DEPARTMENT OF FISHERIES AND FAUNA
WESTERN AUSTRALIA

REPORT IV

REPORT ON THE BARRAMUNDI FISHERY IN WESTERN AUSTRALIA

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Department of Fisheries and Fauna
Western Australia

REPORT

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April-May 1969

I - INTRODUCTION

(a) Relevant files

No. 338/68 Fisheries and Fauna
Conservation (Ord River Scheme). A general file on conservation in the region of cultivation and irrigation land below the Ord dams, and in the water storage area.

No. 224/62 Fisheries
Closed waters Fitzroy River. Proclamation File.
Deals with the problems of amateur (line) anglers versus professional and amateur net fishermen with respect to barramundi in the Fitzroy River. In 1963 the river was proclaimed closed to net fishing for three miles upstream and downstream (tidal) from Langey Crossing (the old crossing of the main Derby-Broome Rd), the closest and most popular angling site to Derby. A request was later made for all of the freshwater reaches of the Fitzroy to be closed to netting.

No. 248/60 Fisheries
General correspondence re fishing in the Ord River.
Deals with concern over the influence of barriers to migration of fish and depletion of stocks caused by fishing of accumulations of fish at barriers, with special reference to barramundi.

(b) Natural history of Barramundi - summarised from Dunstan, D.J. (1959). The Barramundi lates calcarifer (Bloch) in Queensland waters. Div. of Fisheries and Oceanography. Tech. Paper. No. 5 C.S.I.R.O.

(i) Barramundi are widely distributed in rivers and estuaries in the semi-tropical and tropical regions of the Indo-Pacific from South China to the Persian Gulf and along the coast of northern Australia. The limiting factors to the distribution appear to be temperature and salinity.

(ii) Habitat.
Rivers with a large catchment area and a muddy or sandy bottom: These streams are sluggish and meandering in their middle reaches, and have a medium flow velocity and a con-

tinuous, though often slow discharge, which rarely falls below 15,000 acre feet/month. The main rivers of the east coast and the Gulf are of this type. During the dry months of the year 0+ fish are found in the lower freshwater reaches and in land-locked lagoons formed by overflow of the flooded rivers during the wet season. In the deep holes in the upper reaches of the rivers 1+ fish are found; mature fish inhabit the tidal reaches at the mouths of the rivers.

Short, deep, straight, fast-flowing rivers: These rivers, rising in coastal ranges of high rainfall, have small catchment areas, with little or no storage. Falls on these rivers present complete barriers to up-river movement of fish. There are very few barramundi in these streams.

Impermanent rivers - The upper reaches of these streams have sandy or pebbly bottoms and are reduced to a series of isolated water holes in the dry season. Barramundi are absent from the upper reaches and scarce in the lower reaches.

Minor water ways - These are muddy streams and swamps near the coast which are in contact with coastal waters only during the wet season. The swamps act as reservoirs during the dry season. Immature barramundi are plentiful and widely distributed in these permanent waterways.

Tidal creeks - These discharge into mangrove swamps but receive little freshwater. Barramundi are rarely taken in these areas.

The factor limiting abundance in northern Australia appears to be the absence of large rivers which flow permanently (to allow upstream migration of young fish and survival during the dry season).

(iii) Generally barramundi prey on smaller fish or crustacean species.

(iv) Barramundi from freshwater have large amounts of fatty tissue, they are sluggish, and their flesh is soft. Barramundi from salt water have firm flesh and very little fat.

(v) No adult fish with well-developed gonads were taken in non-flowing freshwater, or land-locked coastal lagoons. Large adults with well developed ovaries were taken during late spring and early summer in backwaters of coastal bays and

estuaries. In Queensland a down-river migration of maturing fish to coastal waters takes place in spring. In major rivers the post-larvae were observed swimming up-river along the banks out of the main run of the current. The adult fish remain in the brackish lower reaches of the rivers. In Queensland waters the smallest female barramundi, with well developed gonads, was 76 cm in length, 11 lb. in weight, and 2 years of age. The spawning season is prolonged and has two major periods -- October-January and January-March. These periods correspond to, firstly, the spawning of mature fish which can move downstream before the wet season and, secondly, to spawning of fish released from land-locked lagoons and river waterholes by later flooding.

(vi) The legal minimum length is 20 inches (50 cms). Net fishing in freshwater is illegal. Gill netting is the principal method of commercial capture of this fish, although licensed traps are permitted. Traps are used in mangrove areas near the mouths of rivers where it is impractical to net.

The abundance of barramundi in east Queensland rivers, as measured by the commercial catch, appeared to be closely related to the flow of fresh water. The Fitzroy and Burdekin Rivers gave markedly higher annual catches than other rivers.

Stream	Catchment Area (sq. miles)	Annual Discharge (x) (1,000 acre feet)	Annual runoff (inches) (y)	x/y	Annual Catch (lbs)
Fitzroy	54,522	4,200	1.29	3,256	28,352
Burdekin	50,489	6,210	2.3	2,696	50,836

These rivers were clearly the ones with the highest holding capacity of a slow but perennial freshwater discharge, and a large area of brackish tidal water. There was a significant positive correlation between average monthly river discharges for the Fitzroy and Burdekin and the average monthly catch of barramundi. Catches increase from September (the driest month) because of the downstream migration of mature barramundi to spawning grounds. In the Burdekin 45% of the yearly catch is taken during the wet season, January-March, when the discharge is 80% of the yearly total.

In the Fitzroy the catch is 37.4% for these months and the

discharge 72% of the yearly total.

Monthly Discharge (1,000 acre feet)

Month	Burdekin	Fitzroy
Jan.	750	800
Feb.	2,300	1,450
March	1,950	800
April	600	400
May	150	150
June	100	50
July	75	150
Aug.	50	50
Sept.	25	10
Oct.	25	150
Nov.	100	100
Dec.	250	300

Although barramundi formed only 1.7% of the total fish marketed through the Fish Board in Queensland, there was a ready demand. During recent years increasingly greater catches of barramundi have been air-freighted from the Gulf of Carpentaria waters to inland Queensland towns. The total catch exported from this developing area exceeded the marketed catch on the east Queensland coast, where the recorded catch had declined since 1947 (apparently from overfishing in those years and, in the years after this paper, also due to damming of the streams).

(c) This trip to the Kimberley region of W.A. was made from April 22 to May 10. Broome was the starting and end point of the trip. Mr. R.J. Baird, the Department's Pearling Superintendent at Broome, accompanied me and we used his 6 cylinder Landrover for transport.

A few days prior to the start of the trip the weather changed from a hot humid summer monsoonal type to the dry winter climate (hot clear days and cool nights) which is the northern tourist season. The wet season usually extends from mid-December to mid-March.

The period of the trip was close to the earliest one can traverse the region by road after the wet season. Although the tracks had dried out water was still flowing over even small creek crossings and, in many cases, work was still proceeding on the annual reconstruction of crossings.

During the height of the wet season the localities mentioned are almost all isolated by flood waters.

The Lands Department Office at Broome advised that the best maps available for the Kimberley region were those published by the oil firms. The Fitzroy River and tributaries follow the southern boundary of the region, and the Ord River and tributaries, the eastern boundary. Between these two major river systems there are other watersheds draining to the north and north-west. According to the Land Office these rivers are virtually inaccessible overland, even in the dry season.

The trip was organised so as to learn as much as possible about the following situations and problems on the Fitzroy and Ord Rivers:

(a) The commercial barramundi fishery in the estuaries of both rivers.

(b) The influence of the Fitzroy Barrage and Ord Diversion Dam, and proposed Ord Main Dam, on the migrations of fish - especially barramundi, i.e.

  (i) The extent of accumulations of fish below the structures,

  (ii) the occurrence of fish above the structures, and

  (iii) the likely magnitude of these structures as obstacles to movements of fish at different flow stages.

(c) The controversy of amateur line-fishing versus amateur and professional netting of barramundi in freshwater reaches of the Fitzroy River, especially near Derby.

Due to the short duration of the trip, the large distances to be covered and the lack of knowledge of the river conditions and localities, a planned sampling of the rivers was obviously not practicable. However, at the start of the trip we obtained a 16' diameter, 1" mesh, throw net, a 3" mesh gill net and a small aluminium boat with oars. Attention was given to the problems of sampling with a view to the possibility of future trips.

II RESULTS

FITZROY RIVER

(a) Commercial fishing for barramundi.

We visited the lower Fitzroy River area (Photo. 2) on 25th April and again on the return trip on 7th May. The only professional taking barramundi was "Nuggett" Moore. He was camped just downstream from the 3-mile net fishing limit below Langey Crossing (see situation map 1). On high spring tides the seawater extends up to Langey Crossing. Moore had his 7" gill-net set opposite his camp where daily tidal influence occurs. He had been making good catches of barramundi since the area became accessible after the wet season. Best catches were made during the first six weeks each year after the "wet" ended. Catches appeared to be influenced by moon phase since fish were captured at night. He was setting a second, new gill net, at the time of our second visit. He had one assistant.

Barramundi were bought from Moore by Ron Ah Chee who has a freezer at Derby. Ah Chee supplies the local hospital, and Cockatoo and Koolin Islands BHP Camps with the fish. Ah Chee thought that he handled about 3-4 tons of barramundi each season. He started handling the fish in 1952. The situation was definitely a buyers market, despite the barramundi being a highly preferred eating fish.

In Ah Chee's freezer on 7th May were 20 barramundi which he had bought from Moore during the previous week at 35 cents/lb. (A general price Moore gets here and elsewhere). (Moore had caught 17 fish in his net on the night previous to our second visit to him and had pulled out the net before the night was finished as this number was more than he could dispose of). The fish in the freezer were mostly 75-80 cms in length and about 12 lbs. each in weight. There were two fish about 90 cms in length (we had obtained scales from a 90 cm, 16 lb. fish Moore had tethered at his camp on 25th April). The smaller fish would seem to be the bulk of the catch. These fish could be in their third year and most probably spawned for the first time last wet season.

