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SEA HATCHERIES LTD.
A Company incorporated in W.A.
Aquaculture and Fisheries Research and Development

DEVELOPMENT OF BARRAMUNDI (LATES CALCARIFER BLOCH)

HATCHERY AND FARMING TECHNIQUES IN AUSTRALIA

OCTOBER 1983 - JUNE 1985

FIRTA PROJECT ~~38/83~~ 83/38

FINAL REPORT

by

M.P. Heasman, J.C. Ryall & I.R. Hockings

(Sea Hatcheries Ltd.)

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Preamble

The central aims of this project were to identify major practical constraints to the development of a commercially viable barramundi hatchery and farming enterprise in Northern Australia and to demonstrate that hatchery rearing of barramundi constituted a feasible alternative to the importation of exotic species, especially nile perch (Lates niloticus) as a means of improving freshwater angling in Queensland.

In October 1985 'Sea Hatcheries' was incorporated as a public company in preparation for the establishment of a commercial marine hatchery and barramundi farming venture. In the same month the Queensland Government formally announced the suspension of its nile perch project.

Introduction

Research operations were initiated in October 1983 when 'Sea Hatcheries' signed a lease agreement with the Cairns Port Authority for 2000 m² of floor space within no. 2 Main Wharf shed in Cairns. By November, a seawater pumping and filtration system and a basic laboratory comprising facilities and equipment

Figure 1: M. Heasman inspecting algal cultures at Sea Hatcheries experimental hatchery, no. 2 Main Wharf, Cairns. (April 1985)

for the production of marine algae (Fig. 1) and rotifers (*Brachionus plicatilis*), (used as live food for barramundi hatchlings), were operational. In the same month, field studies to identify sites and timing of spawning in wild barramundi, and hence a source of hatchlings for subsequent larval rearing and farming trials, were initiated at Weipa, (600 km N.W. of Cairns) in the Gulf of Carpentaria (Fig. 2).

Scope of STudies

Research completed over the total duration of the project (October 1983 to June 1985) may be divided into 3 broad categories:

1. Spawning in wild and captive fish as a source of hatchlings.
2. Hatchery production of fingerlings.
3. Feeding and growth studies.

These topic areas are dealt with separately below.

1. SPAWNING STUDIES

Introduction

At the commencement of this study, information on the sites and timing of spawning in wild barramundi stocks in Australia was extremely limited. Isolated records of spawning fish and gonadal condition information provided by R. Garrett and D.J. Russell (Queensland Department of Primary Industries, pers. comm.) together with anecdotal information from commercial fishermen, indicated that maximum spawning activity occurred in late spring and summer. This information, although scant, served as the basis of an annual barramundi fishing closure from December to January which was introduced as part of an overall management strategy in 1981 (Quinn, 1984). This closure falls within the

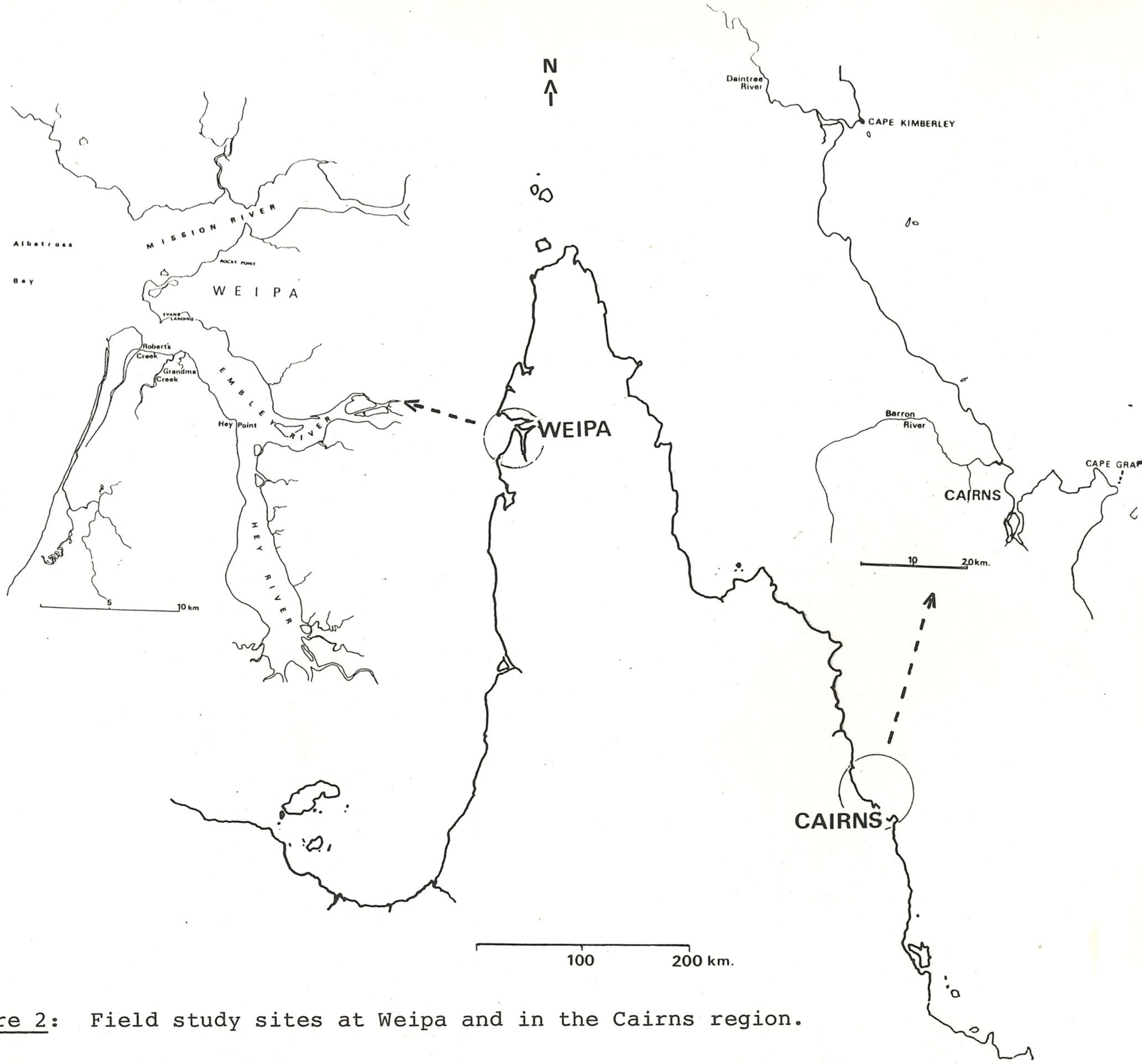


Figure 2: Field study sites at Weipa and in the Cairns region.

Field study site, Hey Point, Weipa.

spawning season reported for barramundi in Southern Thailand (mid-spring to late summer) where successful stripping of ripe wild fish and hatchery rearing was initiated in 1973 (Wongsomnuk and Manevonk, 1983).

<u>Materials and Methods</u>

<u>Study sites</u>:

In October 1983 a decision was made to study natural spawning activity of barramundi in the Hey and Embly River estuary at Weipa in the north eastern Gulf of Carpentaria (Fig. 2). The decision to mount field studies at Weipa, some 600 km from Cairns, was made on the basis of the following considerations:-

1. The area had been closed several years earlier to commercial netting and hence was likely to carry much higher numbers of fish than areas on the east coast near Cairns.
2. Stocks of barramundi in the region comprised so-called pygmy fish, a genotype (genetic race) that matures at an earlier age and smaller size than stocks to the south (Davis, 1984).
3. Though remote, Weipa boasted a fine all-weather daily air service which would enable hatchlings to be air freighted back to Cairns within 24 hours of hatching and hence well within the 72 hour period from hatch to first feeding.
4. As the Hey/Embly River estuary falls within a much dryer zone than the Cairns region, spawning was likely to occur within the sheltered estuary itself where netting could continue in virtually all weathers.

