

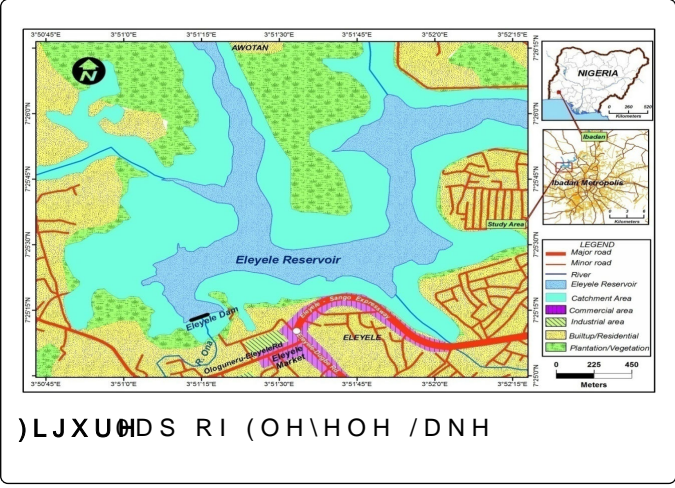
*URZWK 3DWWHUQV DQG \$RSHQ DFFHV V DUWLFOH GLVWULEXWHG XQG HU WKH WHUP RI

LQ (OH\HOH /DNH 6RXWKZHVW 1LJHULD
.DUHHP 2.20DQUHZDMXKSR (\ZULVDVRODQ2\$NLQWXQGH 0\$
'HSDUWPHQW RI \$TXDFXOWXUH DQG)LVKHULHV 0DQDJHPPHQW 8QLYHUVLW\ RI ,EDGDQ 1LJHULD
)HGHUDO &ROOHJH RI)UHVKZDWHU)LVKHULHV 7HFKQRORJ\ 30% 0DLGXJXUL 1LJHULD
'HSDUWPHQW RI :LOGOLIH DQG)LVKHULHV 0DQDJHPPHQW 2VXQ 6WDWH 8QLYHUVLW\ 1LJHULD
1DWLRQDO 8QLYHUVLW\ RI /HVRWKR 'HSDUWPHQW RI \$JULFXOWXUH 5RPD .LQJGRP RI /HVRWKR 6RXV
&RUUHVSROGLQJDDXWRZJ 'HSDUWPHQW RI \$TXDFXOWXUH DQG)LVKHULHV 0DQDJHPPHQW 8QLYHUVLW\
ND\NDJ #\DKRR FR XN
5HFHLYHG GD\H \$FFHSWHG GD\OH 3XEOLVKHG G\$XVXIV
&RSULJKW .DUHHP 2. HW DO 7KLW LV DQ RSHQ DFFHV DUWLFOH GLVWULEXWHG XQG HU WKH WHUP RI
XVH GLVWULEXWLRQ DQG UHSURGXFWRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXU

\$EVWUDFW
+HSVHXLVVRGRFRPPHUF LD00\ YDOXDEOH ILVK DQG LV FRQVLGHUH G DV HGGHPLF V
FRQGLWLRQ+H\$FWMRKRHURP /DNH (OH\HOH 2\R 6WDWH ZHUH LQYHVWLJDWHG DV D
HVVHQWLD0 IRU EULQLQJ LW WR FXOWXUH \$ 7RWDO RI VSHFLPHQV DQG
FROOHFWHG EHWZHHQ -XQH DQG \$XJXVW 7KH PRUSKRPHWULF LQGLFHV
/HQJWK 6/ %RG\ :HLJKW %: DQG 6WRPDFK :HLJKW 6: ZHUH DVVHVHG XVLQJ
OHQJWK ZHLJKW UH\DDVLRQ &RQLGSLWLRQ IDZHUHU FDOFXODWHG 6H\ UDWR RI 0D
)HPDOHV ZDV REWDLQHG ZKLFK VKRZV D IHPDOH GRPLQDWHG SRSXODWLRQ 7KH
%: UDQJHG IURP FP DQG J UHVSHFWLYHO\ /HQJWK ZHLJKW U
FDOFXODWHG DV
/RJ %: ORJ 6/ U
7KLW DQDO\VLV VKRZH G VLJQLILFDQW UHODWLRQVKLS EHWZHHQ WKH VWDQGDUG
UHODWLYH FRQGLWLRQ IDFWRU .Q FDOFXODWHG UDQJHG IURP ZKLOH WK
IDFWRU IDOO ZLWKLQ WKH UDQJH UHFRPPHQQHG IRU IUHVKZDWHU ILVK VSHFLHV L
WKH ILVK IROORZV FXEH ODZ DQG H\KLELWHG SRVLWLYH DOORPHWU JURZWK 7KL
PDQDJHPPHQW DQG JXLGH IRU IXWXUH FXOWXUH WULDOV

