

Fig. 2 Inspection potential of N independent surveillance patrols in an operating area each capable of inspecting 6 boats per hour.

b. Nighttime Resources Control. Night time resources control by the NP on the Mekong-Bassac Rivers consists of curfew enforcement. Violators of curfew will be treated in an undetermined manner, dependent on the environment and tactical situation. For the purposes of this study it will be assumed that the behavior of a patrol upon detecting a curfew violator is effective in preventing that violator from repeating his offense with some reasonably high probability. The requirement for the detection of curfew violators is primarily concerned with preventing movement along the rivers. It is also desirable to prevent movement across rivers but as has already been established that requires a much higher level of surveillance.

Illicit traffic attempting to move along the rivers at night will operate from streams and small canals where it can hide during the day. Since many of these streams and canals are under day time surveillance by military forces, especially in government controlled areas, the traffic will attempt to move with as few such stops as possible. Thus, it will attempt to move on the rivers for a few hours each night at speeds up to several kilometers per hour. Typically it may be broken from cover a few hours after dark, perhaps 2200, take up to one hour to reach the main stream, move on the main stream for a few hours, perhaps for or five and take another hour to make cover before dawn. At 10 km per hour, a reasonable high speed for a covertly operating boat or boats moving down stream, a curfew violator could cover 50 km in five hours movement. Therefore, it is assumed that a revisit time of 10 hrs for night patrols (14)

would achieve a 0.5 probability of encounter. If the probability of detection of a curfew violator encountered by a PPB patrol is no less than 0.1 then the night time detection criteria can be reconciled with the day time criteria of 10% per 100 km. The detection probabilities of PPBs against covertly moving boats on the rivers are in fact probably as low as 0.1. Thus, a revisit time of 10 hours or less will be set as the night patrol performance criteria.

c. Patrol Assurance. In estimating the requirements for the "worst case" and to establish reasonable numbers of patrols for the present assets, some planning criteria is required. In accordance with the assumption that night patrols should take priority in the planning of patrols, the criteria have been set that the first night patrol should have a 0.95 probability of being made, the second, if two are required a 0.85 probability. These probabilities are determined just based on the assumed availability. For the daytime patrols, 0.95, 0.90 and 0.85 probabilities of the first second and third are set. These latter criteria are applied only to the estimation of force requirement for the "worst case". For the present force level day patrol assignments the number of day patrols planned was limited by the number of PIBs available. In calculating the number of boats probably inspected the probable patrols were considered.

For purposes of comparison the probability of performing night time patrols by the planned force/level is shown where

it fails to satisfy these criteria.

d. Boat Utilization. Utilization of boats is measured as the fraction of time that an assigned boat is utilized. Although the assumptions made above will assure relatively low utilization it is of interest to note. It will be seen that within the same assumptions utilization can vary through the different rules by which patrols are assigned.

6. RESULTS. The results of the analysis are presented in this section. The capability of the MP with their present assets and planned bases is examined. Also examined is the case using the planned bases but a modified allocation of the boats. Then force levels required for a "worst case" situation are determined. The effect of communications limitations on the ability of the MP to cover the entire area is briefly discussed and the influence of the assumption about traffic and the criteria for detection are discussed.

a. Planned Allocation of Boats. The surveillance capability of the planned bases with their planned assets is shown in Table 4. The small number of boats available limits the coverage possible, especially at night. For each base except Can Tho one night patrol is planned, and for all but Ap Binh Long and Dai Ngai these can be achieved within the assurance criteria. Those two bases have only a limited capability for making a night patrol. The two night patrols from Can Tho could be employed

*to reinforce the Dai Ngai area. The revisit times for
my the old Cao Long and An Cam Son are excessively long. It allows*

has been made in this allocation for major maintenance on the boats. Any boat that is temporarily put out of service will significantly reduce the capability of its respective base.