Most fishing activities were confined to the edge of deeper tidal channels in from Hey Point, approximately 5 km upstream

Figure 3: F.V. Archer River, which served as a mother ship for field research conducted at Weipa in 1983/84 and 1984/85. Note shark proof floating cages moored to the bow. These were used to hold barramundi for hormonal induction of spawning trials.

Figure 4: Hey Point, Weipa, October 1984. Note net dinghies and in the foreground a 1000 litre tank used to hold barramundi during hormonal induction trials.

and between Grandma and Roberts Creeks.

Field studies at Weipa were conducted between 22nd November 1983 and 12th February, 1984 and between 8th October, 1984 and 2nd February, 1985. Fishing for wild spawning fish was extended to the Cairns region in February 1984 after the conclusion of the spawning season in the Weipa region.

Fishing gear:

In 1983/84, 2-4 50 m monofilament gill nets comprising mesh sizes of 6½" (line 70) and 5" (line 40) were deployed each fishing night in the Weipa area. A smaller mesh size (4½", line 40) net was used to replace 5" nets during the 1984/85 spawning season. This was in response to poor catches of small male fish during the previous spawning season.

All fishing activities were staged from a 17 m mother vessel, the F.V. Archer River (Fig. 3), owned by Mr. Fred Zeimer, a licensed barramundi fisherman. Nets were deployed from 4-5 m outboard powered aluminium dinghies (Fig. 4) and either tended continuously or checked at 30-60 minute intervals.

The breeding condition of fish was determined by inserting a 1 mm I.D. clear polythene catheter 2-3 cm into the gonopore and withdrawing a small sample of gonadal contents. Ova samples were then examined at 50 x and measured with an optical micrometer (Fig. 5). All fish were sexed, measured to the nearest centimeter (total length) and weighed to the nearest 0.1 kg.

A random sample of female fish were sacrificed on each fishing night to record ovarian weight and hence a quantitative assessment of breeding condition, i.e. ovarian index ($= \frac{\text{weight of ovaries x 100}}{\text{total liveweight}}$). Small (25-100 ml) samples of eggs from ovulating (=ripe running = spawning) fish were stripped into clean 500 ml beakers (Fig. 6) and mixed with 1-2 ml of fresh

Figure 5: M. Heasman (minus beard) examining and measuring barramundi egg samples aboard F.V. Archer River at Weipa in November 1984.

Figure 6: Commercial fisherman Mr. George White and Mike Heasman stripping eggs from a spawning 15 kg barramundi at Cape Kimberly, November 1985.

or chilled semen (milt). Free running milt from male fish was collected in sterile 5 ml disposable syringes and stored for a maximum of 48 hours on ice (0°-5°C).

Results

Size composition of catches:

Size frequency histograms for barramundi captured in the Hey/Embly River estuary at Weipa during the 1983/84 and 1984/85 breeding seasons are presented in Figs. 7A & B. Catches taken with 5" line 40 and 6" line 70 monofilament net in 1983/84 were characterized by a very low proportion (16%) of male fish. This problem was rectified in the subsequent 1984/85 breeding season with the substitution of 4½" line 30 nets for 5" line 40 nets. Smaller males comprised almost 40% of total catches. Catches taken in 4½" and 6" nets were highly complementary. Males comprising 70% of catches taken in 4½" nets (Fig. 8A) while females comprised almost 80% of catches taken in 6" nets (Fig. 8B). The overall total catch of 563 fish comprised 180 males ranging from 41-83 cm and 383 females from 43-98 cm.

The very small lower size limit of these pygmy barramundi females would seem to indicate that some fish mature as primary females rather than undergoing a secondary sex inversion from males. This may also explain the apparent bimodalism in the size frequency distribution for females (Fig. 7B).

Spawning sites:

Spawning fish were captured at a variety of sites where routine fishing operations were mounted, i.e. at or near deeper tidal channels. Most spawning nights were characterized by still calm conditions. With progressive vitellogenesis (yolk deposition in eggs), relative ovary weight increases up to a maximum of

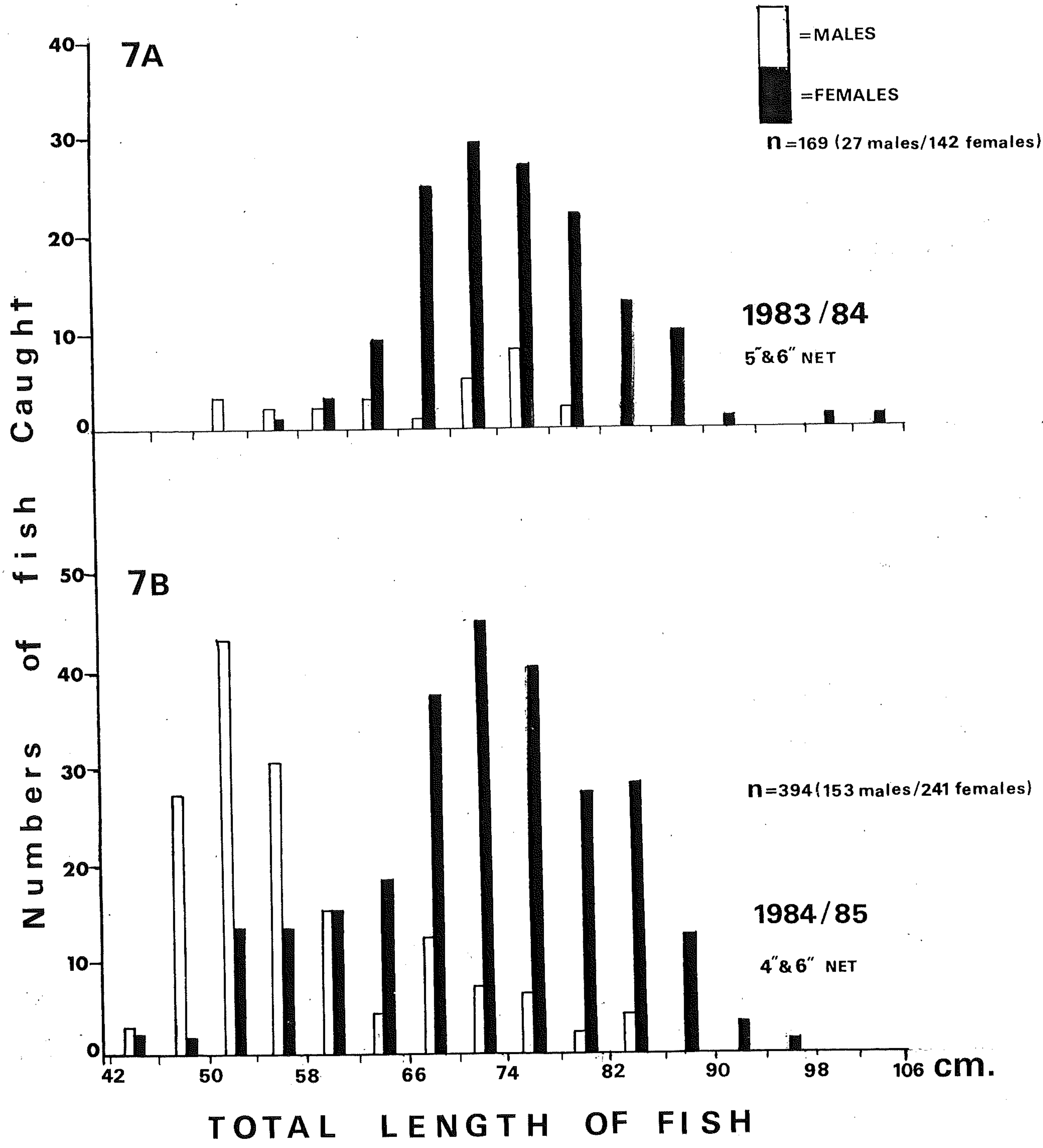


Figure 7: Length/frequency distribution for barramundi netted at Weipa during the A. 1983/84 and B. 1984/85 breeding season.

