Recovery of the critically endangered river pipefish, *Syngnathus watermeyeri*, in the Kariega Estuary, Eastern Cape province

P.D. Vorwerk[a], P.W. Froneman[b*] and A.W. Paterson[a]

An intensive ichthyofaunal survey in the permanently open Kariega Estuary along the Eastern Cape coast has identified a breeding population of the critically endangered river pipefish, *Syngnathus watermeyeri*, within the middle and upper reaches of the system. This is the first recorded capture of this species in the estuary for over four decades. We suggest that the presence of *S. watermeyeri* is the result of the heavy rainfall within the region, which contributed to the establishment of optimum habitat requirements (mesohaline conditions and increased food availability) of the pipefish.

Introduction

The river pipefish, *Syngnathus watermeyeri*, was originally recorded in only three Eastern Cape estuaries, the permanently open Bushmans and Kariega estuaries, and the temporarily open/closed (TOC) Kasouga Estuary.[1] The pipefish is typically associated with beds of submerged macrophytes (mainly *Zostera capensis* and *Ruppia cirrhosa*), where it feeds almost exclusively on zooplankton.[2] Sexual maturity is attained at approximately 10 cm standard length (SL) and the lifecycle is completed within the estuary.[3] Whitfield and Bruton[4] suggested that the observed decline in abundance of this species within its home range was likely due to reduced habitat and food availability, resulting from catchment management practices, mainly abstraction of fresh water.

The *South African Red Data Book on Fishes*[5] was the first publication to acknowledge that the river pipefish was threatened and advised that the 'status and conservation of the species' be established. Between 1989 and 1992, extensive surveys were conducted within the home range of the pipefish to determine its status. No specimens were recorded in the three estuaries during the survey.[6,7] Before 1996, the last specimens had been collected from its historical range in 1963, which led to the *1994 IUCN Red List of Threatened Animals*[8] describing *S. watermeyeri* as extinct. The validity of this classification was questioned by Whitfield and Bruton,[4] as 50 years had not passed since the last specimens had been collected in the wild. Since these publications, a breeding population of *S. watermeyeri* was identified in the TOC East Kleinemonde Estuary.[9] In 2003, however, a flood event in this estuary resulted in the apparent localized extinction of *S. watermeyeri*, which was thought to be the result of the dramatic decline in the availability of suitable habitat due to the submerged macrophyte beds being flushed out to sea. No specimens have subsequently been recorded in the East Kleinemonde Estuary, as the macrophyte beds have not subsequently re-established. Here we report on the discovery of a cohort of the endangered river pipefish in the permanently open Kariega Estuary, which is most likely due to the re-establishment of a salinity gradient in the estuary and increased food sources resulting from enhanced freshwater inflow.

Materials and methods

An intensive survey of the ichthyofauna of the littoral zone of the Kariega Estuary was undertaken between 2 and 9 November 2006 (Fig. 1). In total, 60 stations were occupied along the length of the estuary. A 5-m seine net with a 500-μm mesh size was used for sampling. In addition, temperature and salinity were measured,

[a]South African Environmental Observation Network (SAEON) Elwandle Node, Somerset Street, Grahamstown 6140, South Africa.
[b]Zoology and Entomology Department, Rhodes University, Grahamstown 6140, South Africa.
*Author for correspondence.
E-mail: w.froneman@ru.ac.za