.H\ZRUGAIH SVHVRVH HQJWK ZHLJKW UHODWLRQ DQG FRPPHUV 1LJHULD SULQFLSD
&RQGLWLRQ IDFWRU (OH\HOH /DNH \H DU URDGRGD DLDLWMM KIG RQRPLF DQG QX
YDOXH > @ \$ PHGLXP VL]H \$IULFDQ SLNH
,QWURGXFWRQ IDW FDUERK\GUDYHUBQG DVK WLV > @
VSHFLHV SUHIHUV TXLHW DQG GHHS ZDWH
(OH\HOH 0DNLQJ FRQVWUXFWHG KLQHQJWK XSDUWNJ+LQZARLUPWGLS DQW RI
FRQVXPSWLRQ DQG FRQVHUYDWLRQ LQFRPPHUV ZHDWFDWFKULDLQ \$QWKRYJK /DNH E
TXHVW WR FUHDWH D PRGHUQ ZDWHU VXSSEHYO WHERWRPHHO WKH LFKOLGDH JHR
ZDWHU VFDUFLW\ IRU WKH HPHUJLQJ ,EDGDQ PHWURSORLV OHG WR WKH
FRQVWUXFWLRQ RI (OH\HOH 'DP RQ WKH PDYDXYL RU 9DQJWK ZHLJKW UHODWLRQ
VWRUDJH FDSDFLW\ RIH ODNH 0L\$RQDHO QV\HWRGRK GULVSRULQKEER QJ\
DQG UDLQ\ VHDVRQV WISLFD0 RI WURSLFD0 HQYLURPHQW \$GHLYDQXREOFHQR
IDPLOLHV OLNH &LFKOLGDH &KDQQ LGD WKH KOLYLODLW FDOFXODWHG SRVLWLYH LPSP
+HSVHWLGDH &ODULLGDH 2VWHRJORV LQJHWHW FDOFXODWHG UDQJHG IURP
ODNH > @ \$PRQJ W\KSHWRVXURXURP DQVPSRUWDQW NORZOHG JH RI WKH HQ
}VKVSHFLHV RI}FRPPHUV LQOV ZKR VH ELRQFH HQFH WKLW VWXG\ LQYHVWLJDWHV WKH
DGHTXDWHO\ VWXGLHG FRQGLWLRQ+H\$FWMRKRHURP DQDJHPPHQW VXV
+RGGRFK FRPPRQO\ NQRZQ DVH\$S0RFDQSLRQ DQDDQ D\SHUHOXGH WR PD
VROH UHSUHVHQWDWLYH RI WSKH LHPLOA ZHSHQWLGDH
GLVWULEXWHG DURXQG :HVWHUQ DQG &HWLHULDO \$ULFDQ DQ &HWKRGRV VWV VORZ D
VKDOORZ ZDWHUV RI ULYHUV LQ WKH SODLQV DV ZHO0 DV HVWXDULHV DQG D YD
RI RWKHU IUHVKZDWHU \$IDELVYDWRXV IHHGLQJ RO VHYHUDO
VSHFLHV RVKFRDOLHQJ DPEXVK LQ GHQVH YHJHWDWLRQ DQG WKH\
IHHG SULDULO\ RQ FLFKOL \$VULDDQ \$ULPHLGH (OH\HOH LV VLWXDWHG LQ 1RUWK Z
KLJKO\ SULFHG)LVKXSDWMLQRIGJHULD)LVKXSDWMLQRIGJHULD LV UHODWLYHO\ ORZ

