

Department of Zoology, University of Queensland

**Field Observations on the
Reproductive Behaviour of a Pomacentrid Fish,
*Acanthochromis polyacanthus***

By D. R. ROBERTSON

With one figure

Received: 18. 4. 1972

Introduction

The reproductive behaviour of a number of pomacentrid species has been described (for reviews see BREDER and ROSEN 1966, REESE 1964 and WICKLER 1967). Throughout the family, elaborate reproductive behaviour involves nest-site selection and defence, pair formation and spawning and parental care. Field observations, made in association with other behavioural work over a two year period, indicate that the reproductive behaviour of *Acanthochromis polyacanthus* (BLEEKER) differs significantly from that described for other species of the family.

Methods

Field observations using snorkel and SCUBA were made throughout 1970—71 at Heron Island on the southern Great Barrier Reef (23° 27' S. Lat., 151° 55' E. Long.) where the species is abundant and distributed widely over the shallow areas of Heron Reef. Many casual observations were made while engaged in other activities, and several nest sites and family groups were watched over periods of several days. Six individuals were collected from pairs for sex determination. None was tagged.

Observations

A. Pair Formation and Nesting

The species can be observed throughout the year singly or in aggregations of up to a hundred or so individuals. The breeding season starts in mid-spring (October) and continues for at least 4 months. The initial stages of pair formation were not observed. The process apparently occurs a few days prior to egg laying as pairs (♂ and ♀) were frequently observed close to future nest-sites.

During pair-formation, both individuals defend the area about the site against conspecifics and less vigorously against small predatory fishes.

Courtship occurs throughout this period of pair-formation. Conspecifics are attracted by courting individuals, sometimes approach but are driven away. Courtship consists of (i) selection and (ii) preparation of the nest-site. There is no apparent development of special courtship colour patterns by either ♂ or ♀. In non-reproductively active individuals colour patterns vary from pale blue-grey body, with the unpaired fins darker basally, to an overall very dark grey. Courting individuals of both sexes are usually medium-dark grey. Spawning was not observed and there may be some development of special colours close to or at that time. The sexes can be distinguished by the shapes of their genital papillae — thin and pointed in the ♂, stout and blunt in the ♀.

The great majority of nest-sites were located well inside small caves in dead coral and consequently were inaccessible to the observer. Activities defined as selection of nest-sites were directed towards several potential sites by the same pair. Selection includes the frequent performance by both sexes of a characteristic exaggerated swimming-type movement which is directed toward the site. Starting a meter or so from the site the fish moves slowly toward the site with its unpaired fins spread and caudal peduncle and tail wagging slowly from side to side. The mate often responds to this Waggle-swimming by approaching and following the performer. Exaggerated swimming movements of a more dramatic form have been reported in other species of pomacentrids for example by HELFRICH (1958) and SALE (1971). These movements are performed by ♂♂ attempting to lead ♀♀ to the spawning site and consist of the ♂ repeatedly moving toward the ♀ and back to the nest. Preparation of the nest-site was observed only twice. Both ♂ and ♀ inspect the site and bite off small projecting growths, which are then either chewed up or carried several centimeters away and dropped. At the site both sexes often perform a motor pattern similar to skimming in *Chromis caeruleus* as described by SALE (1971) and by MYRBERG *et al.* (1967) in *Ch. multilineata*. Skimming in *A. polyacanthus* consists of a 1/2-second burst of rapid body trembling frequently followed by the fish's shooting forward several centimeters. Skimming may be performed close to the site or with the ventral surface of the body in contact with it. Courtship activities have been observed throughout the parental stages as well as prior to spawning.

B. Spawning

Spawning was not observed owing to the inaccessibility of nest-sites. Only two egg masses were seen both of which contained roughly 100–150 eggs. Each mass was irregularly shaped with the eggs scattered over an area 2–5 cm² on a flat surface, one on a vertical face of dead coral rock and the other on the underside of a dead plate coral. Fry in newly hatched clutches also number around 100–150 which suggests consistently small egg numbers.

C. Parental Care

Parental care may be divided into two phases — care of eggs and fry. Both parents are involved. Care of eggs appears to consist only of defence against conspecifics and small predators, such as wrasses, are chased away. No fanning or cleaning of the eggs was observed and may not occur.

