



**E EFEC F E E**  
**F DA A DAD E A**

**CA A DA DA A**

+ (, - (.. (% / \$, -) (

```

,-./-0102'-3'241'.-51,6578',5-,9':0'-8;18'
2-'<11':3':2':0;6,1<'24187/162:',1331,2<='
#4181'47>1'?110'0-'<26;:1<'2472'1@7.:01;
241'1331,2<'3'<281<<'0'A18B'1@/81<C
<:-0='(26;:1<'47>1'<4-D0'2472'A18E',70'?1'
87/;:5F':0;6,1;60;18'<281<<365',-0;:C
2:-0<='G-8'24:<'817<-0H':2':<'/81;:,21;'
2472'A18B'1@/81<<:-0'D:55'?1'<281<<'70;'
10;-I10-6<' )J%# '<10<:2:>1':0'17,4'81I:-0'
-3':02181<2='
! "#$%K'L.75E'D7<',4-<10'7<'7'I101'-3'
:02181<2'?1,76<1':2':<':0>-5>1;':0'241'
/-<:2:>1'2870<,8:/2:-0'5--/'0'241'.-51,C
6578',5-,9='+@/81<<:-0'/722180<'781'2F/:C
,755F'702:/47<:',-3'A18BH';61'2-'241'
37,2'2472'241<1'2D-',5-,9'I101<'782:,C
:/721':0',-./51.10278F'2870<,8:/2:-075M
2870<572:-075'7,2:>:2:1<'NG:I681'OPBB='Q1'
/81;:,2'2472'L.75E'1@/81<<:-0'D:55';:</57F'
/722180<'3'-<:,5572:-0'2472'781':0'
-//-<:21'/47<1'-3'A18B=
&'()*K')CG-<'D7<',4-<10'7<'7' /-<:2:>1'
,-028-5'?1,76<1':2',70'?1'62:5:R1;'7<'
7'?:-.78918'3-8',1556578'7,2:>:2FBSHOT='
U121,27?51'51>15<'3',CG-<'D-65;':0;:,721'
2472'241',155'D7<'I1018755F'817,2:>1'2-'
<281<<BB=')CG-<'75<-';:</57F<'7',:8,7;:70'
/722180'-3'7,2:>72:-0H'D:24'51>15<'?1:0I'
4:I41<2';68:0I'241'70:.75V<'D791',F,51='
G-8'24:<'817<-0H',CG-<'1@/81<<:-0':0'241'
4://-,7./6<'70;'7.FI;757'<4-65;';:</57F'
4:I418'51>15<'72'W#EX'2470'W#Y='(281<<'
D:55'75<-'/8-. /2'7'87/;:':0;6,2:-0'-3'
,CG-<=

```

Figure 3: Simplified model of the mammalian mo'

! "#\$% "&' ( ) \* + ! ) +

Z-4', -, &". ' \*?%ZVM=%O, 2\*%@( \$(%4'7'4(4%  
(7(-.5%' -2"%! "#\$%4'!! (\$(-2%. '812[4, \$A%  
rooms as described in supplementary figure  
F=%/" "4%, -4%@, 2(\$%@( \$(%, 7, '. .6.(%, 4%  
'6'2#3=%D!2(\$%, \$'\$7, .%, 2%21(%!, )'. '25?%  
\$, 2\*%@( \$(%8'7(-%:%@((A\*%2"%%, )). '3, 2'U(%  
2"%21(' \$%-(@%(-7'\$"-3(-2=%%01(%%, )). '3, <  
2'"-%&(\$'"4%!\*%7'2, .%!"\$%(-\*#\$'-8%21, 2%  
, -5%4'\*&. , 5(4%\*2\$(\*\*%(!!)2\*%, \$(%4#(%2"%  
21(%(9&(\$'3(-2, .%2\$(, 23(-2%\$, 21(\$%21, -%, %  
\$(, )2'"-%2"%%, %-"7(.%(-7'\$"-3(-2=%D-'3, .%  
@(\$(%(21'), . .5%2\$(, 2(4%, -4%21(' \$%#\*(%  
'-%21'\*%(9&(\$'3(-2%@, \*%, &&\$"7(4%65%21(%  
\- '7(\$\*'25%!"%G". "\$, 4"]\*%Z-\*2'2#2' "-, .%  
D-'3, .%G, \$(%, -4%\\*(%G"33'22((=

