# MECHANICAL IMPROVEMENTS TO KILLALOE EEL WEIR IRELAND

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# MECHANICAL IMPROVEMENTS TO KILLALOE EEL WEIR IRELAND

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CATCHING METHODS
RUNNING WATERS
POWER-STATIONS

ABSTRACT. — This paper describes some specially designed eel — catching equipment for Killaloe Weir, operated by the Electricity Supply Board, Ireland. By the use of hydraulic power, which enables heavy frames to be lifted, the difficulty of catching eels at the Navigation opening has been overcome. There is also a description of the conversion of hand-operated nets at another part of the weir, to frames raised and lowered by hydraulic power also.

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BARRAGE ÉLECTRIQUE

RESUMÉ. — Cette étude décrit quelques engins destinés à la capture des Anguilles au barrage électrique de Killaloe en Irlande. La difficulté de capture des Anguilles dans le canal de navigation a été surmontée par l'utilisation de la force hydraulique qui permet de soulever de lourds cadres. La transformation de filets manœuvrés à la main, à un autre endroit du barrage, en cadres qui se lèvent et s'abaissent par un procédé hydraulique, est décrite.

## INTRODUCTION

Killaloe Eel Weir on the River Shannon is at its present location following its construction by the Electricity Supply Board of Ireland in 1940. The River Shannon fisheries came under the control of E.S.B. after the river had been developed to produce hydro-electric power in 1928. Experimental work and improvements at Killaloe weir have been described by D.P. O'LEARY *et al.* in previous papers to EIFAC.

The writer has been associated with the provision of Engineering assistance to the E.S.B. Fisheries Management since 1979 and has designed the equipment described in this paper. Due to the present financial restrictions, there remains much to be done to complete the mechanisation of all the weir.

The paper sets out the work done as an example which may encourage the development of new sites for eel catching or the improvement of existing weirs, especially where labour is scarce or costs are high.

## THE NAVIGATION SPAN

The first part of Killaloe Eel Weir selected for mechanisation was at the bridge opening of 9.6 m whidth, which is called the Navigation span.

Because of river boat traffic, this water channel could not be impeded with any permanent fixtures for eel nets, and even when eel nets were set it would be necessary to allow for the passage of boats above them.

To avoid environmental objections when the catching gear was out of the water, it was necessary to store the frame at a height to allow the passage of boats underneath, and not to be visible above the road bridge parapet walls (Fig. 1).

These objectives were achieved by using a specially strengthened steel frame of 8.7 m × 1.7 m to withstand the maximum water velocity of 1.9 m/sec. at this location. The frame size allowed 3 nets of 9.2 m perimeter at the mouth to be attached, and generally allowed about 1.7 m depth of water over the frame when in catching position. The weight of the frame without nets is approx. 580 kg. The res-

