J>; MEHB: IKCC?J ED

P>IJLK

GRKB .-¬.0) /--0 ± S>K@LRSBO

at the Morris J. Wosk Centre for Dialogue, Simon Fraser University

Followed by a community workshop on Vancouver Island, June 14–16, 2003

>asfplov @l j j fqqbb

M^qof`f^ D^ii^rdebo) Afob`qlo) @bkqob clo @l^pq^i Pqrafbp)
Pf j lk Co^pbo Rkfsbopfqv

Of`e^oa E^baof`e) ?flildv Abm^oq j bkq) J b j lof^i Rkfsbopfqv
lc Kb tclrkai^ka

Gbcc Erq`efkdp) ?flildv Abm^oq j bkq) A^ielrpfb Rkfsbopfqv

J f`e^bi J ^dbb) Po+ Moldo^ j Afob`qlo) Qfabp @^k^a^

@o^fd Loo) Bub`rqfsb Afob`qlo) T^qbopeba T^q`e P^i j lk
Pl`fbqv

?of^k Ofaabii) P`fbk`b >asfplo) M^`fª` Cfpebofbp Obplro`b
@lkpbos^qflk @lrk`fi

Prj j fq Pmlkplop

>qi^kqf` P^i j lk Cbabo^qflk

?@ >_lofdfk^i Cfpebofbp @l j j fppflk

?@ P^i j lk J ^ohbqfkd @lrk`fi

@bkqob clo @l^pq^i Pqrafbp) Pf j lk Co^pbo Rkfsbopfqv

Ab^k lc P`fbk`b) Pf j lk Co^pbo Rkfsbopfqv

Bksfolk j bkq @^k^a^

Cfpebofbp ^ka L`b^kp @^k^a^

J loofp G+ Tlph @bkqob clo Af^ildrb

KL>> %K^qflk^i L`b^kf` ^ka >q j lpmebof`
>a j fkfpqo^qflk&

M^`fª` Cfpebofbp Obplro`b @lkpbos^qflk @lrk`fi

Pfboo^ @ir_ lc ?@

Qfabp @^k^a^

RP Bksfolk j bkq^i Molqb`qflk >dbk`v

S^k`lrsbo >nr^ofr j

S^k`lrsbo Clrka^qflk) Ifsfkd Ofsbop Qorpq Crka

T^qbopeba T^q`e P^i j lk Pl`fbqv

Tfia P^i j lk @bkqbo

Tloia Tfiaifcb Crka

Pqrabkq ^ka KDL ?rop^ofbp molsfaba _v

BPP> Qb`eklildfbp) Iqa+

IDI Iqa+

@l j j rkfqv Tlohpelm lk S^k`lrsbo Fpi^ka Pmlkplop

L`b^kp J ^k^db j bkq Obpb^o`e Kbq t loh
%Ifkhfkd P`fbk`b tfqe Il`^i Hkl tibadb Klab&

M^`fª` P^i j lk Clrka^qflk

S^k`lrsbo Clrka^qflk) Ifsfkd Ofsbop Qorpq Crka

Qefp pr j j fq) m^oq lc qeb Pmb^hfkd clo qeb P^i j lk pbofbp
%t t t+pcr+`^,`pqrafbp,p`fbk`b,p^i j lk+eq j &) t fii bu^ j fkb qeb
`roobkq pq^qrp lc dil_^i ªpebofbp·) qeb ob`bkq `lii^mpb lc `l^pq^i
b`lpvpqb j p/ %b+d+ qeb Kloqe >qi^kqf` `la ªpebov& ^ka qeb

■ *Tuesday, June 10*

Thursday, June 12—Day 2

Asia Pacifc Hall

State of salmon stocks and habitat (continued)

Moderator: John Fraser, Chair, Pacifc Fisheries Resource Conservation Council

570-¬67-- ^ j
Pq^qb lc @^k^a^$p cobpe t^qbo apebp
John Post, Chair, Division of Ecology, Department of Biological Sciences, University of Calgary

67--¬670- ^ j
S^of^_fifqv fk p^i j lk ofsbo i^kap`^mbp7 c^`qlop ^ccb`qfkd obpqlo^qflk pqo^qbdfbp
Jack Stanford, Jessie Bierman Professor of Ecology and Director, Flathead Lake Biological Station, University of Montana