WXY

?60+#0@

D!2(\$%21(%:<@((A%, )). '3, 2'"-%&(\$'"4?%  
\$, 2\*%@( \$(%8'7(-%('21(\$%, 4\$(-. .)2"<  
3'(\*%KDQRM%"\$%) "-2\$". %K^PDCM%#\$8(\$'(\*=%  
B"21%2\$(, 23(-2%8\$"#&\*%\$(('7(4%6'. , 2(\$, .%  
&(\$'2"-(#3%'-)'\*'"-%"-%"\$4(\$%2"%%(9&"\*(%  
21(% , 4\$(-. .%8. , -4\*=%Z-%21(%DQR%8\$"#&?%  
\*#6\_()2\*]%, 4\$(-. .%8. , -4\*%@( \$(%. ") , 2(4%, -4%  
\$(3"7(4%#\*'-8%'-2(\*2'-. , %2'\*\*#(%!"\$)(&\*=%  
01(%^PDC%8\$"#&%!".. "@(4%21(%\*, 3(%&\$")(4#\$(%

**E** %

01(%\$( \*#.2\*%!"3%21(%DVHfD%,-,.5\*' \*%!"%  
(,)1%8(-(%@'21'-%(,)1%OHZ%,\$(%\*#33,\$'U(4%

DQR<sup>1</sup>k%1"@(7(\$?%21,2%2\$(-4%@,\*%-"2%4'\$( )2.5%  
"6\*(\$7(4=%01(\$(%@,\*%,%3,'-(!!()2%!"!%  
2'3(%'-%GDF?%GDL%, -4%BED=%01\*(%\$15213\*%  
,\$(%)"-\*'2(4%@'21%&&\$ (7'"#\*.5%&#6.'\*1(4%  
\$(\*,)\$)1%@'21%,4\$(-.%'2,)2%,-'3,.<sup>LT</sup>=

Although insignificant, there was a  
8(-(\$,.%2\$(-4%!"!%S0;%1,7'-8%1'81(\$%(9&\$(\*<  
\*' "-%21,-%SOFTk%1"@(7(\$?%21' \*%2\$(-4%@,\*%  
\$(7(\$\*(4%'-%\*1,3%,-'3,.%'-%GND=%01' \*%  
\$( \*#.2% ' \*%)"-\*'2(-2%@'21%"21(\$%(9&(\$' <  
3(-2\*%21,2%\*1"@%>(\$:%3OVD%, -4%>NO:%&\$"2('-%  
. (7(.%'4' \*%&. ,5%"&&"\*'2(%\$15213\*%21,-%  
BED%, -4%1' &&" ),3&#\*<sup>L'LT</sup>=%Z-2(\$(\*2'-8.5?%  
@(%!"#-4%21,2%21' \*%2'3(%!"4,5%4'!!(\$<  
(-)%1,4%21(%&&"\*'2(%&,22(\$-%'-%DQR%\$,2\*?%  
resulting in a significant time by adrenal  
\*2,2#\*%'2(\$,)2'"=-

/#2#\$(%2#4' (\*%\*1"#.4%(9,3'-(%21(%\$".(%  
4'!!(\$(-2%25&(\*%!"%2\$ (\*\*"\$\*%&. ,5%'-%>(\$:%  
(9&\$ (\*\*'"=-%0(\*2\$, '-2%\*2\$ (\*\*%, )2'7,2(\*%  
21(%P>D%,9' \*?%3,A'-8%'2%,%8"4%), -4' <  
4,2(%2%\*2#45%3'.4%\*2\$ (\*\*=%h1'.(%3'.4%  
\*2\$ (\*\*%4'4%-"2%,.2(\$%>(\$:%(9&\$ (\*\*'"-%?  
4'!!(\$(-2%\*2\$ (\*\*%3"4(.%3,5%5'(.4%4' \*'3<  
'.,\$%\$( \*#.2\*=%D%8"4%\*2,\$2'-8%&" '-2%@"#.4%  
6(%,-.5U'-8%&\$". -8(4%, -4%\$( &(,2(4%\*2\$ (\*\*%  
6( ),#\*(%21(\*(%)"-4'2'"-%\*1,7(%6((-%\*1"@-%  
2"%3"4#. ,2(%3,-5%&\$") (\*\*(%21,2%, \$(%#-4(\$%  
)' \$),4',-%)"-2\$".<sup>Li</sup>=%