After hatching, both parents continue care with the fry remaining close to their parents for perhaps a month. Newly hatched fry, about 5 mm long, are

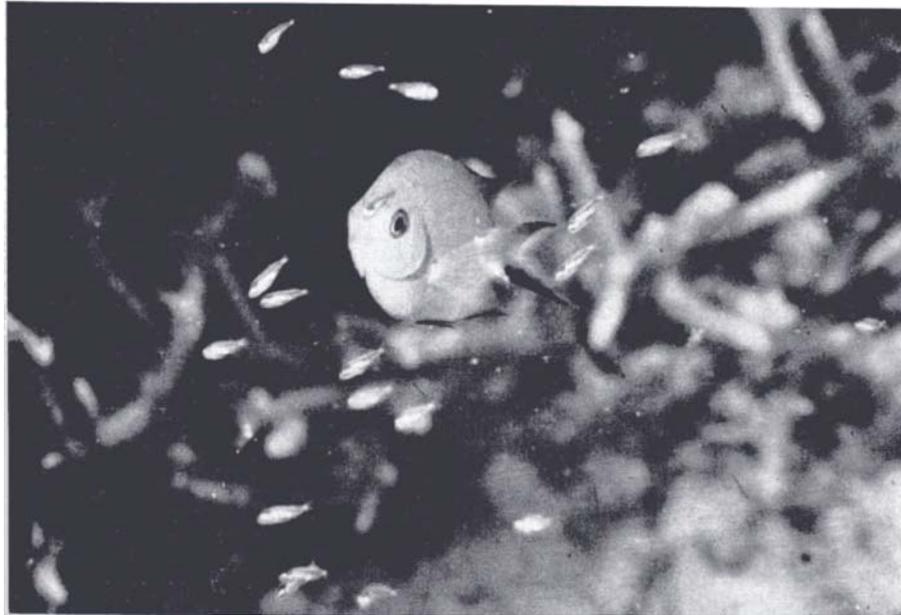


Fig. 1: *A. polyacanthus* with part of fry school.
3 fry are glancing — 1 on forehead and 2 behind pectoral fin

transparent with a pale orange-brown stripe along the upper back on each side. At approximately 15—20 mm they assume the adult coloration and remain with the parents until they are about 25—30 mm. Newly hatched fry remain in a tight school close to the presumed spawning cave. The school gradually spreads out with increasing age, moving about at greater distances from the cave, and schools of older fry often intermingle. Parental defence also gradually weakens as the fry become older. Conspecifics are again chased away as are actual and potential fry predators. These include *Cheilinus chlorurus*, *Coris variegata*, *Halichoeres melanurus*, *Lutjanus carponotatus*, *Pseudolabrus guntheri* and *Thalassoma lunare*. Attempted predation increases the vigor of defence. Non-predatory species such as *Chromis caeruleus*, *Ch. ternatensis*, *Labridithys cyanotaenia* and *Pomacentrus sufflavus* are usually ignored unless they get very close to schools of small fry. Parents with very young fry also chase away large *A. polyacanthus* fry of neighbouring families. When threatened, schools of fry tend to bunch up and move towards the substrate, eventually retreating in a compact mass into cover. There do not appear to be any special conspicuous signals exchanged between parents and fry in periods of danger.

As well as taking planktonic material, fry may possibly feed from the skin of their parents. Frequently, when a parent slowly swims through or very close to the school of fry, a few of them will approach very close and bounce repeatedly against the adult's body (Fig. 1). They appear to make oral contact with the skin. WARD and BARLOW (1967) have described very similar behaviour, termed glancing, in the young of certain species of cichlid fishes. By glancing, the fry of these feed on mucus on the parents' skins. Glancing in *A. polyacanthus* is most strongly shown by young fry and appears to diminish with age. Occasionally fry will also glance on other species of small fishes that are slowly swimming past e. g. *Pomacentrus tripunctatus* and *Chaetodon rainfordi*. Prior to and during glancing, there are no apparent special signals given by the

parent and fry approach stationary or slowly moving parents. Parental reactions to glancing are generally neutral. Parents do not appear to solicit the attentions of fry in any particular manner or actively facilitate these attentions by any special behaviours. However, the advances of fry may be rejected, with the parent moving away several centimeters.

