

## Re-evaluation of the distribution of the Smooth Frog, *Geocrinia laevis*, in South Australia.

Steven J. Walker and Peter M. Goonan  
Environment Protection Agency

### Introduction

There have been few comprehensive studies to document the distribution of the frogs of South Australia. Brook (1984) produced an atlas of the known distribution of the frog fauna of SA by condensing the published and unpublished data from various sources. Other published studies have generally been focused on unusual range extensions and first records in the State (e.g. Tyler 1971, Johnston 1990, Bird and Tyler 1990). Overviews and species lists for the State are given in Tyler (1977, 1978, 1994, 1997).

Since 1994 the South Australian Environment Protection Agency has conducted a frog census in September (November in the first year, September thereafter) of each year which involves the public making tape recordings of the frogs calling from waterways throughout South Australia. This work has highlighted the distribution and a measure of the abundance of frogs in those parts of the State where participants take recordings; generally from the more southern parts of SA (Goonan et al 1997, Goonan et al 1998, Walker et al 1999). The results from this programme have highlighted a number of species which are poorly represented or have not been recorded through the method being applied by the census. The Smooth Frog, *Geocrinia laevis*, has not been recorded between 1994 and 1998 in this programme (Goonan et al 1997, Goonan et al 1998, Walker et al 1999).

*Geocrinia laevis* is a medium sized frog (22 – 35mm) with short limbs and smooth skin. Pale pink patches are present underneath the legs and in the groin. The belly tends to be mottled or densely covered with grey or dark brown flecks (Barker et al 1995, Tyler 1978, Woodruff and Tyler 1968). It is easily confused with *Crinia signifera* or *Pseudophryne* species. The Smooth Frog does not breed in water, instead it lays large unpigmented eggs in loose, elongated masses attached to moist vegetation. Major development occurs inside the egg capsule and following flooding tadpoles hatch in the water, with complete development taking about six months (Barker et al 1995, Tyler 1994). The habitat of *G.laevis* is reported as being leaf litter in dry sclerophyll (*Eucalyptus*) and pine forests subject to temporary flooding.

*Geocrinia laevis* was first reported in South Australia from a specimen (SA Museum R8118) collected near Mt Burr in 1966 (Woodruff and Tyler 1968). Prior to this it was known from four separate populations in Tasmania, King Island, the Grampians and South West Victoria (Beck 1975, Woodruff and Tyler 1968). Between 1968 and 1974 a major survey was undertaken in the South East of South Australia and South West Victoria to determine the distribution of this species in the area (Beck 1975). The results of this survey found that, in South Australia, *G. laevis* was confined to the Reedy Creek and Dismal Swamp drainage system in the lower South East (Beck 1975).

Despite the occasional museum record and the capture of a small number of specimens during a Biological Survey of swamps in the region (Foulkes 1998), no major reports of this frog have been made since the Beck survey. The purpose of this study was to conduct field surveys to document the distribution and status of *G. laevis* in South Australia.



**Figure 1.** The Smooth Frog *Geocrinia laevis* collected from Canunda National Park.

### **Methods**

A review was carried out of existing data sources (published and unpublished records) including SA Museum Records and National Parks and Wildlife Service regional surveys. This provided a number of locations which were superimposed onto floristic vegetation maps of the South East to assist in the identification of possible additional locations that may provide suitable habitat for *G. laevis*.

Mr Barrie Grigg from Forestry SA, Mt Gambier also provided maps of Forestry land and suggested possible areas to look for frogs.

Surveys were undertaken during three separate trips in March, June and August 1999 to search known and possible sites for the presence of *G. laevis*. The first activity at each site was to listen for the presence of any calling *G. laevis* males. Males call from the ground in moist leaf litter and among grass. The call is a long slowly pulsed rattling or creaking sound, the first note often being the longest - "cre-e-e-e-e-e-ek cre-e-e-ek cre-e-ek cre-e-ek" (Barker et al 1995, Woodruff and Tyler 1968). If any males were found to be calling an attempt was made to locate and capture those males by triangulation. As the call of the Common Froglet *C. signifera* is quite variable and can sometimes sound very similar to the call of *G. laevis* calls suspected of being *C. signifera* but sounding

somewhat like *G. laevis* were recorded at a number of sites with a Sony DAT recorder and directional microphone for later examination.