BCDEF

%

%%^2\$ (\*\*%1,4%-"%(!!N)2%"-%BCDEF%(9&\$ (\*\*'"-%  
'-%1'&&" ),3&#\*%"\$%,3584,.,=%01(%\$( \*#.2\*%  
show a significant time of day effect in  
GDF%, -4%GDL%!"\$%>(\$:%@'21%(9&\$ (\*\*'"-%6('-%8%  
1'81(\$%,2%SOFT=%B3,.F%4' \*%&. ,5(4%1'81(\$%  
(9&\$ (\*\*'"-%,2%SO:%'-%6'21%!"!%21(\*(%6\$, '-%  
\$(8'"-%%,%@(.%.%,%BED=%01(%3".( )#.,\$%  
)".)A%3"4(.%\*#88(\*2\*%21,2%>(\$:%(9&\$(\*<



# EFFEC F C A B EAC AB DA CE FEED BE A A D AB A E F EE A C B E F F

C, 4 ' \* " - % ^ , - A " 7 ' 2 U

! " # \$ % & ' ( ) \* + \$ , - \* # . / # 0 1 2 \$ % 0 & 3 \$ - \$ ' & \* + # 0 \$ 1 # / # 4 \$ 5 & 0 \$ % 6 ' ' \$ 2 # . 2 7 \$ 1 ' # - , # \$ 8 ) , 2 \$ ( ( ( 4 " & \* & 0 , 9 & 6 0 \* - ' 4 / & 3

## AB AC

01(%j\$(,2%B,\$\$'(\$%O((!%'\*%,-%(92\$(3(.5% )'3&.(9%( )"\*5\*2(3?%1"3(%2"%3"\$(\$21,-%F?`aa% fsh species and countless other verte< 6\$,2(\*%,-4%'7(\$2(6\$,2(\*=%G#\$\$(-2.5?%,% 3,\*\*'7(%)"\$,.%6.(,)1'-8%(7(-2%'\*%)#\$\$'-8% K21(%!"#\$21%!"#21(\*(%7(-2%'\*'-)(%FidM?% @1')1%'\*%A'..'8%. '7(%)"\$,.,%.'7(\$%21(% \$((!=%G"\$,.%6.(,)1'-8%)"#\*\$%6(,)\*(%!"% 8."6.,%).'3,2(% )1,-8(%,-4%\*#6\*(g#(-2% \$\*' '-8%)"(,-%2(3&(\$,2#\$(=%01(%&#\$\$%\*" (% "!%21%'\*%2#45%@,%\*%2%"'-7(\*'2'8,2(%21(% g#(\*2'"-%!"#1"@%)\$,%%6.(,)1'-8%,!!()2\*% three sympatric butterflyfish species, *Chaetodon auriga*, *Chaetodon ocellicaudus*?% , -4%*Chaetodon plebeius*?%,2%P"\$\*( \*1"(%O((!% , -4%>.,!\$(5%Z\*.,-4%O((!?'%6"21%.) ,2(4%""!% 21(%)" , \*2%"!%E'U,\$4%Z\*.,-4?'%D#\*2\$,.' ,=% 01(%&\$'3,\$5%15&"21(\*' \*%\*2,2(\*%21,2%)"\$,.% bleaching has a negative effect on fsh ,6#-4,-)(%6(,)\*(%'2%4(\$(\*(%%21(% ,3#-2% of live coral for fsh to feed on and use , \*%\*1(.2(\$=%01(%\*" )"-4%15&"21(\*' \*%\*2,2(\*% that omnivorous fsh, or generalists, will 6(% ,6.(%2%"%#\*\$'7(%6(22(\$%'-%,%6.(,)1(4% environment than coralivorous fsh, or \*&( )' ,.'\*2\*=%/'\*1%,6#-4,-)(%,-4%6(1,7'"\$% 4,2,%%@(\$%)"..' )2(4%#\*' '-8%,%7' \*# ,.%6(.2% 2\$, -\*( )2%3(21"4%, -4%\*#6\*2\$,2(%)"3&"\* '2'"-% 4,2,%%@(\$%)"..' )2(4%#\*' '-8%,%.'-(%2\$, -\*( )2=% O(\*# .2%\*4'4%-2%) .( ,\$.5%\*#&&"\$2%('21(\$% 15&"21(\*' \*=%/" ) ,.%\* &( )' (\*%@(\$%"7(\$ ,.% 3"\$(\$ ,6#-4,-2%,2%>.,!\$(5%Z\*.,-4%O((!?'% @1')1%'\*1"@ (4%21(%3"\*2%) "\$ ,.%6.(,)1'-8?'%6#2% !" ) ,.%\* &( )' (\*%\* &(-2%3"\$(\$2'3(%!( (4'-8%,2%

