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DESIGN IMPROVEMENTS AND EVALUATIONS OF THE FISHING PERFORMANCE OF KIRIBATI FISHERIES DIVISION CANOES

by

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Summary

Under the Kiribati FAO/UNDP Boat building programme five prototype outrigger sailing/outboard canoes have been constructed, KIR 1 to KIR 5. These have been rigged and tested by the Fisheries Division under specifications established by a naval architect Qyvind Gulbrandsen. The basic design has proven to be popular, a private boatbuilder has been established on Tarawa to meet orders and a pilot Outer Island boat building scheme has been set up on Butaritari Island.

Successful deep bottom fishing trials were carried out with the canoes in the period May-August of 1984, in the Gilbert Group using FAO type reels and with the services of SPC Master fisherman Pale Taumaia. Demonstration trips were again undertaken in November - December of 1985 by A.F.O. Rimeta B. Tinga for fisherman of South Tarawa. Design improvements suggested by this useage have been carried out to the reels, which are now in production and being used in the field. In an effort to further improve the fishing performance of the KIR canoes prototype trolling booms were fitted to the KIR 4 model, these proved to be a resounding sucoess. As the canoes do not have the same interior dimensions of skiffs and as part of the Kiribati boat building scheme a local person has been trained in the practice of cold molding fibreglass for ice box which are designed to fit KIR canoes,; These ice boxes being of competative price than imported ice boxes. Trolling trials on the KIR 4 achieve comparable results with a Hawaiian commercial troller and with improved operating costs.

Table 1. Summary of KIR canoes constructed up until June 1986.

Type of craft		Island	Quantity	Ownership
Kir 1 7.25m	PRO A:	Tarawa	5	Private
(Flat bottom power/sail		Butaritari	1	Fishing group
canoe 9.9 hp)		Kuria	1	Private
		Aranuka	1	Council
		Nonouti	1	Private
		Fiji	1	Government
		Japan	1	Private
Kir 2 7.25m	PRO A:	Tarawa	4	Private
(vee-bottom		Butaritari	1	Private
sailing canoe 4hp-5hp)		Tabiteuea North	3	1 Fishing group
				2 Private
		Onotoa	1	Council
		Christmas Island	1	Government
		Cook Island	1	Government
		Japan	1	Private
Kir 3 5.9m	PRO A:	Marakei	1	Private
(2 man canoe, paddle, sail,				
outboard 2hp)				
Kir 4 7.25m	PRO A:	Tarawa	5	Private
(improved version Kir 1, up to 15hp)				
		Christmas Island	1	Private
Kir 5 11m	PRO A:	Christmas Island	1	Government
(flat bottom power/sail canoe)				
(15 to 25 hp O/B)				

Summary		
	Kir 1	11 craft
	Kir 2	12 craft
	Kir 3	1 craft
	Kir 4	6 craft
	Kir 5	1 craft
		31 craft

DESIGN IMPROVEMENTS AND EVALUATIONS OF THE FISHING PERFORMANCE OF KIRIBATI FISHERIES DIVISION CANOES

Introduction

The Kiribati F.A.O./UNDP Boatbuilding project has the following aims and objectives;

(a) To upgrade the capability and capacity of local I-Kiribati boat builders to construct improved outrigger canoes in terms of its sea worthiness, safety fishing performance, and fuel consumption and thereby offering a cost effective substitute to other powered fishing craft.

(b) To increase artisanal fishing catch at reduced fuel costs and improve income earning opportunities of artisanal fisherman.

(c) The tradition I-Kiribati boatbuilders have little knowledge of modern boat design and building materislas, and their traditional canoes although being perfectly suitable for subsistence fishing is inadequate for commercial fishing. As fuel is very expensive and fish cheap in Kiribati, economical commercial fishing craft had to be developed and made available to the fisherman as part of the fisheries development programme.