670-¬.-7-- ^ j Af^ildrb pbppflk

.-7--¬.-7.2 ^ j Obcobpe j bkq _ob^h

Potential threats to wild salmon and solutions

Moderator: Malcolm Windsor, Secretary, North Atlantic Salmon Conservation Organization

.-7.2¬.-712 ^ j
Kbq*Mbk p^i j lk c^o j fkd7 c^fifkd lk qt l colkqpÆ^k b`l* cllqm

■ *Friday, June 13—Day 3*

Asia Pacifc Hall

570-¬67-- ^ j
Pvklmpfp lc a^v q t l ^ka efdeifdeqfkd lc mlpqbop'
Terry Glavin, Marine Conservation Advisor, Sierra Club of BC

Solutions (continued)

Moderator: Fred Whoriskey, Vice President Research and Environment, Atlantic Salmon Federation

J ^k^db j bkq plirqflkp7 ^mmif`^qflk lc mob`^rqflk^ov mofk`fmib,^mmol^`e `^pb pqrav
67--¬670- ^ j
>k lsbosfb t lc qeb mob`^rqflk^ov ^mmol^`e fk ªpebofbp
Randall Peterman, Professor, School of Resource and Environmental Management, Simon Fraser University

670-¬.-7-- ^ j
>mmif`^qflk lc qeb mob`^rqflk^ov ^mmol^`e ql qeb `lkpbos^qflk lc tfia >qi^kqf` p^i j lk pql`hp
Malcolm Windsor, Secretary, North Atlantic Salmon Conservation Organization

.-7--¬.-70- ^ j Af^ildrb pbppflk

.-50-0-b-ð12@MOLQBQBPPQBQ!_ob^hA m ξM p pl " ¶ AMb v)k` qe ي] m7- ł ľ ق" Ʒ v p ґ Mqiiβ¼ ɜя v)qo ṣ w̄ zvi¾ mw

.-712¬..7.2 ^ j
Molqb`qba ^ob^p clo k^qfsb p^i j lk7 ^ pqo^qbdv clo molqb`qfkd
pSi)P pkfa C_O afO bopfqv ^`olpp qeb kloqebo] pL odplpla `! cbp " ˅ ˛ p ˅ ɜ˜ ˛ к aploi J

S)P5 p p` S N

klqbp

Abpmfqb fqp pq^qrp ^p ^ «^dpefm pmb`fbp) t fqe ^ ilq lc dlla

. .

j lkbv ^ka j lob mblmib pqravfkd ^ka t lohfkd lk qeb molib j
t lria klq obpriq fk j lob ªpe fk qeb ofsbop _rq qeb i^`h lc ^k

