patch in a leeward valley (Wace 1961). Both plants have their closest relatives in the South American region, although they are not necessarily capable of wind-mediated dispersal.

In view of *P. xylostella's* original distribution on Marion Island, the implications of the above model, and its exceptional migratory abilities (1 000 km.day^{-1} (Lokki *et al* 1978, Talekar *et al* 1985), Crafford & Chown's (1990) hypothesis of oversea colonisation appears to be reasonable, leaving the issue of *P. xylostella's* mode of transport to the islands unresolved. A biochemical (allozyme of mtDNA) comparison of the population on Marion Island with populations from the farms where the produce for the station was purchased would resolve this issue. However, Crafford & Chown's (1990) suggestion that the moth should be considered a natural coloniser, irrespective of its mode of transport, and that the founder event should be followed, remains pertinent.

Finally, the model has important implications for the siting of pollen traps and other devices that are used for monitoring propagule arrival in the sub-Antarctic and other windswept areas. As such, it is relevant to the Biological Investigations of Terrestrial Antarctic Systems (BIOTAS) programme of the Scientific Committee on Antarctic Research (SCAR) (Lewis Smith 1988). Monitoring colonisation events, and relative catches in propagule traps, located at specific sites on sub-Antarctic Islands, could also provide evidence capable of falsifying the hypothesis.

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Feeding biology of *Acantholatris monodactylus (Pisces: cheilodactylidae)* at Tristan da Cunha and Gough Island, South Atlantic

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The feeding biology of the fivefinger, Acantholatris monodactylus *from Tristan da Cunha and Gough Island is described. Comparison of stomach and hindgut contents indicates that stomachs are more suitable for dietary analysis in this species. It is apparent that a slight shift in diet may occur with size and season. Comparison of the diets of fishes collected at Nightingale and Gough Islands with those collected at Tristan Island indicate that locality plays an important role in determining the diet of this species. Significant differences in sea surface temperatures between Tristan da Cunha and Gough Island suggests that this physical parameter is of prime importance in regulating the availability of food items and therefore diet in* A. monodactylus.

Die voedingsbiologie van die "fivefinger", Acantholatris monodactylus, *afkomstig van Tristan da Cunha en Gough-eiland word beskryf. Vergelyking van maag- en derminhoud dui aan dat maaginhoud meer geskik is vir dieetanaliese in hierdie spesies. Dit blyk dat effense verskille in die dieet voorkom met grootte en seisoen. Vergelyking van die diëte van visse wat op Nightingale- en Gough-eiland versamel is, met dié van Tristan-eiland dui aan dat lokaliteit 'n belangrike rol speel in die samestelling van die dieet van hierdie spesies. Betekenisvolle verskille in see-oppervlaktemperature tussen Tristan da Cunha en Gough-eiland dui aan dat hierdie fisiese parameter van primêre belang is met betrekking tot die beskikbaarheid van voedsel en dus die dieet van* A. monodactylus.

Introduction

The fivefinger *Acantholatris monodactylus* is a fish species that occurs only at oceanic islands and seamounts in the south Atlantic and south Indian Oceans. The species has been reported from Tristan da Cunha, Gough Island and Vema Seamount in the south and south-east Atlantic Ocean (Penrith 1967), and from St Paul and Amsterdam Islands (Sauvage 1879), Walters Shoal and various seamounts (Duhamel 1984, Collette & Parin 1991) in the south Indian Ocean. Little has been published on the biology of *A. monodactylus*. Beurois (1976) carried out a dietary study on the species at Amsterdam Island as part of an investigation on the marine resources of that island group.

The Tristan da Cunha group consists of Tristan, Nightingale and Inaccessible Islands, which lie on the eastern slopes of the Mid-Atlantic Ridge at 37°05'S, 12°17'W. Gough Island lies approximately 200 nautical miles to the south-east at 40°19'S, 12°17'W (Fig 1). All the islands have relatively narrow shelf areas (e g extending a maximum of about 1.5 nautical miles to sea at Tristan Island) that then drop off into abyssal depths (Fig 2).

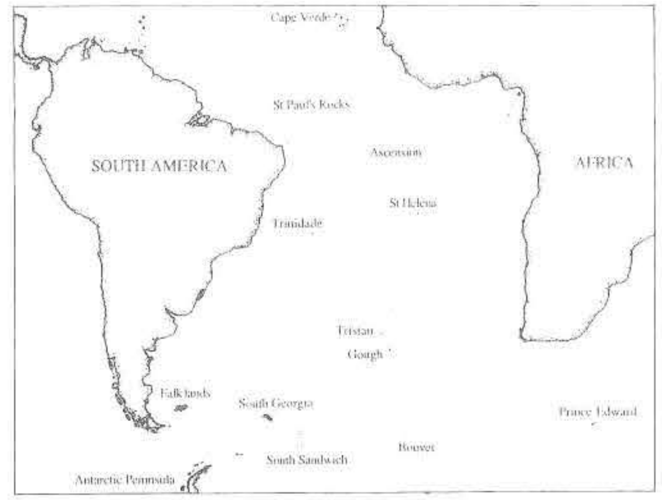

Fig 1: The position of Tristan da Cunha and Gough Islands in the South Atlantic Ocean