Moore appeared able to supply Ah Chee with sufficient fish to meet the Derby demand. He was also making the longer trip to Broome with fish for hotels and the hospital. Ah Chee has tried to extend his supply lines to Perth, where he believes barramundi would bring about $1.20 a lb. (Some have.) Although at Broome there are several fish traps operating close to the town, and in which very large numbers of small queen fish and bream were seen to be captured, the local people have a high regard for barramundi and it is a definite tourist attraction on hotel menus. J. Greysmark, a professional fisherman who operates a trap at Broome, is installing a fish freezer. It seems he has had considerable experience with netting the upper Fitzroy for barramundi.

Neither Moore nor Ah Chee could comment on the influence of possible changes in the abundance of barramundi over the past few years on the catch of barramundi, possibly because the market is easily satisfied with a small amount of fishing.

Another professional fisherman, Neville of Derby, was licensed by R. Baird during the trip.

No estimate was gained of the supply of barramundi to the trade by other former (part-time) professional fishermen who, in Baird's opinion, used the professional license primarily to gain a tax reduction on the purchase of outboard motors. Some of these fishermen appeared to have netted in the tidal region, and together with amateur netters, have come in conflict with line fishermen by netting freshwater pools, particularly near Langey Crossing, e.g. at Telegraph Pool, during the dry season when the river is reduced to pools and the fish are more confined.

(b) Net versus line-fishing conflict, especially on the river close to Derby.

In 1963, upon request of the Derby Shire Council, the river was proclaimed closed to net fishing for 3 miles upstream and downstream from Langey Crossing. This proclamation was renewed in 1968. In 1963 this Crossing was the main road between Broome and Derby and together with the access roads was kept in good order. The situation recently changed. A new main road and bridge (Willare Bridge) now exists upstream from the Crossing and the track into the Crossing from Derby has deteriorated markedly, the Crossing being now not negotiable.

I talked to Mr. Tonkin, the Shire Clerk at Derby. He was not officially aware of the conflict which his predecessor had called to our attention. However, he was aware that all the councillors favoured a complete ban on net fishing in the (freshwater of the) Fitzroy. The request for the ban was made to the Department of Fisheries and Fauna in May 1967 (File 224/62). I summarised the problem for him, mentioning the deterioration of access to Langey Crossing and the fact that the public was now more likely to go to Willare Bridge to fish. The net fishing ban does not encompass the new Willare Bridge reaches of the river.

The number of points of access to the Fitzroy River upstream from this lower area appear to be limited. Conflict between net and line fishermen would also apply to these places.

There appear to be very good reasons for treating the barramundi in freshwater as a fish to be taken only by amateur fishermen with lines. This argument will be given in the conclusions to this report after some of these reasons have been illustrated later in this section.

(c) The Fitzroy Barrage

The barrage was erected (December 1961) and is maintained by the P.W.D. (locally J. Robinson) for the diversion of water to the irrigation projects of the Northern Development Co. managed by D. Schilling at the Camballin Headquarters (see Situation Map 2).

Two periods were spent at the barrage - at the start of the trip and on the return journey when we knew that some of the barrage gates had been closed off.

We tried to gain access to the river for a few miles upstream and downstream from the barrage but without success.

Description of the Barrage as an obstacle to fish movement.

See diagram 1 and photographs 3-6 and 10. The barrage is 44 miles from the Derby-Fitzroy Crossing bitumen road. The track to the barrage from Camballin (where the P.W.D. are located) is flooded in the wet season. Consequently most of the barrage is set to collapse at peak floods. The 8 large gates on the left-hand side of the barrage operate submerged outlets below the apron. These are removed before the floods and stacked on the left bank. The automatic gates are designed to fall flat at peak floods.

The only period of the year when barramundi or other fish could pass up over the barrage would be during floods when there is a smooth continuous flow over the submerged apron. It is possible that one-year old barramundi, which have passed the previous year below the barrage may thus pass upstream during flooding. However, these conditions would probably be too early for young of the year fish to pass.

As soon as practicable after the floods the automatic gates are erected and the other gates are installed. Water allowed to pass through the submerged outlets on the left side of the barrage is flowing much too strongly to allow fish to swim through the outlets. One of the automatic gates was still down during our trip but the fish could not pass up the massive shute of water passing through the gap. Water flowing over the automatic gates (during our second visit) presented an impossible jump of about 11' to fish. The river flow was falling rapidly during our visit (the left-hand side outlets were shut off between our two visits). The remaining automatic gate, lying flat, was to be erected shortly after we left. The only water then that would pass the barrage during the rest of the dry season would be that in excess of irrigation diversion demands. This excess water would fall over the 8' automatic gates onto the apron which itself was 3' above water level during our visit.

Robinson of the P.W.D. at Camballin confirmed that the timing of the annual erection of gates, adjusting water flows, etc., depended solely on the river flow and thus these operations occurred at different dates each year.

Two parties visited the barrage, during our visit, to collect Cherabim (Macrobrachium spp.). In addition to drop nets they collected Cherabim off the barrage itself, although this was prohibited and dangerous. One party returned with a boat and collected a second large bin of cherabim off the right side apron. Very large numbers of Cherabim were observed, towards evening and at night, attempting to climb up over the barrage. Many of these, down to a very small size, were seen on the barrage apron. Apparently, according to Dr. George of the W.A. Museum, Cherabim spawn in the estuaries and migrate upstream in the young stages in a similar manner to barramundi.

Cherabim fishing would seem to be on a comparable level of public appreciation to marroning in the South-West.

Only one type of fish were seen to jump at the barrage. These were the spangled perch (Therapon unicolor) which are similar in form to barramundi. Small fish 8-15 cms in length jumped at dusk and sunrise, and sporadically during the day, at the white water spurting between the automatic gates. During our second visit when water flowed over these gates jumping was observed very closely at the right-hand side wall where the water flow was weakest. These small fish often managed the 3' jump onto the flat concrete apron but of course could not jump the gate.

There were numerous other fish below the barrage. I had only one throw off the barrage with the throw net. This resulted in the capture of fork-tailed catfish (Neoarius australis) varying in length from about 3" to 9". No further throws were made because the spiny catfish took a long time to be disentangled. These catfish were also observed in schools below the apron and fish up to 3 lbs. in weight were captured on lures.

Long Toms (Stenocaulis krefftii), mullet, bony bream (Fluviolosus sp.) and rifle fish (Toxotes chatareus) were also observed below the apron of the barrage. Many of these were small young fish.

During our second visit we set the 3" gill-net above the barrage overnight. We caught 32 fork-tailed catfish from 1 to 3 lbs. in weight, 1 ox-eye herring (Megalopes cycloides) about 1½ lb. in weight, and 2 bony bream about ½ lb. each in weight.

No barramundi were caught (by net or line) or seen above or below the barrage. With the throw net I later caught a 0+ barramundi, 16 cms

in length, at Moore's camp on the lower Fitzroy (also very small bony bream, mullet, and catfish).

(d) Fitzroy River - upper reaches.

We examined the river at Geike Gorge, near Fitzroy Crossing. The river at the downstream end of the gorge breaks up from a long, deep pool into gravel riffles. (photo. 9). The Margaret River enters this pool just upstream from the riffles. A party camped here just prior to our visit had caught on a line one barramundi, length 75 cms, from which I obtained scales. According to locals, mostly fish of about 10-15 lbs. are caught with occasional ones up to 30 lbs. A party from the local mission had caught 4 barramundi in one night here a few nights before our visit but while we were there had no luck. J. Greysmark of Broome while stationed at Fitzroy Crossing netted barramundi nearer the town. He said that as late as 1967 he netted fish at Fitzroy Crossing although he expressed the opinion that barramundi fishing was poor now in the Fitzroy.

We set the 3" gill-net out from the bank just upstream from the Margaret River. From 5.30 p.m. to 7 p.m. 13 fork-tailed catfish (1-2 lbs.), 1 bony bream, and 1 freshwater crocodile (7' long) were captured.

A considerable amount of casting was done with the best rod equipment and lures available for barramundi but without success.

Numerous small spangled perch, Long Toms and rifle fish were seen. Cherabim were also present.

ORD RIVER

(a) Commercial fishing for barramundi.

Besides the Ord River there are a number of other rivers, noted for Barramundi, which enter the west arm of Cambridge Gulf. The King River near Wyndham supplies freshwater to the town; at present water is pumped from a waterhole but during this dry season a start is being made to dam the river. The other rivers, Pentacost, Durack, and Forrest, have not been interfered with by dams.

The Ord River is 14 miles by boat from Wyndham and there are 30 miles of tidal water up to Carlton Crossing.

Trevor Nelson, formerly of the Department of Fisheries and Fauna, said that the professional monthly returns were inadequate before he started to fill them in and even after he started to do this work some

returns were not made. He estimated that 10-12 tons of barramundi (35 cents/lb.) were taken each year from the Ord River tidal region and some also from the Pentacost River by 6-7 fishermen. (There are 3 registered fishing boats at Wyndham). Most of the fish were caught early in the dry season. The catch satisfied the local market. Nelson is resuming professional netting of barramundi soon (he was awaiting the arrival of a new boat and outboard). No other information was available. We did not visit the tidal region.

Accompanied by Nelson we used the throw net in drying-up water holes 12 miles out of Wyndham and at Parry's Lake where he had caught barramundi some years ago. None were caught. We also heard through Nelson that a road gang at the Crossing of the Dunham River (which flows into the Ord River just below the Diversion Dam) had been catching small fish (barramundi), a week or so before. We set a 7" gill-net and a 3" gill-net across pools on the flowing river at the Crossing overnight. One barramundi, 45 cms. in length, was caught (3" net). Cobblers, fork-tail catfish, spangled perch, gudgeon, and rifle fish were also seen. We tried the throw net at a number of small creek crossings on the old road back to Wyndham, catching Long Toms, ox-eye herring, bony bream, mullet, and rifle fish but no barramundi.