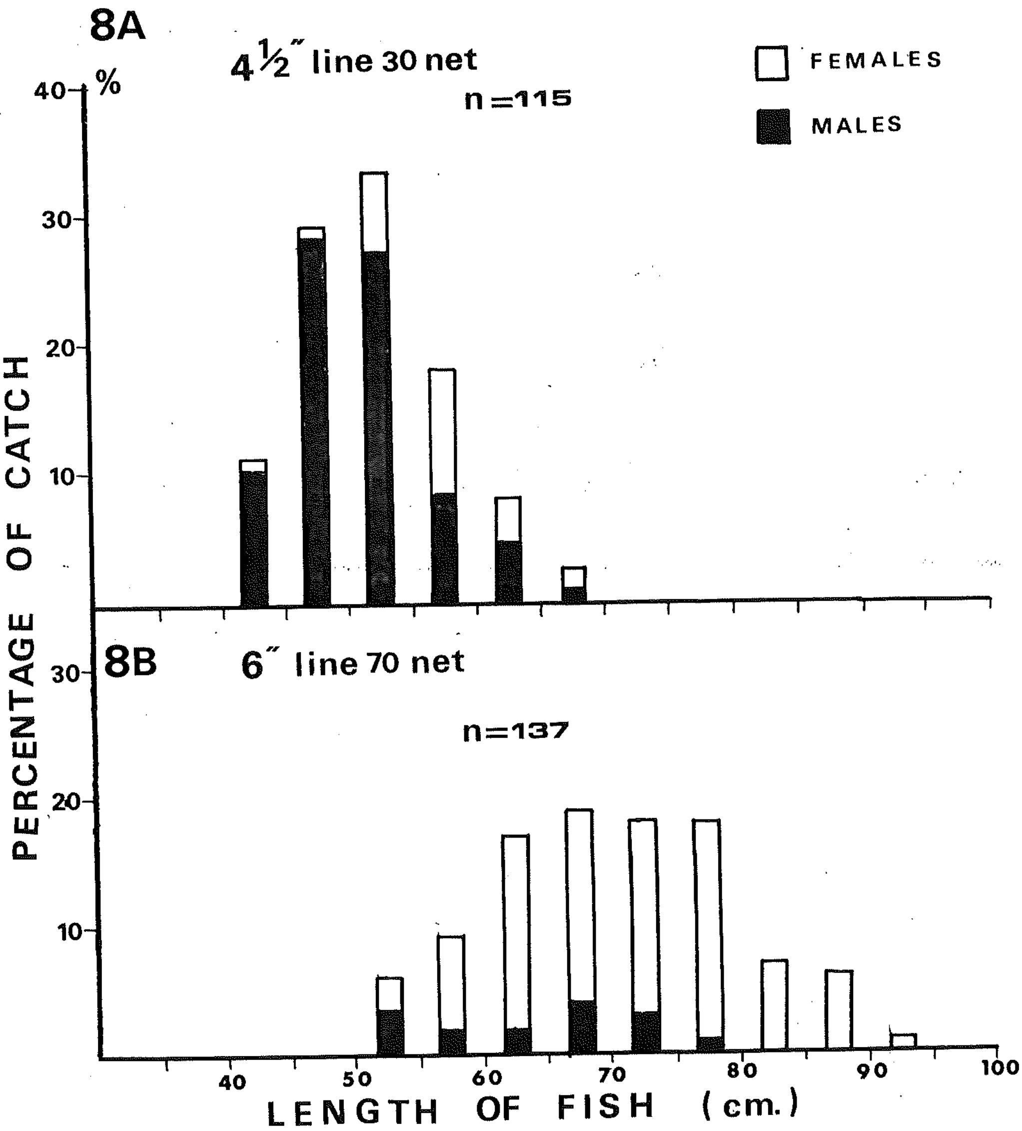


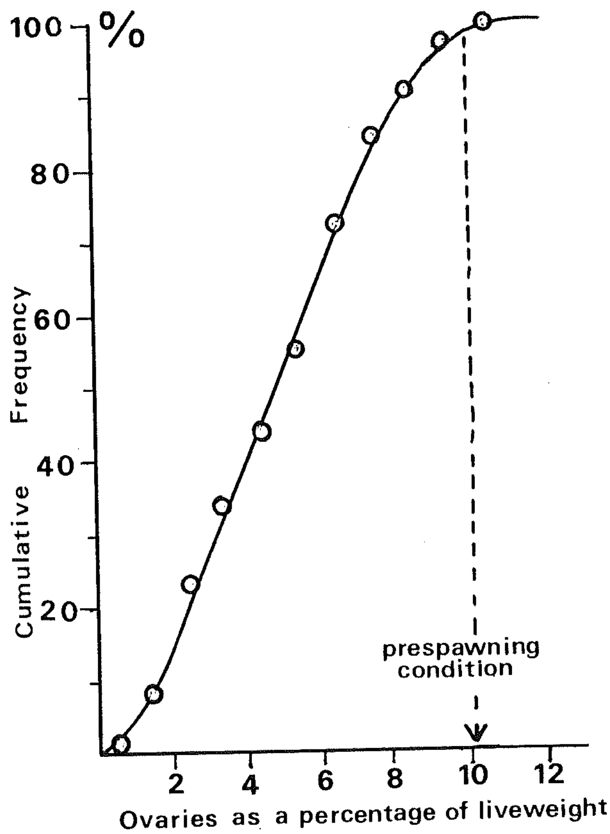
Figure 8: Length distribution of barramundi captured in A. 4½" line 30 and B. 6" line 70 monofilament net at Weipa in the 1984/85 breeding season.

about 10% liveweight within a day or so of spawning. (See figure opposite.)

Spawning times:

Breeding condition data for the 1983/84 and 1984/85 spawning seasons are presented in Figs. 9A & 10A and in Figs. 9B & 10B respectively. In 1983, the first year of sampling,field studies were not initiated until November, i.e. near the end of the breeding season. These limited data for 1983 nevertheless do appear to conform closely with those for the subsequent 1984 breeding season. In 1984, ripening of the ovaries of female fish appeared to progress in a synchronous manner from late August or early September, at which time local amateur and commercial fishermen first reported significant development of 'roe' in captured fish (F. Zeimer, A. Otto and S. Denman, pers. comm.).