All evidence to date suggests that these islands lie within the influence of the Subtropical Convergence (STC) (Lutjeharms *et al* in press, Andrew *et al* 1993). It has been suggested that seasonal changes in stratification in the ocean around the islands may lead to increased nutrient availability and therefore higher primary productivity during the summer months (Allanson *et al* 1981, Andrew *et al* 1993). Fig 3 shows insolation-related differences in the sea surface temperatures at Tristan and Gough Islands (from all available data up to 1980).

At Tristan da Cunha the fivefinger is an important food and bait fish and constitutes the largest percentage in terms of weight and numbers of species caught by handline. Approximately 18.5 tonnes are taken each year (unpublished data from present study). Juvenile and adult fivefingers occur supra-benthically in a wide variety of habitats and in depths from about 1.5 m to at least 200 m. The larval stage can last up to 12 months and is spent in the pelagic zone. Larvae metamorphose into supra-benthic juveniles at a size of about 70 mm Total Length (TL). The species grows to a size of at least 670 mm TL and a weight of 4 kg and reaches an age of at least 25 years (Sivertsen 1945, Andrew *et al* 1993).

It has been found that growth and reproduction are tem-

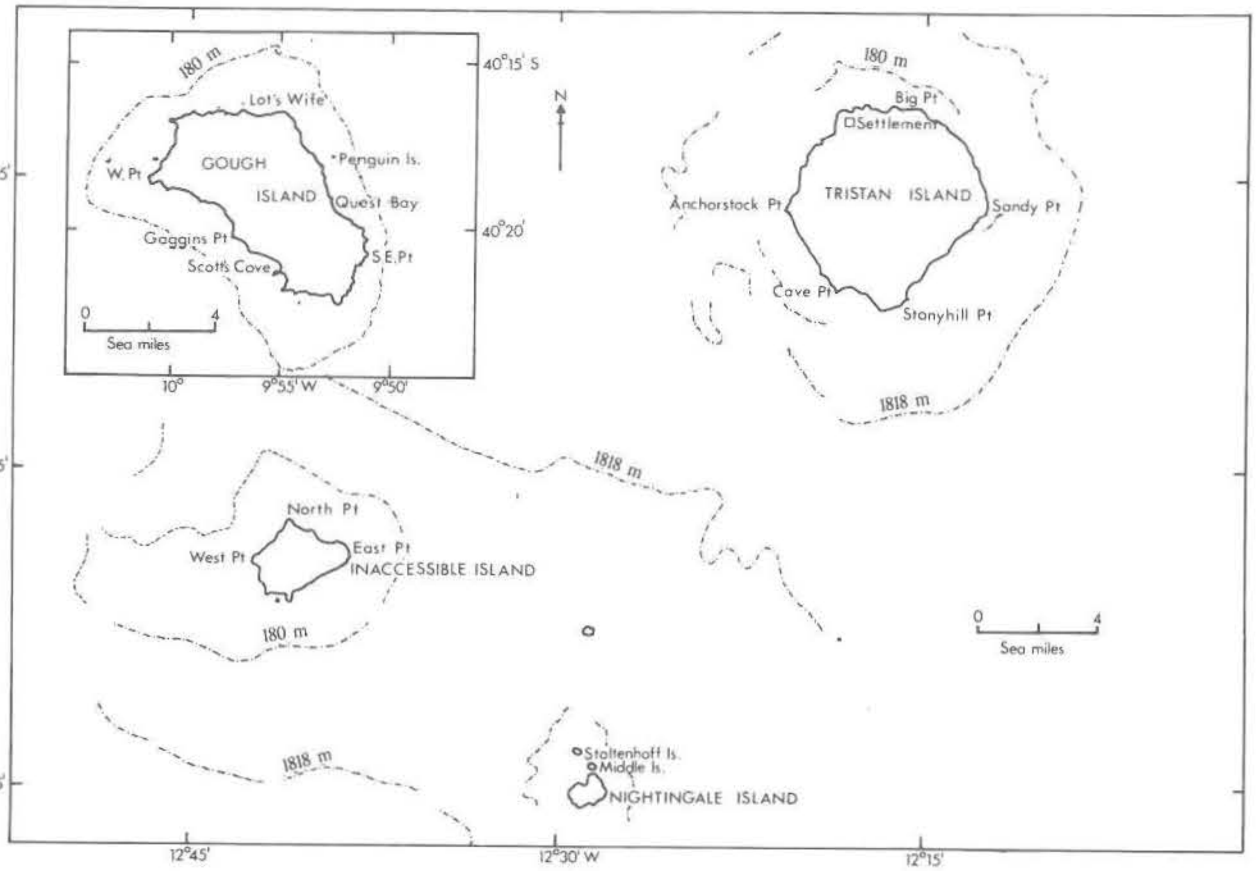

Fig 2: The Tristan da Cunha group with Gough Island inset showing the 180 m isobath around the islands (after Roscoe 1979)