(b) Ord River Dams

The model of the Ord Main Dam was viewed at Claremont before the trip. The Engineer-in-Charge of the design laboatory was not aware that barramundi migrated upstream as young fish.

At Kununurra, Bert Scott, the District Officer took us out to the Diversion Dam which was opened in 1963. (Photo. 11). The large gates were all shut down (they operate manually or automatically) but some flow downstream still occurred due to leakage. With one or two gates partly open there is no possibility of fish swimming through the gate, or even up the long flat smooth aprons, due to the velocity of the flow. There only remained the possibility that at the height of major floods (when all the gates are open) fish could move over the submerged aprons by swimming close to the banks.

With the gates closed on manual we looked at the pools at the base of the dam. There were very large numbers of small fish. The throw net caught Chanda perch (Chanda gulliveri), mullet (Liza diadema), bony bream, Long Toms, and fork-tailed catfish but no barramundi.

Scott mentioned that "lay-abouts" camped near the dam braved the automatic gates to spear the fish.

Scott also said that large numbers of barramundi up to 14 lbs. were congregated below the dam in February. Many of these were netted out.

We later met Neil Kenworthy, the District Engineer. Both he and Scott expressed concern over the congregations of fish, especially barramundi, below the dam but were unaware that upstream and downstream migration plays a major part in the life cycle of barramundi. Both men seemed keen to alleviate the situation, apparently influenced not only by the sight of the concentrations of fish but also by the poor fishing in the dam. Kenworthy talked of a temporary fish ladder they had thought of trying on a central gate.

Kenworthy pointed out that the flow of the river below the dam altered as it was now and that it would be reduced even more when the main dam was built. There would be some years when little excess water would flow on down the river.

We visited Ivanhoe Crossing below the diversion dam one evening and morning (Photo. 13). This is a raised concrete road across the river. Water was flowing through 2' diameter pipes set in the crossing. Between the flows of two of these pipes I caught 19 0+ barramundi with the throw net. These fish were uniform in size and averaged 25 cms in length (scales were obtained). Fish were not seen jumping. However, the barramundi congregated near pipes where the flow was rapid and the jump for them an obstacle. (Diagram 2).

Kenworthy said that large numbers of barramundi were caught in February at the Crossing (purely as an access point) when it was submerged.

In File 248/60, Sir Hudson Fysh complained bitterly about the Crossing as an obstacle to fish movement. It is a great pity I think that the P.W.D. engineers responsible for designing these structures are not made aware of the problem for with little or no expense at the time of construction, provision could easily be made for the passage of small fish particularly at low flows.

The Ivanhoe Crossing is now obsolete as a road from Wyndham to Kununurra and the Wyndham side has fallen into disrepair.

We borrowed the P.W.D. boat and outboard motor one afternoon during our stay. The 3" gill-net was set for 1 hour about 2 miles up from the dam wall. No fish were caught (there was said to be some catfish in the dam). With the throw net I caught a few bony bream and rifle fish in a muddy bay.

Talking with the locals at the Ord Club it was discovered that they went across the border into the N.T. for barramundi and fished the tidal reaches of the Keep River with nets.

(c) Ord River upstream from the Diversion Dam.

We visited the main dam site but the P.W.D. Officer-in-Charge, Hocking, was away (Photo. 14). A keen line fisherman said, however, that he had not seen any barramundi.

We then journeyed down the Duncan Highway passing through the best country of the trip. The Behn and Negri Rivers were flowing well. There were perch and rifle fish at the Crossings. Greysmark at Broome had told us that in the late fifties he had seen large numbers of barramundi in the Merilla Gorge on the Nicholson River, a tributary of the Ord. We found the Gorge but it was inaccessible and the water holes were clouded with algae so fish could not be seen if present. The river was not flowing. On the trip to Wyndham it was noted that the Panton, Ord and Bow Rivers were dry where they crossed the Great Northern Highway.

WILDLIFE

Black cockatoos, budgerigars, hawks, rainbow birds, pigeons, finches, etc. were common everywhere. The only marsupial seen was the agile wallaby between Camballin and the barrage on the Fitzroy and on the main road from Ershire Range to the Camballin turnoff. Bustards were seen at Camballin. Domestic mice were seen at Nicholson where they had burrowed into cracks in the ground near a bore. Cormorants, kites, egrets, brown fish hawks, and a night hawk were seen at the Fitzroy Barrage.

Trevor Nelson emphasized the importance of reserving Point Springs near Wyndham where rock wallabies and a rare cane plant exist. The P.W.D. wants the area for a water reserve but he says that bores could easily be put elsewhere.

Neil Kenworthy at Kununurra mentioned that massive dosages of insecticides were needed on the irrigation crops. Three entomologists were working there on the problem of controlling insect plagues. The sprayings should kill a lot of wildlife and could get back into the river fairly readily.

III CONCLUSIONS

(a) Commercial Fishing.

The estuarine barramundi is a highly regarded table fish in the Kimberleys (Roughley in "Fish and Fisheries of Australia" rates barramundi as one of the best six table fish in Australia).

A limited amount of net fishing in the tidal reaches of the Fitzroy and Ord Rivers at present satisfies the local demand. With an increasing population in the north, possible markets further afield, and a strong possibility that abundance has been reduced in the past few years by damming of these rivers, these sources could be rapidly overfished in the near future. It is possible that when this happens there will be access roads to the tidal reaches of other, at present inaccessible streams, or these streams could be net fished from runabouts sent from larger boats with freezers anchored at the mouths of the rivers (as has been done in New Guinea).

The Department should ensure that the full catch data from commercial fishermen are collected so that changes in the fishery can be followed in the future and over-fishing anticipated.

The bulk of the Fitzroy barramundi catch appear to be small young fish. Research sampling of the Fitzroy and Ord catches for one season is, therefore, necessary to ensure that most of these fish have spawned at least once, i.e. a minimum legal size limit, or net mesh size, may be required.

(b) The taking of barramundi in freshwater with nets should be made illegal because:-

(i) Production of immature fish is thought to occur in freshwater;

(ii) there is ample scope for catching commercial numbers of mature barramundi, after they have spawned at least once, in the tidal reaches of the rivers;

(iii) freshwater barramundi are poorer in eating quality relative to estuarine fish;

(iv) there is conflict between line anglers and some net fishermen because the latter fish at the same comparatively few access points along the river when the barramundi are confined to pools during the dry season;

(v) net fishing in freshwater can result in the destruction of the protected freshwater crocodile;

(vi) the Shire authorities in the region favour the ban. It would appear to be pointless to prescribe a netting ban for each particular access point to the rivers. This was done at Langey Crossing where the situation has now changed;

(vii) the majority of tourists and inland people would be satisfied to catch a few 10 to 15 lb. barramundi by line fishing. Any more fish captured would be wasted, or must be sold, in most cases;

(viii) the ban would naturally extend to include use of nets in general in freshwater in the north. The northern inland fishing could then be encompassed within state-wide freshwater fishing regulations although with this ban no further catch limits would be necessary for nothern freshwater fish in the near future.

(c) Dams, barrages, and crossings as barriers to the movements of fish.

(i) Accumulations of native fish and crustacea were found below the Fitzroy Barrage and the Ord River Diversion Dam. It is obvious therefore that these dams are interfering with a natural movement upstream of these animals. These animals appear to be able to maintain themselves in greater or lesser numbers above the obstacles particularly in the Fitzroy River. However, there are three ecological reasons for believing that the dams have upset the natural communities of these rivers. Firstly, the average size (and age) of individuals of different species of animals in streams tends to increase in a downstream direction. Many species have a stage in their life-cycle which migrates upstream when the first phenomenon is shown to compensate for it. Secondly, although aquatic animals in temperate rivers generally are not swept downstream by floods unless they are actually killed by mechanical injuries this might not be true of tropical rivers where flood conditions are extreme. Thirdly, barramundi and cherabim, at least of the species encountered, have major migrations along the rivers which are frustrated by obstacles such as dams.

(ii) It is axiomatic that if the barramundi matures in freshwater then the number of fish reaching maturity and migrating to spawn in the estuary, is dependent upon the extent of the freshwater upstream from the estuary. If (only) one-year old fish can pass over, say, the Fitzroy Barrage, then their numbers are still influenced in the above manner.

(iii) Consideration could be given to introducing an exotic fish to the Ord Diversion Dam. A predaceous game fish could be found which would fit the water temperature conditions, say, and breed in the dam. However, this fish may not survive in very large numbers on a food chain of native fauna if the latter is unfavourably influenced by the dam wall as a barrier to the life-cycle of its species. This appears to be the case with the Diversion Dam (which has been on trial in this regard for six years). Moreover, the introduced fish might not be able to cope with other highly variable environmental conditions which are peculiar to the region, such as summer flooding. The Diversion Dam would seem to present an unstable environment similar to conditions in the natural river because it ceases to act as a dam during floods. However, during the dry season it provides a very large acreage of water for fish production similar in fact to a huge river water hole. Only the native fish are adapted to these conditions, so the best that could be done to provide fish in the dam would be to allow fish to pass over the Diversion Dam gates.

(iv) When it is built the Main Ord Dam will be a more stable environment than the Diversion Dam. If the obstacle of the Diversion Dam gates is not overcome for barramundi and an abundant community of the smaller, native fishes builds up in the Main Dam, the introduction of an exotic predaceous game fish could be considered.

If barramundi could be successfully passed into the Diversion Dam there then remains the problem of their passage into the Main Dam. The flow predictions supplied by the P.W.D. for the Ord contained in this report indicate that the spillway will overflow in 90% of the years. The spillway on the Main Dam will have a slow fall of 1 in 400 feet for the most part down a natural (Stonewall) creek. The spillway is situated well north of the dam wall and will flow into the Diversion Dam some distance below the main dam wall. There will also be regulated outlets at the base of the main dam wall but these can not be considered as possible access routes for fish moving upstream. Fish will, however, congregate here due to the attraction of the flowing water.