As the result of long useage of the Kir canoes by Fisheries Division Fishing Skipper Mark Day and Assistant Fisheries Officer Rimeta Tinga, new gear has been developed for the canoes and modifications suggested. With the acceptance of I-Kiribati for the Kir canoes, see table 1, the logical next step was taken, the local production of ice boxes to preserve the catch, training of the I-Kiribati box maker coming under U.N. Boat builder Mike Savins.

Trolling boom modification/design

With the increasing use of F.A.D's for fishing, and a on going F.A.D. programme it was decided to look at other methods of fishing with the KIR canoes. Initially the boom idea was started with Christmas Island in mind as the closeness to the Market of Hawaii has led to the formation of a successfull troll fishery for Wahoo (Acanthocybium solandri, Yellowfin tuna Thunnus albacares and trevally caranx) sp.

In 1985 Fisheries Division undertook a Resource Survey of the Northern Line Islands. To assess the troll fishery the Fisheries Vessel Nei Tewenei was rigged to troll using an adaption of the West Coast, U.S.A. Salmon trolling rig. When rigging Kir 4 it was decided to scale down the rig from Nei Tewenei.

Boom mounting and construction

Initially the booms were mounted on the forward beam, amidships, but this proved unsatisfactory and a small cross beam was made and placed just forward of the mast.

The cross beam is lashed to the rails on each side of the canoe, however to save room on a mono hull this could be attached to the floor or seat.

At the centre of the cross beam we have two $\frac{3}{4}$ inch plywood cheeks on each side, with two $\frac{1}{2}$ inch brass bolts as the axle for both booms. If bamboo is available in-country this would be suitable for the booms. Alternatively either sawn or laminated timber to the specified measurements in drawing sheet No.3.

Trolling rig

Please refer to Appendix 1 sheets 1 and 2. The booms were positioned at such a angle so as the top of the boom did not extend any higher than the mast, to allow the halyards to work easily.

6mm ø p.p. (poly propeylene) rope was used on all the stays, with the exception of the Stainless steel main fore stay. Each stay was adjusted so no movement was possible for the booms, no matter how the canoe moved in the water.

A total of seven lines were run. Three on each boom and one from the top of the mast. The shock lines were tied to the end of each boom, one on the end and then 100mm apart. The shock line used was 4mm ø Tarred nylon which has high stretch and return performance, this did away with the need of rubber shock cord. If a material with out stretch and return performance was used a rubber shock must be added. The length of the shock cord used was 4.5 metres approximately to achieve the position shown on Appendix 1, sheet 1. A heavy duty brass 3 way, trolling swivel was then tied in.

From the 3 way swivel a short tag line of 2mmØ braided nylon runs back to the after beam. The length of these is variable to allow for the configuration and line position shown. To the remaining portion of the swivel the chain, 9mm, is tied. 9 links to the outside line, 3 links to the middle line, and 6 links to the inner line. The line from the mast head has no chain. From the chain runs crimped 400 kg B/S monoline, with a cork screw brass trolling swivel on the end. Line lengths must be in the range shown to allow the canoe to come hard around and fish to be pulled in without tangles.

Trolling performance

After two test runs of catching no fish the correct speed was found for the combination of craft and lures. No tangles occured when coming around or when pulling in fish (sharks did cause a few problems as they spin once hooked).

With a load of 3 persons, ice and ice box and fuel (40 litres) (total load approx 350 kilos) a fuel consumption figure of 8 litres, hr was achieved when trolling at full speed. With the same load trolling at half speed a fuel consumption of 2.8 litres per hr was achieved. Comparison trials were done with a 7.5m Yamaha skiff with a 40 hp engine, and the canoe was found to burn exactly 50% as much fuel as the skiff.

200 kg B/S line was tried on several lines in attempt to cut costs but it was found to be too light and led to only lost fish. With this method of trolling it was also found to be a bit small to pull in easily. Note when fish are hooked the canoe slows only slightly to allow the fish to be pulled in, the canoe never stopped moving through the water.