In addition, active searches were carried out during the day and early evening which involved looking under logs, leaf litter, stones, and amongst vegetation for a minimum of one hour at each site visited. Any frogs which were found were collected and placed in large canvas or plastic bags for later examination. All species of frog encountered were collected for the purpose of providing opportunistic data for the Frog Census and the National Parks and Wildlife Service opportunistic database. Frogs were released on site at the conclusion of collecting and identification.

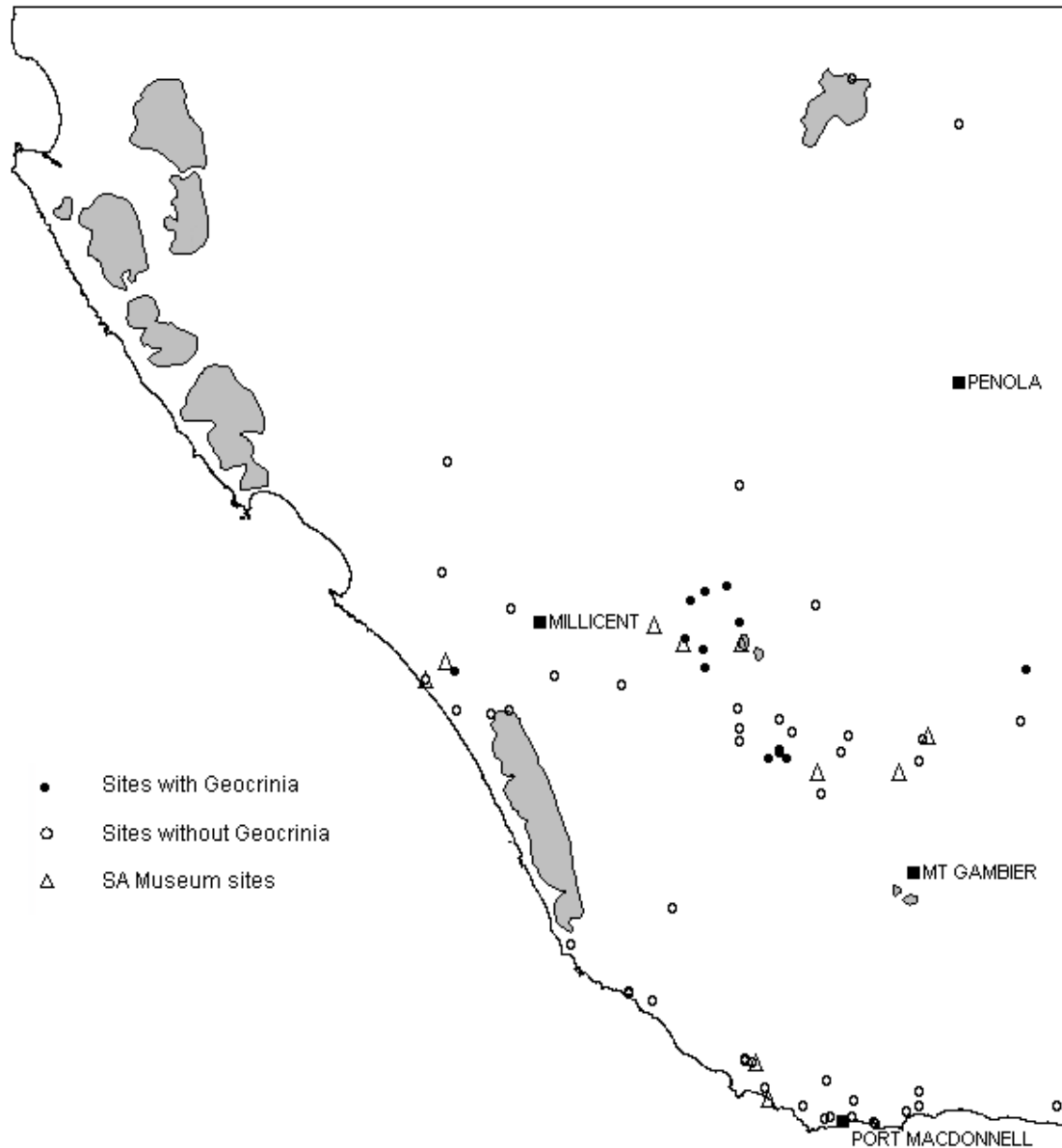
A number of plant samples were also collected for later identification to determine the common composition of flora associated with the sites in which *G. laevis* were found.