porally influenced by seasonal temperature fluctuations at Tristan da Cunha (unpublished data from present study). It was hypothesised that the seasonal and spatial temperature changes would also have an effect on the availability of food and thus the diets of the fishes occurring at these islands.

Methods

Stomachs and hindguts were removed from fish over an eighteen-month period (October 1988 to March 1990) while TGA was based on Tristan da Cunha. Most of the fish sampled were obtained from the catch of the local

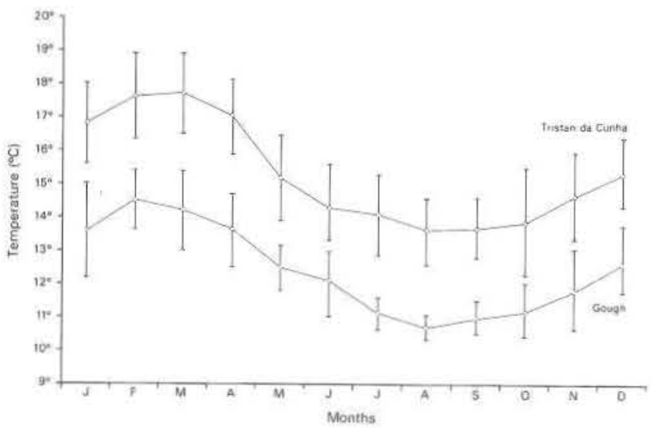

Fig 3: The monthly mean sea surface temperatures with standard deviations for each month for the islands of Gough and Tristan da Cunha. These calculations are based on all available data until 1980. (After Andrew et al 1993)

rock lobster fleet. The fleet consists of 18 to 22 two-man powerboats that catch fish for food and lobster bait with handlines in water ranging from 10 m to 150 m. The Tristan Island fleet fishes only on the shelf around this island. Smaller specimens were in addition collected at Tristan Island with hook and line from the shore and in rockpools using rotenone ichthyocide. Fishes were also collected with hook and line and in lobster traps at Nightingale and Inaccessible Islands from the shore and from aboard the 600-tonne Cape Town based rock lobster vessel mfv *TRISTANIA II:* Samples were obtained at Gough Island from the shore using handlines and also off-shore from lobster traps. Using these methods it was possible to collect gut samples of fish, ranging from 182 mm to 575 mm TL, from water ranging from 1 m to over 200 m depth. A total of 375 fish were examined for gut contents. All the fish were measured for TL and mass to the nearest millimeter and gramme respectively. Of the 375 fish, 102 specimens had food remains in their guts and were used in this study.

Stomachs and hindguts were removed from fresh specimens and preserved in buffered 10% formalin solution. After three months the material was transferred to 50% propyl alcohol. Gut contents were identified to the lowest possible taxon and weighed to the nearest 0.01 gramme. The percentage contribution by mass of each food group in individual stomachs (Windell & Bowen 1978) and the overall percentage frequency of occurrence (Hynes 1950) was calculated. A ranking index for each food type was calculated by multiplying the percentage frequency of occurrence with the mean percentage mass of each food group and dividing the product by 100 (adapted from Hobson 1974).

Table 1

Comparison of food groups represented in 63 stomachs (S) and 44 hindguts (H) of *A. monodactylus* (TL 182-575 mm) collected at Tristan Island

