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THE ENIGMATIC JUNGLE PERCH - RECENT RESEARCH PROVIDES SOME ANSWERS

by

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INTRODUCTION

Mountain trout, aholehole, sesele, sakelo, ika droka, mahore, umatari, jungle perch - all names given thoughout their wide Indo-Pacific range to small silvery fishes of the family Kuhliidae. Found in both marine and freshwater habitats, from east Africa to Hawaii, most of the six or so species have characteristic tail marking which give them their common name of flagtail perch. They are believed to be most closely related to the well known north American basses (Centrarchidae). Although good food fish, most flagtails attain relatively small sizes (less than 300 gm) and arouse little interest where they occur, other than as a minor subsistence food item.

The exception is the largest member of the family, the jungle perch, Kuhlia rupestris (Lacepede), which grows to 450 mm in total length and 3 kg in weight and has acquired, in Australia at least, the reputation as a "legendary angling species" (Merrick and Schmida, 1984), as well as a considerable mystique. A handsome silvery species, with black markings dorso-laterally and a dark blotch on each caudal lobe (Figure 1), it is also regarded as excellent eating.

The typical jungle perch habitat (figure 2) is fast-flowing perennial coastal streams in rain forest areas. In Australia, for example, the species is apparently restricted to the north-eastern and central Queensland coast and is absent from the slow-flowing Gulf of Carpentaria and Northern Territory rivers. Reliable literature records for the Pacific Islands show jungle perch to occur as far east as American Samoa (Wass, 1984), but it is not recorded from French Polynesia (Randall, 1985) and most of Micronesia (Schultz et al., 1953; Gawel, pers. comm.) being generally restricted to high islands where there are perennial streams. Records of Kuhlia from low islands and atolls generally involve the wider ranging primarily marine species K. marginata and K. mugil. There are, however, two spcies endemic to the eastern Pacific – K. sandvicensis (aholehole) from Hawaii and K. nutabunda from Easter Island. K. rupestris was introduced to Hawaii (Brock, 1960), but has not survived (Kanayama, 1967).

For a fish which is so well known and widely distributed, the life history of jungle perch remains an enigma. It is mostly found in freshwater, but does it breed there? Why are K. rupestris rarely seen in estuaries with other Kuhlia species? Do they grow rapidly enough to be considered for aquaculture in preference to introduced exotics?