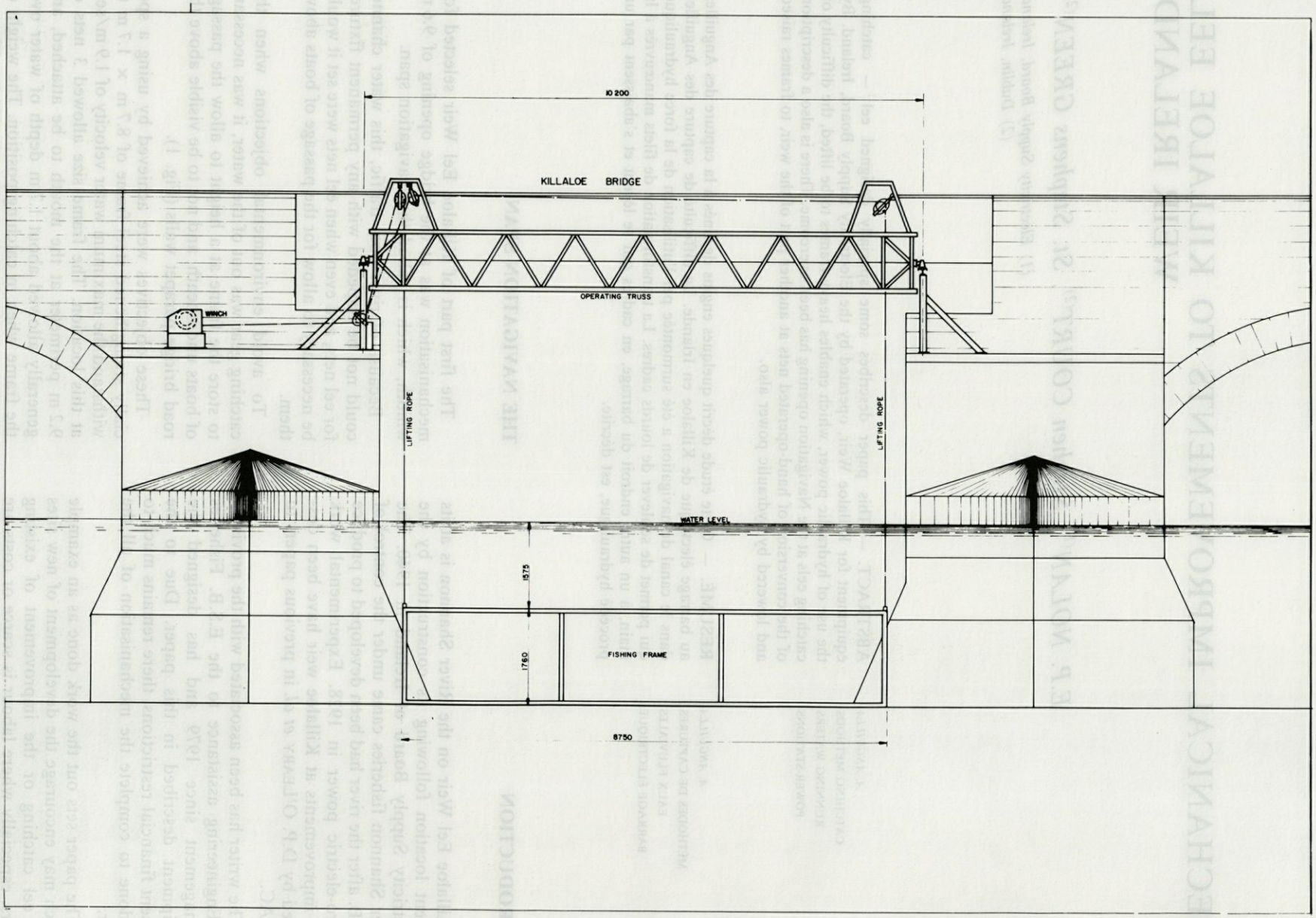
10 200
KILLALOE BRIDGE
OPERATING TRUSS
WINCH
LIFTING ROPE
LIFTING ROPE
WATER LEVEL
1575
1760
FISHING FRAME
8750

Fig. 1.

