POND CULTURE OF PACIFIC OYSTERS CRASSOSTREA GIGAS IN TASMANIA

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SUMMARY

The three experiments conducted to spawn and grow C. Gigas were only partly successful, with total mortality of larvae occuring in 14 days: spawning and larvae growth to this period being successful on each occasion. Further experiments in an attempt to determine the reason for failure using the species O. Angasi resulted in settlement and successful ongrowing of large numbers of this oyster: up to 25mm before removal to the sea. It would appear, therefore, that insufficient food was not the cause of larvae mortality with C. Gigas. It is assumed that the drop in pond temperature overnight was responsible for larvae mortality. It is suggested that some method of heat retention overnight could result in the successful rearing of C. Gigas in ponds.

Processors have asked for supplies of O. Angasi to market as a complimentary product to C. Gigas. Success with the production of this oyster by a very cheap method of rearing and growing in ponds warrants further work in this field.

CONTENTS

1. INTRODUCTION

The Pacific Oyster (Crassostrea Gigas) offers considerable potential for an extended Tasmanian and Australian Shellfish Culture Industry. (DIX 1975) estimates a sale potential value of $3.8 million, based on prices at that time. (Johnston 1978) estimates potential sales 3 million dollars.

Industry expansion demands consistant and adequate supplies of oyster spat for planned development. The current source of Tasmanian spat, the Tamar River, has been inconsistant with resultant detrimental effects on oyster production. Alternative sources of "natural spat" are not available, and artificial production had to be considered. This involves either a hatchery or pond rearing of larvae.

Capital and labour costs are low compared to hatcheries.

Having viewed on two occasions the successful rearing of the European Oyster (Ostrea Edulis) in Co Cork, Ireland, a project backed by the Irish Sea Fisheries Board and Department of Fisheries, it was decided to follow as closely as possible the methods used by this Company, Atlantic Shellfish Ltd.

2. LOCATION

The ponds were installed at Murdunna on the shores of Norfolk Bay, Southern Tasmania.

3. POND CONSTRUCTION

(a) Two ponds of 800,000 litres capacity were excavated in light sandy soil using a small bulldozer. It was deemed necessary to excavate rather than excavate and elevate (as with conventional "Turkey Nest" dams) to ensure the stability of the soil prior to lining. The ponds were situated 50 metres from the sea and the elevation was 6 metres above sea level. Dimensions of the ponds: 30 metres square, 2½ metres deep, with 45° sloping sides. (Fig. I)