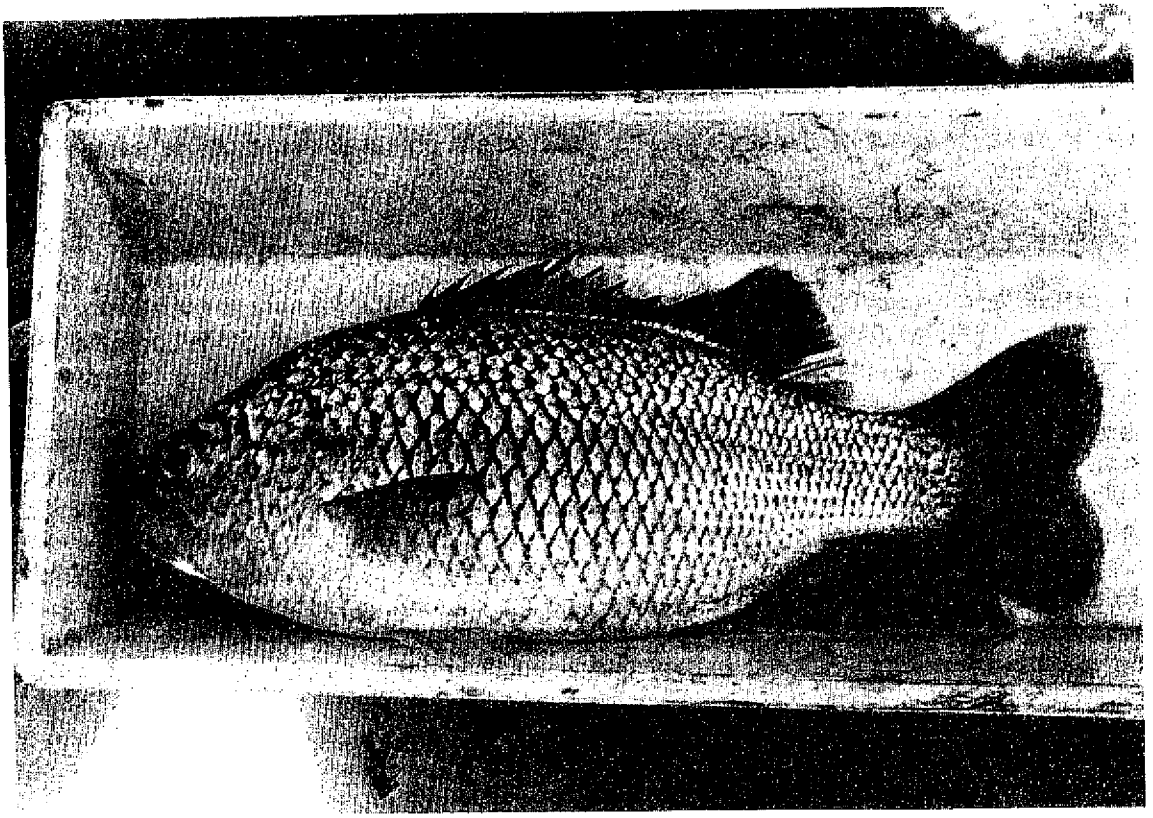

Photo: A.D. Lewis

Figure 1: Kuhlia rupestris, the jungle perch

Photo: A.D. Lewis

Figure 2: Typical jungle perch habitat

Small scale research projects were recently initiated independently, by the Queensland Department of Primary Industries Fisheries Research Branch and the Fiji Fisheries Division to unravel some of the details. This joint article presents some of the early results of these studies.

RATIONALE AND METHODS

In Fiji, jungle perch are most commonly known as ika droka (probably a corruption of ika ni waidroka , or "river fish"), ika ni vatu ("fish of the rocks") and, somewhat wistfully, as "Fiji trout". They are an important subsistence food in the interior of the large islands

The species could not be considered for stocking the recently constructed man made impoundments of Monasavu and Vaturu as it was not known whether they reproduce naturally in fresh water. The exotic tilapias (Sarotherodon mossambicus and S. niloticus) and black bass (Micropterus salmoides) were ultimately used. In addition, there were reports that "ika droka" numbers were diminishing as a result of increased river siltation, presumably associated with improper logging and agricultural practices in catchment areas, and with illegal net fishing. The part-time project undertaken by the Fiji Fisheries Division therefore aimed to gather basic life history and population data.

In North Queensland, it was considered desirable to introduce this popular sport fish to the growing number of freshwater storage reservoirs. Again, it was not known whether such introductions would be self-sustaining. Conservation measures in response to a public perception that natural populations had decreased were also being called for. The DPI Fisheries Research Station at Walkamin (on the Atherton Tablelands) therefore initiated a study of the reproductive biology of jungle perch.

Saltwater Creek, a small coastal stream 20 km in length near Mossman (16°25'S, 145°25'E) was chosen as the Queensland study site. Between November 1983 to February 1985, jungle perch were sampled by rod and line in the fast flowing upper reaches and by 2" (5 cm) mesh gill nets in the lower reaches, with some individuals transferred to ponds at Walkamin for experimental work. Specimens sacrificed were routinely processed to obtain basic biological data and otoliths for age and growth studies. Smaller numbers of fish were also collected from nearby streams.

Fiji's third largest river, the Navua, draining the central south coast of Viti Levu, the main island, was chosen as the Fiji study area. The main river is approximately 90 km long, flowing through spectacular gorges for one third of its length and entering the sea at 18°15'S, 178°12'E. Sampling commenced in August 1984. Specimens collected in the upper reaches by rod and line were generally tagged and released. Some of those gill netted (2.5" (6.5 cm) and 3" (7.5 cm) mesh) in the lower reaches were also tagged, as the species proved quite hardy despite slight damage sustained during gillnet capture. Specimens were also purchased from local markets. Basic biological data and otoliths were obtained from most non-released specimens. During 1985, sampling was extended to streams in the more extensive Rewa River system, but this work is not discussed in the present account.