b. Suggested Allocation of Present Assets. The surveillance capability for the planned bases using the same total assets but allocated differently is given in Table 5. A more uniform capability is achieved throughout the area. All the bases can perform one night patrol although five cannot quite achieve the criteria of 0.95 probability of making patrol. The revisit times remain the same except for Can Tho which remains acceptable. Dai Ngai and Ap Binh Long are both able to perform night patrols with high assurance, an aspect of the mission that seems most important in their patrol areas. The improved capability is achieved with two PPBs held out as rotational boats in maintenance.

c. Requirements for Worst Case Traffic. In Table 6 the numbers of boats for each base are given to achieve a 10% detection probability (revisit time less than 10 hours at night and inspection of 10% of peak traffic and average traffic). The peak and average traffic assumed for this condition are 300 and 150 boats per hour or the equivalent of 30 and 15 boats per kilometer assuming an average traffic speed of 10 km per hour. A specific difference between day patrols of this plan and the former two is that only enough PIBs are allocated to

TABLE 4

Planned M.P. Bases, Assets and Practical Operations

BASE	ASSETS		PRACTICAL # PATROLS		COVERAGE OF AREA			BOAT USE % OF TIME	
	# PFB	# PIB	NIGHT	DAY	NIGHT	DAY	DAY	PFB	PIB
			2 PFB- 2 PIB NO. (PROB)	1 PFB- 1 PIB or 2 PIB	REVISIT TIME HRS. (1)	PR TRAFFIC FOR 10% INSPECTION OVER 100 KM BOATS/HR	PROB NO. BOATS PATROLS CAN CHECK		
				(2)		165 (2)	42	38	41
AP BINH LONG	2	3	1 (.72)	1	3.5	110	116	38	40
MY THO	5	5	1	2	11.5	120	116	38	34
VINH LONG	5	6	1	2	10.4	110	106	42	34
CAO LANH	4	6	1	3	11.0	285	131	42	27
AP LONG HUNG	4	8	1	2	6.2	140	116	38	34
TRUC GIANG	5	6	1	2	8.5	110	116	38	34
AP CAM SON	5	6	1	2	11.0	80	43	38	32
DAI NGAY	5	6	1	1	7.3	135	98	39	43
CAN THO	2	4	1 (.72)	2	4.5	160	106	42	34
LONG XUYEN	6	6	2	2	7.6	130	106	42	34
CHAU DOC	4	6	1	2	9.9				

(1) - Applies where indicated number of patrols are performed.

(2) - Day patrol cannot be performed if night patrol is made.

TABLE 5

Planned M.P. Bases, Suggested Asset Assignment and Use

BASE	ASSETS		PRACTICAL # PATROLS		COVERAGE OF AREA			BOAT USE % OF TIME	
			NIGHT	DAY	NIGHT REVISIT TIME HRS. (1)	DAY PR TRAFFIC FOR 10% INSPECTION OVER 100 NM BOATS/HR	DAY PROB NO. BOATS PATROLS CAN CHECK	PFB	PIB
			2 PFB- 2 PIB NO. (PROB)	1 PFB- 1 PIB or 2 PIB					
AP BINH LONG	3	4	1 (.94)	1	3.5	165	51	38	35
MY THO	6	6	1	3 (1)	11.5	155	174	40	42
VINH LONG	5	6	1	2	10.4	120	116	38	34
CAO LANH	5	6	1	2	11.0	110	116	38	34
AP LONG HUNG	3	6	1 (.94)	2	6.2	190	87	38	34
TRUC GIANG	3	6	1 (.94)	2	8.5	140	87	38	34
AP CAM SON	5	6	1	2	11.0	110	116	38	34
DAI NGAI	3	4	1 (.94)	1	7.4	80	51	38	35
CAN THO	4	6	1	2	9.3	130	106	42	34
LONG TUYEN	3	6	1 (.94)	2	7.6	160	87	38	34
CHAU DUC	4	6	1	2	9.9	106	106	42	34

SPARES

2

(1) - About 4% of time only 2 day patrols can be made

TABLE 6

Recommended M.P. Bases Assets and Use for Mekong Basase Resources Control for Assumed Worst Case