(v) There is very little practical experience with fish ladders in Australia. Consideration has been given in Queensland to introducing Nile Perch (Lates niloticus) (which closely resembles barramundi but breeds in freshwater) to provide fish in rivers where dams have caused a deterioration in the populations of barramundi. Unbeknown, I think, to the Queensland authority on the situation, is the fact that a fishway had to be provided for Nile Perch on the Jebel Aulia Dam on the Nile River near Khartoum in the Sudan. The design of this and other fish-ways is contained in "Design of Fishways and other Fish Facilities" by C.H. Clay:- Published by the Department of Fisheries of Canada. Clay is the Department's Chief Engineer on the Pacific Coast. He brings together all known information on the subject of fishways up to 1961.

It is, therefore, possible to suggest sites for fishways on the Fitzroy Barrage and Ord Diversion Dam (see Diagrams 3 and 4, photos 7, 8, and 12). The Fitzroy structure would be small but the Ord structure would be much larger. If any move is to be made towards fishways I think that a small experimental structure should be tried on the Fitzroy Barrage. The design should have features which will allow variation in the conditions provided for the passage of fish and a fish trap should be incorporated into the structure so that conditions of maximum efficiency can be found for the passage of the fish.

(vi) The Fisheries Department should be routinely informed of all imminent constructions of a minor nature on streams such as small weirs and river crossings. It is thought that if the P.W.D. engineers responsible for designing these structures are made aware of the requirements of fish the ultimate design could very easily allow the passage of fish without any difficult or expensive modifications later.

(vii)

	Catchment area (sq. miles)	Avg. Annual discharge (1,000 acre feet)
Fitzroy	33,400	5,000
Ord	21,050	4,300

The Ord and Fitzroy in Western Australia appear to be somewhat smaller than the Burdekin and Fitzroy in Queensland. No other comparable figures are available from the P.W.D. However, it is known that the annual dishcarge of the Western Australian rivers varies greatly from year to year. The annual cycle of monthly flows for the two rivers are similar for any one year. The flows in the Western Australian rivers appear to be more extreme between the wet and dry season.

It would seem that the Ord and Fitzroy (as barramundi streams) approach the magnitude of the best Queensland streams. Conditions may be more variable from year to year however, and more extreme in the direction of low flows in the dry season.

(viii) Avenues of possible research work on barramundi Commercial fishery.

For the Ord River, I think that we could arrange with Trevor Nelson for the collection of lengths and weights of fish, scale samples, sex organs and catch data from his personal catches at least.

For the Fitzroy River it would be necessary to have a technical officer located at the fishing camp on the estuary to collect data from

the catches.

Independent sampling by the Department could be done at either place. A boat and outboard could be hired at Broome from Greysmark and at Wyndham from Nelson (intermittently). Nets would have to be provided by the Department for the Fitzroy. Three months, (March, April, May) should be covered by this work although the starting time would depend for the Fitzroy, from the point of view of access, on the particular season.

Migration.

This aspect could be best studied at Kununurra as all sites are accessible in the wet season. The months February, March, April would be likely to be the relevant period. A boat and outboard are available from the P.W.D. at Kununurra.

LIST OF FISH ENCOUNTERED ON THE TRIP

COMMON NAME	SCIENTIFIC NAME	FRESH-WATER	ESTU-ARINE	MARINE
Archer or rifle fish	Toxotes chatareus	x		
Spangled perch or grunter	Therapon unicolor	x	x	
Banded grunter	T. percoides	xx	x	
Ord River grunter	T. alligatoris	xx	x	
Forktailed catfish	Neoarius australis	x	xx	
Cobbler or inland catfish	Neosilirus brevidorsalis	xx	x	
Giant Chanda perch	Chanda gulliveri	x	x	
Ox-eye herring(tarpon)	Megalopes cycloides	x	x	x
Bony bream	Fluviolosus sp.	x	xx	x
Ganges gobey	Glossogobius giurus	x	x	
Rainbow fish	Melanotaenia nigrans	x		
Mouth or mighty	Glossamia aprion	xx	x	
Ord River mullet	Liza dussumieri	x		
Freshwater mullet	Trachystoma petardi	x		
Broad headed mullet	L. diadema	x		
Cherabim	Macrobrachium sp.	x	x	
Long Tom	Stenocaulus krefftii	x	x	

NUMBER OF LICENSED FISHING BOATS

Wyndham	3
Broome	3

NUMBER OF LICENSED PROFESSIONAL FISHERMEN

Issued from Broome for

Broome	11
Derby	2
Wyndham	1

Issued from Wyndham for

Kununurra	1
Wyndham	3

LOG OF KIMBERLEY TRIP

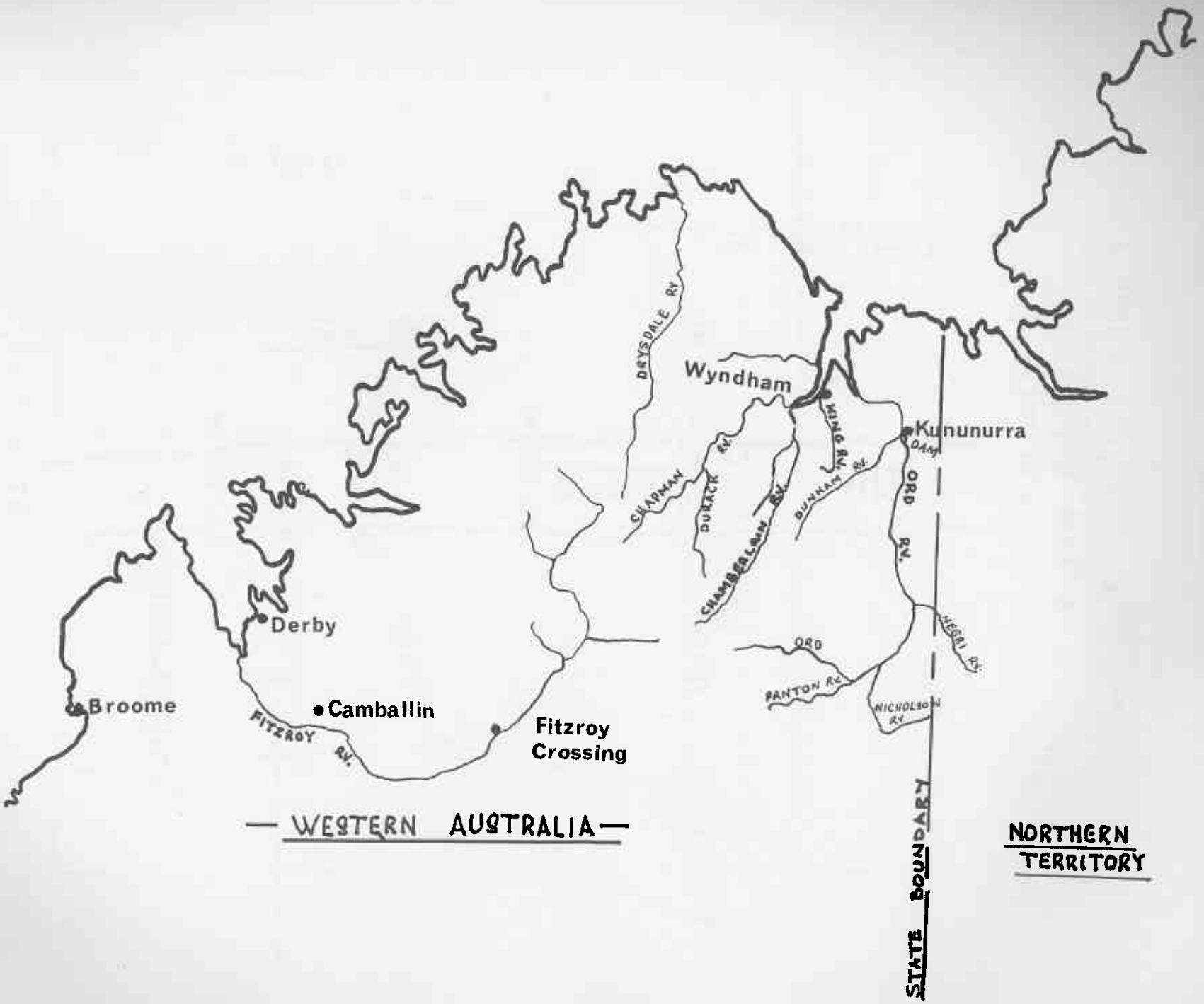
by

R. BAIRD and N. MORRISSY

In Landrover WAG (6 cylinder fuel capacity 45 gallons)

DATE	PLACE OVERNIGHT	MILEAGE READING START OF DAY	MILES DONE PREVIOUS DAY	PETROL
April 24	Broome	17,233	0	Filled 22nd April
25	Derby	17,390	157	Filled (16 gals)
26	Fitzroy Barrage	17,570	180	
27	" "	17,598	28	
28	Fitzroy Crossing	17,767	169	
29	Geike Gorge	17,783	16	Filled at 17,799 ($28\frac{1}{2}$ gals.)
30	Bore Halls Creek	18,058	275	
May 1	Wyndham	18,265	207	Filled (28 gals)
2	Dunham Crossing	18,360	95	(+ 6 gals back at Wyndham
3	Kununurra	18,516	156	
4	"	18,551	35	Filled (10 gals)
5	Bore Nicholson	18,848	297	Finished main tank 35 gals at 19,089
(5	Fitzroy Crossing	19,132	284	Filled ($36\frac{1}{2}$ gals)
6	Erskine Range	19,220	372	
7	Fitzroy Barrage	19,287	67	
(7	Derby	19,392	105	)
8	Broome	19,550	263	