POPULATION STRUCTURE

It became clear early in both studies that females attained considerably larger sizes than males and that a degree of sexual segregation was occuring along the lengths of the streams. The gears in use, articifial lures and 2" (5 cm) gill nets, captured few fish below 15 cm standard length (SL). The length-frequency data discussed below comprises adult and sub adult fish only. Note that all length measurements used are standard length (from the tip of the snout to the base of the caudal peduncle).

Figure 3 shows the length-frequency distribution of 187 males and 75 females examined from North Queensland. No males longer than 23 cm SL (O.4 kg) were taken, whereas females up to 35 cm SL (1.3 kg) were recorded. Half of the females in the sample were larger than the largest male. Males were rarely captured in the upper reaches; on the other hand no females were caught in the Saltwater creek estuary or at the salt water/ fresh water interface. The largest fish taken from Saltwater Creek was 29.5 cm (0.8 kg).

The comparable Fiji data (Figure 4), 109 males and 32 females, shows a similar size distribution by sex. It is a considerably smaller sample since most fish, 317 out of 400, were tagged and released. As in the Queensland sample, there were no males larger than 23 cm SL whereas 60 per cent of the females were above this size.

All fish sexed in the lower reaches (n=106) were males. In the smaller upper reaches sample (n=35), the female:male ratio was approximately 10:1

Figure 5 shows the size distribution of all tagged fish (n=317, measured to the nearest cm at release), divided into upstream and downstream components relative to a point just above tidal influence, 5 km from the mouth. Only five of the 124 downstream fish are 23 cm SL or greater. These are assumed to be females. The upstream fish, as expected, are larger with the largest being 34 cm SL (1.2 kg estimated).

It thus appears in both situations that the smaller males generally do not move far from tidal influence. Their clumped distribution in gill net catches also suggests they may aggregate or school to some extent.

Segregation is not total, as evidence bu occasional catches of females in estuaries and regular but minor catches of males upstream. Overlap of adult males and females is obviously limited. Very little information is yet available on the distribution of juveniles along the stream length.

LENGTH-WEIGHT RELATIONSHIPS

The following length-weight relationships were fitted for jungle perch in north Queensland. Preliminary data from Fiji indicate similar relationships.

Females (n=75): $\text{Weight} = 1.4041 \times 10.5 \ (SL^{3.1418})$

Males (n=187): $\text{Weight} = 1.701 \times 10.5 \ (SL^{3.1108})$

All fish (n=332): $\text{Weight} = 3.6268 \times 10.5 \ (SL^{2.9628})$

Females are significantly heavier than males for a given length.