BASE	PATROL AREA LENGTH MI	ASSETS		PRACTICAL PATROLS			COVERAGE OF AREA			BOAT USE PFB
		#PFB	#PIB	NIGHT	DAY		NIGHT REVISIT TIME HRS. (1)	DAY Pk. TRAFFIC FOR 10% INSPECTION OVER 100 MI BOATS/HR	DAY PROB NO. BOATS CAN CHECK	
				2 PFB-2 PIB NO. (1)	1 PFB-1 PIB or 2 PIB	PIB PATROLS	PIB PATROLS			
MY THO	102	9	11	2	3	2	5.1	300	242	37
CAI BE	78	6	8	1	2	2	7.8	315	190	33
CAO LANH	98	9	11	2	3	2	4.9	310	242	37
CHO MOI	74	6	8	1	2	2	7.4	325	190	33
TAN CHAU	62	6	6	1	2	1	6.2	300	154	33
TRUC GIANG	71	6	8	1	2	2	7.1	330	190	33
PHU VINH	78	6	8	1	2	2	7.8	315	190	33
VINH LONG	74	6	8	1	2	2	7.4	325	190	33
DAI NGAI	73.5	6	8	1	2	2	7.4	325	190	33
CAN THO	77	7	7	1	3	1	7.7	320	209	36
LONG XUYEN	78	6	8	1	2	2	7.8	315	190	33
CHAU DOC	78	6	8	1	2	2	7.8	315	190	33

PIB
42
41
42
41
44
41
41
41
41
41
46
41
41

SPARES / 4

TOTALS 83 99

(1) - Probability ≥ 0.95 for first, ≥ 0.85 for second

(2) - Probability $\geq .95$ for first, $\geq .99$ for 20, $\geq .85$ for 30

perform the planned patrols. Where PPBs are unable to perform a planned patrol, no substitute PIB patrol is made. This results in a higher ratio of PPBs to PIBs. It also results in a slightly lower utilization of PPBs and slightly higher utilization of PIB. Another explanation for this is that last minute adjustment in patrols is not taken into account and the number of boats assigned is the number required to achieve the desired assurance. This worse case estimate, allowing for 4 spare PPBs, totals 83 PPB and 99 PIB.

The plan is structured on twelve bases. Two new bases are added to the area, Cho Moi and Cai Be, to fill in sections that are difficult to reach from the planned bases. One of the planned bases Ap Binh Long is eliminated in this new set because its location makes it difficult to integrate into the total system with a reasonable number of boats. Other less important changes in bases suggested to improve the overall structure, are at Ap Cam Song and Ap Long Hung which would be better sited at Phu Vinh and Tau Chau respectively. These bases and their operating areas are shown in Figure 3.

d. Limitations of Radio Equipment. The current operations of MP on the Mekong-Bassac complex are seriously influenced by the limitation of the radio equipment of the patrol boats. All of the boats use low power voice transmitters that are limited to about 20 km reliable range. Since the performance of surveillance by patrol units implies good communications at all times, the fully effective operating radius of the MP boats is no more than the range of their communications systems. In addition, even on the