On the first sampling occasion (8th October) of the 1984/85 breeding season, ovaries comprised approximately 6% of liveweight on average. Ovary weight increased to about 8% of liveweight immediately prior to spawning one week later. (Spawning fish were captured on successive nights - 15th and 16th October - 3 and 4 days after full moon). The generalised spent condition of most females on the next sampling occasion (19th to 21st October) constitutes further supporting evidence of synchronised spawning. A second well defined and apparently synchronous spawning occurred one month later (12th and 13th November) following the subsequent full moon. Secondary ripening of ovaries proceeded swiftly, ovary weight increasing from 1-2% of liveweight (spent condition) to more than 8% prior to the second spawning in November. This simple pattern thus described was complicated by the capture of spawning fish 6 days after the new moon. Such intermediate spawning activity would nevertheless appear to be relatively minor in magnitude in that no fish with advanced ovary condition



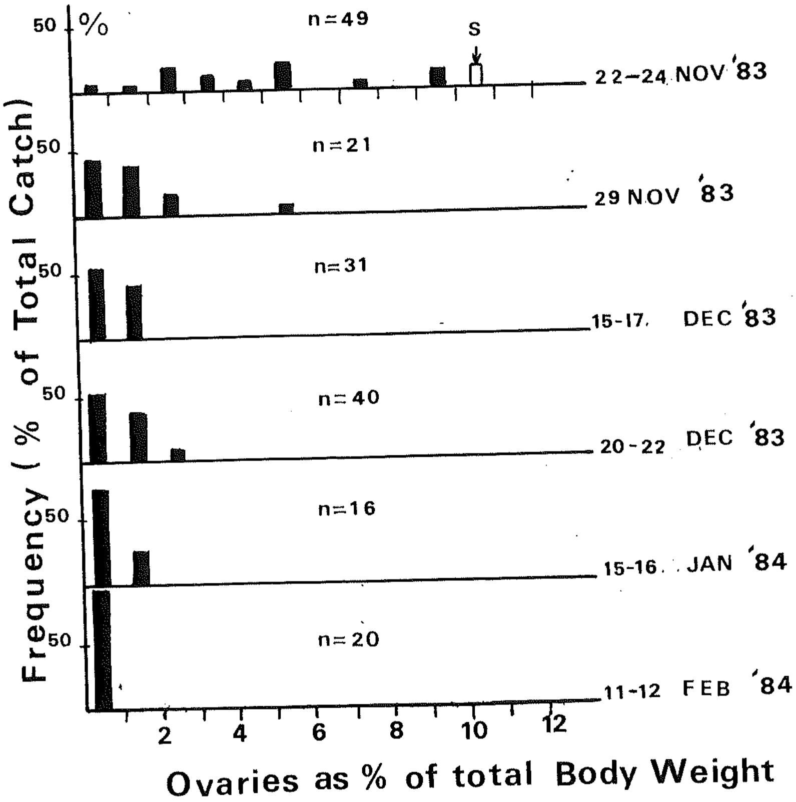


Figure 9A: Distribution of female barramundi from Weipa in 1983/84 grouped according to their ovary condition, i.e. ovary weight as a percentage of liveweight.

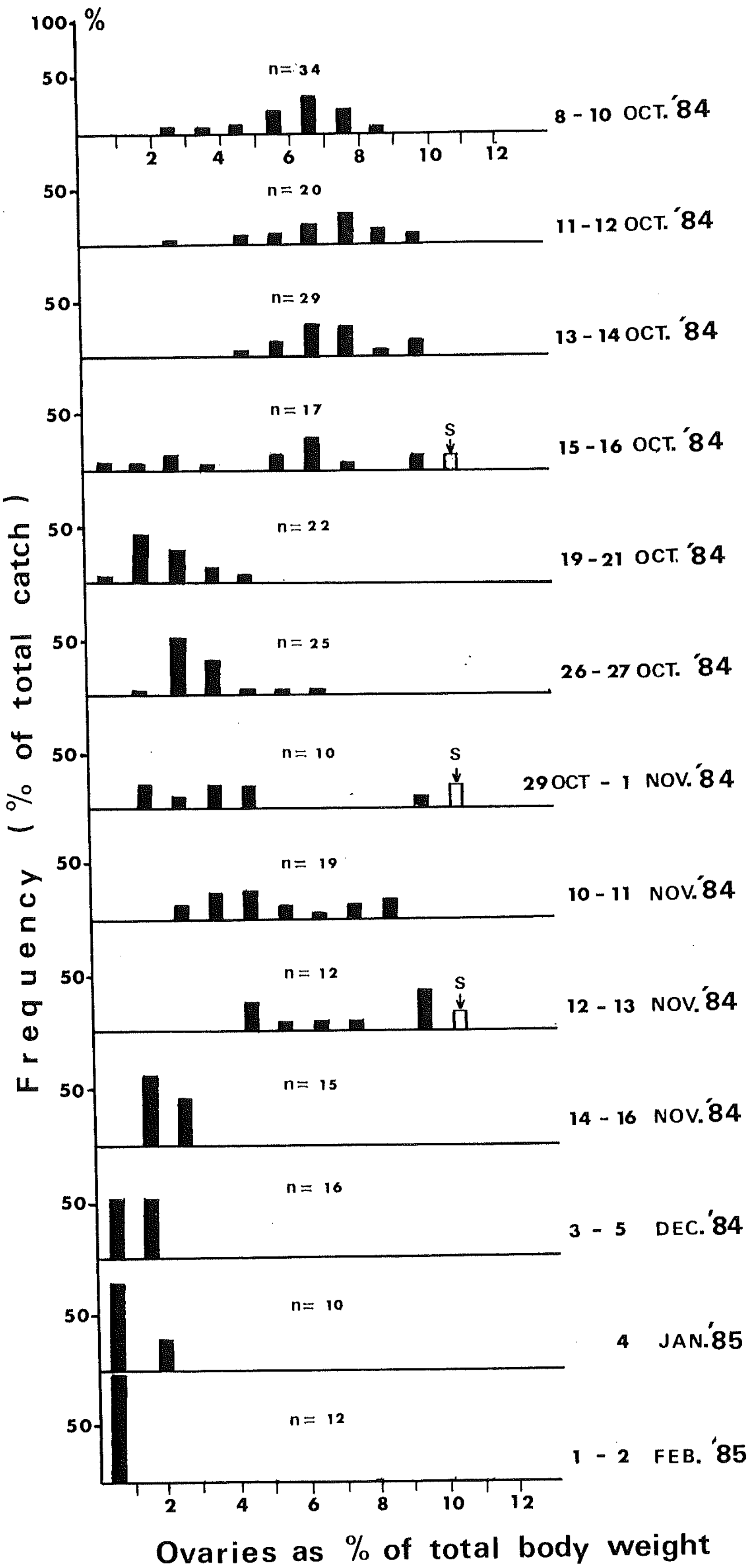


Figure 9B: Distribution of female barramundi from Weipa in 1984/85 grouped according to their ovary condition, i.e. ovary weight as a percentage of liveweight.

was captured in either of the 2 intervening sampling occasions, i.e. 19th-21st and 26th-27th October (see Fig. 9B). All fish sampled 2-4 days after the second (November) spawning were found to be spent. Progressive regression of ovaries, indicating the end of the 1984/85 breeding season occurred subsequently.

East Coast Studies

Fishing activities for spawning fish were more limited, being focused around anticipated times of spawning. Ripe running fish were captured between Cape Grafton in the south and Cape Kimberly in the north (Fig. 2) during January, February, March and December 1984 and January and February, 1985. Spawning females ranged from 9.5-18.0 kg liveweight while males ranged from 3.5-8.0 kg.

2. HATCHERY TRIALS

Introduction

The first consequential hatchery rearing of barramundi was achieved in 1973 at Songkhla in Thailand (Maneewongsa and Tattanon, 1982). Since then hatchery technology has been expanded and refined both in Thailand, where production increased from 200,000 in 1973 to an estimated 2-300 million in 1984 (Dr. P. Suraswadi, Deputy-Director, Department of Fisheries, Thailand, pers. comm.) and elsewhere - S.E. Asia, Taiwan and southern Japan.

In Thailand, hatchlings are acquired in a number of ways by different hatcheries. Hormonal induction is needed to induce spawning of captive fish in hatcheries at Prachnab Kirikhan, Cholburi, Satul, Rayong and Phuket. In other hatcheries that lie adjacent to natural spawning grounds, such as Songkhla, captive fish spawn without induction in tanks on the same days as their wild counterparts and over the same season, i.e. April to October (Maneewongsa, 1982).