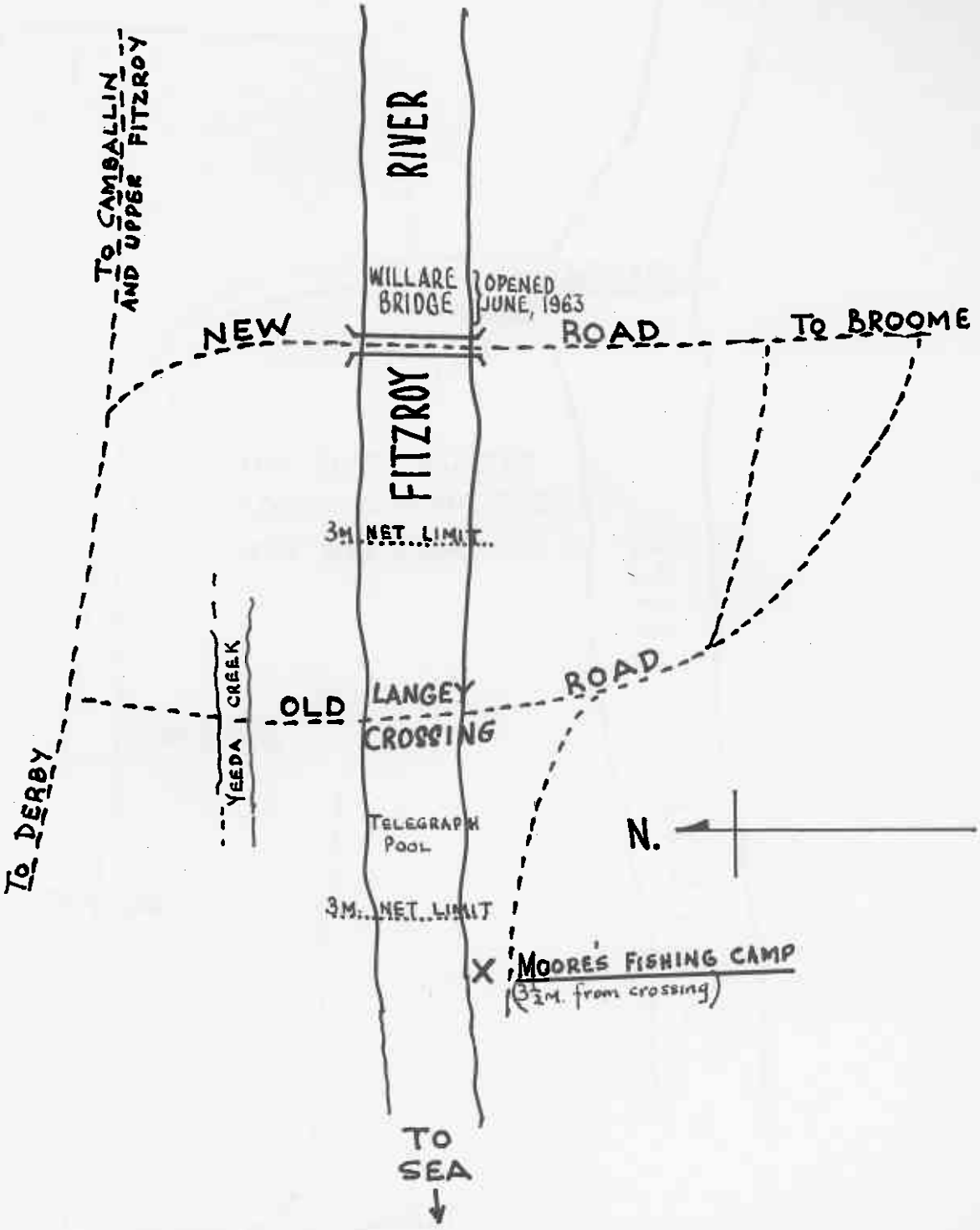
Total mileage 2,317 Approx. 125 gallons
Estimates of M.P.G. - 14.4, 16.6, 17.9, 15.4, 15.9
Average = 16.04 M.P.G.


Wyndham
Kununurra
DAM
Derby
Broome
Camballin
Fitzroy Crossing
DEYSDALE RV
CHAPMAN RV
DURACK RV
CHAMBERLAIN RV
KING RV
DUNHAM RV
ORD RV
ORD
PANTON RV
NICHOLSON RV
NEGRI RV
FITZROY RV
— WESTERN AUSTRALIA —
STATE BOUNDARY
NORTHERN TERRITORY

— LOWER FITZROY RIVER —

SITUATION MAP 1.

(NOT TO SCALE)



— FITZROY RIVER BARRAGE —

SITUATION MAP 2.

(NOT TO SCALE)

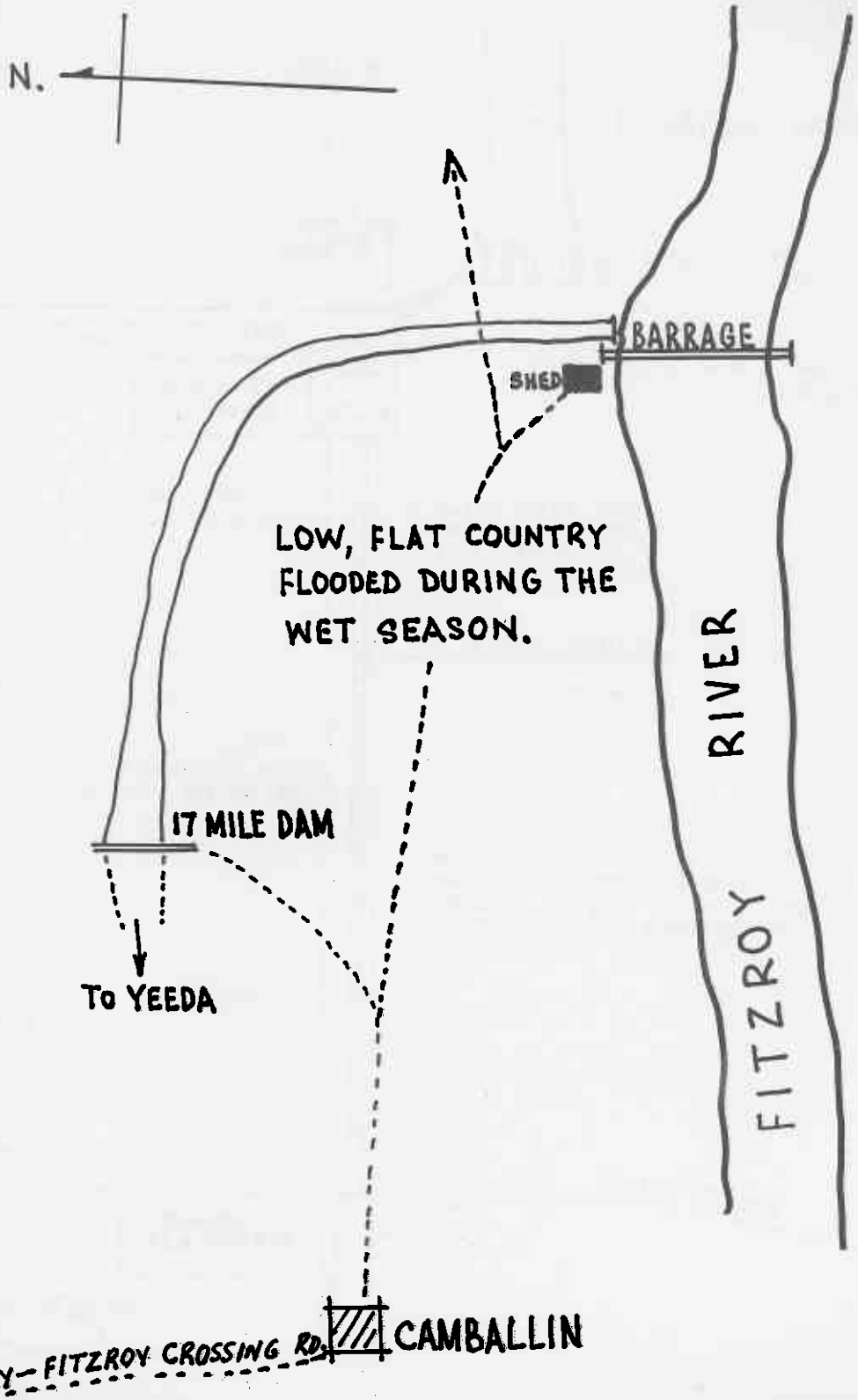


DIAGRAM 1

FITZROY RIVER BARRAGE

(NOT TO SCALE)