### **Results**

A total of 58 locations were visited (Fig. 2), including 10 sites based on museum records and two sites from the NPWS Vertebrate survey (Table 1). Some of the museum sites could not be located precisely and it appears that the coordinates given may be slightly inaccurate; in these cases nearby sites with suitable habitats were sampled instead.

*Geocrinia laevis* was present at 12 sites within the Reedy Creek/Dismal Swamp drainage area, and also from a site in the Canunda National Park (Table 1). *Geocrinia laevis* was not found near the Pt MacDonnell area where it has been reported from Museum records.

A total of six *G. laevis* were actually collected (two from The Marshes, two from Mt Burr, one from Honan's Scrub and one from Canunda National Park (Fig. 1.)). The presence of calling males permitted a positive identification of the species at these and other locations. Analysis of the recordings which had been made of suspected *C. signifera* calls both by ear and with the aid of a computer based spectrograph (Avisoft SAS-Lab Pro Version 3.5b (Specht, R. (1998)) positively identified only one site with *G. laevis* (site 17). All other recordings were confirmed as being *C. signifera*.



**Figure 2.** Surveyed distribution of *Geocrinia laevis* in the South East of South Australia. Sites from SA Museum records are included for reference.

**Table 1.** Summary of collection from *Geocrinia laevis* survey.

Site	Site Name	Species Present	Northing	Eastings
1	Boggy Lane, Pt MacDonnell	no frogs	5792273	472109
2	Rd to Ewen's Ponds	CS	5790308	474889
3	Ewen's Ponds	CS, NS, LE	5791237	481573
4	Smith Dairy Paddock, Pt MacDonnell	CS, NS	5789141	480268
5	Pt MacDonnell Roadside 1	CS, LE	5788615	474788
6	Finger Point Sewage Treatment Works	CS	5789705	469703
7	Pt MacDonnell Roadside 2	CS, LP	5791417	465937
8	Clark's Park 1	CS, LP, LE	5788450	471983
9	Clark's Park 2	LP	5788658	472408
10	Winterfield Creek	CS, LE	5794394	463919
11	Honan's Scrub 1	GL, CS, LD, LE	5825111	467855
12	Boggy Field 20km Sth of Kalangadoo	GL, LE	5825930	467020
13	Honan's Scrub 2	GL, CS, LE	5825057	465885
14	Honan's Scrub 3	GL, LE	5825661	466967
15	Woolwash (Forest Reserve)	CS, LE	5826663	463233
16	Farm Paddock	CS, LE	5828028	463028
17	Brooksby's Lane nr Lake Leake	GL, CS, LE	5838999	462902
18	Mt Burr Forest 1	GL, CS, LE	5841169	457848
19	Mt Burr Forest 2 nr Quarry	GL	5842091	459437
20	Roadside nr Mt Burr	GL, LE	5842629	461534
21	The Marshes 1	GL, LE	5836207	459157
22	The Marshes 2	GL, CS, LE	5837195	457385
23	Main Rd to Penola	LT, LE	5852677	463127
24	Blanche Forest	CS	5821386	471415
25	Roadside Ditches nr Blanche Forest	CS, LE	5827642	468524
26	Rd to Mt Gambier Airport	CS	5824809	481466
27	Wandilo Forest 1	CS, LE	5825726	473453
28	Wandilo Forest 2	CS	5827306	474196
29	Grundy's Lane, Telford Scrub	CS, LT, LE	5826940	481863
30	Roadside1, Mingbool	CS, LE	5828919	491833
31	Roadside2, Mingbool	GL, CS	5834231	492158
32	Deadman's Swamp	CS	5889595	485429
33	Hacks Lagoon	CS	5894048	474497
34	Black Fellows Caves 1	CS	5800392	454443
35	Black Fellows Caves 2	CS, LE	5801231	451917
36	25km from Mt Gambier nr Kongorong	CS, LE	5809735	456451
37	Burkhills Lane between Millicent and Tantanoola	CS, LE	5833315	444247
38	Lake Bonney SE	CS	5829735	439611
39	Rendelsham Roadside	CS, LE	5843643	432622
40	Lake McIntyre	CS, LP, LT	5840108	439699
41	Red Rd, Mt Burr	CS	5832359	451034
42	Kalangadoo/Glencoe Rd	CS, LE	5828895	467217
43	Derrymoore Rd	CS	5840604	470977
44	Reedy Creek/Mt Hope Drain	CS, LP	5854923	433217
45	Peacock Rd nr Ewen's Ponds	CS, LE	5789711	481573
46	Racecourse Bay	CS, LE	5787892	477102
47	Boggy Field nr Road (nr SAM site)	CS, LT	5794127	464617
48	Winterfield Creek 2	CS, LP	5794201	463827
49	Carpenter Rocks1 Drain	CS, LP, NS	5805998	446013
50	Canunda Pk 1	no frogs	5829723	434216
51	Canunda Pk 2	GL	5833737	433832
52	Glencoe West Rd	CS, LP, LT, NS, LE	5830001	462875
53	The Marshes 3	GL	5834345	459415
54	Canunda Pk 3	no frogs	5832804	431016
55	Lake Bonney SE 2	CS	5829296	437835
56	Glenelg River nr Prince Margaret Caves	no frogs	5789731	495613
57	Carpenter Rocks - Pt MacDonnell Rd	LP, NS, LE	5800998	452021
58	Roads from Pt MacDonnell to Ewen's Ponds and Allandale East	LP, NS, LE	5788002	476927