POND DETAIL

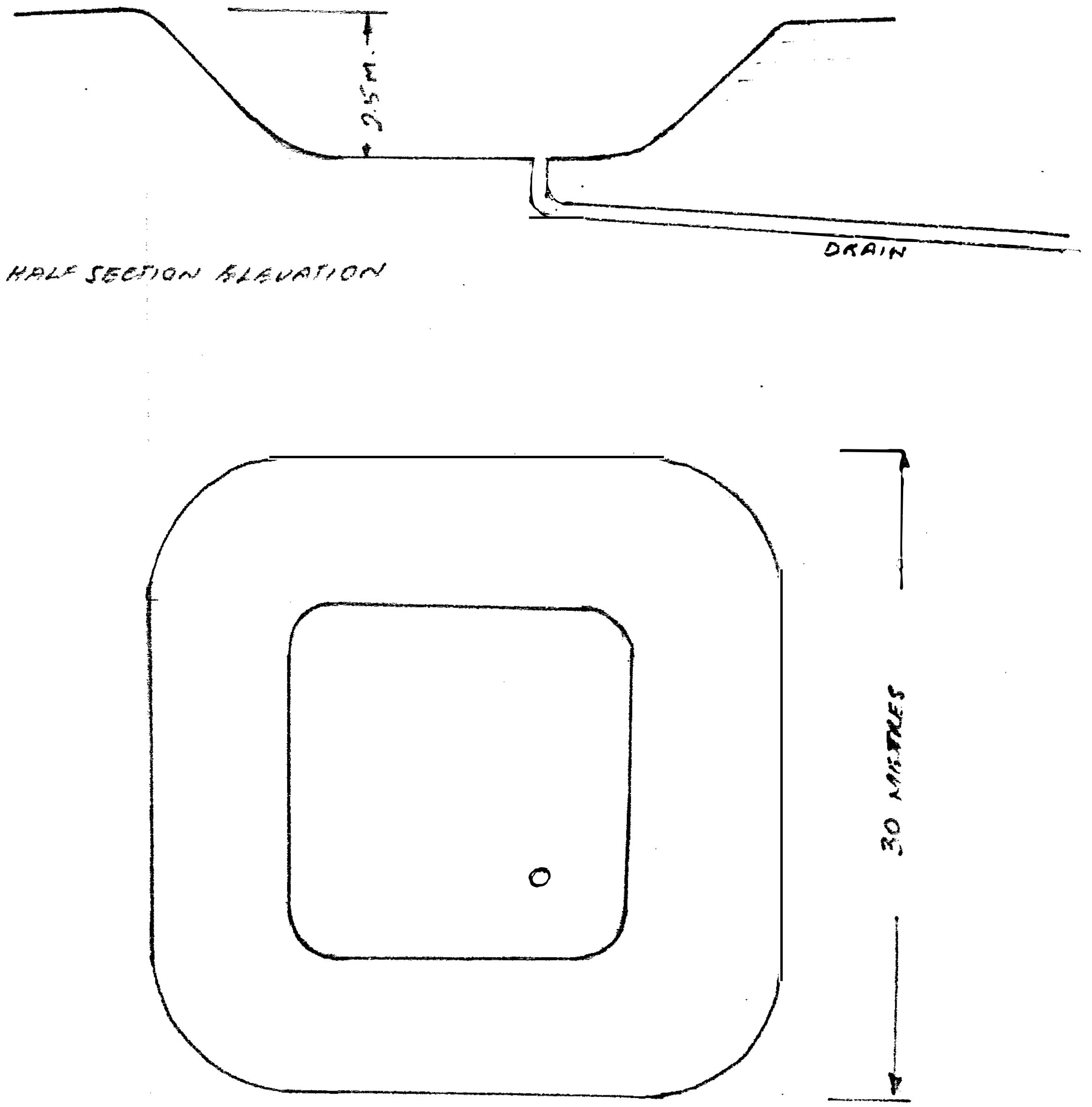

Fig. (I)

(b) Lining

The lining was manufactured from Dunlop Butyl Rubber purchased in 27.43 metre long, by 1,370mm rolls, 1mm thick joined with 100mm tape and glue to form a 35m x 35m liner. (Fig II). The lining was laid in the excavated site around which a trench 0.5m wide by 0.3m deep was excavated to bury the edges and secure the liner. (Fig. III).

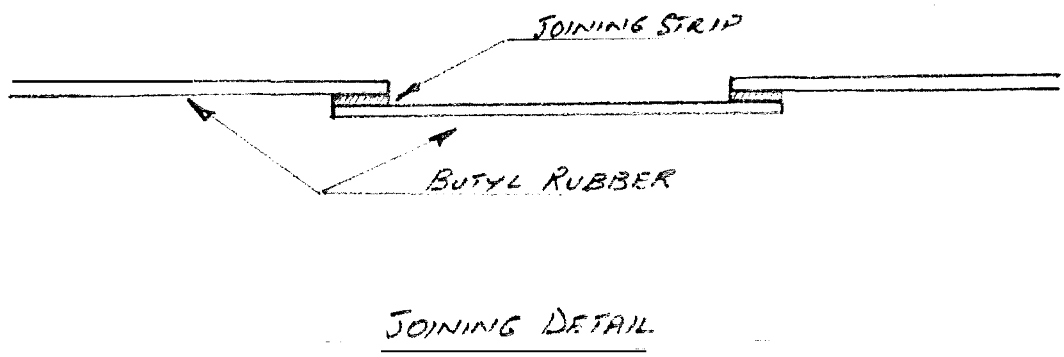

Fig. (II)