The booms showed no signs of weakness in adverse weather conditions (18 + knot wind) or with multiple hook-ups, one occassion 5 hook ups at once, 3 on one boom, two on the other.

Catch Data

Trial trips carried out on Christmas Island gave the following results in May/June 1986. Fuel cost (including oil) A$0.82 per litre on Kiritimati.

Fishing time	Fuel used	Fuel consumption	No. men	Catch weight
1. 7.5 hours	22 litres	2.9 l/h	3	93.2 kg
Catch breakdown	15 Trevally		45.2kg	
	2 Wahoo		28.5 kg	
	5 Barracuda		15.7 kg	
	2 Flagtail Rock Cod		3.8 kg	

Fishing time	Fuel used	Fuel Consumption	No. men	Catch weight
2. 6.5 hours	18 litres	2.76 l/h	2	109.5 kg
	Catch breakdown	12 Trevally	54.5kg	
		2 Wahoo	26.30kg	
		6 Barracuda	22.72kg	
		3 Rock cod	5.9kg	
3. 9 hrs	22 litres	2.4 l/h	2	64 kg
	Catch breakdown	2 Wahoo	35.1kg	
		2 large trevally	11.3kg	
		1 shark	18.0kg	
4. 6 hrs	11.3litres	1.8 l/h	2	34.9 kg
	Catch breakdown	1 Wahoo	12.4kg	
		2 trevally	12.6kg	
		4 flagtail rock cod	9.9kg	
5. 7 hrs	20 litres	2.8l/h	2	120.3 kg
	Catch breakdown	5 Wahoo	85.8kg	
		2 trevally	24.5kg	
		3 yellow fin	12.0kg	
6. 6 hrs	23 litres	3.4 l/h	3	151.7 kg
	Catch breakdown	7 Wahoo	92.75	
		5 trevally	29.85	
		5 yellow fin	10.00	
		1 shark	19.1	
7. 5 hrs	16 litres	3.2l/h	2	3 Wahoo 57.6 kg

Using $\frac{\text{total weight}}{\text{time x men}}$ = kg/man/hr cpue

for the above trips;

1. CPUE = $\frac{93.2}{22.5}$ = 4.1

2. CPUE = $\frac{109.5}{13}$ = 8.4

3. CPUE = $\frac{64}{18}$ = 3.5

4. CPUE = $\frac{34.9}{12}$ = 2.9

5. CPUE = $\frac{120.3}{14}$ = 8.57

6. CPUE = $\frac{151.7}{20.1}$ = 7.54

7. CPUE = $\frac{57.6}{10}$ = 5.76

Discussion

MV "Tasu", a multi-purpose commercial fishing vessle, Hawaii based, operated in the waters around Kiritimati in the period January to March of 1985. The vessel was 17m long, powered by a 250 hp Detriot diesel, with a 100 hp anxillary engine, crewed by 4 people and trolled nine lines. Her daily operating expenses ran out A$35.00 per fishing hour, and her average fishing day consisted of 13 hours, with the remaining 11 hours spent drifting (running costs then around A$12.00 per hr). So to keep the "Tasu" at sea for 24 hours cost around A$587.00).

Tasu data (from Fisheries Division catch reports).

Trip		Duration	Species	Wt (kg)s	CPUE (kg/man/hr)
1.	27-29/12/84	3 days	Wahoo	522.5kg	
			Yellowfin	110.2	2.25
			Trevally	10.0	
			Bafracuda	2.27	
			Total	647.97 kg	
2.	3/1-8/1/85	5 days	Wahoo	819.5	
			Yellowfin	221.37	2.7
			Trevally	232.72	
			Barracuda	35.00	
			Total	1308.59 kg	
3.	10-15/1/85	5 days	Wahoo	1268.18	
			Yellowfin	335.0	3.5
			Trevally	82.72	
			Barracuda	19.09	
			Total	1704.99 kg	