Northings and Eastings as on Australian Map Grid, Zone 54.

(GL = *Geocrinia laevis*, CS = *Crinia signifera*, LD = *Limnodynastes dumerili*, LP = *Limnodynastes peroni*, LT = *Limnodynastes tasmaniensis*, NS = *Neobatrachus sudelli*, LE = *Litoria ewingi*)

### Vegetation and Habitat

As suggested from the literature (Barker et al 1995, Tyler 1978) *G. laevis* were found in depressed clearings subject to inundation at the edges of native forests or pine plantations (Fig. 3), with the exception of a single boggy farm paddock (site 12). This latter site was located only a few hundred metres from the nearby forested area. Despite their close proximity to main roads three sites (sites 17, 20, and 31) where *G. laevis* were found were also clearings near forests.

The cleared areas tended to be composed predominantly of reeds, grasses and sedges, with the occasional shrub and herbaceous plant. The major plants collected from the sites were the Nobby Clubrush (*Isolepis nodosa*), Sea Rush (*Juncus kraussii*), and Variable Sword-sedge (*Lepidosperma laterale*). Other plants commonly seen included the Buttercup (*Ranunculus* sp.), Spiny Mudgrass (*Pseudoraphis spinescens*) and other assorted grasses. A number of fallen branches and other timber from logging also provided habitat under which frogs could shelter.

Dead and dying reeds, sedges and grasses formed a heavy mat which retained moisture and provided a network of refuges in which *G. laevis* and other frogs could hide (Fig. 4). As a result it was almost impossible to catch the frogs, even when triangulation methods suggested they were only a few centimetres from the collectors. An intensive search through the undergrowth and under fallen timber produced little more success.

Frogs of other species were in abundance and were collected from a number of locations. A complete list of the sites visited, and frogs present can be found in Table 1.

A number of frogs were collected when they were seen on wet roads at night, but no *G. laevis* were found at these times.



**Figure 3.** Clearing in Mt Burr Forest, typical habitat of *Geocrinia laevis* in the South East of South Australia.



**Figure 4.** Dense mat of vegetation which provides shelter for a number of frog species.

#### Other species associated with *G. laevis*

Of the sites where *G. laevis* was detected three sites had no other species detected, five had one additional species, four had two species and one site had three species (Table 1). The Brown Tree Frog *Litoria ewingi* and *C. signifera* were commonly found with *G. laevis*, indicating some similarities in habitat requirements among these small ground-dwelling frogs.

It is also worth noting that the Brown Striped Marsh Frog *Limnodynastes peroni*, Spotted Grass Frog *Limnodynastes tasmaniensis* and Sudell's Frog *Neobatrachus sudelli* were not found at sites with *G. laevis* (Table 1), perhaps indicating some differences in habitat requirements among these species.