DERYH VHD OHYHO DQG VXUURXQGHG E\ TXDUWILJGJH KLOOV WRZDUG WKH
 GRZQVWUHP VHFWRQ ZKHUH WKH GDPHEDUUDJH LV ORFDWHG \$ QXPEHU RI
 VWUHP FKDQQHOV VHUH DV IHGLOJ UHFKDUJHLOVWUHPV WR 0WKHDOH
 ZHWODQGHEODNL KDV D VXUIDZLWKDDPHDQ NP
 GHSWK RIH ZLBHW DQG QDUURZHVW DUP RI WKH ODNH LV "DERXW
 P DQG P UHVSHFWLYHO\ KDYLQJ IRUHHVHUHVHUYH ZLWK PFK YHJHWDLRQ
 VWUHWFK RQ HDFK VLGH (OZLWK WKH ZDWHU XDOO)
 OHYHO ULVLQJ GXULQJ HDUO\ SHULRG RI 6'0LQ OD[VHDVRO ,W FRYHUV VRPH SDUWV
 ,MRNRGR \$SHW \$ZRWDQ 2ORJXQ HUX \$JEDMH ,GL RVDQ 3RO\WHFKQLF RI
 ,EDGDQ DQG (OH\HOH)VKEZPXK LWKHFEHOOWK ZHLJKW UHODWLRQV KLS RI +H
 GRPLQDWHG E\ ,ODMH DQG <RUXEDV +ZPHOHFWXWVWUHPV HOG WKH DWDQGLQJ HGH
 }VKLQDUPLQJ DJUR SUWUHVFLQJ DQG ERDW



)LJXUHS RI (OH\HOH /DNH

&ROOHFWLRQ RI VDPSON

6DPSOHVRIWKH VWXG\ ZHUH FROOHFWHG IRUWQLJKWO\ GXULQJ
 -XQH WR \$XJXVW IURP 6'0LQ OD[DQG 6'0LQ OD[
 XVLQJ 6'0LQ OD[6'0LQ OD[6'0LQ OD[
 KXGUH DQG VSHFLPHQV RIWKH VDPSON
 OHQJWK DQG ZHLJKW UDQJLQJ IURP
 UHVSHFWLYHO\ 2I WKH WRWDO QXPEHU
 ZHUH IHPDOHV

ORUSKRPHWULF PHDVXUHPHQWV LQFOXGH 7RWDO /HQJWK 7/ DQG
 6WDQGDUG /HQJWK 6/ WR WKH QHGHVW 6'0LQ OD[6'0LQ OD[
 WKH QHGHVW J RI HDFKDWSEWPNWUHPDKXZHLJKW UHODWLRQV KLS ZDV FDO
 IURP WKHU 7ZD VDNHQ IURP WKH WLS RI WKH VQRXW PRXWK
 FORVHG WR WKH H\WDOQG 6'0LQ OD[6'0LQ OD[
 WKH PLG SRLQWRIJEDQXWV DQJLQJ PHDVXULQJ ERDUG ZKLOH %:
 ZDV PHDVXUHGXVLQJ D WRS ORDGLQJ OHWOHU EDODQFH > @

/HQJWK ZHLJKW UHODWLRQV KLSV ZHUH
 Lf " ZKHUH : LV WKH WRWDO ZHW ZHLJ
 6/ FP DQG D DQG E DUH WKH HTXDWL
 OHDVW VTXDUHV PHWKQJ (FROOHFWUHPV
 LVRPHWULF YDOXH RI E DQG DGRGHW
 IDFWRU ZKLFK VKRZV WKH GHYLDWLRQ
 ZDV GHWHUPLQHG 6'0LQ OD[6'0LQ OD[@
 ZKHUH : ZHLJKW LQ J DQG
 / OHQJWK LQ FP

5HVXOWV

H OHQJWK ZHLJKW IUHTXHQF\ GLVWULGXWLRQV RIWKH VDPSON
 /DNH (OH\HOH LV VKRZQ LQ 7DEOH 6'0LQ OD[6'0LQ OD[WKH WRWDO OHQJWK IUHTXHQF\
 RI VSHFLPHQ ZDV LOOXWDOHWZHUH)XQGHWR UDQJH
 IURP WR FP LQ WRWDO OHQJWK DQG WRWDO ZHLJKW ZDV UDQJHG
 EHWZHHQ WR J