4.	18-22/1/85	4 days	Wahoo	1761.81	
			Yellowfin	413.18	
			Trevally	68.18	5.8
			Barracuda	9.5	
			Total	2,252.67 kg	
5.	25-29/1/85	4 days	Wahoo	935.45	
			Yellowfin	628.18	
			Trevally	24.55	4.16
			Barracuda	10.90	
			Total	1599.08 kg	
6.	1-5/2/85	4 days	Wahoo	1,169.54	
			Yellowfin	214.54	3.6
			Total	1,384.08 kg	
7.	9-12/2/85	3 days	Wahoo	425.68	
			Yellowfin	16.36	1.67
			Trevally	38.18	
			Total	480.22 kg	

The "Tasu" did more trips but for the purposes of camparison the first consectutive seven trips were taken. Using the CPUE figures for the KIR 4 canoe with booms, trolling six lines; for the seven trial trips we achieved a average CPUE of 5.82 kg/man/hr. The "Tasu" over her first seven trips achieved a average CPUE of 3.38 kg/man/hr. It should be mentioned the period of the Tasu fishing is traditionally a good period for troll catches of Wahoo, whereas May-June is a poor period.

It can clearly been seen that canoe's performance with trolling booms compares very favourable to a much larger, more expensive unit, the "Tasu". If one goes a step further and reviews operating costs the picture becomes even better. Over the seven trips the KIR 4 canoe cost approximately A$2.25 per hour to operate, whereas the Tasu costs approximately A$24.45 per hour (on a 24 hr day basis). Investment for a KIR 4 fully equipped is A$3,200.00 (booms, ice box, fishing gear), Tasu class of vessel A$250,000.00

By addition of trolling booms the KIR 4 canoe becomes a very attractive craft for this type of fishery, providing high return for low investment.

Acknowledgements

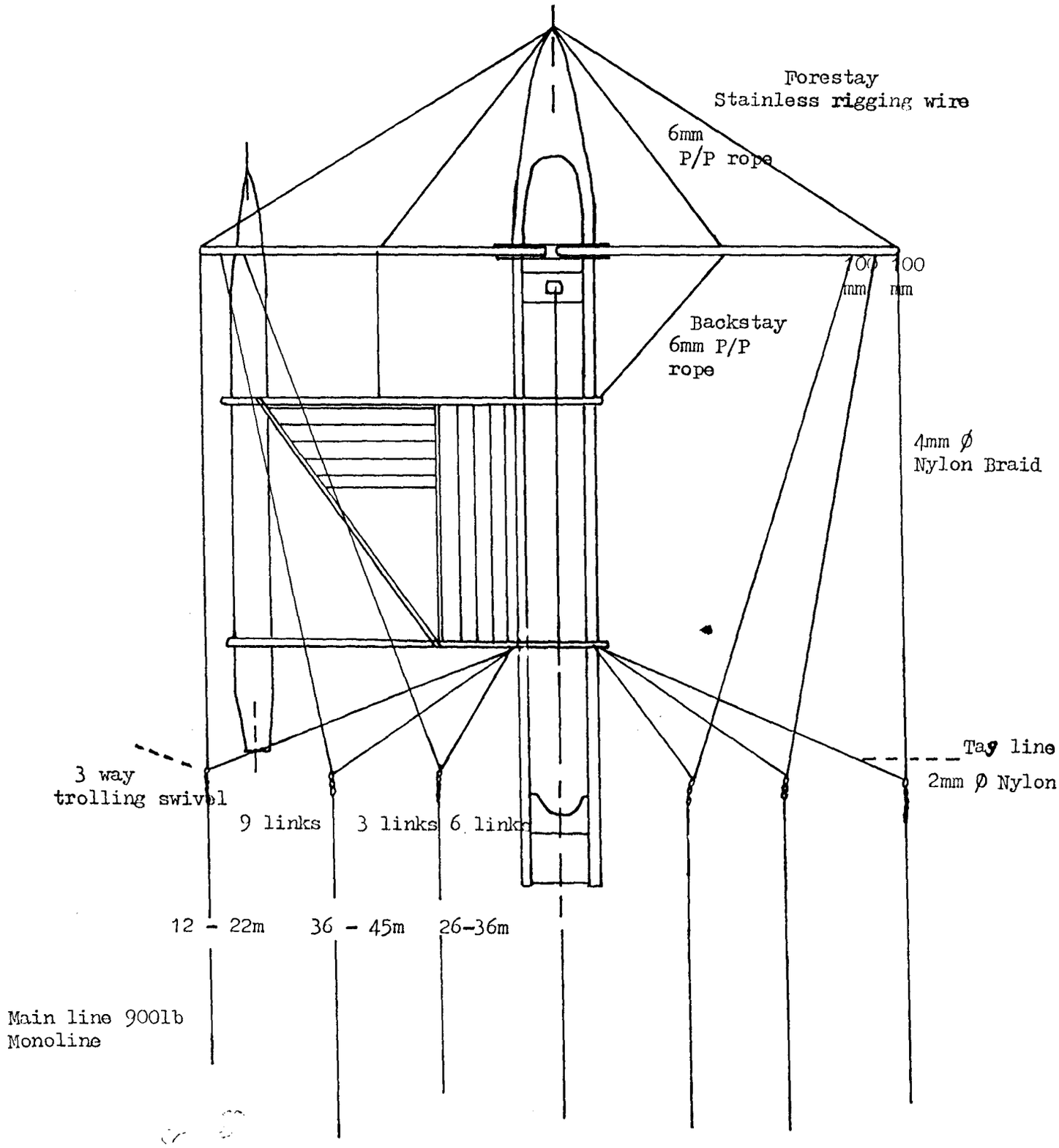
Acknowledgements should be given to UNDP/FAO for their support of the Kiribati boat building programme, and to Captain Tom Wood of the M.V. "Tasu" for his help on Kiritimati in rigging the Fisheries Vessel Nei Tewenai with trolling booms.