Prey species	% Frequency occurrence		Mean % mass		Rank	
	S	H	S	H	S	H
ALGAE	68.3	72.7	58.0	60.7	39.6	44.2
Phaeophyta	54.0	45.5	43.1	41.6		
Ulva sp.	19.0	22.7	11.3	16.6		
Remains	15.9	9.1	3.6	2.5		
PISCES	23.8	4.5	17.0	3.2	4.0	0.1
Nelabrichthys ornatus	1.6	2.3	1.6	0.9		
Remains	22.2	2.3	15.4	2.3		
POLYCHAETA	9.5	13.6	4.5	9.0	0.4	1.2
Spirorbis sp.	3.2	9.1	1.5	9.0		
Remains	6.3	4.5	3.0	0.03		
UNIDENTIFIED REMAINS	7.9	22.7	4.3	11.4	0.3	2.6
AMPHIPODA	9.5	20.5	2.2	3.0	0.2	0.6
MACRURA	4.8	4.5	3.4	1.0	0.2	0.05
Jasus tristani	4.8	4.5	3.4	1.0		
ECHINOIDEA	3.2	6.8	3.2	6.8	0.1	0.5
OPHIUROIDEA	4.8	2.3	1.7	0.05	0.08	T
BRACHYURA	4.8	4.5	1.2	0.5	0.06	0.02
SALPIDAE	1.6	—	1.0	—	0.02	—
SIPUNCULIDA	1.6	6.8	0.7	0.09	0.01	T
CIRRIPEDIA	1.6	—	0.9	—	0.01	—
BRACHIOPODA	1.6	4.5	0.01	4.0	T	0.2
OPISTHOBRANCHIA	1.6	—	0.2	—	T	—
ISOPODA	1.6	4.5	0.04	0.2	T	T
COPEPODA	1.6	—	0.04	—	T	—
POLYPLACOPHORA	—	4.5	—	0.09	—	T

T = Trace, i e items with a rank < 0.01

In order to determine if the contents of stomachs and hindguts differed, the contents of 63 stomachs and 44 hindguts of fishes ranging in size from 182 mm TL to 575 mm TL collected at Tristan Island were compared. To determine if a shift in diet occurred with size in this species, fish from Tristan Island were separated into two size classes. Stomach contents of 30 fish smaller than 350 mm TL and 33 fish larger than 350 mm TL were compared. The stomach contents of 14 specimens from Nightingale and Inaccessible Islands (180 mm to 420 mm TL) were compared with 63 stomachs taken from fish collected at Tristan Island (182 mm to 575 mm TL) to determine if there was a change in diet with locality at the northern islands. To test if a shift in diet with season occurred, the stomachs from 21 fish caught in winter (219 mm to 467 mm TL) and 42 fish caught in summer (182 mm to 575 mm TL) at Tristan Island were compared. Finally, the contents of 25 stomachs from fish collected at Gough Island (256 mm to 435 mm TL) were compared with 63 stomachs from fish collected at Tristan da Cunha (182 mm to 575 mm TL). The last two comparisons were carried out to determine if diet was affected by seasonal and spatial differences in oceanographic conditions.

Spearman Rank Correlation Coefficients (*rs*) and *t* values were calculated from percentage frequency of occurrence data in order to determine if the diets in the above comparisons were significantly correlated. A one-tailed *t* test was carried out after an *rs* adapted for ties in the rank data had been calculated for each comparison using the methods described by Siegel (1956) and Fritz (1974).

Results

Table 1 shows that indigestible material was concentrated in the hindgut of *A. monodactylus*. Algae were highly ranked in both stomachs and hindguts indicating that virtually no digestion of the macrophytic material

Table 2

Comparison of food groups represented in the stomachs of *A. monodactylus* smaller (n = 30) and larger (n = 33) than 350 mm TL

Prey species	% Frequency occurrence		Mean % mass		Rank	
	< 350 mm	> 350 mm	< 350 mm	> 350 mm	< 350 mm	> 35 m
ALGAE	66.6	75.8	53.5	62.2	35.6	47
Phaeophyta	50.0	57.6	41.4	44.7		
Ulva sp.	13.3	24.2	10.1	12.4		
Remains	16.7	15.2	2.0	5.1		
PISCES	26.7	21.2	18.5	15.5	4.9	3.
Nelabrichthys ornatus	—	3.0	3.0	—		
Remains	26.7	18.2	18.5	12.5		
POLYCHAETA	16.7	3.0	6.8	2.3	1.1	0.0
Spirorbis sp.	6.7	—	3.1	—		
Remains	10.0	3.0	3.7	2.3		
UNIDENTIFIED REMAINS	6.7	9.1	6.2	2.5	0.4	0.
AMPHIPODA	13.3	6.1	2.9	1.7	0.4	0.
ISOPODA	6.7	—	3.1	—	0.2	-
ECHINOIDEA	3.3	3.0	3.3	3	0.1	0.0
OPHIUROIDEA	3.3	6.1	3.3	0.2	0.1	0.0
SIPUNCULIDA	3.3	—	1.5	—	0.1	-
CIRRIPEDIA	3.3	—	1.8	—	0.06	-
MACRURA	3.3	9.1	1.5	6.5	0.05	0.
Jasus tristani	3.3	9.1	1.5	6.5		
BRACHYURA	3.3	6.1	1.5	1	0.05	0.0
SALPIDAE	—	3.0	—	2.0	—	0.0
BRACHIOPODA	—	3.0	—	0.02	—	T
OPISTHOBRANCHIA	3.3	—	0.3	—	T	-
COPEPODA	3.3	—	0.1	—	T	-

T = Trace, i e items with a rank < 0.01

took place. Soft, easily digestable material such as fish, salps and sipunculids ranked much higher in stomachs that in hindguts while the relatively indigestible calcareous tubes of *Spirorbis* sp., the exoskeletons of amphipods and the shells of brachiopods were concentrated in the hindgut. The statistical comparison of the percentage frequency of occurrence of items found in the stomach and hindgut ($rs = 0.625$; $t = 3.83$; $P < 0.01$) showed a significant correlation between the two. However, differences were apparent in mean percentage mass of particular ingested items.