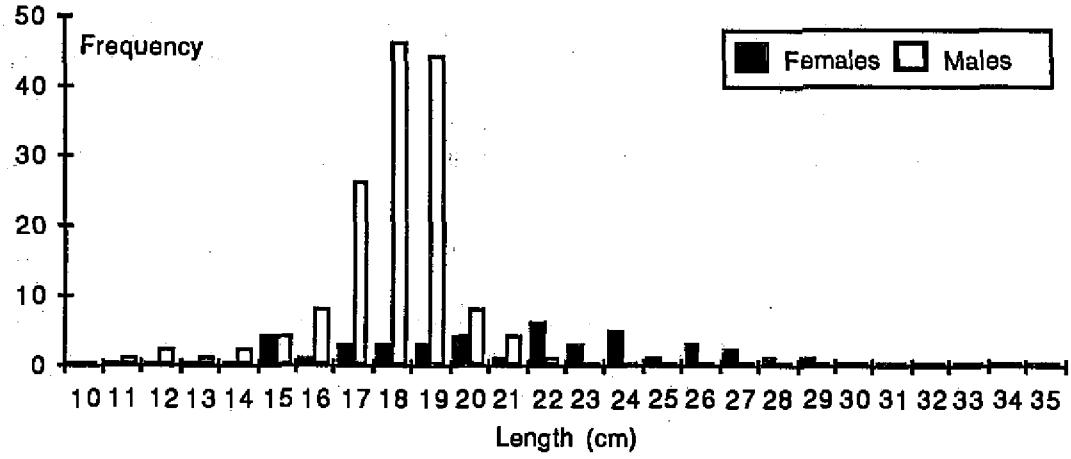

Figure 3: Length distributions of Kuhlia rupestris from north Queensland

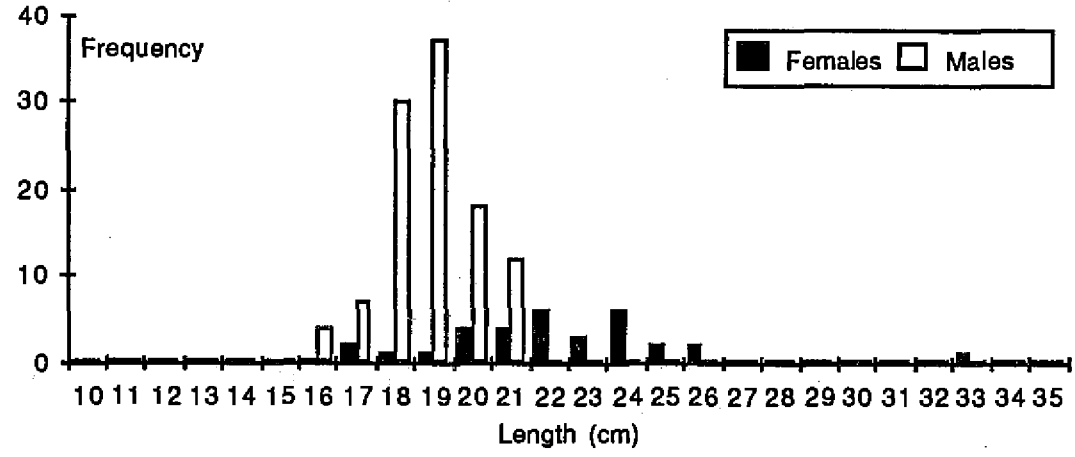

Figure 4: Length distributions of Kuhlia rupestris from Fiji

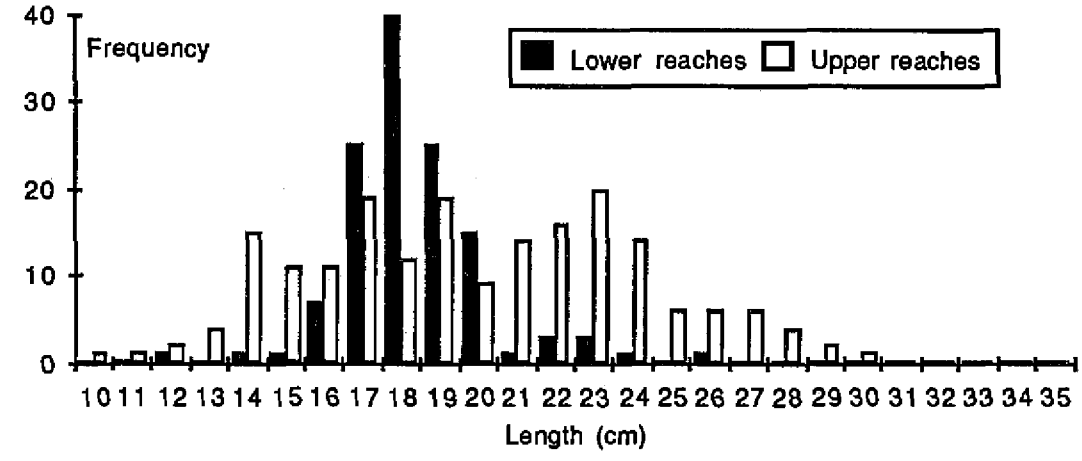

Figure 5: Length distributions of Kuhlia rupestris from upper and lower reaches of rivers in north Queensland and Fiji