Special thanks is given to the efforts of the Fisheries Division and in particular to Barerei Onorio, Chief Fisheries Officer, who encouraged the presentation of this paper.

SHEET NO: 1

APPENDIX 1

TROLLING BOOM RIG: KIR 4



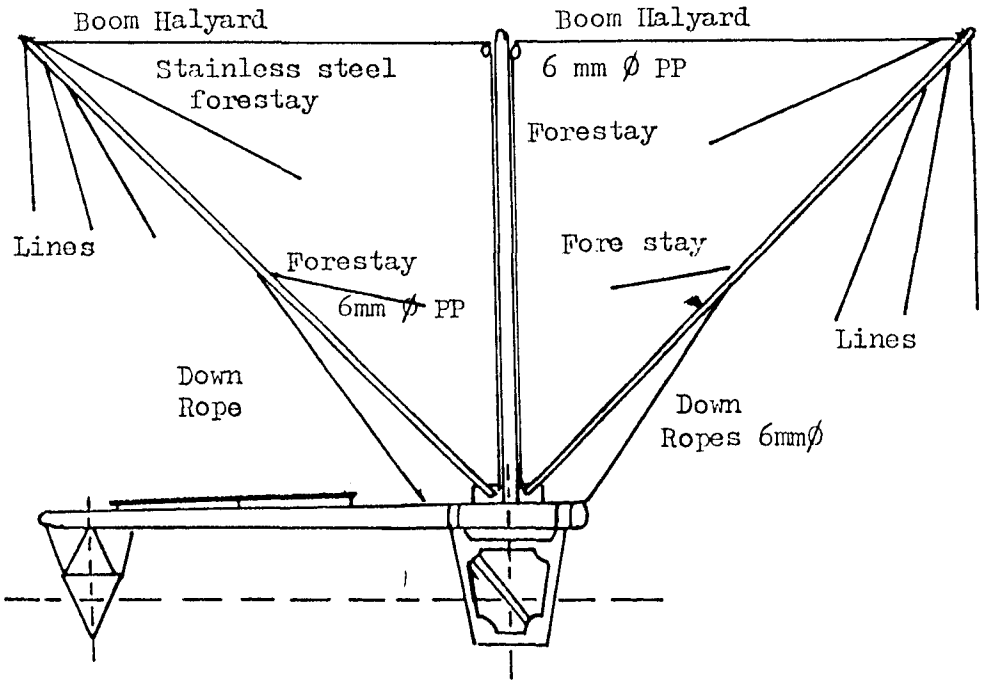
Not to scale

C.M. Day June 86
FISHERIES DIVISION, REP OF KIRIBATI.