Table 2 shows that macroalgae were less important in the diet of smaller *A. monodactylus* than in larger specimens. It is also apparent that a greater variety of small benthic invertebrates were taken by smaller specimens. Invertebrates eaten by both small and large fivefingers generally ranked higher in the diet of small fishes. The diets of smaller and larger specimens showed no significant correlation at $P < 0.0005$ ($rs = 0.603$; $t = 3.54$).

Table 3 indicates that algae formed the most important ingested item for *A. monodactylus* at Tristan Island as well as Nightingale Island. The major difference in the diets at the two islands was the greater importance of small rock lobster, *Jasus tristani,* in the diet at Nightingale Island as compared to Tristan Island. A statistical test was not carried out on this data because of the small size of the sample from Nightingale Island.

Table 4 shows that algae, fish and polychaetes were the most important items found in the stomachs of *A. monodactylus* during both summer and winter. A greater variety of invertebrates were taken during summer while *J. tristani* seemed to be preyed on to a greater extent in winter. Amphipods ranked higher in the diet during summer. The diets of specimens collected in summer and winter showed a significant correlation at $P < 0.01$ ($rs = 0.725$; t 4.93). However, once again differences in the mean percentage mass of particular ingested items were apparent.

A much greater variety of organisms were fed on by *A. monodactylus* at Gough Island as opposed to Tristan Island. Table 5 shows that 22 food groups were found in the stomachs of fish collected at Gough Island while only 16 groups were found in the stomachs of fish from Tristan Island. Algae formed a relatively insignificant part

of the stomach contents of fish from Gough Island while at Tristan Island this was the major component of the stomach contents. Sea urchins and amphipods were ranked higher in the diets of fish from Gough Island than from Tristan Island. *Spirorbis* sp. tubes were absent in the stomachs of specimens from Gough Island. No significant correlation at $P > 0.1$ was found between the diets of specimens from the two localities ($rs = 0.084$; $t = 0.469$).

Discussion

Because of the advanced stage of digestion of food in the hindgut, stomach contents gave a better representation of the food utilised by *A. monodactylus*. Contrary to the findings of Beurois (1976) at Asterdam Island, soft-tissued prey was difficult to identify and hard exoskeletal and calcareous material accumulated in the hindgut of specimens collected during the present investigation; a phenomenon noted in other dietary studies (e g Froglia 1977). It was therefore decided to use only stomach contents for subsequent analyses.

Algae were found to pass from the stomach through the hindgut without any visible digestion taking place. Large amounts of algae are thought to be ingested in order to digest epiphytic organisms on the algal fronds. The three most common algal species ingested were the two kelp species, *Laminaria pallida* and *Macrocystis pyrifera*, and the green alga *Ulva* sp. These species were commonly covered with the sedentary polychaete *Spirorbis* sp. The calcareous tubes of this polychaete were often found either mixed with undigested algal material in the stomach and hindgut or packed without algae in the hindgut. Beurois (1976) found that although algae occurred infrequently in stomachs at Amsterdam Island, fragments of *Macrocystis pyrifera* present in the intestine were often encrusted with the Bryozoan *Cellepora hyalina*. This suggests that the species selected particular fronds that supported large concentrations of encrusting invertebrates.

Table 3

Comparison of food groups represented in the stomachs of *A. monodactylus* from Tristan Island T (n = 63), and Nightingale and Inaccessible Islands N (n = 14)