The minimum time for *C. signifera* and *L. ewingi* are reported as 49 days and 6-7 months respectively (Tyler 1994) but it is known that metamorphosis can be completed in approximately 30 days for *C. signifera* and 2 months for *L. ewingi* (SJW pers. obs.). In comparison *Lim. peroni* may take up to 11 months (Tyler 1978), *Lim. tasmaniensis* and *Neobatrachus sudelli* have a minimum tadpole life of 3-5 months and 4.5-7 months respectively (Tyler 1994). Therefore it is quite likely that the need for a long lasting supply of water in which to complete the tadpole stage limits the presence of these three species in areas where *G. laevis* is found. A single Eastern Banjo Frog *Limnodynastes dumerili* (tadpole stage 12-15 months (Tyler 1994)) was found at Honan's Scrub with *G. laevis*, but as it was the only one detected in the entire survey it is possible that this individual entered the area from the bordering property.

#### **Discussion**

With the major and continual modifications to the drainage system in the South East it seemed pertinent to determine the current status of the Smooth Frog in South Australia. Consideration was given to the possibility that *G. laevis* may inhabit areas which are vulnerable to agricultural development and that in the absence of any detailed knowledge of their current distribution it is possible that proposed development in the future may impact significantly upon this species.

*Geocrinia laevis* was found at 13 sites in the South East of South Australia during this study. With the exception of the site in Canunda National Park all of the sites were within the Reedy Creek / Dismal Swamp drainage area. This follows the reports of Beck (1975) with the addition of the Mingbool site further to the east.

Beck (1975) suggested that the site at Canunda was probably the result of "eggs or larvae washed down one of the man-made drains which cross the area between the Millicent Hills and the coast". It seems more likely however that the population at Canunda National Park is a relict of a previous distribution that covered much of the South East north of Mt Gambier. Prior to the drainage scheme in the South East, which first began around 1862, much of the Upper South East of South Australia experienced periods of severe flooding or inundation (South East Drainage Board 1980), with many localities having permanent or near permanent waters. The water movement in the Millicent area



tended to be directed North West towards Kingston SE, or South West towards Lake Bonney (i.e. in the direction of what is now Canunda National Park).

The locations where *G. laevis* can now be found are all areas which previously had permanent swamps and wetlands, including the Canunda site, and would have been at least closely connected during the wet months. Even though man-made drains were created in the area between 1862 and 1956 (South East Drainage Board 1980) to increase surface flow to the Lake Bonney area and to drain land for agricultural development and allow expanded settlement in the region, this area always had a high rainfall and natural drainage features that probably enabled populations to colonise the Canunda location prior to drainage activities.

Since the Beck survey a number of *G. laevis* have been collected in South Australia, some reported to the SA Museum (M Hutchinson pers. comm.) and others to the SA Frog and Tadpole Study Group (SJW pers. comm.). Included in the Museum records are two sites to the west of Pt MacDonnell near the coast. One location (Museum record named 'Blanche Bay') was a coastal shrubland / sedgeland in sand dunes and it seemed an unlikely habitat for *G. laevis* to have been found there in the recent past. The closest location, just over the sand dunes, which may have been suitable for frogs (Site 7) had frogs present including *Lim. peroni* and *C. signifera*, but there was no indication of *G. laevis*.

A number of sites sampled around the other southern location (Section 346 Hundred of Kongorong) also yielded no sign of *G. laevis*. There was no evidence to suggest that there had been any significant land use changes since the Museum records were collected there in 1983. The predominant land use in the area appeared to be grazing of livestock, with the majority of the land cleared of vegetation.

### Management

At most of the locations which were confirmed to have *G. laevis* present the species was abundant (more than 50 frogs calling). Provided the habitat at these areas remain largely undisturbed the species does not appear to be under any obvious threat of decline in the region. Both the Marshes wetland area and Honan's Scrub are native Forest Reserves (conservation zones) within Forestry SA and as such have the same status as Conservation Parks and are never going to be planted (B Grigg pers. comm.). The sites within Mt Burr Forest are located in unused areas of that forest that are unsuitable due to flooding (B Grigg pers. comm.). It is possible that these sites will be planted at the next rotation, in approximately 25 years, if conditions change. However, if these locations are in their current form (i.e. swampy or boggy areas) they will not be planted and may remain unused indefinitely (B Grigg pers. comm.). There are no plans to clear any native scrub in the foreseeable future (B Grigg pers. comm.).