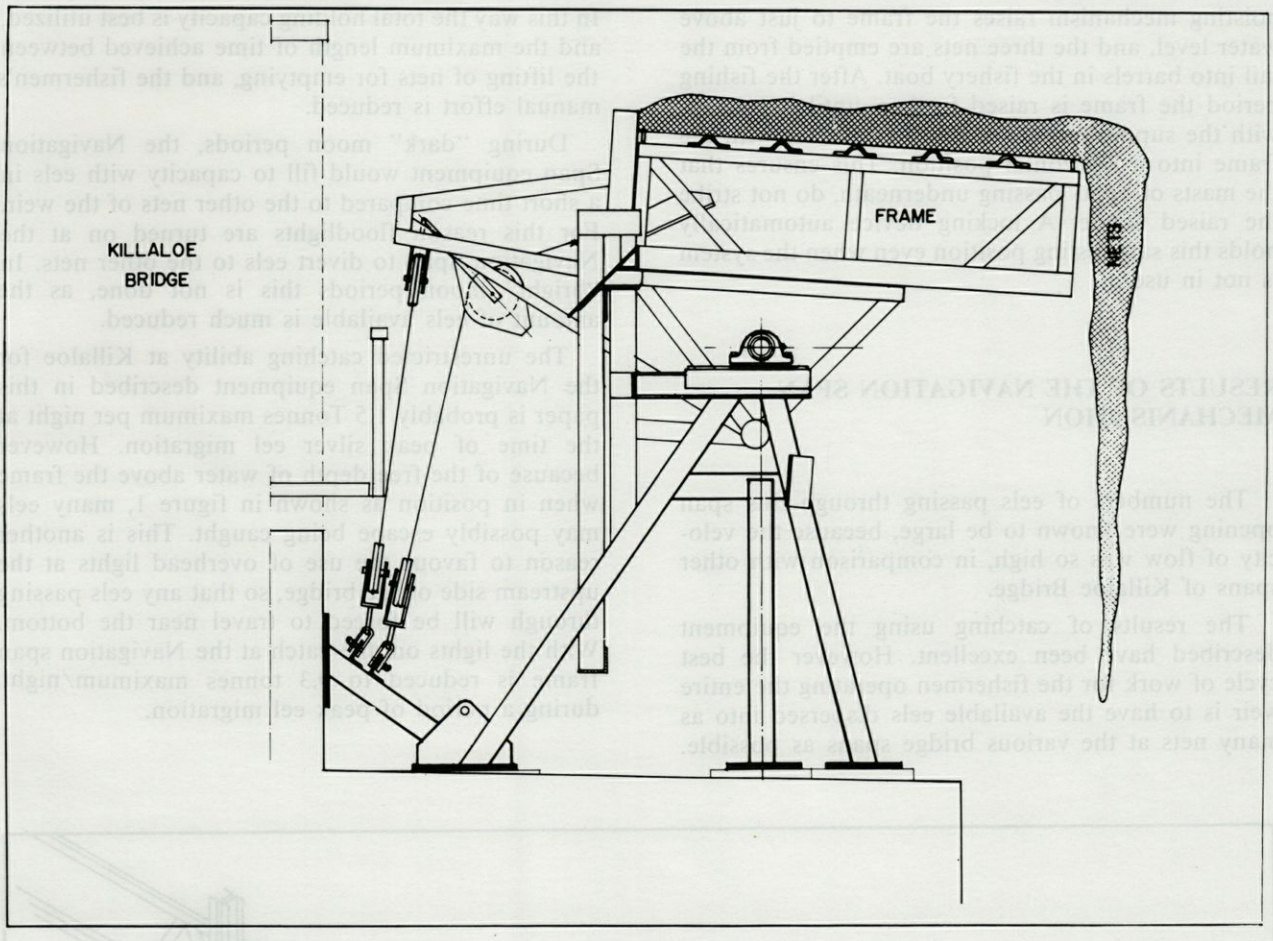


Fig. 2.

traint to hold the frame in position against water flow is provided by wire rope cables anchored to the upstream side of the bridge piers. The frame can be raised or lowered to any position by means of the controls at the side of the span, so that the operator has full fiew. The time taken for raising fully from river bottom to storage position is 50 seconds approximately. The net tails are then tied-in to the steelwork to secure them against wind. The end view of the truss support to the frame is shown in the parked, or storage position on figure 2 without the net tails tied-in to the steelwork.

## POWER UNIT

The energy for operating the navigation span fishing gear is from a high pressure hydraulic power unit driven by a 3 phase electric motor of 7.5 kW. This was chosen (a) because of the reliability of hydraulic powered equipment, especially under bad Winter conditions. (b) because of the ease with which further equipment may be added into a hydraulic powered system which will continue to be energised by the original power unit. This is because only one frame at a time is being lifted or lowered. At Killaloe we also have a device for loading barrels on to road transport which also is powered from the hydraulic circuit. The power unit is located in the fishermen store and workshop building, which is on the West bank of the river, and about 123 metres distant from the winch operating at the Navigation span. This has required special attention to the viscosity of the hydraulic oil so that the power would be transmitted at temperatures down to – 20°C in a severe Winter. The working pressure of the hydraulic pipelines is 150 bar.