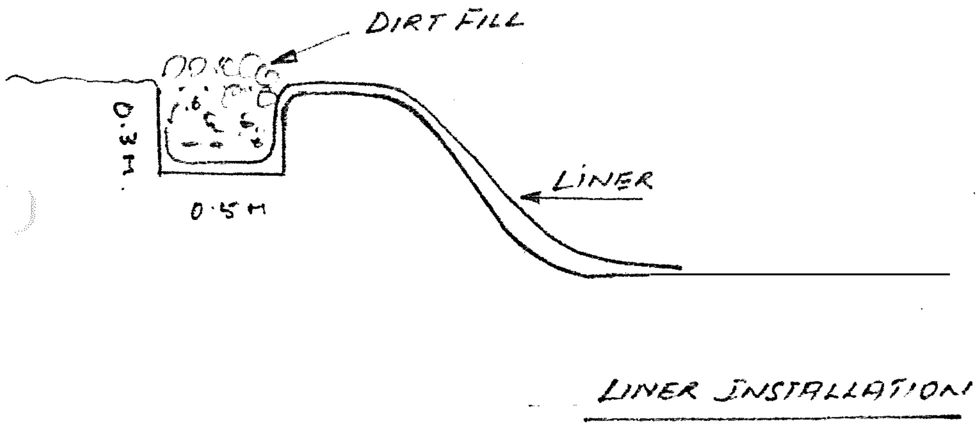

Fig. (III)

4. WINDBREAKS

It was found necessary to erect windbreaks around the ponds using "Paraweb" to reduce the influence of wind causing loss of water temperature, and to avoid foreign matter; leaves, sand etc. blowing into the pool and destroying the ecology of the ponds. This was most effective and reduced wind velocity by 80% on the leeward side.

5. PUMP AND WATER SUPPLY

The pump and supply line was capable of filling each pond to 800,000 litres capacity in three days. The pump was 2½" x 2" capacity driven by a 7½ H.P. 3 phase motor. The supply line being 2" polythene pipe and the intake 2½" polythene. Black polythene was selected as the supply line because of its ability to absorb heat. The line was laid on the surface of the ground with a series of coils in the line to fully utilise this factor in warming the supply of water prior to it entering the ponds. (Fig. IV)

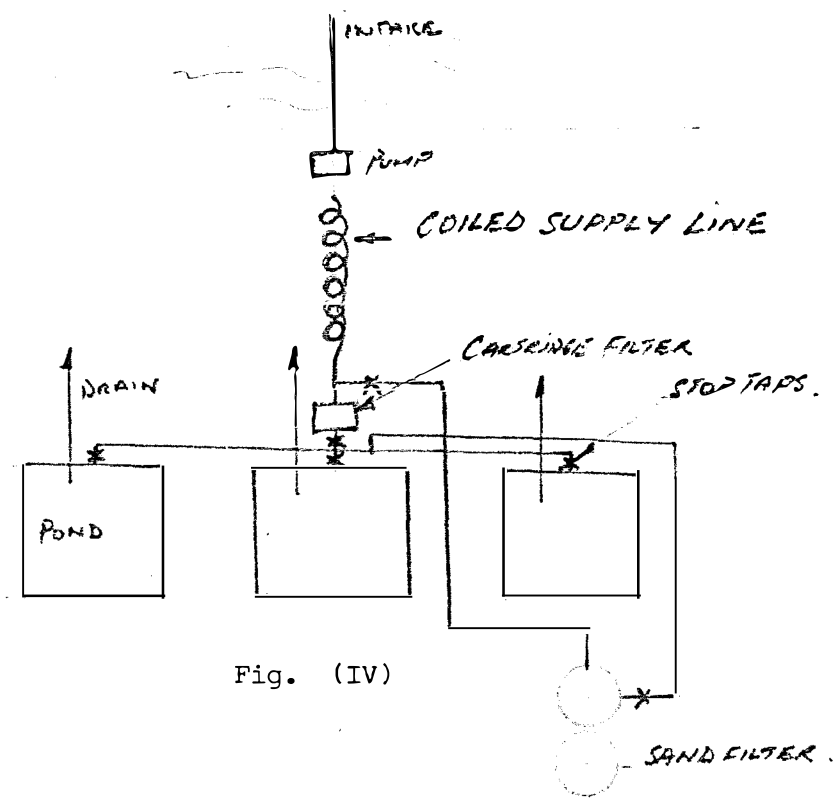

Fig. (IV)

6. FILTERS

Six cartridge filters were installed in parallel at the pond site to filter the incoming water to 10 microns.