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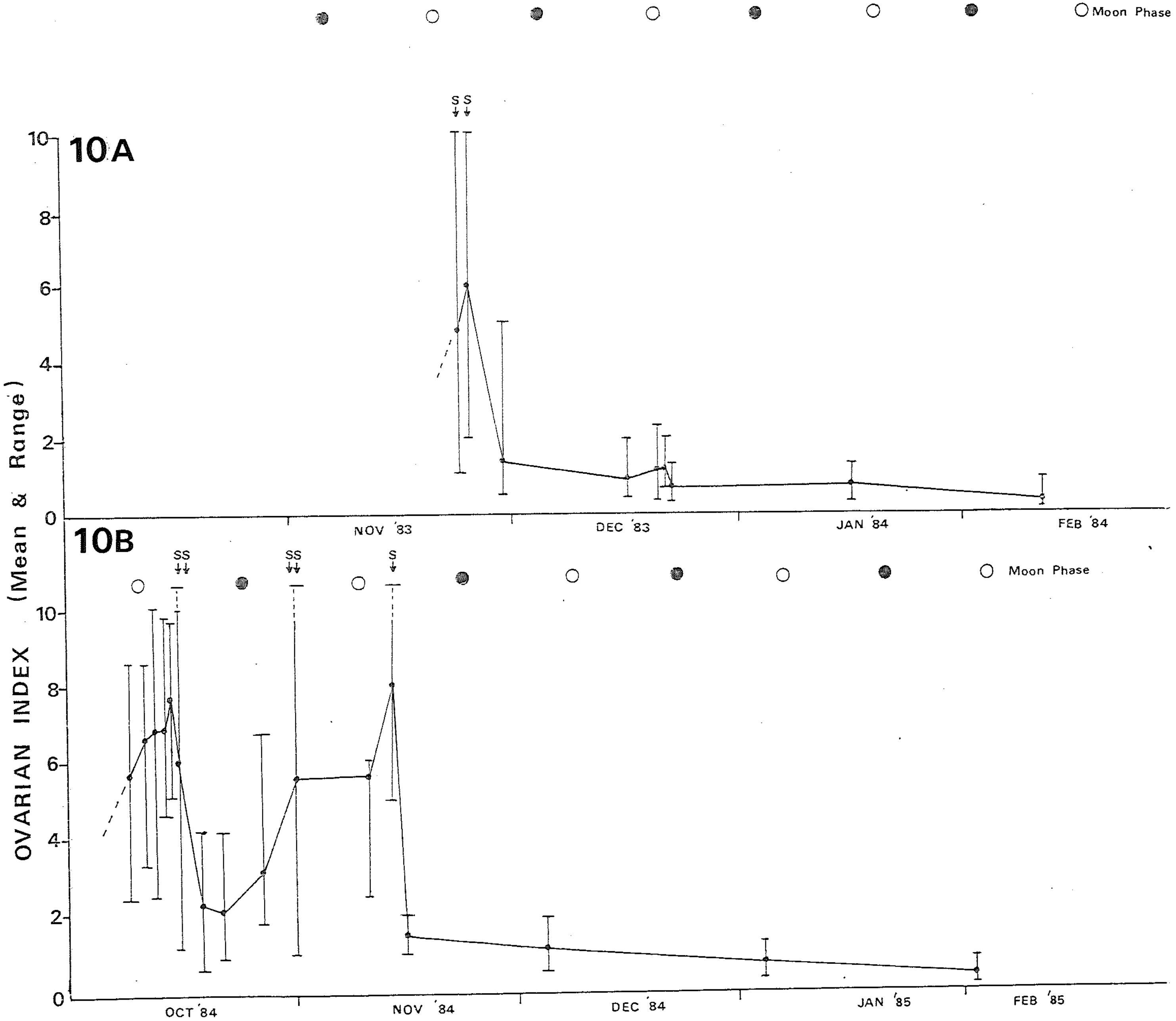

Figure 10: Breeding condition of pygmy barramundi from Weipa (as indicated by mean ovary weight as a percentage of body weight) in A. 1983/84 and B. 1984/85 in relation to moon phase.

Materials and Methods and Results

A. 1983/84 Breeding Season:

Naturally spawning (=ripe running) barramundi, comprising large east coast stock from the Cairns region and pygmy fish from the Hey/Embly River estuary at Weipa, were captured both during the 1983/84 and 1984/85 breeding season using fishing methods and equipment previously described in Section 1. Ripe running females were immediately stripped on capture, 25-100 ml of ova being collected in dry sterile 250 ml beakers and fertilized by the dry method, i.e. addition of 0.5-1.0 ml of undiluted fresh or chilled semen, collected and stored for up to 48 hours in 5 ml disposable syringes. On the occasion of the first capture of spawning fish at Weipa (23rd November, 1983), successful fertilization, incubation and hatching of eggs was prevented by a lack of viable semen. Of the very few males caught with the 5" & 6" net that was being deployed at the time (also see Section 1), only 3 (taken on the night prior to spawning) carried significant quantities ($\geq$0.2 ml) of free running semen. Semen collected from these fish was lost after a small domestic refrigerator in which it had been stored had been accidently switched off. On the following night, additional spawning females were captured just after nightfall but additional males were not caught until 9.30 pm by which time all eggs had apparently over ripened. Ironically, this spawning later proved to be the last for the 1983/84 breeding season at Weipa (also see Fig. 10A). East coast spawning fish were however encountered in the Cairns region on 5th February, 1984 (3 days after new moon). Fertilization rate, as indicated by ova having undergone one or more cleavages, was estimated at 60%. Hatch rate, for unknown reasons, was poor ($<$1%) and only 266 hatchlings were recovered 24 hours after fertilization. Of these, only 45 survived to metamorphosis* and beyond using standard green water methods used in Thailand (Tattanon and Maneewongsa, 1982). Water quality factors were suspected as being the cause of both low hatch and post-hatch survival rates. Accordingly, a revised clear water rearing system (Figs. 11A & B). incorporating continuous filtration and U.V. sterilization of water based on a design developed by Heasman and Fielder (1983) was commissioned prior to the 1984/85 breeding season.

B. 1984/85 Breeding Season:

In Weipa, spawning fish were captured in both October and November. The problem of low male fish capture rate encountered in the previous breeding season was solved with the use of smaller, lighter nets (4½" line 30 - also see Section 1). Variable fertilization and hatch rates (<5-95%) achieved were apparently associated with final critical egg ripening which occurs over a period of about one hour. This problem was rectified during hatchery trials conducted on the east coast in December, January and February, when much greater attention was given to ascertaining the correct stage of ripeness at the time of fertilization. Recently hatched larvae at 250 per litre were air freighted back to the Cairns hatchery in sealed, oxygen charged 20 litre polythene bags packed into 30 litre screw-cap polythene drums.

Much improved larval survival (60-90%) and development rates were achieved with the employment of modified rearing equipment. Mean periods from hatch to 20 mm total length in successive trials with both east coast and Weipa stock varied only marginally,

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* Metamorphosis as indicated by stabilized fin ray counts etc. occurs at a total length of 8-12 mm (Kosotarak & Watanabe, 1984).

Figure 11A: Mike Heasman changing filter screen in fish larval rearing system developed by Sea Hatcheries Ltd. November, 1985.

Figure 11B: Close-up of 2 week old barramundi larvae in rearing bowls. November 1985.

i.e. 23-24 days. Differences in the growth rates of larvae (1.5-12.0 mm) and small juveniles (12.0-60.0 mm total length) reared throughout the 1984/85 breeding season were marginal. Differences between larval and early juvenile growth rates for pygmy Weipa stock hatched on 15th October, 1984 (5 days after full moon) and for east coast stock hatched on 9th February, 1985 (4 days after full moon) are provided in Fig. 12. Marginally greater growth rates exhibited by the Weipa fish were probably due to higher rearing temperatures.