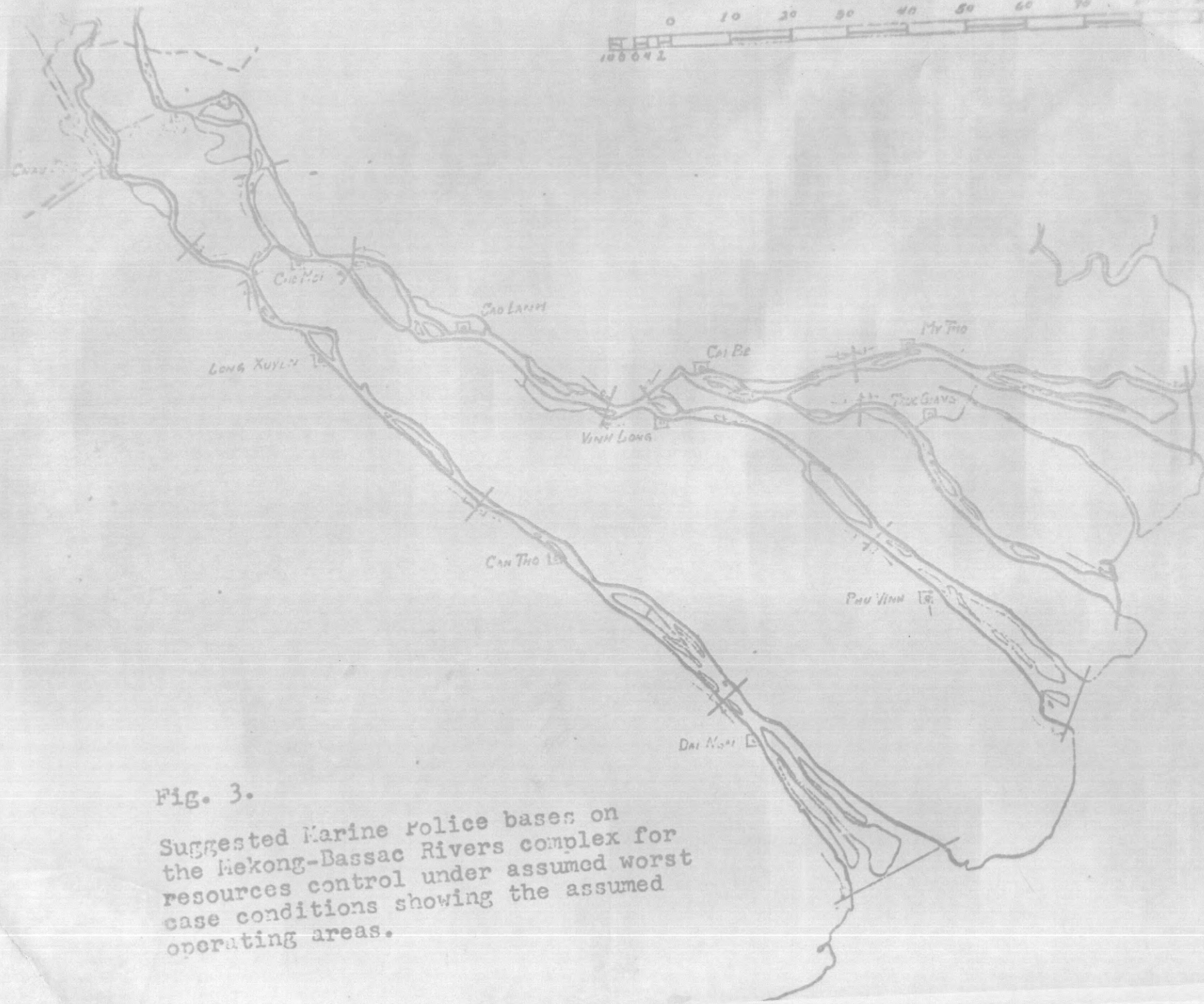
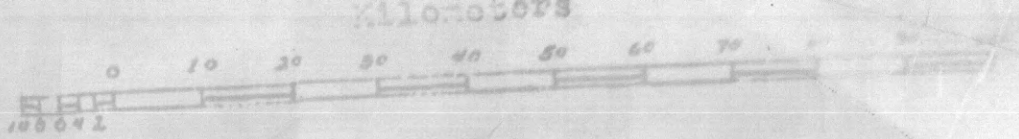


Fig. 3.

Suggested Marine Police bases on the Mekong-Bassac Rivers complex for resources control under assumed worst case conditions showing the assumed operating areas.