Discussion

WICKLER (1967) distinguished two main types of reproductive behaviour in pomacentrids — either the ♂ alone is involved throughout the whole cycle or the ♂ and ♀ together for the whole cycle. In species of the former category, the ♂ develops a special nuptial colour pattern, establishes and defends a territory, prepares the spawning site and courts the passive ♀ who leaves after spawning. The ♂ then cares for and defends the eggs until they hatch (REESE 1964). In the latter both sexes defend the territory, court and care for and defend the eggs. *Acanthochromis*, with 1 known species, is an Indo-pacific genus separated by WEBER and DE BEAUFORT (1940) from the related genera *Chromis* and *Dascyllus*. As described in the literature, *Chromis* and *Dascyllus* species follow the first pattern of reproductive behaviour: *Ch. chromis* (ABEL 1961, SWERDLOFF 1970); *Ch. caeruleus* (SALE 1971); *Ch. cyanea* (ALBRECHT 1969); *Ch. multilineata* (ALBRECHT 1969, MYRBERG *et al.* 1967, SWERDLOFF 1970); *Ch. ovalis* (SWERDLOFF 1970); *Ch. punctipinnis* (TURNER and EBER 1962); *Ch. verater* (SWERDLOFF 1970); *D. aruanus* (SALE 1970); *D. albisella* and *D. reticulatus* (STEVENSON 1963); *D. trimaculatus* (GARNAUD 1957).

The second pattern, with a pair bond continued through the whole reproductive cycle, is more typical of *Amphiprion* and *Premnas*. Fish of these genera are symbiotic anemone-fish. They are territorial throughout life and pairing may be permanent (REESE 1964). At least one *Pomacentrus* species, *P. leucoris*, also follows this pattern (BREder and COATES 1933). *A. polyacanthus* differs from closely related genera of pomacentrids in having both sexes participating fully in all stages of the reproductive cycle. It differs greatly from all other described species of pomacentrids literature, in extending its parental care beyond the egg stage and defending and perhaps feeding the fry for a considerable period. In *Chromis dimidiatus*, another Great Barrier Reef species, both parents apparently care for the fry (A. DOMM pers. comm. 1971). The family Cichlidae is closely related to the Pomacentridae (WICKLER 1967). In many species of this family, the pair remains together throughout the reproductive cycle and both individuals defend and care for the eggs and fry (e. g. BAERENDS *et al.* 1950).

The pattern in *A. polyacanthus* is very similar, however the parent-offspring relationship may not be as highly developed as that of cichlids. The young of *A. polyacanthus* probably remain in the vicinity of the nest and, perhaps, feed off other fishes — mainly their parents. The parents defend their fry and tolerate their advances. Cichlids parents take turns in looking after their fry, and the fry follow them. Parents can also retrieve straying fry and signal them if danger threatens (BAERENDS *et al.* 1950).

Acknowledgements

My thanks to Dr. D. DOW and Dr. J. KIKKAWA for commenting on a draft of the manuscript, Mr. P. GYR for preparing the German Summary, the Great Barrier Reef Committee for the use of Heron Island Research Station facilities and the University of Queensland for financially supporting this research.

Summary

Field observations were made on the reproductive behaviour of a coral-reef pomacentrid *Acanthochromis polyacanthus*.

The breeding season starts in mid-spring. Pairs are apparently formed several days before spawning. Both ♂ and ♀ of the pair defend a territory and select and prepare the spawning site.

No special courtship colour patterns appear to be developed by either sex. Both ♂ and ♀ court using the same motor patterns, which are similar to those described in other pomacentrid species. Spawning was not observed but few eggs are laid.

Both parents defend the eggs but do not appear to fan them. Both parents also care for the fry for a considerable period after hatching, defending them against predators. The fry also appear to feed on the skin of their parents and occasionally that of other fishes.

The parent-offspring relationship does not seem to be as well developed as in fishes of the closely related cichlid family.

Zusammenfassung

Das Fortpflanzungsverhalten des Korallenbarsches *Acanthochromis polyacanthus* wurde im Freiland beobachtet.

Die Fortpflanzungszeit beginnt im Oktober und dauert mindestens 4 Monate. Die Paare bilden sich offenbar mehrere Tage vor dem Laichen. ♂ und ♀ verteidigen ein Revier, ein Laichplatz wird gewählt und vorbereitet. Eine besondere Balzfärbung scheint zu fehlen. ♂ und ♀ haben die gleichen Balz-Bewegungen wie andere Pomacentriden-Arten.