SPAWNING

Apart from one suggestion in the literature that jungle perch probably spawn in brackish water (Lake, 1978) nothing is known of their spawning habits, one of the reasons for undertaking the work. No ripe females were observed in either study[1] although one nearly ripe female (24.5 cm SL) was captured in February 1984 in Queensland in a stream near the study area. Males in spawning condition were observed in north Queensland from late November to April and apparently spent females were observed from January to May. The difficulties of netting estuaries and lower reaches during this period, which is the wet season in both areas, are formidable. High water velocity, abundant debris, and high water levels in the coastal streams make the use of gillnets very difficult indeed, and line fishing other than with baits is similarly precluded.

One of us (AEH) therefore examined sperm motility in sexually mature males at various salinities as an alternative first step in delineating the spawning environment (Hogan and Nicholson, in press). It was found that jungle perch sperm were completely inactive in freshwater, showing maximum activity in water of 20 parts per thousand (ppt) salinity and above. In contrast, the sperm of the co-occuring sooty grunter (Hephaestus fuliginosus) which is known to spawn in fresh water, was completely inactive at 25 ppt and above. This would indicate that spawning occurs in estuaries or the coastal zone.

Further evidence came from serial estuarine sampling at the north Queensland site in February, 1985. There was a short term disappearance of running ripe males from the estuary around the new moon period (19/2/85). Fish were readily caught in quantity each side of this period. This, combined with the rarity, if not total absence, of ripe jungle perch females in numerous serial samples of North Queensland estuaries (Garrett, 1985: Blaber, 1980) and in commercial estuarine fishing catches, suggest that spawning is a well coordinated event of short duration.

We hypothesise that males and females migrate briefly to the edge of the flood plume near river mouths to spawn in salinities of more than 30 ppt. Because of sampling difficulties, rigorous testing of this hypothesis continues to be problematical.

If this hypothesised spawning migration occurs en masse, it presumably would be detected. As females with undeveloped gonads can be caught year-round in upstream areas, it is probable that not all fish migrate downstream to spawn each year. In the larger streams of Fiji and Australia, migrations of 100 km or more would be necessary. It seems likely to us that rainfall regimes may influence the proportion of the population which may spawn each year and the number of migrants which descend streams to the estuary. Spawning presumably occurs over the January - April period. There is still no information on the frequency and timing of spawning by individual fish, or the return of females upstream.

The smallest running ripe male observed was 17 cm SL; an apparently spent 21 cm SL female was recorded. These may approximate jungle perch minimum sizes at first maturity, although the under-representation of smaller fish in samples makes this difficult to pinpoint.

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1 A ripe individual of Kuhlia marginata (19.5 cm SL) was however captured in the Navua estuary early in January 1985.

TAGGING RESULTS

Between 1979 and 1983, sportsfishermen voluntarily tagged 435 jungle perch in various north Queensland rivers using anchor tags. Only 4 recaptures, all short-term, were recorded and extensive slippage of the anchor tags is suspected. Securing these tags behind finray supports is crucial to their long term retention.

In the Navua River, 317 jungle perch have been tagged to date, 191 upstream and 126 in the lower reaches. Anchor tags of two types and a lock-on tag have been used. Relative recovery rates will ultimately be compared.

Figure 6: Prominent Fiji civil servant and keen angler Robin Yarrow displays a recaptured tagged jungle perch

A total of fifteen recoveries (4.9 %) has been received, the longest after 9 months at liberty. Nearly all have shown negligible nett movement from the point of release. The difficulties of sampling postulated spawning areas to recapture tagged fish and conclusively demonstrate downstream female spawning migrations have been pointed out. Very large tagged jungle perch (1 kg plus and therefore females) were observed by divers in march 1986 near the top of the Rewa estuary, many miles from the nearest possible tagging site in the Rewa system. It is possible that these fish were returning upstream after spawning.