Hatchery growth data from the present study are also compared with equivalent data for barramundi reared in Thailand in Fig. 11. The mean hatch to 20 mm total length time of 40 days recently reported by Maneewong et al (1984) is identical to that originally reported by Wongsomnuk and Manevonk in 1973.

Induced Spawning Trials

Spawning induction trials were commenced in November 1983. Some degree of ripening and ovulation (release of ripe ova into the lumen of the ovaries) occurred in fish with a mean ova diameter as low as 0.45 mm. Best results were however achieved with fish with mean ova diameter exceeding 0.525 mm. These would have otherwise spawned naturally within about 72 hours of the time of capture.

Hormones used were HCG ('Pregnyl') alone or in combination with fresh macerated pituitary of other ripe barramundi (Fig. 13). Fish with an initial mean ova diameter of 0.5 mm generally required 2 doses 12 hours apart. The highest degree of ovulation of ripe eggs was achieved with dose rates of 500 i.u./HCG/kg plus 2 pituitary equivalents injected at the base of the pectoral fin. Complete or near complete ovulation occurred only in fish within 72 hours of natural spawning. Fertilization and hatch rates were very variable (<1-90%) but most were at the lower end of this range.

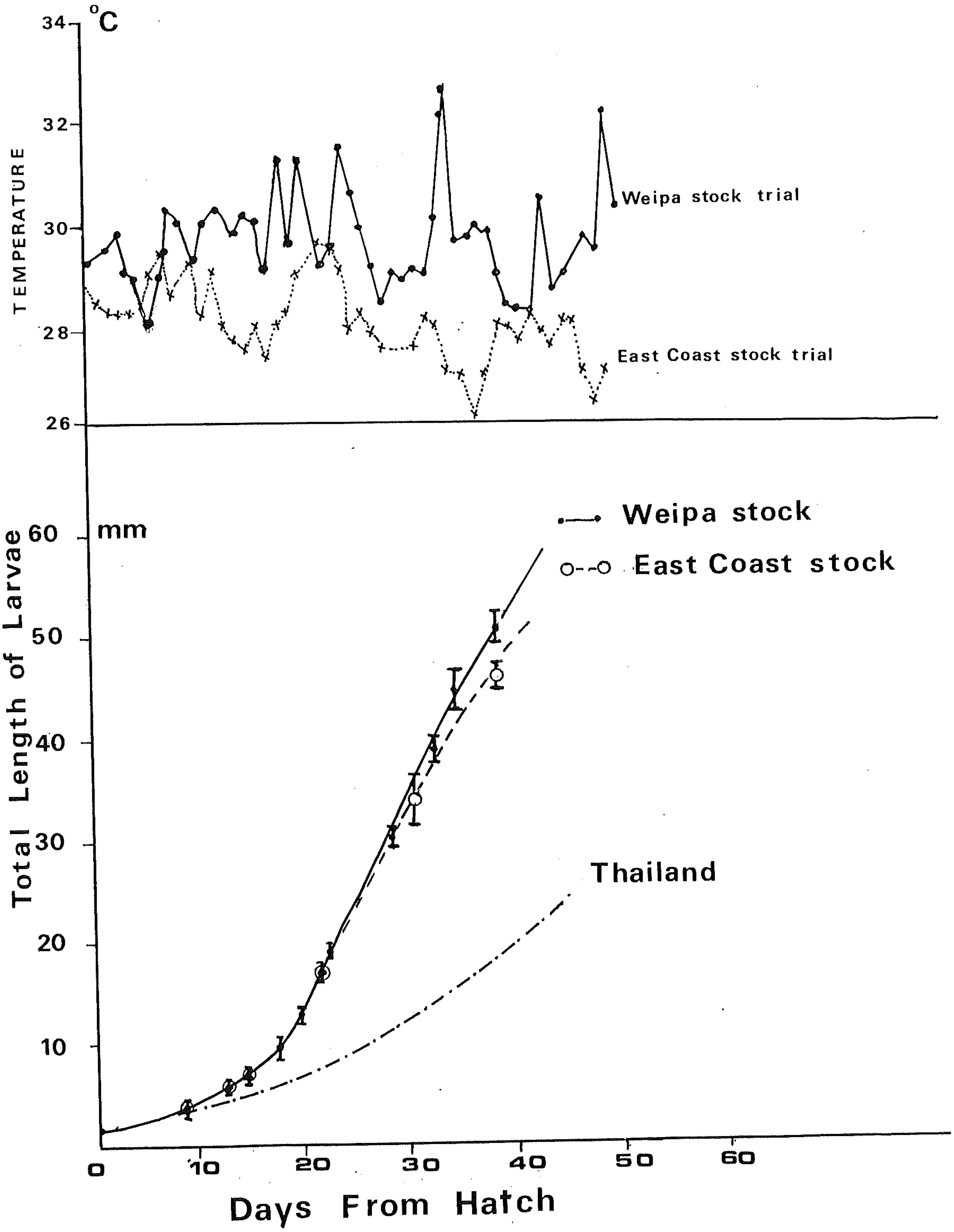

Figure 12: Growth data for barramundi reared by Sea Hatcheries and in Thailand (Wongsomnuk & Manevonk, 1973 and Maneewong et al, 1984).

No attempt was made to induce spawning in captive pygmy broodstock that were caught and shipped back to the Cairns hatchery from Weipa in May 1984 (Fig. 14). These fish did nevertheless come into breeding condition. Mean ova diameters, when examined in December 1984, ranged from 0.15-0.5 mm.

3. FARMING (FEEDING AND GROWTH) TRIALS

Introduction

The most critical constraint to profitable farming of barramundi perceived at the commencement of this study was the potentially high cost of food. Food conversion efficiency figures that had been reported from Thailand (Sirikul, 1982) were alarmingly poor (7-10:1) and well below comparable figures quoted for other carnivorous marine fish (3-5:1). Accordingly, a series of trials to determine whether or not such figures were an artifact of rearing systems (food quality, feeding rates and regimes, stocking conditions, etc.) being employed in Thailand, were undertaken during the course of the present study.

Materials and Methods

Fingerling barramundi used in all trials were reared from hatch in the laboratory as described in Section 2. Food conversion trials were conducted in both fresh and salt water trials in the laboratory, whilst growth rate trials were confined to net cages (Fig. 15) anchored in fresh water impoundments on private properties in the Cairns region. Juvenile barramundi used in all trials comprised progeny of pygmy broodstock from Weipa. All fish were anaesthetised with 10-20 ppm Quinaldine prior to handling and measurement.

13A

13B

Figure 13A: M. Heasman excising pituitary glands of barramundi aboard F.V. Archer River at Weipa. October 1984.

13B: Close-up of pituitary gland being removed from the base of the brain of a barramundi.

Food Conversion Efficiency Trials

(i) Fresh water trials:

Thirty-two juvenile barramundi of initial weights of 19.0-55.5 g were divided into 4 groups of 8. Initial mean weights of fish within each of the 4 groups ranged from 35.3-41.8 g. Each group was placed in 40 litre cylindrical PVC mesh baskets supported by floating collars within a 3 m x 0.5 m above-ground pool. Water was recirculated through a 500 litre coralline sand and gravel filter continuously. Mean temperatures over the 2 successive trials conducted from the 16/4 to 3/5 and from 3/5 to 13/5 were 26.4°±0.9°C and 25.2°±0.7°C respectively, while pH's for the 2 trials ranged between 7.0 and 7.4.