Two concrete culvert pipes, each 4,800 litre capacity, were mounted on concrete bases and interconnected to be used as primary filters as required.

7. POND CONDITIONING AND PREPARATION

New ponds must be prepared and conditioned to remove all traces of adhesive (used in jointing) and other foreign materials present on the rubber from the manufacturing process. This entails filling and scrubbing over a period of three weeks. Larvae death occured within two days in the experiments conducted the previous year when this procedure was not followed. After three weeks the ponds were "seasoned". In the previous year it was found that slime and alga developed on the rubber liner and if not controlled developed to such proportions that the micro algae necessary for larvae food was depleted. To control this problem several thousand periwinkles were introduced into each pond. They effectively consumed these undesirable species.

8. OPERATING PERIOD

Water temperature in the pond needs to be around 24^{o}C for brood-stock to spawn quickly. The operating period, dependant on season, was restricted to four months: December to March. Should night temperatures fall below 18^{o}C larvae mortality was always noted with C. Gigas. Table I shows typical temperature range in the ponds.

Table I

Sample	Temp. Range For Typical Batch		
Date	Max	Min	
29/12/78	23.0	19.0	
5/ 1/79	24.5	19.5	
17/ 1/79	25.0	21.0	
23/ 1/79	26.0	21.0	
26/ 1/79	24.0	21.0	
27/ 1/79	20.5	18.5	
30/ 1/79	23.5	19.0	
1/ 2/79	23.5	18.5	
5/ 2/79	21.0	18.5	
6/ 2/79	24.0	18.5	
8/ 2/79	24.0	19.0	
10/ 2/79	24.5	19.0	
12/ 2/79	22.0	19.0	
*15/ 2/79	17.5	16.0	
18/ 2/79	18.0	15.0	
22/ 2/79	20.0	17.0	
24/ 2/79	22.0	17.5	
27/ 2/79	22.0	17.5	
6/ 3/79	20.0	17.0	
10/ 3/79	21.0	17.0	
15/ 3/79	20.0	16.0	

* Cold South West Winds

8. OPERATION

The ponds were monitored daily; temperature, salinity and larvae counts taken; details were recorded on Field Data Sheets. It was found necessary from time to time to "top up" with additional water to replace loss by evaporation.

9. BROODSTOCK

Adult stock was obtained from my commercial stick and rack lease at Boomer Bay, Dunalley. Oysters were selected for shape, size and "ripeness". Two hundred adult stock was placed in each pond. Spawning occured within 24 hours in each of the three experiments conducted.

Larvae swarmed were sampled by towing a 100mm sieve across the ponds and assessments of larvae numbers made.

10. RESULTS

In each of the three experiments spawning occured within 24 hours of placing broodstock in the ponds. Larvae growth and liveability was extremely good for 5 - 7 days after which mortality increased and growth rates slowed. In every case all larvae had died by 14 days of age. Adequate food appeared to be available and no satisfactory explanation was determined.

In an endeavour to assess the reason for the mortality at that age it was decided, in conjunction with Dr. T. Dix, to attempt to grow the oyster Ostrea Angasi which, because of its shorter laval period and lower temperature requirements for spawning and growth, could, if successful, indicate the reason for failure with C. Gigas.

11. PROCEDURE O. ANGASI

O. Angasi broodstock was collected by diving at Boomer Bay, Dunalley. 500 adult stock was introduced to each pond, and the same procedure followed as with C. Gigas.

Spawning again occured within 24 hours of placing the adult stock in the ponds. Monitoring daily indicated large lavae counts. Spawning Continued to occur over an extended period (up to 4 weeks) while the adult stock was left in the ponds. These were removed when sufficient larvae were estimated to be present (approx. 8×10^6).

12. SETTLEMENT AND CULCH MATERIAL

Various culch materials were used to determine the best culch for settlement and also for ease of spat removal.

(a) Scollop shells - These were punched, threaded on wires and then suspended from ropes across the ponds.

(b) Cement coated Egg Fillers - Paper mache egg fillers were coated with tar and then dipped in a lime cement: some were suspended from ropes, the others placed on the bottom of the ponds.

(c) Nylex shade cloth - Four Nylex polyethylene strips 5 metres long by 1 metre wide were placed in each pond.