Prey species	% Frequency occurrence		Mean % mass		Rank	
	T	N	T	N	T	N
ALGAE	68.3	35.7	58.0	27.3	39.6	9.7
Phaeophyta	54.0	14.3	43.1	11.7		
Ulva sp.	19	—	11.3	—		
Remains	15.9	21.4	3.6	15.6		
PISCES	23.8	7.1	17.0	7.1	4.0	0.5
Nelabrichthys ornatus	1.6	—	1.6	—		
Remains	22.2	7.1	15.4	7.1		
POLYCHAETA	9.5	7.1	4.5	1.7	0.4	0.01
Spirorbis sp.	3.2	—	1.5	—		
Remains	6.3	7.1	3.0	1.7		
UNIDENTIFIED REMAINS	7.9	21.4	4.3	17.8	0.3	3.8
AMPHIPODA	9.5	7.1	2.2	0.2	0.2	0.02
MACRURA	4.8	21.4	3.4	21.4	0.2	4.6
Jasus tristani	4.8	21.4	3.4	21.4		
ECHINOIDEA	3.2	—	3.2	—	0.1	—
OPHIUROIDEA	4.8	—	1.7	—	0.08	—
BRACHYURA	4.8	7.1	1.2	4.0	0.06	0.3
SALPIDAE	1.6	—	1.0	—	0.02	—
SIPUNCULIDA	1.6	—	0.7	—	0.02	—
CIRRIPEDIA	1.6	—	0.9	—	0.01	—
BRACHIOPODA	1.6	—	0.01	—	T	—
OPISTHOBRANCHIA	1.6	—	0.2	—	T	—
ISOPODA	1.6	—	0.04	—	T	—
COPEPODA	1.6	—	0.04	—	T	—
PROSOBRANCHIA	—	7.1	—	7.1	—	0.5
PORIFERA	—	21.4	—	14.7	—	3.1

T = Trace, i e items with a rank < 0.01

These algae all have relatively broad, flattened fronds and hence an enlarged surface area. This might, in addition to encrusting invertebrates, also support high concentrations of epiphytic diatoms that could be digested by the fish. It has been found in other fish species such as *Rhabdosargus holubi* (Blaber 1974), *Sarpa salpa* (Christensen 1978) and *Diplodus sargus* (Joubert & Hanekom 1980) that epiphytic diatoms are utilised, while no cellular digestion of the macroalgae occurs. It is also possible that *A. monodactylus* utilised extracellular carbohydrates present in the mucus on the algal fronds (Montgomery & Gerking 1980, Edwards & Horn 1982, Buxton & Clarke 1991). The intact nature of algal material from the stomach and hindgut suggests that no cellular digestion of the algae was taking place.

The energy expenditure associated with biting off and ingesting large quantities of macroalgae was probably compensated for by the high concentrations of prey species such as *Spirorbis* sp. Also, the densities of macrophytes in a given area were high and energy need not have been expended in searching for and capturing moving prey. The relatively depauperate invertebrate fauna at all the islands (Roscoe 1979) could render the nutritional returns obtained from feeding on organisms on the surface of the algae important to the survival of *A. monodactylus*.

The comparison of the diets of small and large *A. monodactylus* from Tristan Island showed that small individuals fed on a greater variety of small invertebrates than the larger fish. This could result from enhanced hunting success in smaller fish achieved by foraging for food over a greater area. SCUBA observations showed that individuals smaller than 350 mm foraged in loose schools of up to 15 individuals while larger individuals were more often solitary and territorial, inhabiting clefts or caves (Andrew *et al* 1993). Algae formed a smaller proportion of stomach contents in small individuals although macrophytes remained the most important in terms of ingested material.

Small individuals also ingested *Spirorbis* sp. covered algae more often than larger individuals. This too may be a result of the greater mobility of small individuals that enabled them to search for algal stands encrusted with polychaetes. In addition, smaller individuals

Table 4

Comparison of food groups represented in the stomachs of *A. monodactylus* collected during the summer S (n = 42) and winter W (n = 21) at Tristan Island

Prey species	% Frequency occurrence		Mean % mass		Rank	
	S	W	S	W	S	W
ALGAE	76.2	71.4	58.5	57.2	44.6	40.8
Phaeophyta	52.3	57.1	41.7	46.0		
Ulva sp.	21.4	14.3	12.1	9.7		
Remains	16.8	14.3	4.7	1.5		
PISCES	21.4	28.6	14.7	21.6	3.1	6.2
Nelabrichthys ornatus	—	4.8	—	4.8		
Remains	21.4	23.8	14.7	16.8		
POLYCHAETA	9.5	9.5	5.3	5.1	0.5	0.5
Spirorbis sp.	4.8	—	2.2	—		
Remains	9.5	9.5	3.1	5.1		
UNIDENTIFIED REMAINS	7.1	9.5	4.4	4.1	0.3	0.4
AMPHIPODA	9.5	9.5	3.1	0.05	0.3	0.05
ECHINOIDEA	4.8	—	4.7	—	0.2	—
OPHIUROIDEA	4.8	4.8	2.5	0.2	0.1	T
BRACHYURA	7.1	—	1.9	—	0.09	—
SALPIDAE	2.4	—	1.6	—	0.04	—
SIPUNCULIDA	—	4.8	—	2.2	—	0.1
CIRRIPEDIA	2.4	—	1.3	—	0.03	—
MACRURA	2.4	9.5	0.6	9.1	0.01	0.9
Jasus tristani	2.4	9.5	0.6	9.1		
BRACHIOPODA	—	4.8	—	0.03	—	T
OPISTHOBRANCHIA	2.4	—	0.2	—	T	—
ISOPODA	2.4	—	0.06	—	T	—
COPEPODA	2.4	—	0.06	—	T	—