P"\$\*( \*1"(%O((!%)3&,\$(4%2"%>.,!\$(5%Z\*.,-4% O((!=%Z-%,44'2'"-%?%L4\$-60)+-%K"3-'7"< \$"#\*%\* &( )' (\*M%@,%\*%6\*( \$7(4%#2'. 'U'-8%,% @'4(\$%7,\$'(25%!"%3')\$ "1,6'2,2\*%21,-%L4\$ ocellicaudus%,-4%L4\$1'#H#)6,%K)"\$,.'7"< \$"#\*%\* &( )' (\*M?'%6#2%L4\$-60)+-%@,%\*%-"2%3"\$(\$ ,6#-4,-2%21,-%21(%"21(\$%!" ) ,.%\* &( )' (\*% ,2% P"\$\*( \*1"(%O((!%K21(%3"\*2%6.(,)1(4%\*'2(M% ,% &\$(4')2(4=%D.21"#81%-%\*%2\$"-8%)"-)#\*' "-\*% were drawn from the findings of this study, 21(%4,2,% ,.%@%1#3,-\*%2"%6(22(\$%#-4(\$\*2,-4% 21(%6(1,7'"\$%!"%3-'7"\$(\$%,-4%)"\$,.' < 7"\$(\$%'-%1,6'2,2\*%6(' -8%"7(\$)"3(%65%) "\$ ,.% 6.(,)1'-8=%

## D C

01(%j\$(,2%B,\$\$'(\$%O((!%'\*%-"(%!"%21(% ,,\$8(\*2%,-4%3"\*2%) "3&.(9%( )"\*5\*2(3\*"-% the earth, housing more than 1,500 fsh \* &( )' (\*?'%!"\*2(\$'-8%,%) "3&.(9%6' "4'7(\$ <



B, \$\$'(\$%O((!?'!-%@1')1%21(%6'"4'7(\$\*'25%  
"!%21(%\$(!'%'&#&l(.4%65%21(%'-2(\$)"-<  
nected systems of fora and fauna working  
'-%)"3&.(9%8'7(<,-4<2,A(%\$(.,,2'"-\*1'&\*=%  
C,-5%!"%21(%\$(!'%'&#&\$#"#-4'-8%21(%'\*.,-4%  
,.\*%1,7(%6((-%,!!)()2(4%65%21(%)#\$\$(-2%  
)"\$,.%6.(,)1'-8%(7(-2=%D&&\$(''##\*#\*2#45%"-%  
21(%(!!)2\*%!"%)\$,.%6.(,)1'-8%"-%)"\$,.%  
habitats and associated fishes examined the  
6\$(,421%!"%&()('(%21,2%,\$(-8,2'7(.5%  
,!!)()2(4%65%)"\$,.%6.(,)1'-8%K>\$,2)1(22%(2%  
al., 2012). The research revealed that fish  
&()('(%21,2%4'\$)(2.5%!(4%"-%)"\$,.%,\$(%  
3"\*2%\*2\$"-8.5%,!!)()2(4%65%)"\$,.%6.(,)1'-8%  
, -4%4'(%!"!%"-%21(%8\$(,2(\*2%#36(\$\*?%6#2%  
even non-coralivorous fishes still depend  
"-%21(%)"\$,.%\*2\$#)2#\$(%!"\$%21(')\$%1,6'2,2%  
, -4%21#\*%21('\$%&"&#. ,2'"-%4()\$(,\*(%!"\$3%  
)"\$,.%6.(,)1'-8=%O(!%)"\*5\*2(3\*%,\$(%  
so tightly interconnected that all fish  
&()('(%,\$(%,!)()2(4%65%)'.3,2(%))1,-8(?%  
\$\*'-%8%")(-%2(3&(\$,2#\$(?%, -4%\*#6\*(g#(-2%  
)"\$,.%6.(,)1'-8%(7(-2\*%K>\$,2)1(22%(2%,.=?%  
:aF:M=%

