. However, much of the area is considered unsuitable for the species due to inappropriate substrate and depth of water (deeper than 1.2 m). The area of occupancy is estimated to be 1000–2000 m<sup>2</sup>. This figure is based on relatively accurate estimates of the extent of most extant subpopulations totalling approximately 1024 m<sup>2</sup>. However, published accounts of the extent of the largest subpopulation (Pitt Water), the most recently discovered subpopulation (Southport Lagoon) and historical accounts of subpopulations considered extinct, are not available. Given the extent of all other subpopulations, it is highly unlikely that the inclusion of these subpopulations would result in more than a doubling of the estimated area of occupancy. This is due to the restriction of the species to specific substrates within the very narrow littoral zone.

There is no quantitative data to indicate an historical decline in area of occupancy but anecdotal evidence (e.g. Rowland 2001) indicates that some subpopulations are likely to be extinct (see Table 1). This anecdotal evidence implies a decline in the area of occupancy (although it is noted that the decline caused by these localised extinctions has probably been offset by the discovery of additional subpopulations as at Mays Point and Southport Lagoon).

## RESERVATION STATUS

The Tasmanian Live-bearing Seastar occurs in the Pitt Water Nature Reserve (which also falls within the RAMSAR wetland at Pitt Water), Tessellated Pavement State Reserve, Tasman National Park, Southport Lagoon Conservation Area and some coastal Public Reserves. Note that the extent of the reserves is unknown and some may not extend to the low tide mark, therefore may not fully encompass the extent of the subpopulations (the species will occur to about 1.2 m deep i.e. below the low tide level).

## CONSERVATION STATUS

The Tasmanian Live-bearing Seastar was listed in 1995 as endangered on the Tasmanian *Threatened Species Protection Act 1995*. It was downlisted to vulnerable in 2008, following the discovery of new subpopulations, now meeting criterion B (extent of occurrence estimated to be less than 2000 km<sup>2</sup> and area of occupancy less than 0.5 km<sup>2</sup>), specifically B1 (severely fragmented) and B2c (continuing decline in area, extent and/or quality of habitat).

## THREATS, LIMITING FACTORS & MANAGEMENT ISSUES

The main identified threats to the Tasmanian Live-bearing Seastar are interspecific competition, displacement and potential predation from introduced seastars such as the New Zealand Seastar (*Patiriella regularis*) and the Northern Pacific Seastar (*Asteria amurensis*). An additional threat is habitat modification and destruction. Many of the subpopulations of the Tasmanian Live-bearing Seastar are in close proximity to areas inhabited by humans and consequently are impacted by habitat

degradation and modification through anthropogenic causes such as removal of suitable habitat, urban encroachment and run-off of pollutants (TSSC 2009a).

**Interspecific competition from introduced seastars:** Owing to the small, restricted subpopulations of the Tasmanian Live-bearing Seastar it is considered highly vulnerable to interspecific competition and displacement from introduced species such as the New Zealand Seastar and the Northern Pacific Seastar.

**Predation by introduced seastars:** The introduced Northern Pacific Seastar preys upon the Tasmanian Live-bearing Seastar under controlled conditions (Prestedge 1999b). To what extent this threat exists in their normal habitat is unknown, as the Northern Pacific Seastar had not been found in any colony of the Tasmanian Live-bearing Seastar until 2008, when the species was detected at Bambra Reef.

**Habitat modification and destruction:** Many of the subpopulations of the Tasmanian Live-bearing Seastar are in close proximity to populated areas. Human impacts include removal of rocks and suitable substrates from the intertidal zone, urban encroachment, poor land use practices, and pollution-induced disturbances such as eutrophication, sedimentation, increasing water temperature, declining salinity, ground water seepage from urban, industrial and agricultural land uses (Bryant & Jackson 1999). Declines in the colonies and population numbers at various sites may potentially be influenced by reduced water quality due to sewerage treatment plant discharge, seepage from areas serviced by septic tanks and from storm water runoff (Prestedge 1998).

**Recreational activities:** A recent assessment (DPIW 2006b) of the impacts on Southport Lagoon as a result of the proposed change in management of the lagoon waters and the surrounding conservation area found that the proposed boat launching site on the western side of the lagoon may lead to a five to ten fold increase in boat traffic on the lagoon and an increase in recreational fishing. An increase in power boat traffic and recreational fishing has the potential to increase the risk of damage to

the habitat of the Tasmanian Live-bearing Seastar.

## MANAGEMENT STRATEGY

### What has been done?

**Existing management plans:** The Woodbridge Environment Group (Rowland, 2001) developed an action plan providing an education and monitoring program for the Tasmanian Live-bearing Seastar.