T = Trace, i e items with a rank < 0.01

Table 5

Comparison of food groups represented in the stomachs of *A. monodactylus* collected at Tristan Island T (n = 63) and Gough Island G (n = 25)

Prey species	% Frequency occurrence		Mean % mass		Rank	
	T	G	T	G	T	G
ALGAE	68.3	26.1	58.0	5.0	39.6	1.3
Phaeophyta	54.0	21.7	43.1	4.4		
Ulva sp.	19.0	—	11.3	—		
Remains	15.9	8.7	3.6	0.6		
PISCES	23.8	4.3	17.0	4.3	4.0	0.2
Nelabrichthys ornatus	1.6	—	1.6	—		
Remains	22.2	4.3	15.4	4.3		
POLYCHAETA	9.5	4.3	4.5	0.1	0.4	T
Spirorbis sp.	3.2	—	1.5	—		
Remains	6.3	4.3	3.0	0.1		
UNIDENTIFIED REMAINS	7.9	30.4	4.3	13.6	0.3	4.1
AMPHIPODA	9.5	30.4	2.2	10.1	0.2	3.1
MACRURA	4.8	4.3	3.4	0.08	0.2	T
Jasus tristani	4.8	4.3	3.4	0.08		
ECHINOIDEA	3.2	52.2	3.2	31.2	0.1	16.3
OPHIUROIDEA	4.8	4.3	1.7	1.0	0.08	0.04
BRACHYURA	4.8	4.3	1.2	0.04	0.06	T
SALPIDAE	1.6	4.3	1.0	0.9	0.02	0.04
SIPUNCULIDA	1.6	—	0.7	—	0.01	—
CIRRIPEDIA	1.6	—	0.9	—	0.01	—
BRACHIOPODA	1.6	4.3	0.01	0.1	T	T
OPISTHOBRANCHIA	1.6	4.3	0.2	0.05	T	T
ISOPODA	1.6	4.3	0.04	0.1	T	T
COPEPODA	1.6	—	0.04	—	T	—
PROSOBRANCHIA	—	8.7	—	3.7	—	0.3
GASTROPODA	—	4.3	—	0.02	—	T
POLYPLACOPHORA	—	13	—	12.2	—	1.6
PYCNOGONIDA	—	17.4	—	0.5	—	0.09
HYDROZOA	—	8.7	—	0.5	—	0.04
ZOANTHARIA	—	17.3	—	8.2	—	1.4
BIVALVIA	—	4.3	—	1.8	—	0.08
EUPHAUSIACEA	—	8.7	—	6.3	—	0.5
OSTRACODA	—	4.3	—	0.05	—	T

T = Trace, i e items with a rank < 0.01

occurred in larger numbers in shallow water where *Ulva* sp. was the dominant algal species, which had greater concentrations of encrusted *Spirorbis* sp. than the kelps in deeper water.

Although only 14 stomachs were examined from Nightingale Island, it is apparent that the array of food items taken was similar to that taken at Tristan Island. Algae formed the most important item in the guts of fish at both localities although it was found in a smaller proportion of stomachs and in smaller quantities in the Nightingale Island specimens.

Whereas fish formed an important part of the diet of *A. monodactylus* at Tristan Island, juvenile rock lobster, *J. tristani*, were more important than fish at Nightingale Island. Diving observations at Nightingale Island showed that the nature of the inshore area differed from that at Tristan Island. Nightingale Island had very few tidal rockpools and an almost vertical drop-off from the shore to about 10 m whereas the inshore region at Tristan Island consisted of many sheltered rockpools and a gentle drop-off. The shallow rockpools (< 1.5 m) at Tristan Island afforded nursery areas for juvenile rock lobster while at Nightingale Island they occurred in deeper water. *A. monodactylus* that were large enough to feed on small rock lobster were seldom encountered in waters shallower than 2 m. This would effectively decrease the predation pressure on juvenile rock lobster by *A. monodactylus* at Tristan Island. Juvenile rock lobster had very little protection from predators at Nightingale Island. Pollock (pers comm April 1989, Sea Fisheries Research Institute, Cape Town, South Africa) suggested that the topographical differences between the inshore areas of the two islands are so great that the lower abundance of adult rock lobster at Nightingale Island may be attributable to the greater predation of juveniles by fish. Studies on the West Australian rock lobster (Howard 1987) have shown that predation of juveniles by fish is an important factor in regulating the abundance of adult rock lobsters.