There were two identified hypotheses  
\*#\$\$#"#-4'-8%21(%g#(\*2'"-%!"%1"@%)"\$,.%  
bleaching affects fish abundance and  
6(1,7'"\$=%>"\*\*'6.(%9&.,-,2'"-%\$\$(7".7(%  
,\$#"#-4%)"\$,.%\*%,%1,6'2,2%, -4%3,\_"\$%!"%4%  
\*"#\$(%)-%,%\$(!!%())\*5\*2(3=%01(%&\$'3,\$5%  
15%21(\*'%'\*2,2(\*%21,2%)"\$,.%6.(,)1'-8%1,\*%  
a negative effect on fish abundance because  
'2%4()\$(,\*(%21(%3#"#-2%!"%.'7(%)"\$,.%!"\$%  
fish to feed on and use as shelter. Three  
species of butterflyfish were examined in  
21'%'\*2#45J%*Chaetodon auriga*?%*Chaetodon*  
*ocellicaudus*?%, -4%*Chaetodon plebeius*=%Z2%  
'\*%&\$\$(4')2(4%21,2%,..%21\$((%&()('%"!%  
butterflyfish will be more abundant in reef  
1,6'2,2\*%21,2%,\$(% (\*\*%6.(,)1(4%21,-%'-%  
\$((!%1,6'2,2\*%21,2%,\$(%\*2\$"-8.5%6.(,)1(4=%  
In addition, it is predicted that fish  
!"#-4%'-%1'81.5%6.(,)1(4%,\$(%\*%@'..%6(%  
"6\*(%7(4%\*%'33'-8%3"\$(%!\$(g#(-2.5%21,-%  
)2'7(.5%(\$,2'-8?%, -4%7')(%7(\$\*,%!"\$%.(\*\*%  
6.(,)1(4%\*'2(\*=%D&&\$(''##\*#\*2#45%(9,3'-'-8%  
resource partitioning among butterflyfish  
&()('(%\$(7(.,(4%21,2%6'2(%\$2(%'%'%,%8"4%  
'-4'),2"\$%!"%!(4'-8%1,6'2%, -4%\*%'33'-8%  
'\*%,%8"4%'-4'),2"\$%!"%!"\$,%8'-8%KS(A(\$',%  
(2%,.=?%:aa:M=%Z2%'\*%,.\*%&\$\$(4')2(4%21,2%

/'8#\$(%F%4' \* & . , 5 \* % , %1'81(\$% "7(\$ , . . % , 6# - <  
dance of the three species on the reef fat  
) "3& , \$(4%2 "%21(% \$( (! % ) \$ ( \* 2% , 2%6 "21% \* ' 2 ( \* = %