(d) Shellgrit - Clean shellgrit was broadcast over the bottom of the ponds to stop settlement on the butyl rubber.

13. RESULTS O. ANGASI

In all three experiments with O. Angasi settlement was achieved. In excess of 1 million spat was ongrown in No. 1 pond, to average 15mm.

Brood oysters swarmed larvae within 24 hours of placement in the ponds. Larvae swarmed measured approxomately 200µm.

Larvae settled as spat within 16 days at approxomately 320µm.

All culch materials used appeared to be satisfactory with the best collectors being the egg fillers, Nylex shade cloth, scollop shells and shellgrit, in that order. Massive settlement occured on the butyl rubber and it was impossible to remove this spat without damage. All spat was successfully removed from the egg fillers and shade cloth without damage to give culchless spat. The scollop shells were removed to longlines for ongrowing at sea. Spat on shellgrit was not used.

A typical program is illustrated in Table II.

DISCUSSION

As O. Angasi were successfully reared in ponds using the same methods as C. Gigas, it is reasonable to assume that the mortality in C. Gigas larvae was not due to lack of food.

Further experiments will be conducted with C. Gigas and attempts made to control loss of heat during the night period, as it is suspected that larval mortality was caused by sudden drops in temperature overnight.

OYSTER POND CULTIVATION

FIELD DATA SHEET

O. ANGASI — POND NO. 1

Date	Max. Temp	Min. Temp	Sal.	Comments
29/12/78	23.0	19.0	1023	Adult stock added.
5/ 1/79	24.5	19.5	1024	Larvae present. Water sample to Taroona for PH test.
14/ 1/79	25.0	21.0	1024	Settlement occured. Newly spawned larvae present.
17/ 1/79	25.0	21.0	1024	Further settlements. Larvae range 220mm to 280mm.
23/ 1/79	26.0	21.0	1024	Large nos. new larvae present. Water samples to Hobart.
26/ 1/79	24.0	21.0	1024	Old and new larvae present. Settled spat growing well.
27/ 1/79	20.5	18.5	1024	Cold S.W. winds. Estimate 8.5 x 10^6 larvae. Adult brood stock removed.
30/ 1/79	23.5	18.5	1024	Further spatfall. Larvae count still high.
1/ 2/79	23.5	19.5	1024	Pond colour excellent. Large nos. copepods present.
3/ 2/79	24.5	20.0	1024	Eyed larvae present. Pond clearing.
5/ 2/79	21.0	18.5	1024	Settled spat removed to allow more food for larvae.
6/ 2/79	24.0	19.5	1024	Inspection of pond with scuba.
8/ 2/79	24.0	20.0	1024	Pumping new water 4 hrs per day. All larvae settled. No larvae observed.
12/ 2/79	20.0	18.0		Pumping 24 hrs per day.
15/ 2/79	17.5	17.0	1024	Cold S.W. winds. Some culch free oysters obtained 1cm long in three weeks from settlement.
16/ 2/79 - 15/ 3/79	17.5	17.0	1024	Pumping 4 hrs per day to maintain food supply. All oysters removed. Pond drained for cleaning and refilling.

Fig. 5. The G R International Fish Freshness Meter (Torrymeter) applied to a snapper.