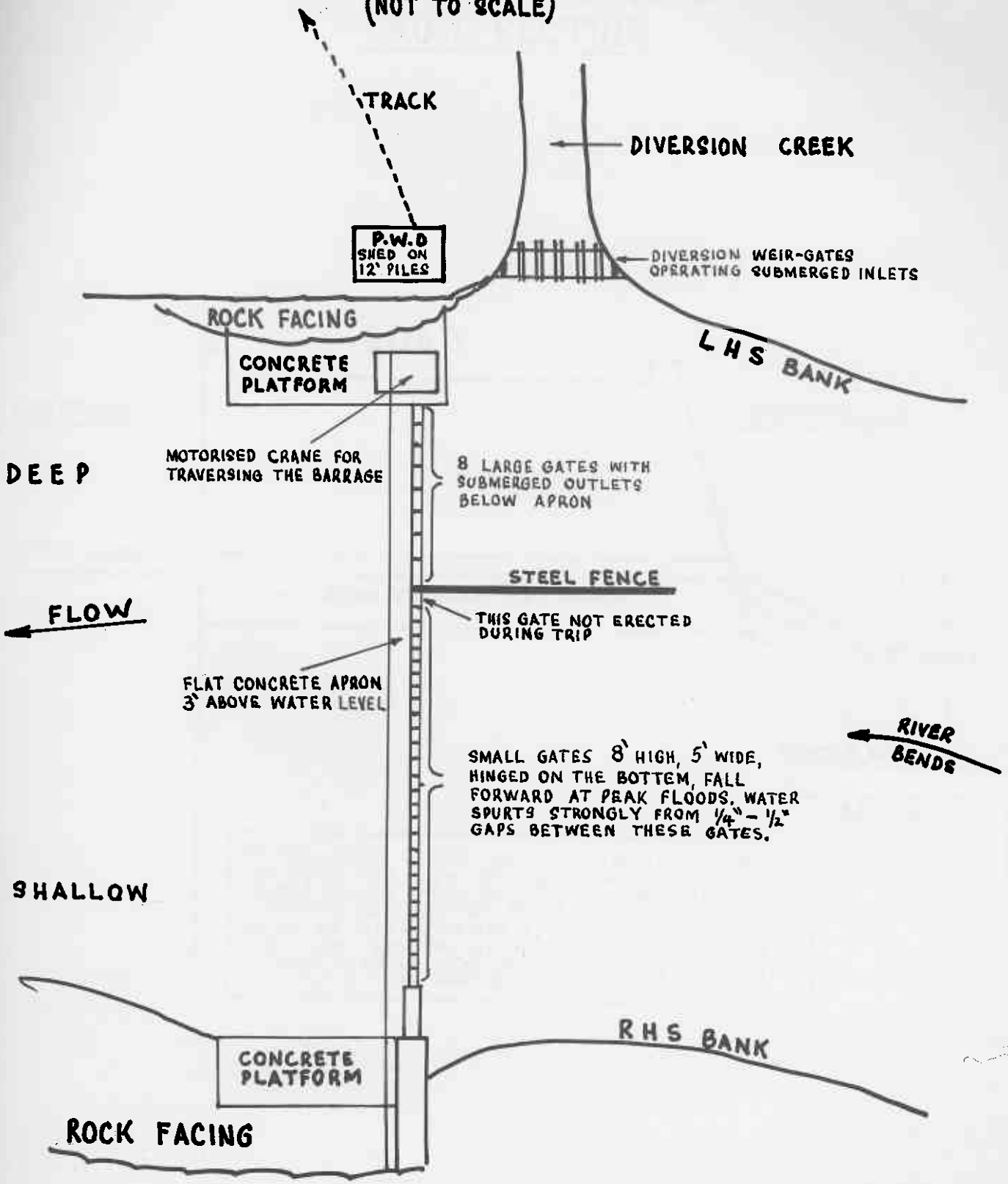
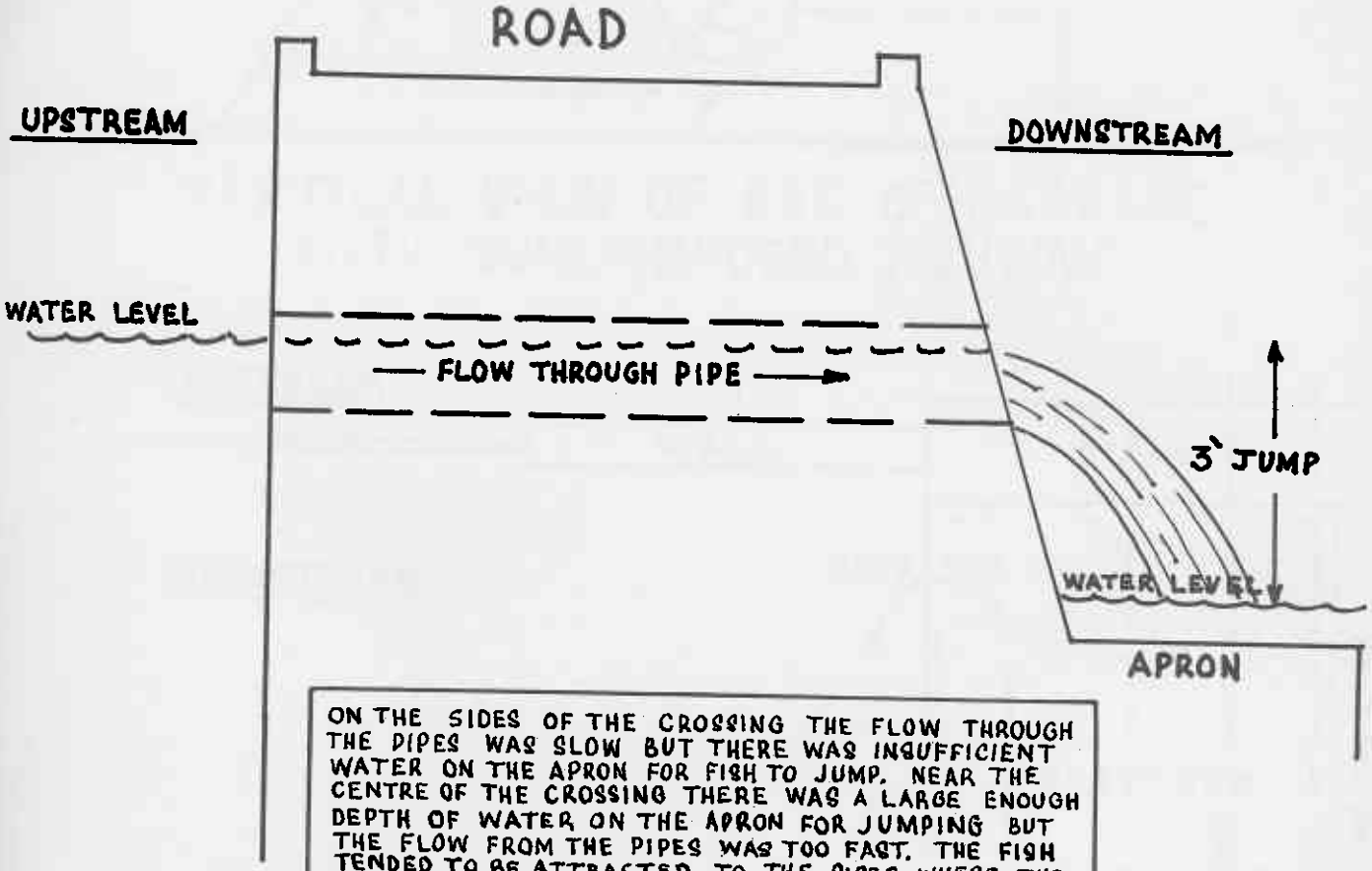


DIAGRAM 2
IVANHOE CROSSING
CROSS SECTION

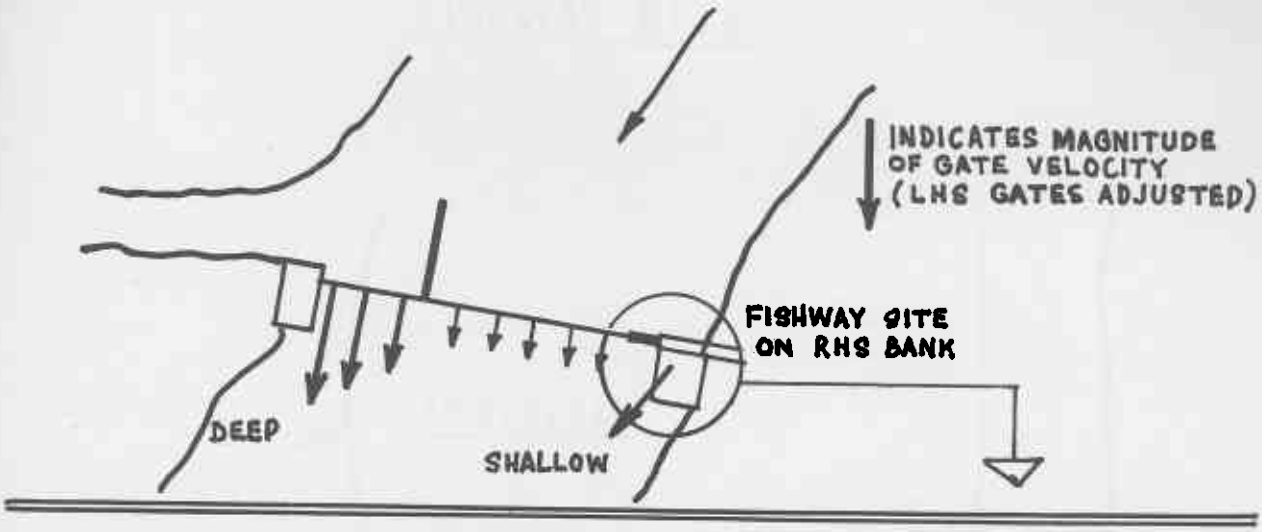


ON THE SIDES OF THE CROSSING THE FLOW THROUGH THE PIPES WAS SLOW BUT THERE WAS INSUFFICIENT WATER ON THE APRON FOR FISH TO JUMP. NEAR THE CENTRE OF THE CROSSING THERE WAS A LARGE ENOUGH DEPTH OF WATER ON THE APRON FOR JUMPING BUT THE FLOW FROM THE PIPES WAS TOO FAST. THE FISH TENDED TO BE ATTRACTED TO THE PIPES WHERE THE THE FLOWS WERE FASTER.

