DEFINING THE CHARACTERISTICS OF BURROWS TO BETTER ESTIMATE ABUNDANCE OF THE GRAPSID CRAB, *HELOGRAPSUS HASWELLIANUS* (DECAPODA, GRAPSIDAE), ON EAST AUSTRALIAN SALTMARSH

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**ABSTRACT**

The present paper reports on use-defined characteristics of burrows to increase the accuracy of abundance estimates of the grapsid crab, *Helograpsus haswellianus*. The crab is common in southeast Queensland saltmarsh where it has been the focus of impact assessments. Burrows are constructed in clay sediments within the intertidal zone and provide a significant pathway for tidal infiltration. Regular maintenance of inhabited burrows is necessary to avoid burrow collapse and is exhibited as fresh sediment deposits near the burrow entrance. Burrows were characterized in terms of their use by *H. haswellianus* and defined as used or unused. Burrow counts were taken from 20 quadrats on two saltmarsh shores which were excavated to determine actual crab abundances. The relationship between surface burrow counts and crab abundance was examined with linear regression to test the accuracy of burrow use characteristics. Results indicate a significant increase in the accuracy of explaining variation in the relationship between burrows and crab abundance, from 33% to 97%, when burrows were defined as used or unused by the crab. Mean density of use-defined burrows predicted *H. haswellianus* density within confidence limits of $\pm 0.16$ crabs/burrow compared to $\pm 0.63$ crabs/burrow when burrows remained undefined. This study provides the most accurate method yet reported for employing burrows as a measure of the apparent abundance of grapsid crabs. The technique could be adapted for use in environmental monitoring or rapid assessment programmes where reliable and accurate measures of infauna abundance are required.

**RÉSUMÉ**

Le présent article étudie les caractéristiques des terriers, liées à leur usage, pour augmenter la précision des estimations d’abondance du crabe Grapsidae, *Helograpsus haswellianus*. Ce crabe est commun dans les marais salés du sud-est du Queensland où il a fait l’objet d’évaluation de son impact. Les terriers sont construits dans les sédiments argileux de la zone intertidale et constituent une voie importante à l’infiltration de la marée. La maintenance régulière des terriers occupés est...
nécessaire pour éviter leur effondrement et se traduit par la présence de dépôts de sédiments près de l’entrée du terrier. Les terriers ont été caractérisés en fonction de leur usage par *H. haswellianus* et définis comme utilisés ou non utilisés. Les comptages de terriers ont été réalisés sur 20 quadrats sur deux rives de marais qui ont été creusés pour déterminer les abondances réelles des crables. La relation entre les comptages de terriers de surface et l’abondance des crables a été examinée avec une régression linéaire pour tester l’exactitude des caractéristiques de l’usage des terriers. Les résultats indiquent un accroissement significatif de l’exactitude de la variation des relations entre les terriers et l’abondance des crables, qui va de 33% à 97%, quand les terriers sont définis comme utilisés ou non utilisés par le crabe. La densité moyenne des terriers à usages définis ont permis de prédire la densité de *H. haswellianus* dans des limites de confiance de ±0,16 crabe/terrier par rapport à ±0,63 crabe/terrier quand les terriers restaient indéfinis. Cette étude fournit la méthode la plus précise jamais rapportée pour utiliser les terriers comme une mesure de l’abondance apparente des crables Grapsidae. La technique pourrait être adaptée pour être utilisée dans la surveillance de l’environnement ou dans des programmes d’évaluation rapide lorsque des mesures fiables et exactes d’abondance de telles faunes sont requises.

**INTRODUCTION**

The grapsid crab, *Helograpsus haswellianus* (Whitelegge, 1889), is common on saltmarsh and mangrove along the eastern coastline of Australia from Queensland south to Tasmania, where it burrows in soft sediments within the intertidal zone. *H. haswellianus* is nocturnal, euryhaline (0 to 65 ppt tested; Marsh, 1982) and forages widely on the shore between tides. This poses a problem for monitoring programmes which sample the apparent abundance of *H. haswellianus* because traditional methods such as pitfall traps may only capture foraging individuals (Chapman et al., 1998) and use of burrow counts to predict abundance have often misrepresented true abundance (McKillup & Butler, 1979; Warren, 1990). Burrows increase the surface area available for tidal infiltration of seawater (Smith et al., 1991), maintaining an important chemical pathway between anoxic sediments and seawater (Nomann & Pennings, 1998), and provide crabs with daytime protection from predation and desiccation as well as being used for courting, breeding, and molting (Morrisey et al., 1999). Methods for estimating crab abundance by defining burrow characteristics which can increase the accuracy of measurements would be useful for grapsid crab monitoring programmes.

The burrowing behaviour of *H. haswellianus* is detailed by Hale (1927) for laboratory observed specimens, Marsh (1982) for field populations in Tasmania, and by McKillup & Butler (1979) for field populations in South Australia. These studies describe *H. haswellianus* burrows as consisting of a single chamber descending to depths of around 40 cm and having either one or a few burrow entrances. In southeast Queensland, the northern distributional limit of the species, the crab constructs burrows at sites throughout the littoral zone but is more common at distances of 30 m or greater from the saltmarsh/mangrove interface.