Beide Eltern verteidigen die Eier, scheinen sie aber nicht zu befächeln.

Beide Eltern pflegen die Jungen eine beträchtliche Zeit nach dem Auschlüpfen und verteidigen sie gegen Feinde.

Die Jungen scheinen von der Haut ihrer Eltern zu fressen, manchmal sogar von der Haut anderer Fische.

Das Eltern — Nachkommen-Verhältnis scheint nicht so gut entwickelt zu sein wie bei den nahe verwandten Cichliden.

Literature cited

- ABEL, E. F. (1961): Freiwasserstudien über das Fortpflanzungsverhalten des Mönchfisches *Chromis chromis* LINNÉ, einem Vertreter der Pomacentriden im Mittelmeer. Z. Tierpsychol. 18, 441—449 • ALBRECHT, H. (1969): Behaviour of four species of Atlantic Damsel-fishes from Columbia, South America (*Abudefduf saxatilis*, *A. taurus*, *Chromis multilineata*, *C. cyanea*; Pisces, Pomacentridae). Z. Tierpsychol. 26, 662—676 • BAERENDS, G. P., and J. M. BAERENDS-VAN ROON (1950): An introduction to the study of the ethology of cichlid fishes. Behaviour, Suppl. 1, 1—242 • BREDER, C. M. Jr., and C. W. COATES (1933): Reproduction and eggs of *Pomacentrus leucoris* GILBERT. Amer. Mus. Nov. 612, 1—6 • BREDER, C. M. Jr., and D. E. ROSEN (1966): Modes of Reproduction in Fishes, pp. 1—941, New York, Natural History Press • GARNAUD, J. (1957): Ethologie de *Dascyllus trimaculatus* (RÜPPELL). Bull. Inst. Oceanogr. Monaco. 54 (1096), 1—10 • HELFRICH, P. (1958): The early life history and reproductive behavior of the maomao, *Abudefduf abdominalis* (QUOY and GAIMARD). Ph. D. thesis, U. Hawaii • MYRBERG, A. A. Jr., B. D. BRAHY and A. R. EMERY (1967): Field observations on reproduction of the damselfish, *Chromis multilineata* (Pomacentridae), with additional notes on general behavior. Copeia 1967 (4), 819—827 • REESE, E. S. (1964): Ethology and Marine Zoology. In: Oceanography and Marine Biology, Ann. Rev. (H. BARNES ed.) 2, 455—488 •

- SALE, P. F. (1970): Behavior of the humbug fish. Australian Nat. History 16, 362—366 • SALE, P. F. (1971): The reproductive behavior of the Pomacentrid Fish, *Chromis caeruleus*. Z. Tierpsychol. 24, 156—164 • STEVENSON, R. A. (1963): Life history and behavior of *Dascyllus albissella* GILL, a pomacentrid reef fish. Ph. D. thesis, U. Hawaii, Honolulu, Hawaii • SWERDLOFF, S. N. (1970): Behavioral observations on Eniwetok damselfishes (Pomacentridae: *Chromis*) with special reference to the spawning of *Chromis caeruleus*. Copeia 1970 (2), 371—374 • TURNER, C. H., and E. E. EBERT (1962): The nesting of *Chromis punctipinnis* (COOPER) and a description of their eggs and larvae. Calif. Fish Game 48, 243—248 • WARD, J. A., and G. W. BARLOW (1967): The maturation and regulation of glancing off the parents by young orange chromides (*Eetroplus maculatus*: Pisces-Cichlidae). Behavior 29, 1—56 • WEBER, M. C. W., and L. F. DE BEAUFORT (1940): The Fishes of the Indo-Australian Archipelago VIII, pp. 1—508, Leiden, E. J. BRILL • WICKLER, W. (1967): Vergleich des Ablaidverhaltens einiger paarbildender sowie nicht-paarbildender Pomacentriden und Cichliden (Pisces: Perciformes). Z. Tierpsychol. 24, 457—470.

Author's address: D. R. ROBERTSON, Zoology Department, University of Queensland, St. Lucia, Queensland 4067 (Australia).