WXY%  
%  
B# " - 8 ) & 0

H6 \* ( \$ 7 , 2 ' " - \* % @ ( \$ ( % \$ ( ) " \$ 4 ( 4 % ! " \$ % L : % L 4 \$  
- 6 0 ) + - ? % T % L 4 \$ 1 ' # H # ) 6 , ? % , - 4 % : L % L 4 \$ & / # ' ' ) D  
caudus = % / ' 8 # \$ ( % : , % 4 ' \* & . , 5 \* % 2 1 ( % & ( \$ ) ( - 2 , 8 ( %  
of time each fish was observed swimming  
4 # \$ ' - 8 % 2 1 ( % 2 1 \$ ( ( < % 3 ' - # 2 ( % " 6 \* ( \$ 7 , 2 ' " - %  
period. It shows that fish spent 6.7%  
8 \$ ( , 2 ( \$ % 2 ' 3 ( % \* @ ' 3 3 ' - 8 % , 2 % > , . ! \$ ( 5 % Z \* . , - 4 %  
O ( ! % 2 1 , - % , 2 % P " \$ \* ( \* 1 " ( % O ( ! ? % , - 4 % L 4 \$ - 6 0 ) + - %  
\* & ( - 2 % 2 1 ( % 3 " \* 2 % 2 ' 3 ( % \* @ ' 3 3 ' - 8 % " # 2 % " ! % , . . %  
2 1 ( % ! " ) , . % \* & ( ) ' ( \* = % / ' 8 # \$ ( % : 6 % 4 ' \* & . , 5 \* % 2 1 ( %  
percentage of time each fish was observed  
# 2 ' . ' U ' - 8 % \* 1 ( . 2 ( \$ % 4 # \$ ' - 8 % 2 1 ( % " 6 \* ( \$ 7 , <  
tion period. It illustrates that fish  
\* & ( - 2 % F i = : r % 3 " \$ ( % 2 ' 3 ( % # 2 ' . ' U ' - 8 % \* 1 ( . 2 ( \$ %  
, 2 % P " \$ \* ( \* 1 " ( % O ( ! % 2 1 , - % , 2 % > , . ! \$ ( 5 % Z \* . , - 4 %  
O ( ( 4 ? % , - 4 % L 4 \$ 1 ' # H # ) 6 , % # 2 ' . ' U ( 4 % \* 1 ( . 2 ( \$ % 2 1 ( %  
3 " \* 2 % " # 2 % " ! % , . . % 2 1 ( % ! " ) , . % \* & ( ) ' ( \* = % / ' 8 # \$ ( %  
2c shows the percentage of time each fish  
@ , \* % " 6 \* ( \$ 7 ( 4 % ! ( ( 4 ' - 8 % 4 # \$ ' - 8 % 2 1 ( % " 6 \* ( \$ <  
vation period. It illustrates that fish  
\* & ( - 2 % T = : r % 3 " \$ ( % 2 ' 3 ( % ! ( ( 4 ' - 8 % , 2 % P " \$ \* ( \* 1 " ( %  
O ( ! % 2 1 , - % , 2 % > , . ! \$ ( 5 % Z \* . , - 4 % O ( ! ? % , - 4 % L 4 \$  
ocellicaudus % \* & ( - 2 % 2 1 ( % 3 " \* 2 % 2 ' 3 ( % ! ( ( 4 ' - 8 %  
" # 2 % " ! % , . . % 2 1 ( % ! " ) , . % \* & ( ) ' ( \* = % / ' 8 # \$ ( % : 4 %  
displays the percentage of time each fish  
was observed interacting with other fish  
4 # \$ ' - 8 % 2 1 ( % " 6 \* ( \$ 7 , 2 ' " - % & ( \$ " 4 = % Z 2 % \* 1 " @ \* %  
that fish spent 27.3% more time interacting  
with other fish at Palfrey Island Reef  
2 1 , - % , 2 % P " \$ \* ( \* 1 " ( % O ( ! ? % , - 4 % L 4 \$ 1 ' # H # ) 6 , %  
' - 2 ( \$ , ) 2 ( 4 % 2 1 ( % 3 " \* 2 % " # 2 % " ! % , . . % 2 1 ( % ! " ) , . %  
\* & ( ) ' ( \* = %

5) + 6 0 # \$ = 4 \$ < # 0 / # \* 2 - + # \$ & % \$ 2 ) 3 # \$ L 4 \$ - 6 0 ) + - 7 \$ L 4 \$ 1 ' # D  
beius, and C. ocellicaudus were observed (a)  
swimming, (b) utilizing shelter, (c) feeding,  
and (d) interacting with other fish during the  
three-minute observation period at Horseshoe  
Reef and Palfrey Island Reef.

0 , 6 . ( \* % F % , - 4 % : % 4 ' \* & . , 5 % 2 1 ( % 3 ' ) \$ " 1 , 6 ' <

?6H,20-2#

/'8#\$(%L%4'\*&.,5\*%21(%7(\$,8(%&(\$)(-2%  
)"7(\$%!"%6(-21')%) "\$, .%, -4%#6\*2\$, 2(%  
"6\*(\$7(4%, ."-8%. '-(%2\$, -\*)2\*%, 2%P"\$\*( \*1" (%  
O(!%, -4%>, .!\$(5%Z\*., -4%O((!=%^"!2%) "\$, .%  
@, \*%3"\*2%, 6#-4, -2%, 2%P"\$\*( \*1" (%O(!?%  
@1(\$ (, \*%\$#66. (%@, \*%21(%&\$"3' -(-2%8\$"#-4<  
)"7(\$%, 2%>, .!\$(5%Z\*., -4%O((!=%D.21"#81%  
\*"!2%) "\$, .%@, \*%4"3' -, -2%"7(\$, . .%, 2%  
P"\$\*( \*1" (%O(!?%21(\$ (%@, \*%, %\*.'812.5%  
8\$(, 2(\$%, 3"#-2%!"%1, \$4%4(, 4%) "\$, .%21, -%  
\*"!2%) "\$, .% "-%21(%\$( (!%) \$( \*2%, 2%21' \*%\*' 2(=%