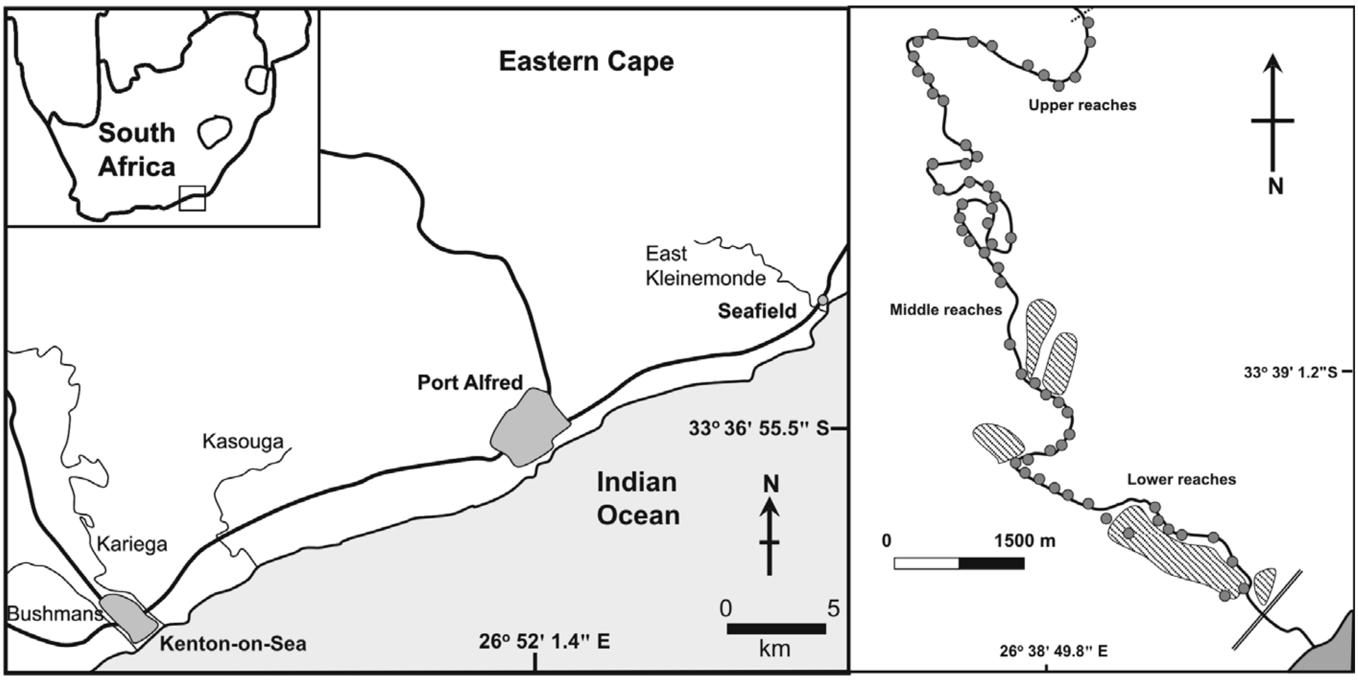

Fig. 1. Map of the sampling stations within the Kariega Estuary during November 2006. Also indicated are the locations along the South African coast of the four estuaries mentioned in the text.