Fish were fed twice daily on a ration of chopped blue pilchard (*Sardiops neopilchardus* Steindachner) and norther herring (*Harengular koningsbergeri* Weber & de Beaufort). Food consumed was determined by the difference between weight of food offered and the drained weight of residual food that was removed approximately one hour later.

(ii) Salt water trials:

Larger juvenile fish ranging from 79-205 g were divided into 3 groups of 5, 10 and 14 and stocked in 0.15 m^3 rectangular net enclosures to assess food conversion efficiencies under variable stocking densities. Two successive trials were conducted between 10/9 and 23/9/85 and between 23/9 and 8/10/85. A diet of chopped blue pilchard was fed once per day. Food consumed was again determined by the difference between the weight of food fed and the drained weight of residual (uneaten food).

Results

(i) Fresh water trials (Table 1):

Relative food consumption for all replicates varied between 6.9 and 8.4% of liveweight/day. Differences in food consumption

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Figure 14: Captive broodstock being hand fed by Sea Hatcheries staff. Cairns, September, 1985.

Figure 15: Fresh water cage reared barramundi being fed by Sea Hatcheries staff. March, 1985.

between replicates in both series of trials were minor. Conversion efficiencies for individual replicates ranged from 2.8 to 4.1:1 (food:fish weight gained). The overall value was 3.35:1.

(ii) Salt water trials (Table 2):

Relative food consumption for individual treatments ranged from 2.5 and 4.0% of liveweight/day with no clear influence of stocking density up to 17kg/m³. The major differences between these and much higher relative food consumption rates recorded from fish reared in the fresh water trials are the product of lower temperatures and use of larger juvenile fish.

Growth rate:

Progressive growth data for 2 groups of farmed fish that hatched towards the end (3rd March) of the 1983/84 breeding season and near the beginning (13th November) of the 1984/85 breeding season are depicted in Fig. 16.

Fish spawned early in the breeding season initially grow rapidly, benefiting from high spring and summer water temperatures and reach harvestable size (500-600 g) in 200 days (6½ months). (See Fig. 16). Fish from late spawnings (end of summer or early autumn) encounter falling water temperatures during early juvenile growth and require a considerably longer period of about 300 days (i.e. 10 months) to attain marketable size.

Whilst the breeding season of barramundi in North Queensland spans a period of about 6 months (mid-October to mid-March), differential growth of their offspring will result in a peak harvest season spanning about 9 months.

Growth rate data of barramundi reared in this study are compared in Fig. 17 with those reported for wild fish (Grey and Hill, 1979). Weight gain of farmed barramundi is considerably faster than for wild fish. For example, minimum legal size in

TABLE 1

Results of Food Conversion Efficiency trials
Conducted in Fresh Water 16th April to 13th May, 1985

1st Trial	n	Weight of fish in g. Initial wt. mean ± S.D.	Final wt. mean ± S.D.	Stocking Rate kg/m³ Initial	Final	Weight gain Per fish	Total	Food(g) consumed	Food consumed:wt. gained	Daily food consumed as a % of liveweight
Replicate 1	8	39.6±12.2	61.1±20.6	7.9	12.2	01.5	172	524	3.0:1	7.6
" 2	8	35.3±10.2	48.9±9.8	7.1	9.8	13.6	109	447	4.1:1	7.7
" 3	8	41.8±3.4	61.1±3.8	8.4	12.1	19.3	155	524	3.4:1	7.5
" 4	8	36.7±8.9	50.8±12.1	7.3	10.2	14.1	113	413	3.7:1	6.9
						Sub-totals:	549	1908	3.5:1	7.5
2nd Trial										
Replicate 1	8	61.1±20.6	82.2±27.0	12.2	16.4	21.1	169	475	2.8:1	8.3
" 2	8	48.9±9.8	62.6±15.8	9.8	12.5	13.7	110	375	3.4:1	8.4
" 3	8	61.1±3.8	77.3±8.2	12.2	15.5	16.2	130	414	3.2:1	7.5
" 4	8	50.8±12.1	62.7±15.7	10.2	12.5	11.9	95	356	3.7:1	7.8
						Sub-totals:	504	1620	3.2:1	8.0

TABLE 2

Results of Food Conversion Efficiency Trials Conducted

In Sea Water under Variable Stocking Rates

10th September to 8th October, 1985

1st Trial	n	Weight of fish in g. Initial wt. mean ± S.D.	Final wt. mean ± S.D.	Stocking Rate kg/m³ Initial	Final	Weight gain Per fish	Total	Food(g) consumed	Food consumed:wt. gained	Daily food consumed as a % of liveweight
Treatment 1	5	132.4±32.6	147.0±35.7	4.4	5.0	14.6	73	266	3.6:1	2.9
" 2	10	136.1±34.0	150.7±39.0	9.1	10.0	14.6	146	473	3.2:1	2.5
" 3	14	140.1±45.3	154.8±50.0	13.0	14.5	14.7	206	713	3.5:1	2.7
						Sub-totals:	425	1452	3.4:1	2.7
2nd Trial										
Treatment 1	5	147.0±35.7	172.0±38.1	5.0	5.7	25.0	125	480	3.8:1	4.0
" 2	10	150.7±39.0	173.7±44.9	10.0	11.6	23.0	230	950	4.1:1	3.9
" 3	14	154.8±50.0	181.2±63.0	14.5	17.0	26.4	370	1270	3.4:1	3.6
						Sub-totals:	725	2600	3.6:1	3.7

Queensland (50 cm total length and about 1.5 kg) is attained in about 2 years in wild fish but in only one year by farmed fish.

It may be noted that for wild fish, annual weight gain stabilizes at about 1.5 kg per year from the 4th year onwards. These data could be used in support of the argument to raise legal minimum size of barramundi in Queensland from 50 cm (1.5 kg) to 62.5 cm (3.0 kg).

4. SUMMARY AND CONCLUSIONS

1. Sites and timing of spawning in wild populations of barramundi in Northern Queensland were identified.

2. A race of pygmy barramundi in the Hey/Embly River estuary at Weipa were found to undergo 2 successive and largely synchronous spawnings in October and November, i.e. approximately one month apart.

3. These 'peaks' in spawning activity occurred 0-6 days after full moon. Secondary peaks in spawning activity occurred 3-7 days after new moon.

4. With progressive vitellogenesis (yolk deposition in eggs) ovary weight increases to a maximum of approximately 10% of liveweight.

5. The breeding season of barramundi stocks in the region of Cairns begins in November and continues until February or March.