APPENDIX 1

SHEET NO. 2

TROLLING BOOM RIG: KIR 4

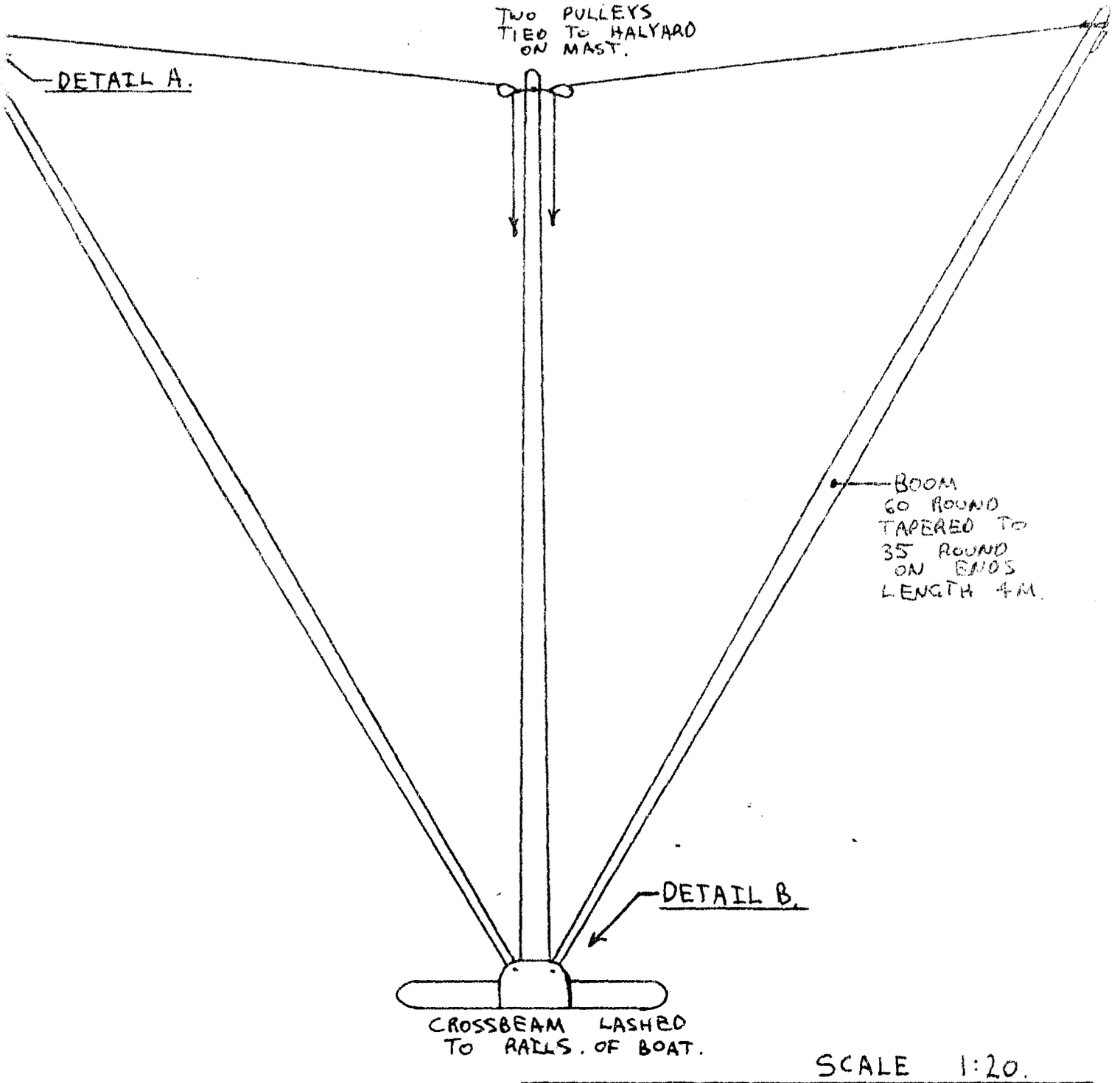


C.M. Day June 1986