obi^qfsbiv il t clo j ^kv lc qeb p^ j b c^`qlop qe^q `^rpba qeb
lofdfk^i ab`ifkb+ Fk pmfqb lc qeb c^firob lc j lpq bccloqp ql obpqlob
orkp lc t fia p^i j lk) qeb mlif`v %^ka ibd^iiv j ^ka^qba& dl^i lc
obpqlofkd orkp lc t fia orkp ^mmb^op pqfii ql bkglv t fabpmob^a
mr_if` prmmloq+ ?fiiflkp lc alii^op `lkqfkrb ql _b pmbkq fk ^ pl*
c^o c^fiba ^qqb j mq ql obsbopb qeb ilkd*qbo j lsbo^ii ab`ifkb+ E l t
`^k fq _b qe^q qeb *direct* `^rpbp lc qeb ab`ifkb ^ob ob^plk^_iv t bii
hkl t k) e^sb _bbk pqrafba fk dob^q abq^fi) ^ka qeb mr_if` ^mmb^op
ql _b prmmloqfsb lc `e^kdfkd qeb al t k t ^oa qo^gb`qlov clo t fia
p^i j lk) vbq qeb ilkd*qbo j moldklpfp fp mllo clo @^ifclokf^)
Lobdlk) T^pefkdqlk) ^ka Fa^el< Qeb ^kp t bo fp qe^q bccb`qfkd
^kv `e^kdb fk qeb ilkd*qbo j al t k t ^oa qobka clo t fia p^i j lk
fp mol_^_iv crqfib fk qeb ^_pbk`b lc pr_pq^kqf^i pefcqp fk qeb
core aofsbop+ Bu`bmq clo `if j ^qb ^ka l`b^k `lkafqflkp) q t l `lob
aofsbop lsbo t ef`e pl`fbqv e^p j fkf j ^i `lkqoli) qeb lqebo `lob
aofsbop ^ob lkbp pl`fbqv *can* `lkqoli7 %.& qeb b`lkl j f` oribp lc
qeb d^ j b) bpmb`f^iiv qeb fkqbok^qflk^i ^ka al j bpqf` aofsb clo
b`lkl j f` bcª`fbk`v8 %/& qeb fk`ob^pfkd p`^o`fqv ^ka `l j mbqfqflk
clo hbv k^qro^i obplro`bp) bpmb`f^iiv clo efde nr^ifqv t ^qbo8 %0&
qeb o^mfaiv fk`ob^pfkd kr j _bop lc er j ^kp fk qeb obdflk ^ka qeb
obnrfob j bkq ql j bbq qebfo _^pf` kbbap8 ^ka %1& fkafsfar^i ^ka
`liib`qfsb ifcb pqvib `elf`bp ^ka moflofqfbp+ T fqelrq pr_pq^kqf^i
`e^kdbp fk qebpb clro) fkqboobi^qba `lob aofsbop) qeb pq^qrp lc
t fia p^i j lk qeolrde qefp `bkqrov t fii ifhbiv cliil t qeb t bii*
al`r j bkqba m^qe lc qeb m^pq .2- vb^op+ >k f j m^oqf^i ^ppbpp j bkq
lc `roobkq fkafsfar^i ^ka pl`fbq^i moflofqfbp) ^p obsb^iba _v ^`qr^i
`elf`bp ^ka _be^sflo ql a^qb) molsfabp ifqqib fkaf`^qflk qe^q qeb
mr_if` ^mmb^op t fiifkd j ^hb pm ц` ҽ ƙ ɔ ӟ` v t qe]` я ib`qfsb ifc) m! " q Î " " - ɔ ɔ ƙ ɔ ɔ˜ ƙ` v þ Ⅵ ц ᴀ Ⅵ

mobpbkqbo _fldo^mefbp ^ka ^_pqo^`qp

qeb Orppf^k C^o B^pq+ Qeb o^qflk^ib clo qefp molar`qflk e^p ^ipl s^ofba col j obmi^`b j bkq lc ªpe ilpq fk `l j j bo`f^i l`b^k e^osbpqp ql j fqfd^qflk ^ka obpqlo^qflk lc p^i j lk fk ^ob^p tebob buqbkpfsb e^_fq^q ^iqbo^qflk e^p obar`ba p^i j lkfa sf^_fifqv ^ka ^_rka^k`b+ Lsbo qeb vb^op) tb e^sb _b`l j b sbov pr``bppcri fk molar`fkd ^ `boq^fk qvmb lc molar`q col j p^i j lk e^q`ebofbp) _rq rkqfi ob`bkqiv tb e^sb pbial j nrbpqflkba qeb f j m^`qp qeb molar`qflk ^ka obib^pb lc e^q`ebov ªpe j ^v e^sb lk qebfo cobpe t^qbo ^ka j ^ofkb ^nr^qf` b`lpvpqb j p ^ka qeb prpq^fk^_fifqv lc tfia p^i j lk mlmri^qflkp+ Qefp q^ih tfii ^aaobpp qeb kbd^qfsb f j mif`^qflkp lc e^q`ebov*molar`ba p^i j lk qeolrde afp`rppflkp lc _flildf`^i f j m^`qp ^ka _flafsbopfqv) b`lildf`^i f j m^`qp ^ka `l j mbqfqfsb afpmi^`b j bkq) ªpe ^ka b`lpvpqb j eb^iqe) ^ka dbkbqf` f j m^`qp lc e^q`ebov ªpe ^p qeob^qp ql tfia mlmri^qflkp lc M^`fª` p^i j lk+