Mekong and Bassac the boats will be operating for some time in areas where an unusually high threat exists to them. It is unlikely that any reasonable modern field commander would dispatch his forces regularly into high threat areas to perform surveillance without being able to communicate with them at all times. The individual base restrictions of the 20 km operating radius limitation are given in Table 7. The total length of channels that the restricted patrols can cover from the eleven planned bases is 698 km. That represents just 74% of the total length of 943.5 km. The bases at Can Tho, My Tho and Cao Lanh can reach just over half their operating areas. Furthermore, it should be recognized that some of the areas not reached are especially important for resources control since they are away from the major cities and military bases. Important sectors of the rivers left unpatrolled by this restriction are the lower end of Cu Lao May on the Bassac, at Cu Lao Cac on the Bassac between Can Tho and Long Xuyen, the entire Vam Nao area and around Cu Lao Tay on the Mekong, the divergence of the Ham Luong and vicinity on the Mekong, the lower 25 km of the Ham Luong, the area of the Co Chien near the mouth of the Song Mang Thit and nearly the entire Cua Dai at the mouth of the My Tho. These areas are shown on Figure 4. In the absence of the MP these areas must be patrolled by other forces or left unpatrolled.

e. Variations in Assumptions and Criteria. The important assumptions in the determination of force levels that might be subject to variation are, within small limits, approximately linear factors in determining force requirements.

Table 7

LIMITATIONS IN OPERATING AREAS RESULTING FROM INADEQUATE RADIO EQUIPMENT

BASE	NOMINAL CH. LENGTH IN OPERATING AREA km.	LENGTH OF CHANNEL COVERED	% OPERATING AREAS COVERED
Ap Binh Long	35.0	32	91
My Tho	115.0	50	44
Vinh Long	104.0	97	94
Cao Lanh	96.5	67	59
Ap Long Hung	62.0	62.5	100
Truc Giang	85.5	61	71
Ap Cam Son	111.5	70	63
Dai Ngai	73.5	73.5	100
Can Tho	93.0	52	56
Long Xuyen	75.5	54	72
Chau Doc	<u>92.0</u>	<u>79</u>	<u>85</u>
TOTAL	943.5	698.0	AVERAGE 74%