DIAGRAM 3

FITZROY BARRAGE

FISHWAY SITE



VERTICAL VIEW OF RHS OF BARRAGE WITH SUPERIMPOSED FISHWAY

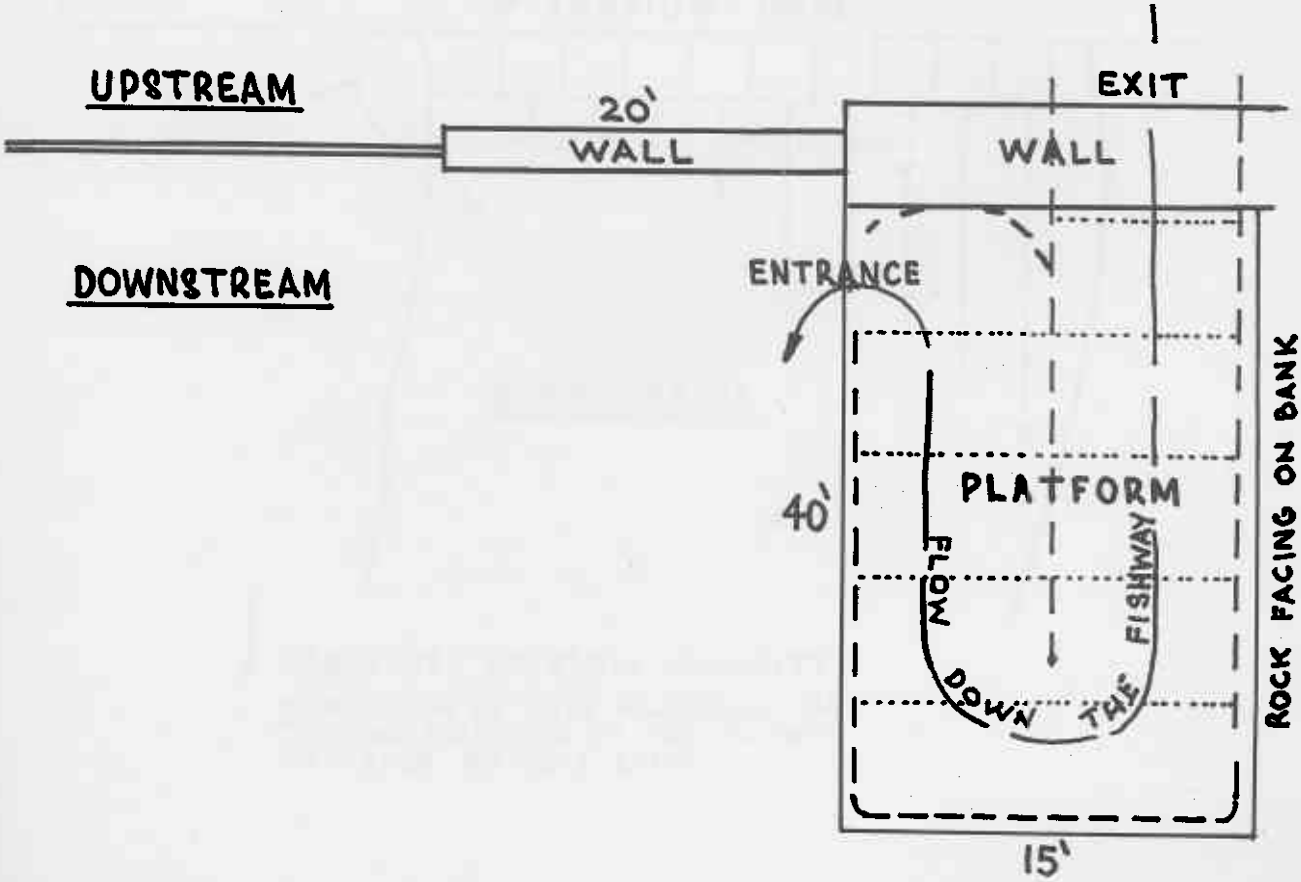
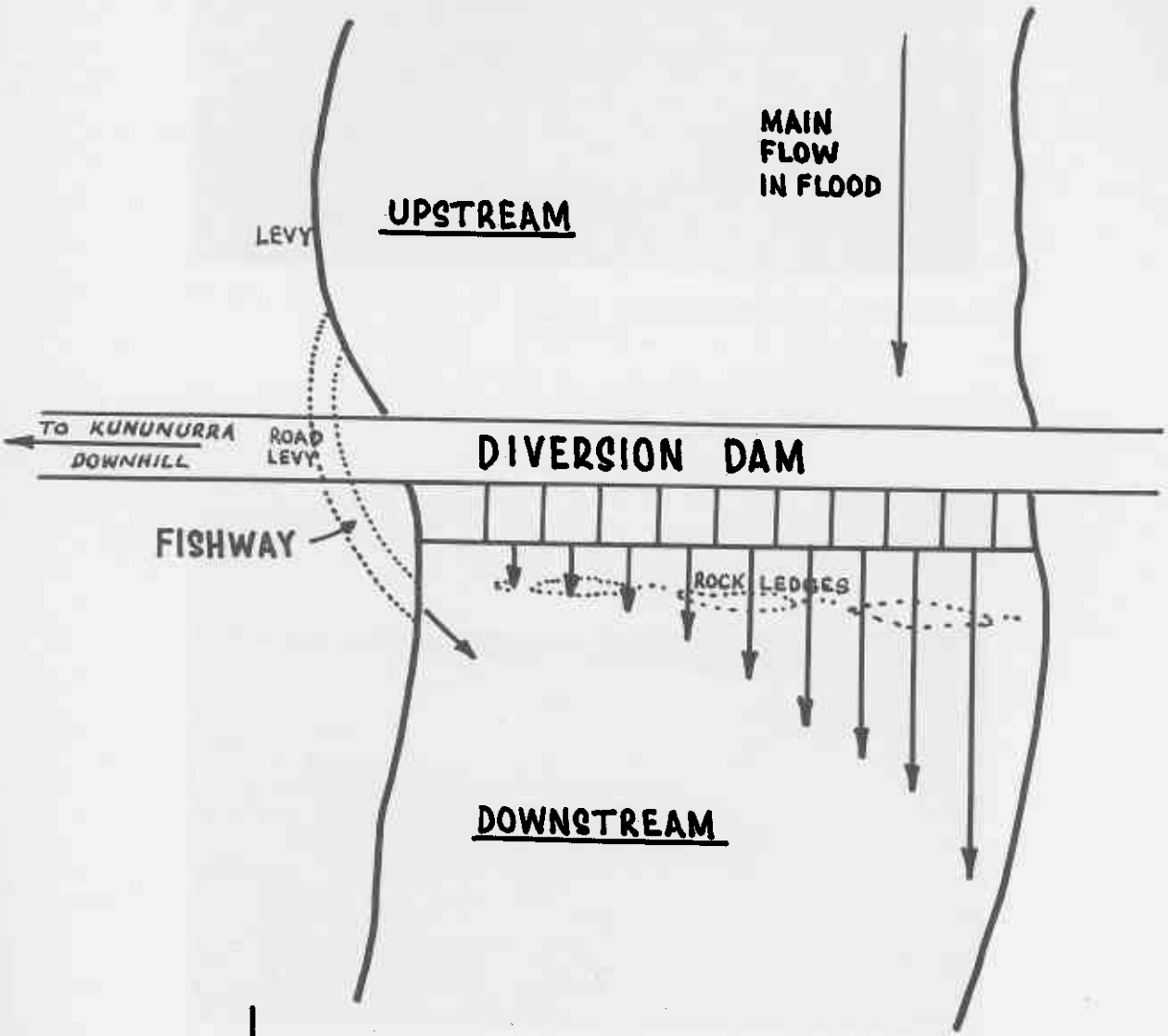


DIAGRAM 4

ORD DIVERSION DAM

FISHWAY SITE



MAGNITUDE OF FLOW VELOCITY

REGULATION OF GATE VELOCITIES USED TO LEAD FISH OVER TO THE FISHWAY ENTRANCE ON LEFT BANK.

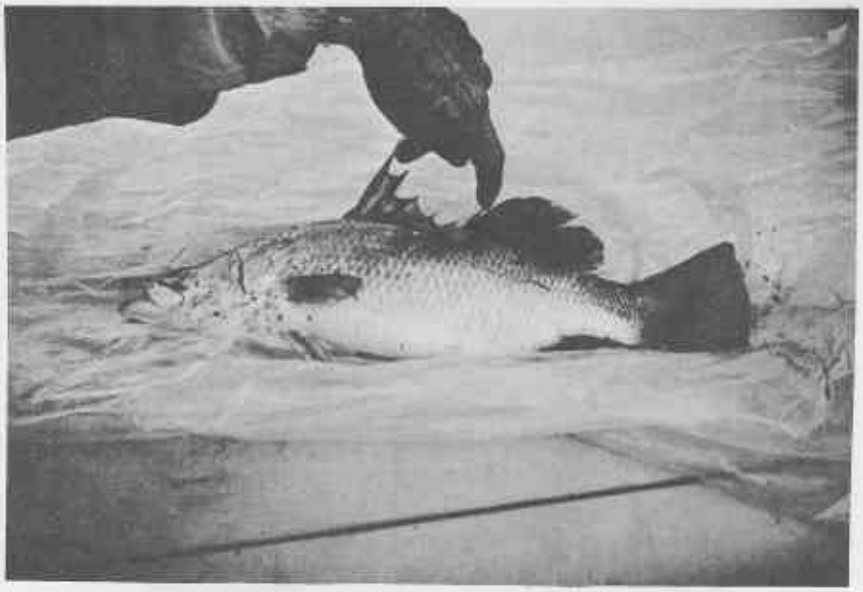


Photo. 1. Barramundi (Lates calcarifer) 45 cms. length, probably 1+

Photo. 2 - Fitzroy River Estuary

Photo. 3. Fitzroy Barrage - Submerged Outlets in Foreground (L.H.S.) Open

Photo. 4. Fitzroy Barrage - Shute of Water over a Collapsed Automatic Gate

Photo 5. Fitzroy Barrage - Far-side (R.H.S.) Showing Apron

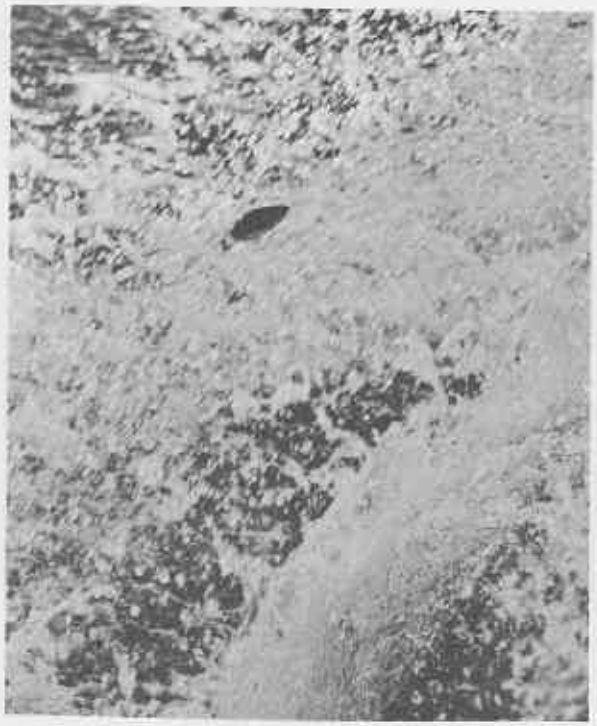


Photo. 6. Fitzroy Barrage - Small Perch Attempting to Jump onto the Fari-Side Apron.