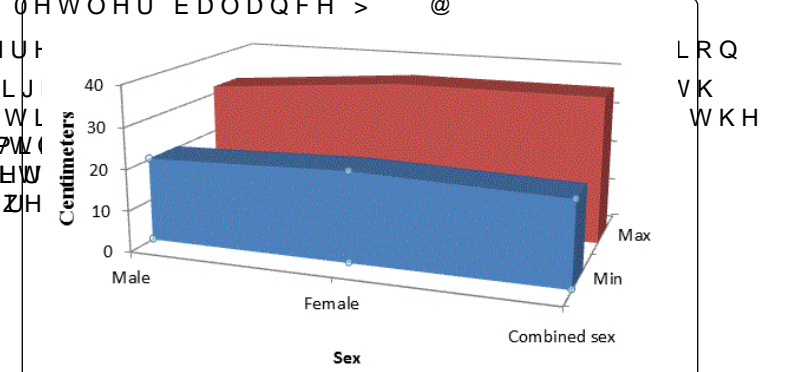
,Q FDVH RI IHPDOHV WKH 7/ DQG %: ZHUH
 DQG WR J UHVSHFWLYHO\ PDOH ZDV F
 s FP DQG WKH PHDQ %: FDOFXODWH
 IHPDOH WKH PHDQ 7/ DQG %: ZHUH FDOFX
 s J 1 UHVSHFWLYHO\ \$OVR W
 WKH VSHFLHV DUH ODOHV s FP)H
 &RPELQHG VH[HSOHQJWK ZHLJKW UHODW
 VDPSONH[SUHVHG E\ WKH UHJUHVVLRQ

'% L ætärws E uäšrlwä

/RJ OHQJWK DJDLQVW ORJ ZHLJKW UHYHD
 WKHUH LV D GLUHFV SRSRUWLRQDOLW\ EH

6H[Q	6WDQGDUG OHQJWK WR PDK ZHLJKW J			
		0LQ OD[0HDQ "	6'0LQ OD[0HDQ " 6'
ODOHV			"		"
			"		"

WRWDO OHQJWK VWRPDK ZHLJKW J UHODWLRQV
 (OH\HOH)VSHFLPHQV ZHUH PDOHV DQG
 (OH\HOH)VSHFLPHQV 6'0LQ OD[6'0LQ OD['HYL



&LWDWLBQHP 2. 2ODQUHZDMX \$1 2VKR () 2ULVDVRQD 2 DQG \$NLQWXQGH 0\$ HSHVHWXKZVCR
%ORFK &DSWXUHG LQ (OH\HOH /DNH 6RXWVGRZLVH VW 1LJHULD)LVK \$TXDF -

3DJH RI

(NHOHPX6DPXHO \$\$= *URZWK 3DWWHUQV\$ ERZHE RQGLW &RQ DFWLRQV)DFWRU /HQJWK
RI)RXU 'RPLQDQW)LVK DSWXUHG LQ 1DNHULD DQG \$EXQDQW DFFHVRN 1NRIURPHU 1LJH
%HUQDULQNRQ\$NDQGH\$GH\HFL\$DDO&VL .DOX .0 8PHKDP 61 2NHUHH) /HQJWK
2UJDQROHSWLF FKDUDFWHULVWLFV /HQJWK ZHLJKW UHODWLRQV LK\$ PQC ERQHWHUHQ
IDFWRU RI 2UHRFKURPLV QLORWLFXV LQ (JDK 6RQXUHQDWPKRQV *\$RI 1LJHULD \$QLPDO 5H
1LJHULD ,QWHUQHW -RXUQDO RI)RRG 6DIHW\
\$IRD\$N,NXO\$D2D /HQJWK :HLJKW 5HODWLRQV LK\$ PQC ERQHWHUHQ PRQ 6* /HQJWK :HLJ
)DFWRU DQG 6WRPDFKHPLFKW RFDVFXDWX DQG &RQGLWLRQV DFFHVRRI \$NDHW \$HQXH VW
6DURWKH RQ RQRW DQG 6URPLGRW LK\$ PQC ERQHWHUHQ 1LJHULD -RXUQDO RI \$QLPDO DQG 3ODQW 6F
3HUFLI RUPKOL (DHLV DHRXWKZH VJHUL DLRSHY \$IRD\$ /HQJWK ZHLJKW UHODWLRQV LK\$
7URS /DEHR RJXQHQLV %RXOHQJHU LQ \$VH
%DJHQO 0HWKRGV IRUVS VURGXFWQWRQLQ LVK \$TXD 6FL
IUHVKZDWHU HG %DFLHQW DFLDFNL RHOSS
%DORJXQ H ELRORJLFDV KXQYHODRRQ 0 VF
HVL\$QLYHUVLV\ RI /DJRV /DJRV