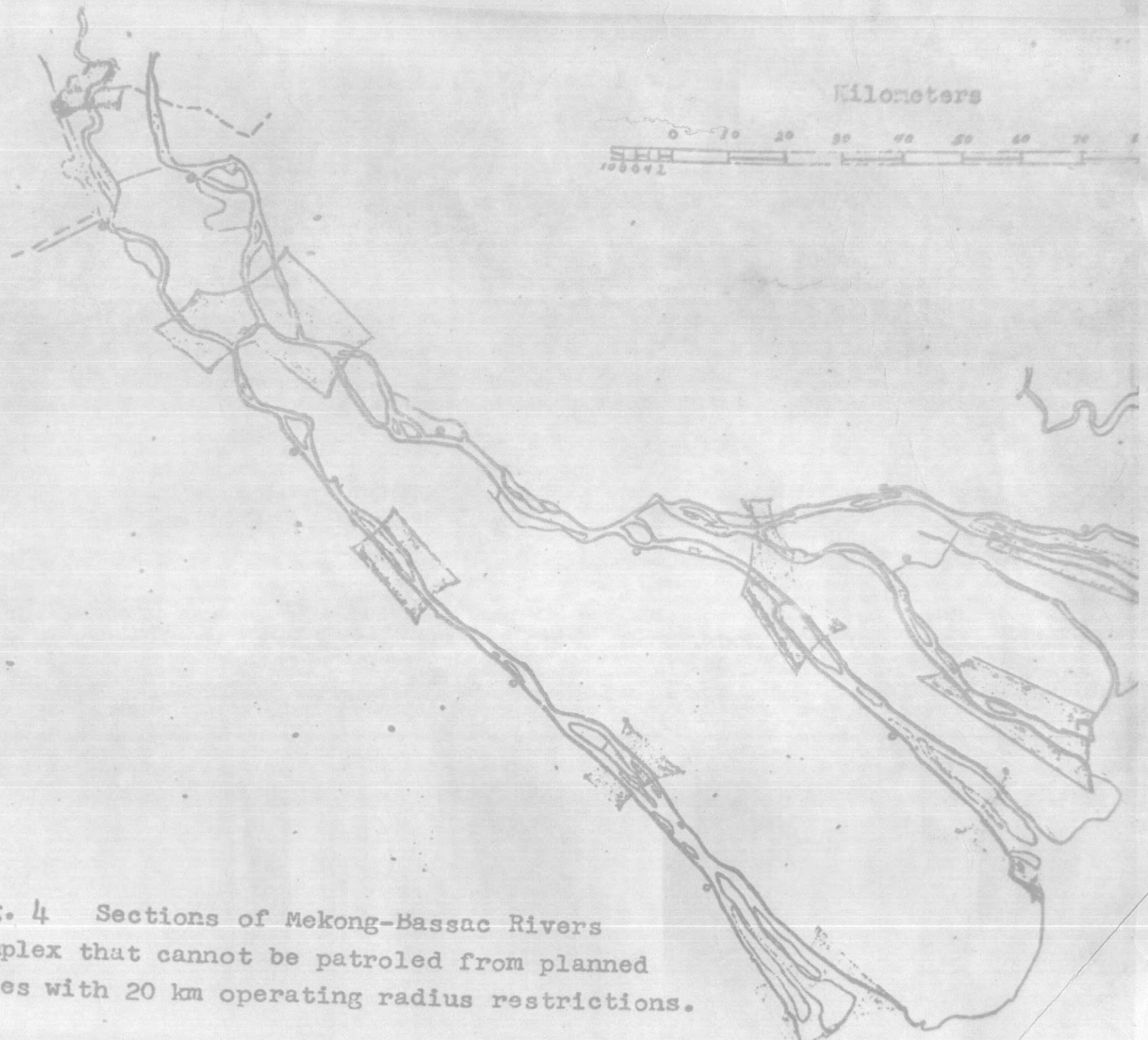


Fig. 4 Sections of Mekong-Bassac Rivers complex that cannot be patrolled from planned bases with 20 km operating radius restrictions.

f. Inspection Rate of Patrols. The rate at which day patrols can inspect boats might be less or greater than assumed by as much as a factor of two (i.e., from 3 to 12 boats per hour). Variation over such a small range will simply require more or fewer patrols proportionately, as long as the inspected fraction of boats remains small, for example, below 30%.

g. Night Detection Probability. The night detection probability may be higher than assumed. If so, higher coverage might be achieved. A significant reduction in the number of boats required cannot result from a higher detection probability since a near minimum number of night patrols is one per base. Fewer than that requires elaborate scheduling and careful randomizing to avoid setting a pattern of night patrol schedules that could be easily exploited. A lower detection probability than 0.10 would indicate a real deficiency. The usefulness of any patrolling under those conditions must be reconsidered. In actuality the detection probability is likely higher than 0.1 if the target is unalerted or uses any but the most general countermeasures.

h. Traffic Level. The assumed traffic levels are seemingly high. The number of day patrols needed is sensitive to both traffic and the detection level desired. The number of patrols needed is shown in Figure 2. The influence of this factor on the total force size needed is shown in Figure 5 for a force that is structured approximately equivalent to that for the "worst case" considered above. The ratio of PPBs to PIBs is about 4:5. The