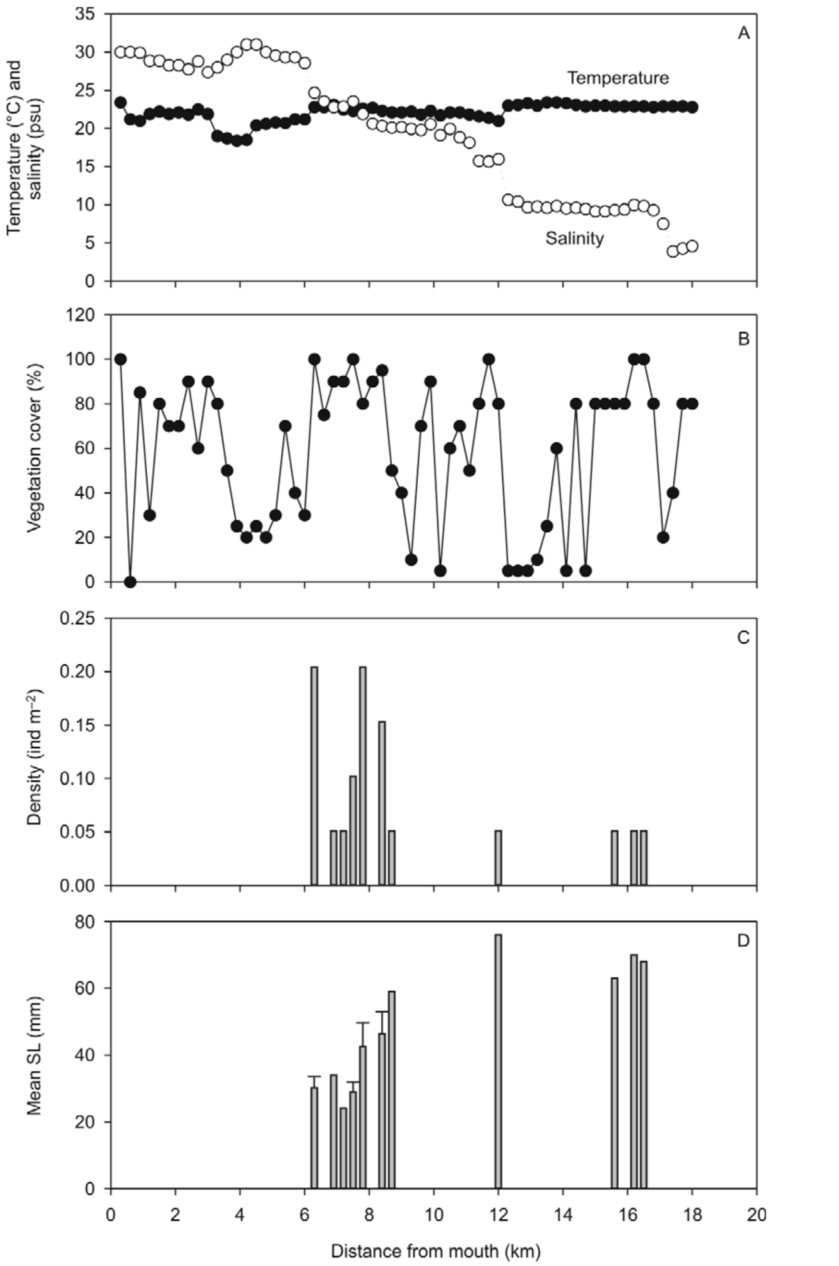

Fig. 2. The physico-chemical environment (**A**), vegetation cover (**B**), density of *Syngnathus watermeyeri* (**C**) and mean standard lengths (**D**) recorded during the November 2006 survey within the Kariega Estuary. SL, standard length; psu, practical salinity unit.

using a Horiba U10 water sampler. The percentage of submerged vegetation cover was also estimated by eye at each station within the *Zostera* beds being sampled.

Results

Water temperature along the estuary was fairly uniform, ranging between 21°C and 25°C (Fig. 2A). A distinct horizontal gradient in salinity was evident, with low-salinity waters (4 psu) recorded at the head of the estuary and marine waters at its mouth (35 psu) (Fig. 2A). The percentage vegetation cover at the various sites along the estuary was highly variable and ranged from 5% to 100% (Fig. 2B).

A total of 20 specimens of *S. watermeyeri* was collected during the survey from the middle and upper reaches of the estuary (Fig. 2C). The length of the specimens ranged from 24 mm to 76 mm, all therefore being juveniles. Pipefish densities ranged from 0.05 to 0.2 individuals per square metre. Peaks in the abundance of the fish were associated with those stations where mesohaline conditions prevailed and the percentage vegetation cover exceeded 80% (Fig. 2B). A distinct spatial pattern in the SL values was evident, with the specimens collected from the middle reaches being smaller (24–59 mm SL) than those observed in the upper reaches (63–76 mm SL) of the estuary (Fig. 2D).

Discussion

The heavy rainfall that fell over the southeastern Cape region during the early spring of 2006 contributed to the formation of a distinct horizontal gradient in salinity in the Kariega Estuary, for the first time since 1991.[6,7,10,11] The biological response to the influx of fresh water into the estuary currently forms part of an extensive study being conducted by members of the South African Institute for Aquatic Biodiversity, the South African Environmental Observation Network (SAEON) and Rhodes University.

The study reported here collected 20 specimens of *S. watermeyeri* from the middle and upper reaches of the estuary. These are the first reported examples of the pipefish in the estuary for over four decades.[4] Further indication of the species' eradication from the Kariega Estuary was the lack of representatives collected by Whitfield and Paterson[11] during quarterly sampling in 1999. All of our specimens were juveniles, with standard lengths ranging from 24 mm to 76 mm. The predominance of juveniles suggests successful breeding/recruitment within the estuary. The apparent spatial variability in the different size classes of *S. watermeyeri* during our study is the first reported for this species.

It is worth noting that, over the past year, further specimens of the pipefish have also been recorded in the temporarily open/closed Kasouga Estuary and the permanently open Bushmans River Estuary within the same geographical region. In both instances the pipefish were associated with extensive beds of submerged macrophytes. Molecular evidence suggests that the specimens collected earlier from the East Kleinemonde Estuary and those gathered in 2005 from the Bushmans River Estuary belong to the same population (M. Mwale, pers. comm.). Although this is speculation, the resurgence of this species in its original home range estuaries may be a result of re-colonization following the East Kleinemonde flood event of 2003. If so, this evidence provides the first indication of coastal transport by *S. watermeyeri*. Alternatively, the populations have been in continuous existence in these systems although at extremely low densities. It appears, however, that the current population is fairly resilient and, following the good rainfall in 2006, the fish had bred successfully, with several juveniles recorded.