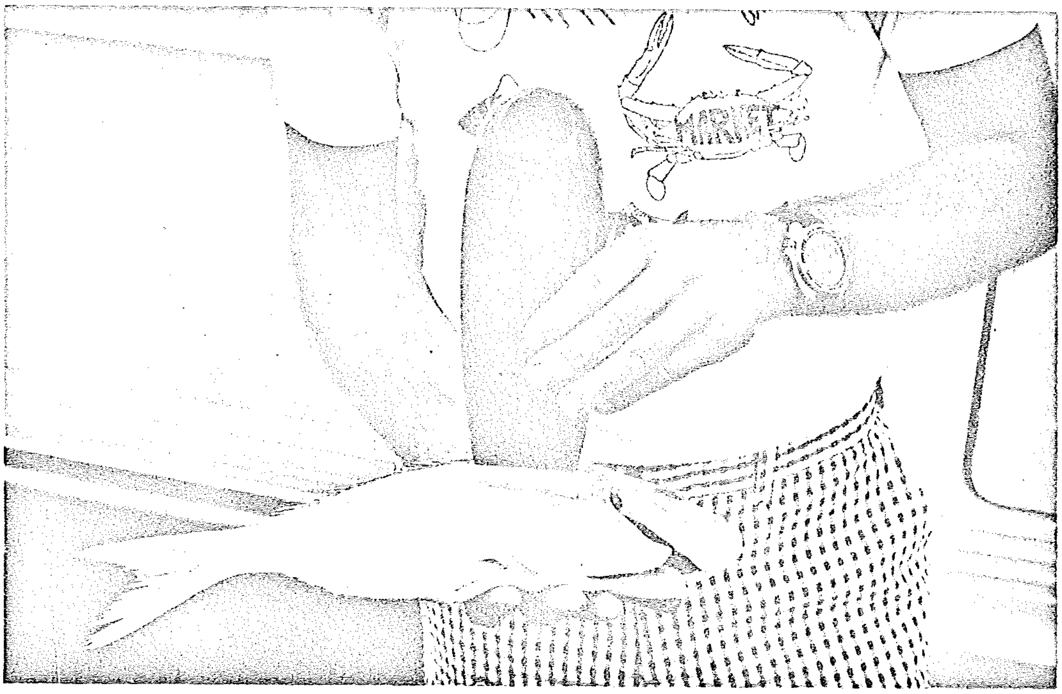

Fig. 6. Suggested Grading of Spoiling Flathead -- (dorsal view).

"A" Grade fish in a very fresh condition; note the bright yellow ring around the bulging eyes and the strong browny colour of the skin; "C" grade fish suitable only for filleting; note the sunken eyes and the pale colour of the fish.

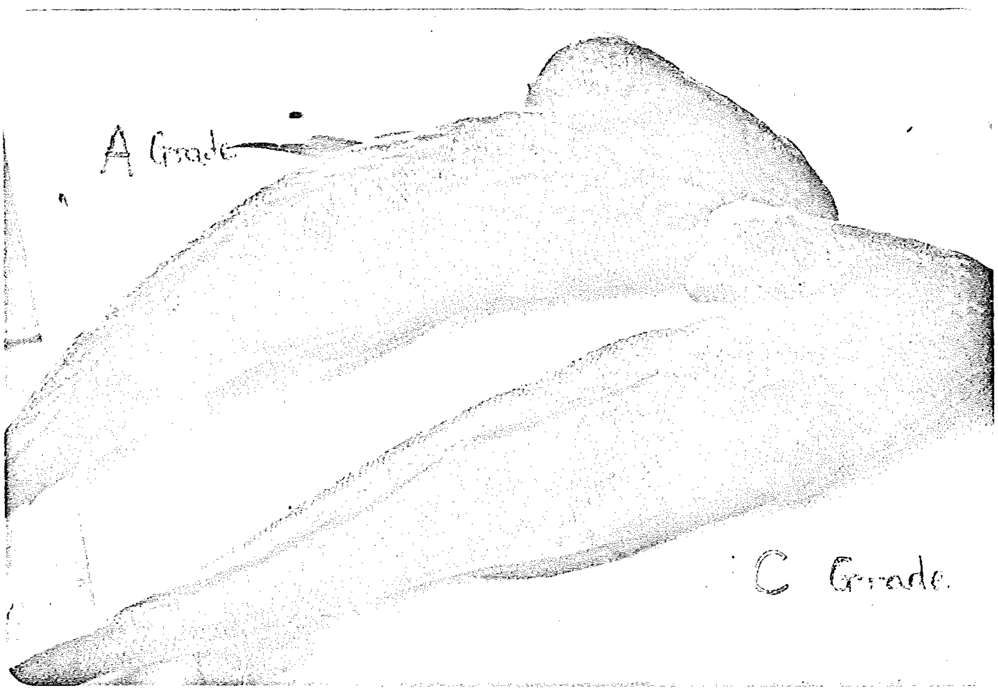

Fig. 7. <u>Suggested Grading of Spoiling Flathead</u> - (ventral view)

"A" grade fish in a very fresh condition; note the white skin of the belly; "C" grade fish suitable only for filleting; note the brown stains on the belly.