The Southport Lagoon Conservation Area has a management plan (DPIW 2006b) that makes specific mention of the Tasmanian Live-bearing Seastar. It highlights the possibility of damage to habitat of the species and potential introduction of marine pests. It makes recommendations regarding trailer use, restricted areas and monitoring.

**Targeted surveys & monitoring:** Dartnall (1969) undertook the original survey, recording the Tasmanian Live-bearing Seastar from three localities (Pitt Water, Roches Beach and Eaglehawk Neck). Hoggins (1976 cited in Rowland 2001) estimated the size of subpopulations at Midway Point, Tinderbox and Eaglehawk Neck. Prestedge (1998) monitored subpopulations of the Tasmanian Live-bearing Seastar on the shore at Pitt Water between 1976 and 1982, and Eaglehawk Neck, Roches Beach and Fortescue Bay in February 1998. During the 1990s additional new colonies were recorded mainly as a result of unsystematic private surveys (Prestedge 2001a). Rowland (2001) undertook an assessment of the abundance the Tasmanian Live-bearing Seastar at a number of locations in south-east Tasmania, excluding the Pitt Water subpopulations. Polanowski (2002) undertook surveys and population counts at several of the known sites, and located a new subpopulation at Mays Point, Lauderdale. In 2006 a survey of the species at Southport Lagoon (for the purpose of developing a management plan for the area) was conducted over five days from October to December. Seven colonies, varying from a few individuals to several hundred seastars, were recorded (DPIW 2006a).

**Sorell Causeway upgrade:** In 1998, the then Department of Roads and Transport undertook structural support and maintenance of a section

of sandstone wall of the Sorell Causeway that had degraded through constant wave action over many years. As part of the upgrade, the Department considered the importance of protecting the threatened seastar in its planning. The Department provided a sandstone façade along the entire intertidal zone of the wall to provide specific habitat for the seastar, which otherwise not have survived or recolonised the structural dolomite boulders. Seastars were relocated by volunteers during the maintenance phase of the works, which were then relocated after works.

**Bridge construction:** In 2001 part of the Pitt Water subpopulation of the Tasmanian Live-bearing Seastar came under threat from the necessary replacement of the bridge spanning the Sorell causeway. The bridge forms part of a major route into Hobart and was replaced due to its deteriorating condition and reduced serviceability for the high volume of traffic and heavy vehicles. A relocation exercise was undertaken during April and May 2001 in which Tasmanian Live-bearing Seastars were removed from the causeway and placed at a number of relocation sites. A total of 21,368 seastars were relocated. A number of monitoring sites were established for future ongoing monitoring of seastar subpopulations (Aquenal 2001).

### Management objectives

- Prevent the loss or degradation of habitat supporting known subpopulations;
- Identify new subpopulations of the species;
- Increase the information and data available on the location, size and condition of known subpopulations;
- Improve the understanding of the ecological requirements of the species.

### What is needed?

- To monitor changes in the status of the species – design and implement a monitoring program.
- To increase understanding of the status of the species – more precisely assess population size, distribution, ecological

requirements and the relative impacts of threatening processes.

- To better document the distribution of the species – undertake survey work in suitable habitat and potential habitat to locate any additional subpopulations.
- To improve protection of the species – control and monitor ballast water to reduce the introduction of additional marine pests.
- To improve protection of the species – ensure infrastructure or development activities in areas where the species occurs do not adversely impact on known subpopulations.
- To improve protection of the species – control access to suitably constrain public access to known sites.
- To improve protection of the species – protect subpopulations of the species through the development of conservation agreements and/or covenants.
- To improve protection of the species – develop and implement a management plan for the control of New Zealand Seastar (*Patiriella regularis*) and the Northern Pacific Seastar (*Asterias amurensis*) in the local region.
- To improve protection of the species – raise awareness of the Tasmanian Live-bearing Seastar within the local community.
- To improve protection of the species – investigate options for linking, enhancing or establishing additional subpopulations.

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**View:**

[www.dpipwe.tas.gov.au/threatenedspecieslists](http://www.dpipwe.tas.gov.au/threatenedspecieslists)

**Contact details:** Threatened Species Section, Department of Primary Industries, Parks, Water and Environment, GPO Box 44, Hobart, Tasmania, Australia, 7001. Phone (03) 6233 6556; fax (03) 6233 3477.

**Permit:** A permit is required under the *Tasmanian Threatened Species Protection Act 1995* and *Nature Conservation Act 2002* to “take” (which includes kill, injure, catch, damage, destroy and collect), keep, trade in or process any specimen or products of a listed species. Additional permits may also be required under other Acts or regulations to take, disturb or interfere with any form of wildlife or its products, e.g. on reserved land.