AGE AND GROWTH

Little time has yet been devoted to attempts to age jungle perch from examination of otoliths, although rings which may be annual checks have been observed in some fish. The limited tagging data from Fiji however suggests that growth of adult females may be slow, with annual increments of the order of 2 cm/year. The smaller males must either exhibit slower growth or have a shorter average life span. Otoliths from a 21 cm male appeared to have seven clear annuli suggesting the former could be the case.

Nakamura (1968) reported slow growth of Kuhlia sandvicensis in Hawaiian ponds, this small species taking 4 years to attain 16-17 cm fork length. Growth of jungle perch in the Walkamin ponds showed great individual variation and was retarded in many fish by persistent nematode infection.

FEEDING HABITS

No work has been done on feeding habits in either locality, although jungle perch are known to be omnivorous, feeding on a variety of crustaceans, insects, small fish and even fruit . One Fijian vernacular name for juveniles refers to its apparent habit of nibbling the legs of bathers in fresh water! Another general Kuhlia name in fijian translates as "spit-eater", referring to the habit of seizing anything which drops into the streams from overhanging vegetation.

CONCLUSIONS

Whilst precise details of aspects of jungle perch life history in general and spawning in particular remain elusive, indications are that the species does spawn in the near shore marine environment over an extended period between January and April, possibly influenced by river levels and the lunar cycle. Fresh water impoundments stocked with the species would therefore require regular restocking, and hatchery techniques similar to those developed for other catadromous species would need to be developed (e.g van der Wal, 1983).

Marine spawning may be characteristic of all Kuhlia species, indicating that they are of primary marine origin despite their success in colonising freshwater habitats. Kuhlia mugil appears to rarely enter freshwater, and in Fiji typically inhabits the surge zone around rocky headlands. K. marginata has been collected on atolls where there is little or no freshwater (Schultz et al., 1953; Bullivant & Mc Cann 1974). One of us (ADL) has observed what appeared to be a spawning aggregation of K. bilunulata on a Fijian coral reef some miles from the nearest stream. K. sandvicensis, the Hawaiian endemic species, migrate as adults to the outer edge of the reef where they can be observed in schools (Tinker, 1974).

In contrast to its cogeners, the jungle perch, does seem to require access to freshwater streams to complete its life cycle. The species' general absence from low islands and atolls has been noted. The requirement may be even more specific. Its distribution (see earlier) indicates that fast flowing streams are clearly preferred. In the eastern Fiji islands, most of which are low coral islands, K. rupestris juveniles (sesere, equivalent to the Samoan name sesele) are recorded from most islands, but adults (which have different and quite specific Fijian names) from a few high islands only. This indicates that perennial streams may play a facultative role in some aspect of the life cycle.

Few details are available on the biology of most Pacific Island and indeed Australian freshwater fish. The similarities in life history pattern between jungle perch and the catadromus eastern Australian bass Macquaria novemaculeata (Percichthyidae), which grows to comparable size are however striking. In the latter species, Harris (1984) has demonstrated sexual segregation of populations (females remain in freshwater), smaller size and slower growth of males, migration of females to the brackish estuarine zone for spawning (although this occurs in late winter), and generally slow growth. Females up to 20 years old and males to 14 years were recorded. Growth is strongly influenced by habitat, and spawning and involution of ovaries do not occur unless there is flooding. Dam construction in eastern Australian rivers has thus had a detrimental effect on bass recruitment in recent years. Females make a precise return homing migration after spawning.

Although there is a little data on which to evaluate alleged declines in jungle perch numbers in both Fiji and North Queensland, some features of the species' biology would appear to render it vulnerable. Its preference for lentic, habitat and general avoidance of silted soft bottom habitat, the probable slow growth rates, susceptibility to gillnetting of males congregated in lower reaches, pollution in some areas, and the possible negative impact of introduced species such as tilapia all suggest that the status of this indegenous food and sport fish merits our close attention.

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