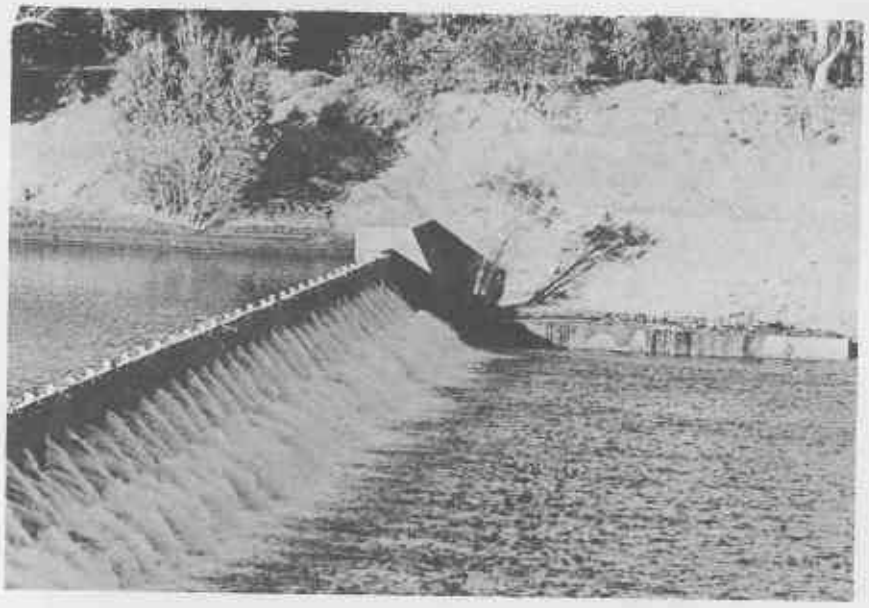


Photo. 7. Fitzroy Barrage - Far or Right-hand Side Site for Fishway

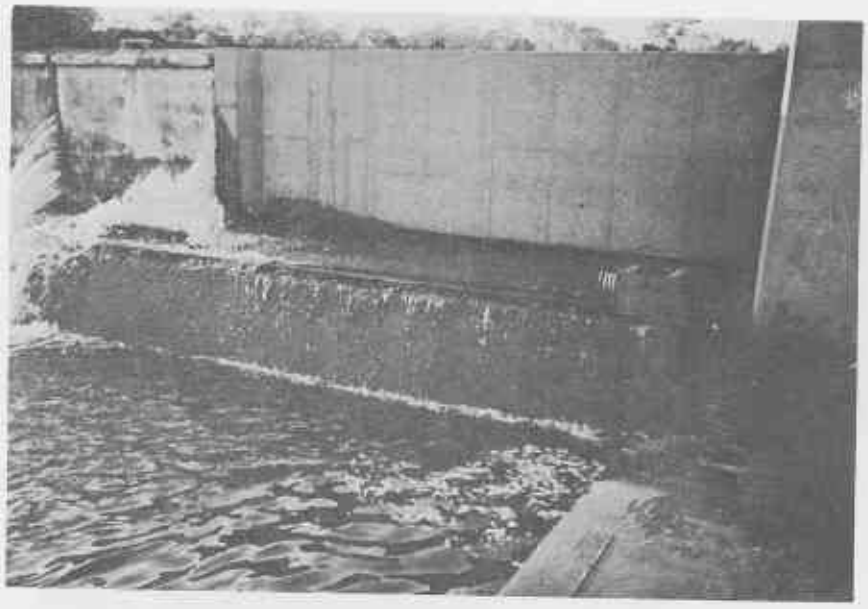


Photo. 8. Fitzroy Barrage - Far or Right-hand Side Site for Fishway

Photo. 9. Fitzroy River - Lower End of Geike Gorge Pool and Entrance of Margaret River in the Background

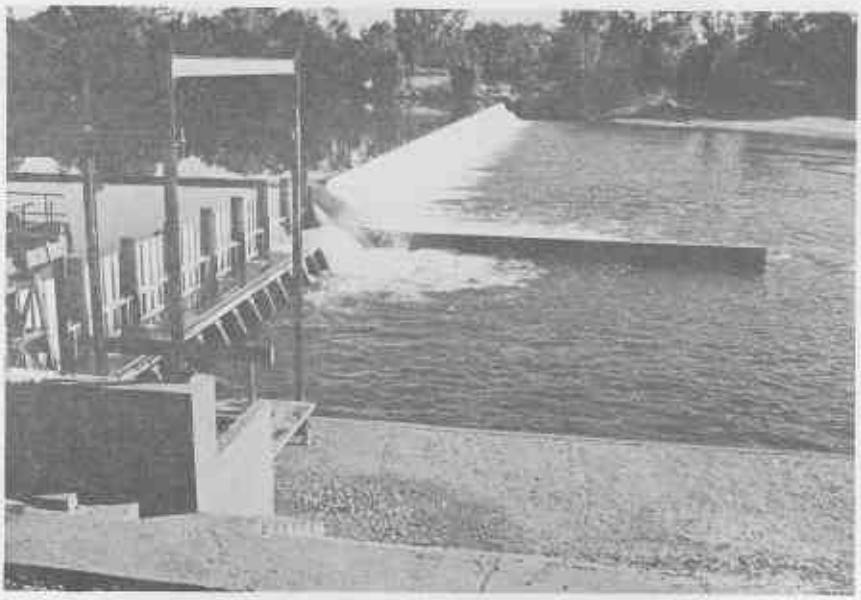


Photo. 10. Fitzroy Barrage - Submerged Outlets in Foreground Shut and Water Overflowing the Automatic Gates

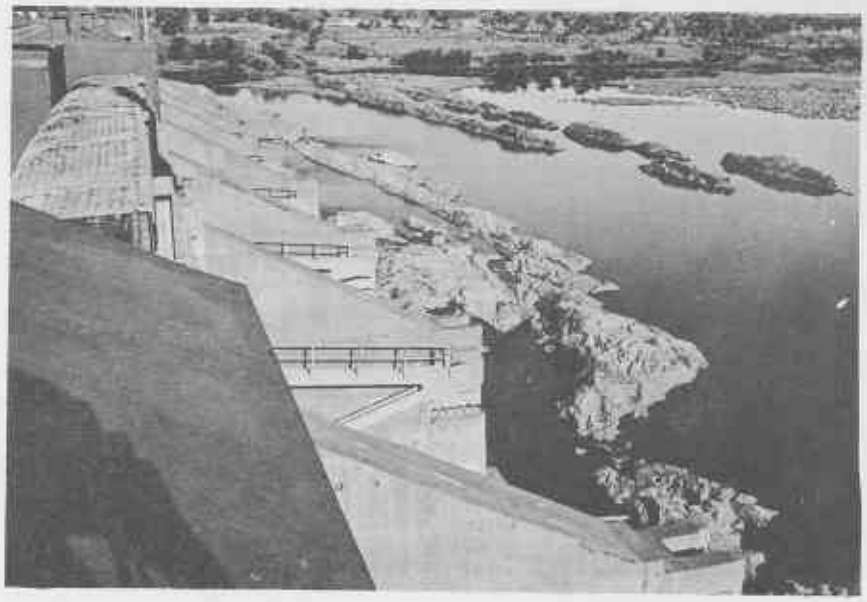


Photo. 11. Ord River Diversion Dam. Downstream View from Roadway

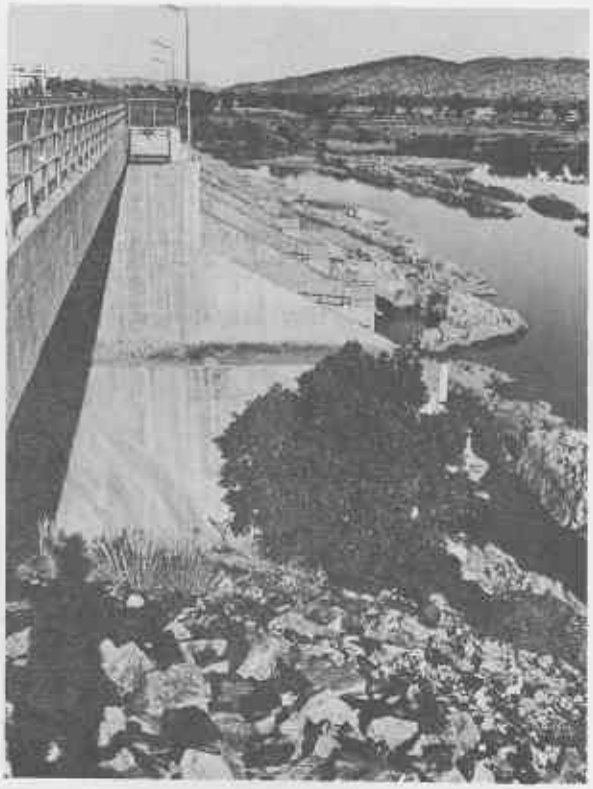


Photo. 12. Ord River Diversion Dam. Kununurra or Left-hand Side Site for Fishway

Photo. 13. Ord River. Ivanhoe Crossing downstream from Diversion Dam

Photo. 14. Ord River Site for Main Dam in Central Valley Saddle

65994/12/69-200-G838