## OPERATION OF THE CATCHING GEAR

On movement of the control lever the support to the frame slowly rotates to approx. a vertical position and the frame descends to the water below. On immersion into the water flow the frame is pulled with the flow and the side cables restrain this movement. Lowering is continued until the frame rests on the river bed. To remove the catch, the

hoisting mechanism raises the frame to just above water level, and the three nets are emptied from the tail into barrels in the fishery boat. After the fishing period the frame is raised further, until it engages with the support cradle which then rotates with the frame into a horizontal position. This ensures that the masts of boats passing underneath, do not strike the raised frame. A locking device automatically holds this safe resting position even when the system is not in use.

## RESULTS OF THE NAVIGATION SPAN MECHANISATION

The numbers of eels passing through this span opening were known to be large, because the velocity of flow was so high, in comparison with other spans of Killaloe Bridge.

The results of catching using the equipment described have been excellent. However the best cycle of work for the fishermen operating the entire weir is to have the available eels dispersed into as many nets at the various bridge spans as possible. In this way the total holding capacity is best utilized, and the maximum length of time achieved between the lifting of nets for emptying, and the fishermen's manual effort is reduced.

During "dark" moon periods, the Navigation Span equipment would fill to capacity with eels in a short time compared to the other nets of the weir. For this reason floodlights are turned on at the Navigation Span to divert eels to the other nets. In "bright" moon periods this is not done, as the amount of eels available is much reduced.

The unrestricted catching ability at Killaloe for the Navigation Span equipment described in this paper is probably 1.5 Tonnes maximum per night at the time of peak silver eel migration. However because of the free depth of water above the frame when in position as shown in figure 1, many eels may possibly escape being caught. This is another reason to favour the use of overhead lights at the upstream side of the bridge, so that any eels passing through will be forced to travel near the bottom. With the lights on, the catch at the Navigation span frame is reduced to 0.3 tonnes maximum/night, during a period of peak eel migration.