6. While successful use was made of hormones for the induction of spawning in recently captured barramundi, consistently

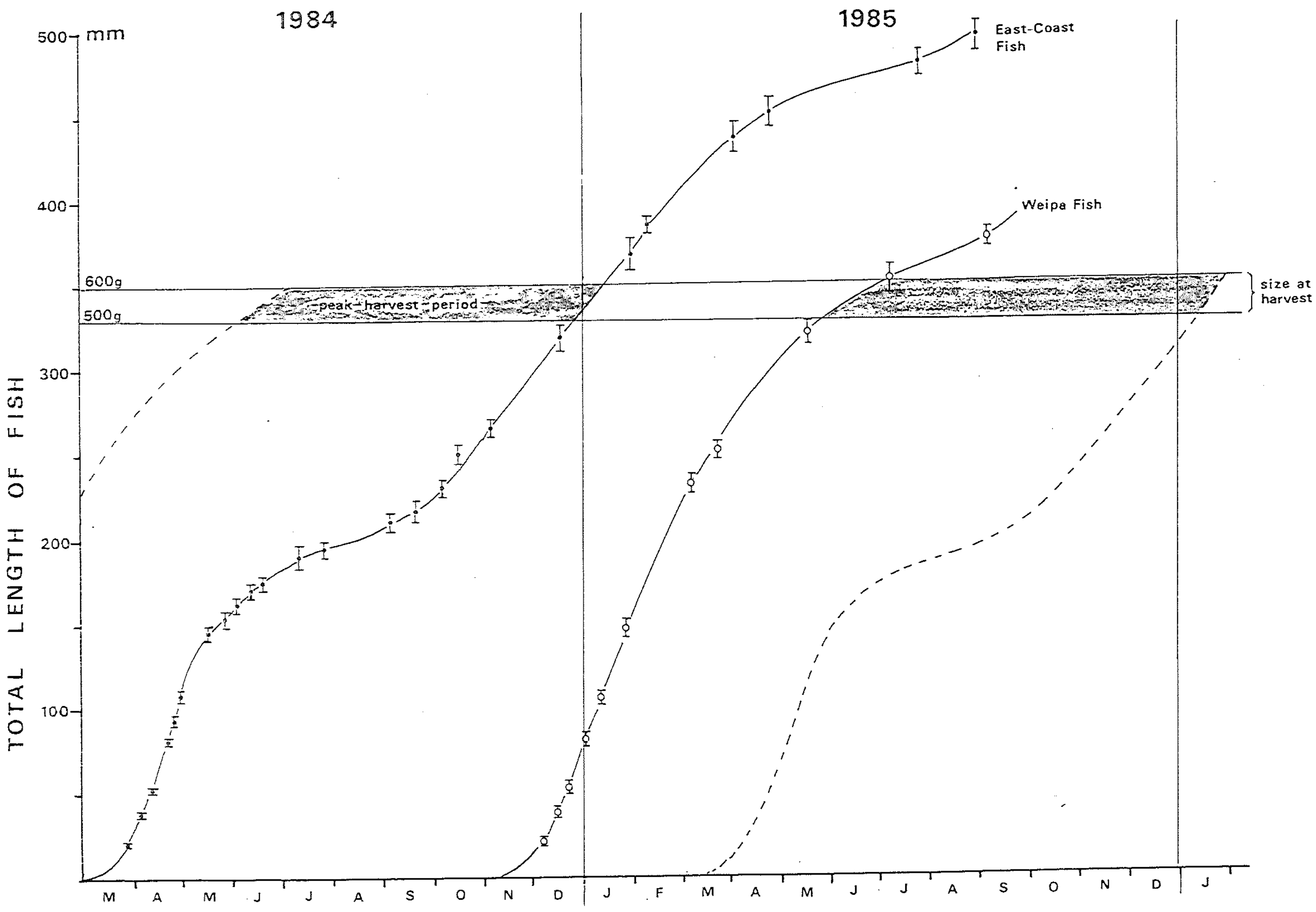

Figure 16: Growth rate data (mean ± S.E.) for Weipa (pygmy) and east coast barramundi reared from hatch by Sea Hatcheries.

high ovulation, fertilization and hatch rates were achieved only with fish that would have otherwise spawned naturally within 72 hours of capture. The provision of captive conditions conducive to natural spawning would seem a preferable option to the use of hormones under commercial hatchery operations.

7. Food conversion efficiencies of 3-4:1 (wet food to live weight gain) achieved with barramundi held both in fresh and sea water were considerably higher than those (7-10:1) generally reported from S.E. Asia (Sirikul, 1982) and comparable with those recently achieved by researchers in Thailand (Kosukavak, 1984).

8. Mean times of hatch to a marketable weight of 500-600 g (see Fig.18) varied from 6½-7 months for fish spawned early in the breeding season to 10-11 months for fish from late spawnings. These results are comparable with a mean grow-out time of 9 months reported from Thailand (Rabanal and Suesanto, 1982).

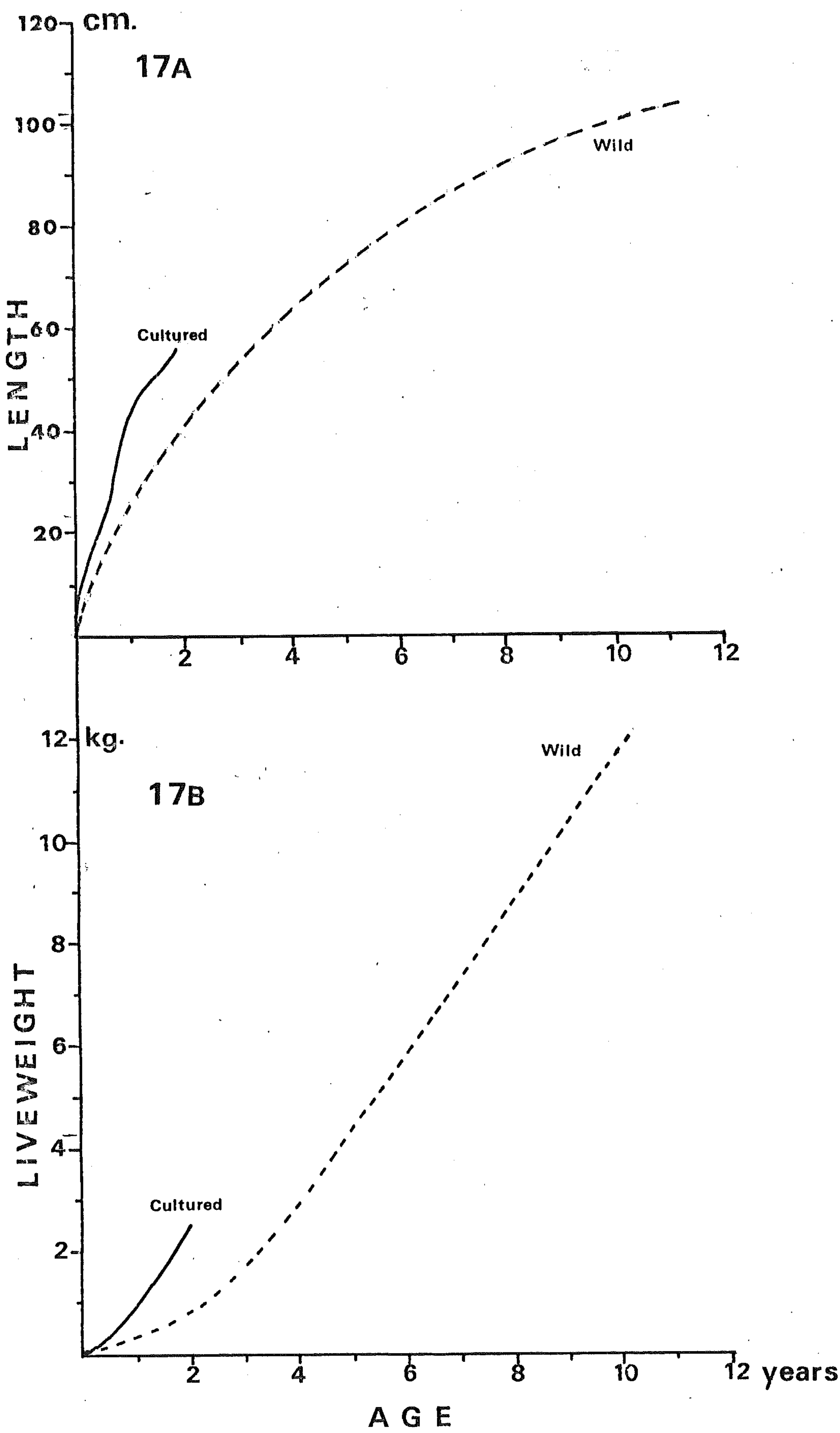

Figure 17: Growth data for wild barramundi and for barramundi reared in the present study. A. Growth in terms of length and B. Growth in terms of weight. Growth data for wild barramundi by Grey and Hill (1979).

Figure 18: Plate size barramundi reared by Sea Hatcheries from hatch during the present project.

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