Fisheries Division, Rep of Kiribati

Not to scale

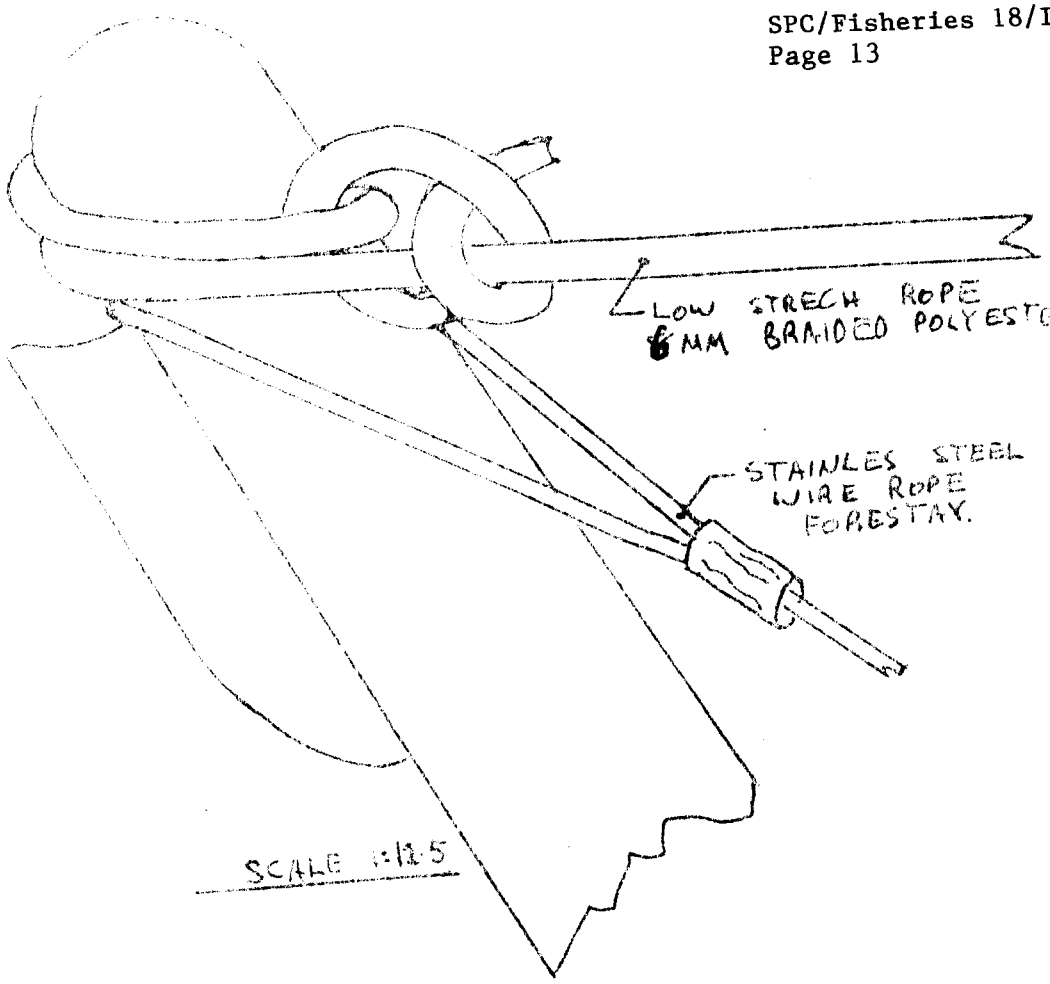
SHEET 3

SHEET No.s 3 and 4 CONSTRUCTION OF TROLLING BOOMS.