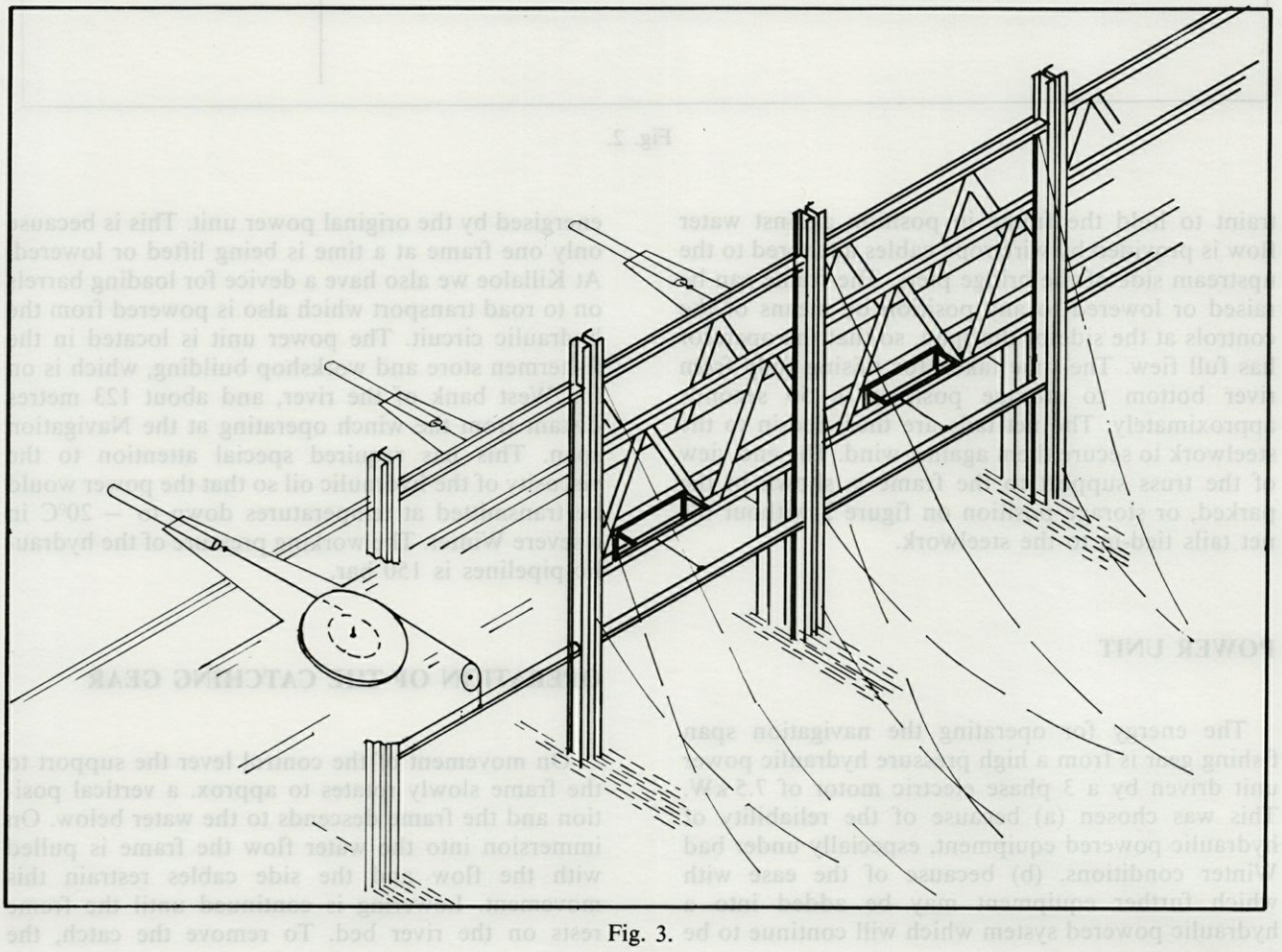

Fig. 3.

## THE NO. 4 ARCH MECHANISATION

This mechanisation is expected to be the initial stage of work which can be continued throughout the weir in future time. Three adjoining fyke nets operated by hand lifting of side poles which slide on steel supports were selected for conversion to mechanical frame operation. These were located on the downstream side of No. 4 arch of the Killaloe road bridge which runs parallel to the weir. A three — dimensional view of the mechanisation may be seen on figure 3.

The work was done to examine the possibility of further mechanisation of the weir in order to reduce the fatigue of hand lifting the nets during fishing activity. In order to keep costs to a minimum the existing footbridge used by the fishermen was used to support the winches which were specially designed by E.S.B.

These winches had to fit below the footbridge deck, in a space only 300 mm high and to be of durable construction. A hydraulic cylinder was used to provide the lifting force, and the required height of lift was arranged by using the principle of two attached drums, i.e. the hydraulic cylinder pulling rope from a small diameter drum which at the same time is turning a large diameter drum which is lifting the frame.

The steel supports of the footbridge were not suitable to guide the frames, as they had become somewhat twisted. Instead new guides were fabricated for the three frames and this allowed rollers at the sides of each frame to run smoothly when lifting and lowering. The net mouths were attached to the frames and were approximately 2 400 × 2 700 mm each.

Very smooth operation has been obtained using mechanical frames. The control valves for raising and lowering were positioned on the guide steelwork at a location which allowed the fishermen to operate the system from their boat. However it has been found that when the nets are in the fully raised position during daytime, when no fishing is taking place, that any winds blowing up-river tend to blow the dry nets on to the control valve handles and enmesh them. It is planned to raise the level of the valves soon.

## RESULTS OF THE NO. 4 ARCH MECHANISATION

The principal results of No. 4 arch mechanisation has been the reduction in the men's fatigue and consequently a raising of catching efficiency. Since eels tend to travel in large quantity on a small proportion of nights when meteorological conditions are favourable, the existence of powered frame lifting equipment allows potential catches to be more nearly achieved. This can be by shortening the cycle time for lifting and emptying the nets compared with human effort, especially after many such operations during the night of an abnormal eel run.

The catching ability of each frame at this part of the weir is much less than the nets close to the Navigation span. At peak migration of silver eels, approx. 65 kg per frame per night would be the maximum catch achieved.

O'LEARY (1979) makes reference to the escape of eels under the sole ropes of the hand-operated nets. The use of the rigid frames at the mouths of these nets is expected to be a contribution to efficiency, although this will not be fully realised until the conversion to frame operation of all the nets along the weir.

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