These preliminary observations suggest the revival of the river pipefish in selected Eastern Cape estuaries. *Syngnathus* *watermeyeri* relies on zooplankton for feeding and young individuals require microzooplankters as a food source.[3,4] Wooldridge[12] indicated that microzooplankters are eradicated from estuaries under low-flow conditions. The eggs of copepods lie dormant until fresh water flows sufficiently to indicate the presence of a food resource (chlorophyll), at which time the eggs hatch. It is worth noting that during a simultaneous study of the zooplankton community in the Kariega Estuary at the time of the heavy rains in 2006, zooplankton density increased fourfold compared with a dry season (November 2005; Vorwerk and Froneman, unpublished data). The revival of the pipefish within the Kariega Estuary may therefore be the result of increased food availability.

The future of the pipefish population established within the estuaries is unclear. It is likely that a return to reduced freshwater inflow, conditions which prevailed over the last decade, will coincide with a decline in food availability. The response of the river pipefish to increased influx of fresh water indicates the need for a freshwater reserve, which would allow estuaries such as the Kariega to provide habitats for species such as *S. watermeyeri.*

The river pipefish should still be considered highly endangered, because of its limited distribution and susceptibility to hypersaline conditions and large flood events. Provision of a freshwater reserve could ensure regular pulses of water to the estuary during appropriate seasons, which would improve the species' chances of survival.

Finally, consideration should be given to changing the common name of this species from the river pipefish to the estuarine pipefish, as suggested by Whitfield.[2] This species has only ever been recorded in permanently and temporarily open estuaries. Changing the common name would therefore indicate its habitat preference and prevent confusion with other pipefish that are truly riverine in nature.

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Asthma, *Euphorbia hirta* and its anti-inflammatory properties

O.E. Ekpo* and E. Pretorius*‡

EUPHORBIA HIRTA IS A PLANT USED IN TRADItional medicine for a variety of diseases, such as cough, asthma, colic dysentery and genito-urinary infection. This plant, belonging to the family *Euphorbiaceae*, is also known as the Australian asthma herb or Queensland asthma weed, and is not toxic when taken in typical dosages. In South Africa, it is commonly used for asthma, which is one of the most common respiratory complaints. Although corticosteroids are considered the best means of defence against this debilitating illness, many people, especially in poor countries, rely on herbal remedies for its treatment. We discuss recently published results to assess the effect of the plant using the BALB/c murine asthma model. We also review the different compounds found in plant extracts, in an attempt to understand the reason for its anti-inflammatory properties. We conclude that the flavonoids quercitrin (converted to quercetin in the alimentary canal) and myricitrin, as well as the sterols 24-methylene-cycloartenol and -sitosterol, exert noteworthy and dose-dependent anti-inflammatory activity. The triterpene β-amyrin also seems to exert a similar anti-inflammatory activity. Tannins and tannic acid derivatives, also present in the plant, have antiseptic effects and the two triterpenoids, taraxerone (EH-1) and 11α, 12α-oxidotaraxerol (EH-2), in *E. hirta* demonstrate antibacterial and antifungal properties. The effectiveness of *E. hirta* in treating asthma may lie predominantly in the synergistic relationships between the flavonoids, sterols and triterpenoids.

*Department of Anatomy, Faculty of Health Sciences, University of Pretoria, P.O. Box 2034, Pretoria 0001, South Africa.
‡Author for correspondence.
E-mail: resia.pretorius@up.ac.za

Introduction

Asthma is one of the most common respiratory complaints in the world today. It affects an estimated 300 million people worldwide, of whom about 50 million live in Africa, 15 million in the U.S., 5 million in the U.K. and 2 million in Australia.[1,2] Ten per cent of asthma sufferers are children and 5% are adults. Asthma mortality in the United States amounted to some 5000 persons in the year 2000. The global prevalence of the disease is expected to rise to 400 million by the year 2025.[3]

Most of the available pharmacological therapies simply control the known mechanisms by which the disease occurs. There is no complete cure for asthma. Pharmaceutical products have been the main source of anti-asthma treatment but some of these have recently been associated with serious adverse effects.

It is estimated that there are about 27 million consumers of indigenous medicine in southern Africa, a large number of whom consult traditional healers for potentially life-threatening conditions.[4,5] An estimated 60% of the South African population is reported to consult traditional healers.[6] Moreover, the steady increase in incidence of asthma has, as with any chronic condition, opened up a new era where sufferers are resorting to alternative treatments.[7]

One of the herbs used against asthma in southern Africa is *Euphorbia hirta* (family *Euphorbiaceae*), also known as the Australian asthma herb or Queensland asthma weed, cat's hair, hairy spurge, spurge or milkweed. In India, the plant is used for