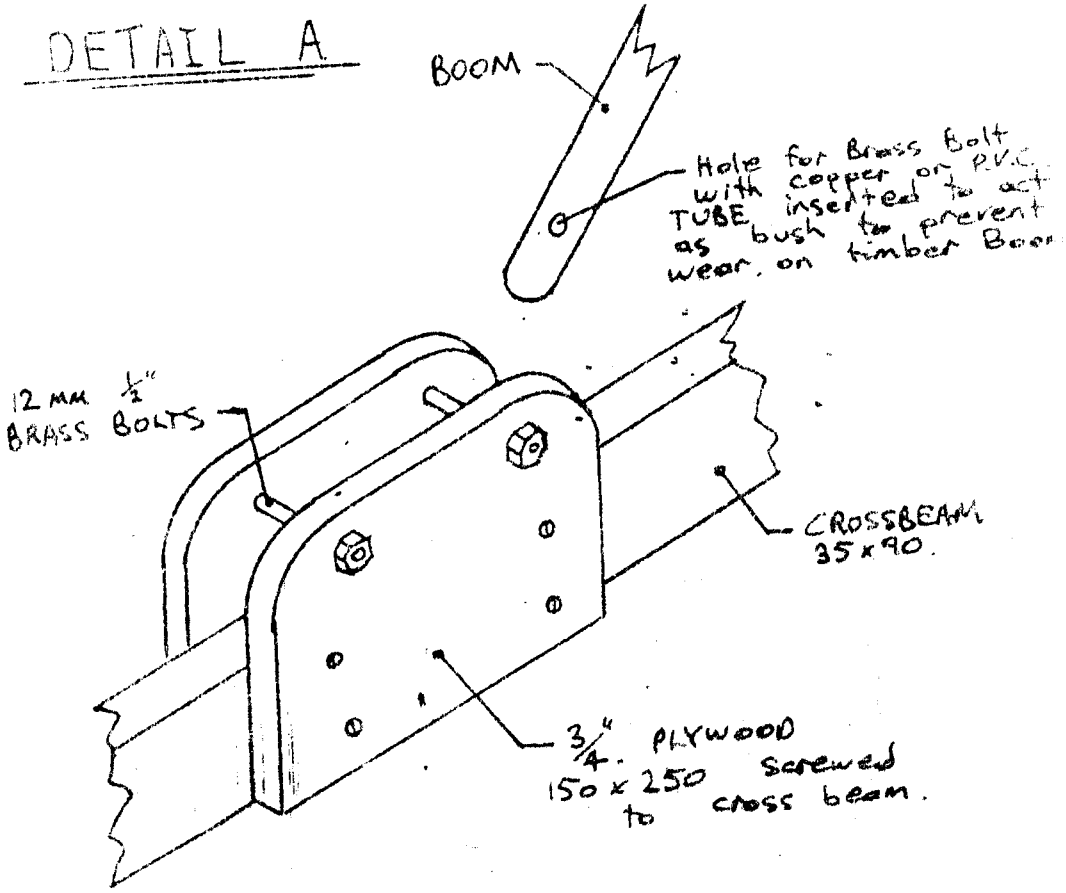


SCALE 1:20.

M SAVINS JUNE 86.



DETAIL A



DETAIL B
SCALE 1:5

M SAVINS JUNE 80