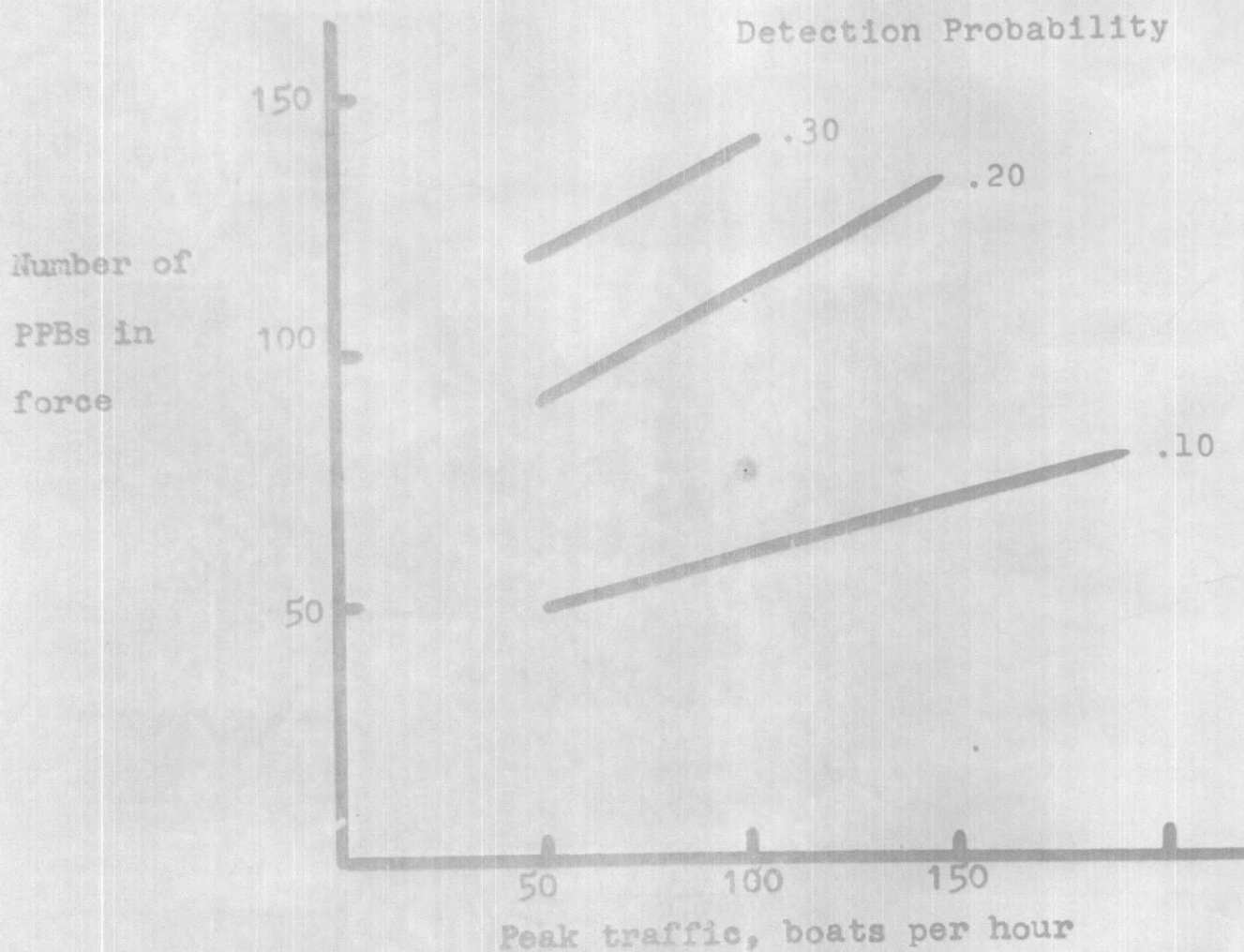


Fig. 5. Number of PPBs required in Marine Police force for resources control on Mekong-Bassac River complex as a function of peak day traffic that must be inspected. Three different probabilities of detection of a violator over 100 km of river course are shown. Assumes that the ratio of PPBs to PIBs is 5:4.

slopes differ largely because the criteria for coverage as previously stipulated, were retained for all three coverage factors; that is, the chance of making the first night patrol is 0.95, the second 0.85, the third 0.75, and for day patrols 0.95, 0.90, and 0.85 respectively.

1. Criteria for Detection. The stipulated criteria throughout this report has been for 10% detection of a violator over a 100 km length of river course. Increasing this requirement roughly linearly increases the number of boats required as long as the required level is relatively low. At very high levels of detection other factors will come into play and the number of boats required becomes excessively high. The required number of PPBs for three levels is shown in Figure 5 for different peak traffic values.