Although *G. laevis* has a restricted distribution it is locally abundant and does not appear to be in danger of decline under present conditions.

## Acknowledgements

We are greatly indebted to Ben Smith (University of Adelaide) for his considerable enthusiasm and assistance in each of the field trips. Mark Hutchinson provided the SA Museum records, and Sandy Carruthers (Planning SA) produced the floristic vegetation maps. Barrie Grigg (Forestry SA) was especially helpful in allowing access to Forestry land and sharing information about the region. Members of the SA Frog and Tadpole Study Group also shared knowledge on the species. Daniel Rogers (University of Adelaide) kindly gave us the use of his DAT recorder and helped with the analysis of calls on computer. David Gooding (EPA) willingly helped in the preparation of the distribution map. This project was funded by a grant from the Wildlife Conservation Fund, support and facilities were provided by the Environment Protection Agency.

## References

Barker, J., Grigg, G.C. and Tyler, M.J. (1995). A Field Guide To Australian Frogs. Surrey Beatty & Sons, Chipping Norton.

Beck, R.G. (1975). Factors affecting the distribution of the leptodactylid frog *Geocrinia laevis* in the south-east of South Australia. *Trans. R. Soc. S. Aust.* **99**(3):143-147.

Bird, P. and Tyler, M.J. (1990). First South Australian record of the fossorial leptodactylid frog genus *Uperoleia* Gray. *Trans. R. Soc. S. Aust.* **114**: 223–224.

Brook, A.J. (1984). "Atlas of Frogs of South Australia." Dept Zoology, University of Melbourne, Publ. No. 4.

Foulkes, J. (1998) Inhabitants of the South East swamps : giant mozzies to rare marsupials. *Parks & Wildlife*. Winter 1998:4.

Goonan, P.M., Gooding, D.G. & Hill, B.M. (1997). "FROG CENSUS 1995 and 1996. A Report on Community Monitoring of Water Quality and Habitat Condition in South Australia using Frogs as Indicators." Environment Protection Authority, South Australian Department for Environment and Natural Resources, Adelaide.

Goonan, P.M., Hill, B.M. & Walker, S.J. (1998). "FROG CENSUS 1997. A Report on Community Monitoring of Water Quality and Habitat Condition in South Australia using Frogs as Indicators." Environment Protection Agency, South Australian Department for Environment Heritage and Aboriginal Affairs, Adelaide.

Johnston, G.R. (1990). *Cyclorana maini* and *Notaden* sp.: Additions to the frog fauna of South Australia. *Trans. R. Soc. S. Aust.* **114**:229.

South Eastern Drainage Board (1980). Environmental Impact Study on the Effect of Drainage in the South East of South Australia. South Eastern Drainage Board, Adelaide.

Specht, R. (1998). Avisoft SAS-Lab Pro Version 3.5b (Computer Programme).

Tyler, M.J. (1971). Discovery in the Everard Ranges of a species of leptodactylid frog new to the fauna of South Australia. *Trans. R. Soc. S. Aust.* **95**: 215-217.

Tyler, M.J. (1977). "Frogs of South Australia." (2<sup>nd</sup> Ed.). S. Aust. Museum, Adelaide.

Tyler, M.J. (1978). "Amphibians of South Australia." Government Printer, South Australia.

Tyler, M.J. (1994). "Australian Frogs: A Natural History." Reed Books, NSW.

Tyler, M.J. (1997). "The Action Plan for Australian Frogs." Wildlife Australia, Endangered Species Program.

Walker, S.J., Hill, B.M. and Goonan, P.M. (1999). "FROG CENSUS 1998. A Report on Community Monitoring of Water Quality and Habitat Condition in South Australia using Frogs as Indicators." Environment Protection Agency, South Australian Department for Environment Heritage and Aboriginal Affairs, Adelaide.

Woodruff, D.S. and Tyler, M.J. (1968). Additions to the frog fauna of South Australia. *Rec. S. Aust. Mus.* **15**(4):705-709.