WXY

D%2"2, .%!"%;`L%1, \$4%) "\$, . \*%K::d%, 2%  
P"\$\*( \*1" (%O(!%, -4%::`%, 2%>, .!\$(5%Z\*., -4%  
O((!M%, -4%TL:;%\*"!2%) "\$, . \*%KLi`%, 2%  
P"\$\*( \*1" (%O(!%, -4%:Lb%, 2%>, .!\$(5%Z\*., -4%  
O((!M%@( \$(%6\*(\$7(4%, ."-8%21(%.'-(%2\$, -<  
\*)2\*=%ib=ar%!"%1, \$4%) "\$, .%K/'8#\$(%;, M%, -4%



CA A E D  
A D E E CE  
A D FFA E D  
ED E F A A

D. ( \_ , -4\$, % > (4\$, U ,

! "#\$%&' ( ) \* + \$ , \$ - \* \$ # . / # 0 1 2 \$ % 0 & 3 \$ - \$ ' & \* + # 0 \$ 1 ) # / # 4 \$ 5 & 0 \$ % 6 ' ' \$ 2 # . 2 7 \$ 1 ' # - , # \$ 8 ) , ) 2 \$ ( ( ( 4 " & \* & 0 , 9 & 6 0 \* - ' 4 / & 3

D-21\$"&"8(-')%).'3,2(%1,-8(%'\*%2\$, -\*<  
!"\$3'-8%21(%-,2#\$,.( -7'\$"-3(-2?%4'\$( )2.5%  
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. ,2'"-%, -4%&. ,)' -8%) "-\*'4(\$,6.(%\*2\$(\*\*%"-%  
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\*( )2"\$\*?%&\$'3,\$'.5%#6\*' \*2(-)(%!, \$3'-8?%  
&\$"3"2(%21(%)"-4'2'"-.,%\$ (. ,2'"-\*1'&%  
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2"%#-4(\$\*2, -4%1"@%!, \$3(\$\*%, 4\_#\*2%21('\$%  
!, \$3'-8%&\$, )2')(\*%@1(-%21(5%(-)"#-2(\$%  
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ship between the five types of capital,

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Adaptive Efficacy

The first outcome variable I looked at was Adaptive Efficacy. Adaptive Efficacy is defined as the farmer's confidence in his ability to manage his farm in the face of changing conditions. Adaptive efficacy increases a farmer's adaptive efficacy. On the other hand, perceived environmental threat decreases adaptive efficacy. Adaptive efficacy seems to have an influence.

As actual rainfall conflicts with expected rainfall, perceived environmental threat decreases adaptive efficacy. Adaptive efficacy increases a farmer's adaptive efficacy. On the other hand, perceived environmental threat decreases adaptive efficacy. Adaptive efficacy seems to have an influence.

Adaptive efficacy is defined as the farmer's confidence in his ability to manage his farm in the face of changing conditions. Adaptive efficacy increases a farmer's adaptive efficacy. On the other hand, perceived environmental threat decreases adaptive efficacy. Adaptive efficacy seems to have an influence.

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\*)', .%), &'2, .%\*((3%2"%6(%21(%., \$8(\*2%  
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 financial and social capital create buffers  
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 21(%\*1"\$2)"3'-8%, \*\*)' , 2(4%@"'21%2\$5'-8%  
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*Research Question 2: Capital and Sustainable Livelihood Outcomes*

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 on Machinery, Hired Help, Wealth 2





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\* , \$5=%O(\* , (\$)1%'-4' ) , 2(\*%21, 2%\$, 21(\$%21, -%  
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AB AC

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'3&"\$2,-2%!,)2"\$\*%2"%3'2'8,2(=%Z-%:aFT?%  
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'-%\$#\$, .%&., )(\*?%, -4%8, \$-((\$4%. '22.(%'-%#2%  
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filtered out responses from non-residents.  
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Figure 5. When participants' information was categorized by place of residence, it was clear that respondents to this survey typically resided in urban areas along the Front Range. Boulder, Denver, and Lakewood accounted for 48% of 2"#0#,1&\*,#,4\$F3&\*+,2\$2"#0#3-)\*)+\$0#,1&\*,#,7\$ a divern p oM M M

21(5%)#.#4%-2%6(%#\*(4%2"%(\*2'3,2(%,%2\$#(%  
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was too small to create valuable confidence  
'-2(\$7,.\*=%D. "-8%@'21%21'\*?%,%&"\$2'"-%"!%



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