APPENDIX A

1. SUMMARY OF MARINE POLICE FIELD REPORTS DATA. The data tabulated in Table A-1 was taken directly from the files of the USAID Marine Police Advisors. This data is compiled monthly from the reports submitted to MP headquarters, by the operating units in the field. Information of interest can be extracted from the data although there is some unfortunate ambiguity that must be accounted for in the following:

a. PPB Availability. The deadline status of equipment is determined at one time during the month and therefore the statistic can be easily rigged. If availability is defined as boats operable divided by boats on hand, and boats operable is given by boats on hand less boats deadlined, an overall average availability of 85% is indicated.

b. Boats Checked per Patrol. A basic measure of resources control activity is boats checked per patrol. This measure gives at least a lower bound on the capacity of the MP to perform this function. In connection with this it is important to know whether a patrol consists of one boat or more than one boat. This is discussed below. It is assumed that each boat operating on the river, whether alone or not, constitutes a patrol. An average of 41 boats checked per boat on patrol is thus derived. Assuming an average of 10 hours of checking gives an average of 4 boats checked/hour.

boat per month can be determined from the summary by assuming a patrol is always a single boat. Patrols per boat assigned to an operational unit would be most desirable. Even though it is known that during the reporting periods some boats on hand were unassigned, there is insufficient information to determine the number of assigned boats. Alternatively, patrols per available boat per month with available boats defined as above in subparagraph a. are of interest. Most of the patrols reported are PPB patrols, although some may be short PIB patrols. Using available PPBs we find an average over 8 months of 17.5 patrols per boat per month. If patrols were more than one boat, then the number would be far too high unless a large number of patrols were performed by other than PPBs. In any event it appears that the utilization of available boats is not high. There is not a large variation from month to month.

d. Percentage of Violators. The fraction of violators found in the course of all this inspecting is of basic interest. Two primary measures are boats detained divided by boats checked and persons detained divided by persons checked. These two ratios both average about .001. Of nearly equal interest is a fact not disclosed by the summarized data; that is, of the persons detained, about 10% are classified VC or VC suspect. In other words about 1 in 10,000 persons checked is detained as VC or VC suspect. Since this number is small compared to the proportion of VC in the population it indicates the VC avoid being inspected,

that is, the patrols are at least successful deterrents.

TABLE A-1

SUMMARY OF MARINE POLICE FIELD REPORT DATA

MONTH END EQUIPMENT STATUS ON HAND/DEADLINE	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FFB	46/3	52/7	52/11	58/9	58/10	64/15	64/11	76/9
FIB motors	126/4	126/6	126/6	126/27	126/12	124/36	124/36	130/5
Assault Boats	18/11	18/12	17/12	18/14	18/16	18/15	18/11	18/1
LCPL	11/6	11/6	11/7	11/7	11/9	11/9	11/9	11/9
ASSIGNED BASE PERSONNEL								
H.Q.	360	373	340	317	353	397	397	335
Phu Xuan T.C.	103	102	102	100	150	97	98	98
RG 31	142	157	109	171	168	170	173	174
RG 41	216	177	192	191	288	189	187	185
RG 42	190	190	188	191	187	194	192	195
RG 43	126	122	121	121	124	156	159	178
RG 44	121	120	118	117	144	148	129	124
RG 45	31	31	35	42	81	87	92	100
CG 21	78	44	52	74	130	187	180	181
CG 11	31	74	76	50	107	112	109	101
ACTIVITIES FOR MONTH								
Total No. Patrols	637	779	808	894	856	848	943	98
Boats Checked	23285	26470	36611	35033	35459	36177	40439	4447
Boats Detained	34	48	57	58	69	33	25	
Persons Checked	138360	169770	238774	226451	235919	265601	283806	26394
Persons Detained	185	147	215	400	170	165	339	20

Note RG 41, 42, 43, 45 operate on the Mekong-Bassac Complex.