The comparisons of the diets of *A. monodactylus* caught in summer and in winter at Tristan Island, and the diets of fish caught at Gough and Tristan Islands were undertaken to determine if temperature changes in the oceanic environment had an effect on the availability of food and thus on diet. Only slight differences in the relative importance of various items in the stomachs of specimens collected in summer and winter were apparent. Algae and fish remained the most important items in stomachs during both seasons. It is interesting to note that no *Spirorbis* sp. was found in stomachs collected in winter at Tristan Island. This indicated an absence of this prey or a dietary shift towards other items during winter. Rock lobster were more important in the diet during the winter months. It is possible that other invertebrates such as amphipods, which have relatively short life cycles, were scarce in winter. Data showed that amphipods were more important in the diet during summer than in winter. If this shift in diet was related to increased availability of this prey item on a seasonal basis it would strengthen the hypothesis (Allanson *et al* 1981) that improved stratification of the water column would result in increased nutrient availability and thus productivity in the summer months.

Beurois (1976) suggested that a seasonal shift in diet in *A. monodactylus* at Amsterdam Island was related to a change in the abundance of particular prey items caused by seasonal variation in oceanographic conditions. More data on the seasonal abundance of prey items such as amphipods need to be collected at Tristan da Cunha to further understand the effects of changes in oceanographic conditions on the diet of *A. monodactylus*.

A comparison of the diets of fish caught at Tristan Island and Gough Island throughout the year indicated that the feeding biology of *A. monodactylus* at the two localities differed greatly. A far larger range of invertebrate animals were ingested by specimens at Gough Island. In addition algae, which formed the most important item in the stomachs of *A. monodactylus* from the northern islands, were of very little significance in the diets of fish from Gough Island. At this island small sea urchins formed the most important part of the diet while amphipods, anemones and chitons were all fed on extensively. The switch from utilising algal epiphytes as a major source of nutrition is thought to be due to a number of intrinsic differences in the marine environment at Gough Island. Firstly, the kelp *Laminaria pallida* that is common at Tristan Island does not occur at Gough Island and is replaced by *Durvillea antarctica* (Chamberlain 1965). It is possible that this brown alga does not support the rich epiphytic growth that *L. pallida* does at Tristan Island. Also, the polychaete *Spirorbis* sp., so common on algae at Tristan Island, was not found in the guts of any of the fish sampled at Gough Island. It is likely, therefore, that this encrusting species does not occur at Gough Island. *Ulva* sp. was also absent from the stomachs of fish collected at this island. This alga was not observed whilst snorkeling at Gough Island. *Ulva* sp. is the most common substrate for *Spirorbis* sp. at Tristan da Cunha. The absence of *Ulva* sp. and *L. pallida* at Gough Island may explain the insignificant contribution that algae made to the diet of *A. monodactylus* at this island. This is regarded as further evidence that *A. monodactylus* at the northern islands selectively feeds on *Spirorbis* sp. encrusted macroalgae.

The close proximity of Gough Island to Tristan da Cunha would suggest that the two localities would have similar environments. However, the difference in mean annual sea temperatures of about 3 °C at Tristan da Cunha and Gough Island (Fig 3) manifests itself in both the distribution and biology of species in the region. A number of fish species common to the Tristan da Cunha group are absent at Gough Island due to differing oceanographic conditions at the two localities (Andrew *et al* 1993). Some species such as *A. monodactylus* are however, able to survive at both localities. Although this species exists successfully at Gough Island, specimens there are morphologically distinct from those at Tristan da Cunha, which exibit proportionally larger head dimensions (Andrew *et al* 1993). The reasons for this are currently being investigated and may be related to oceanographic conditions, food abundance and type, or both. The long-lived pelagic larval and post-larval stages in *A. monodactylus* suggest that the populations at the two localities are not genetically isolated from each other and that the observed morphological differences are a result of environmentally induced phenotypic plasticity.

These investigations clearly show that *A. monodactylus* is a generalist utilising a wide variety of food items in the relatively depauperate environment in which it lives. The species has different diets at different localities and is able to feed intensively on particular food types that are readily available at different localities. It has also been shown that fishes eat differing amounts of particular food types depending on their size and that this shift in diet may be related to mobility rather than an ability to utilise a particular food type.

There was little change in diet with season at Tristan da Cunha indicating that most of the prey species at this island are able to maintain healthy populations throughout the year. The accessibility of juvenile rock lobster at Nightingale Island renders this prey more important to *A. monodactylus* at this island. Finally, it has been shown that the species' diet differs significantly at Gough and Tristan Islands. Beurois (1976) found that *A. monodactylus* at Amsterdam Island also feeds opportunistically. Fish collected inshore and offshore fed on items that were abundant at the particular depths at which they were collected. This strengthens the opinion that the species is strongly adapted to survive successfully in conditions that offer different levels of food availability.

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