O^ka^ii J+ Mbqbo j ^k fp ^ Molcbpplo fk qeb P`elli lc Obplro`b ^ka Bksfolk j bkq^i J ^k^db j bkq ^q Pf j lk Co^pbo Rkfsbopfqv fk ?@+ Eb eliap ^ @^k^a^ Obpb^o`e @e^fo fk Cfpebofbp Ofph >ppbpp j bkq ^ka J ^k^db j bkq ^ka fp Afob`qlo lc qeb @llmbo^qfsb Obplro`b J ^k^db j bkq Fkpqfqrqb) ^ rkfq lk `^ j mrp qe^q c^`fifq^qbp `lii^_lo^qflk ^ j lkd rkfsbopfqv obpb^o`ebop) obplro`b j ^k^db j bkq ^dbk`fbp) ^ka fkarpqov+ Mbqbo j ^k$p obpb^o`e cl`rpbp lk nr^kqfq^qfsb j bqelap ql f j molsb qeb rkabopq^kafkd ^ka j ^k^db j bkq lc ªpe mlmri^qflkp) m^oqf`ri^oiv fk qeb mobpbk`b lc rk`boq^fkqfbp ^ka `lkpbos^qflk ofphp+ Efp obpb^o`e dolrm pmb`f^ifwbp fk absbilmfkd ^ka ^mmivfkd nr^kqfq^qfsb j bqelap ql f j molsb ªpebofbp j ^k^db j bkq+ Mbqbo j ^k e^p pbosba lk s^oflrp mlif`v ^asfplov dolrmp ^ka ebimba ql tofqb qeb .662 Rkfqba K^qflkp Clla ^ka >dof`riqrob Lod^kfw^qflk$p %C>L& *Precautionary Approach to Fisheries.*

Tb_pfqb7 t t t+ob j +pcr+`^,c^`riqv,mbqbo j ^k
Obpb^o`e7 t t t+ob j +pcr+`^,ªpedom

>k Lsbosfb t lc qeb Mob`^rqflk^ov >mmol^`e fk Cfpebofbp

O^ka^ii J+ Mbqbo j ^k) P`elli lc Obplro`b ^ka Bksfolk j bkq^i J ^k^db j bkq) Pf j lk Co^pbo Rkfsbopfqv) 5555 Rkfsbopfqv Aofsb) ?rok^_v) ?+@) S2> .P3+ B j ^fi7 o^ka^ii\mbqbo j ^k=pcr+`^

I^odb s^of^_fifqv) j b^prob j bkq boolo) ^ka lqebo rk`boq^fkqfbp fk ªpebofbp pvpqb j p e^sb kb`bppfq^qba qeb absbilm j bkq lc `^rqflrp ^mmol^`ebp ql qeb bumilfq^qflk) bke^k`b j bkq) ^ka j ^k^db j bkq lc ªpebofbp+ Clo fkpq^k`b) qeb ¦mob`^rqflk^ov mofk`fmib´ ^ka ¦mob`^rqflk^ov ^mmol^`e´ ^ob abpfdkba ql ab^i tfqe rk`boq^fkqfbp ^ka qeb obpriqfkd ofphp _v dfsfkd qlm moflofqv ql j ^fkq^fkfkd _flildf`^i molar`qfsfqv+ @lkqo^ov ql mlmri^o rp^db) qeb ¦mob`^rqflk^ov mofk`fmib´ ^ka ¦mob`^rqflk^ov ^mmol^`e´ ^ob klq pvklkv j lrp) ^ka qefp lcqbk `ob^qbp rkkb`bpp^ov ab_^qb+ Qeb ¦mob`^rqflk^ov mofk`fmib´ dbkbo^iiv f j mifbp qe^q pl j blkb e^p ^ppr j ba qeb tlopq*`^pb p`bk^ofl ^_lrq qeb b`lildf`^i obpmlkpb ql er j ^k afpqro_^k`b) tebob^p qeb ¦mob`^rqflk^ov ^mmol^`e´ ob«b`qp ^ o^kdb lc lkiv j labo^qbiv mbppf j fpqf` bccb`qp lc er j ^k ^`qfsfqfbp lk qeb ^nr^qf` pvpqb j +F j mib j bkq^qflk lc ^ mob`^rqflk^ov ^mmol^`e `^k fkslisb `ellpfkd ^mmolmof^qb obdri^qflkp ^ j lkd ^ o^kdb lc mlppf_ib abdobbp lc obpqof`qflkp lk e^osbpqfkd lo lqebo ^`qfsfqfbp+ Pr`e `elf`bp `^k _b fkclo j ba _v ofph ^ppbpp j bkqp ^ka lqebo nr^kqfq^qfsb ^k^ivpbp qe^q q^hb ^ o^kdb lc evmlqebpbp fkql ^``lrkq ql ob«b`q hbv rk`boq^fkqfbp) bpmb`f^iiv qelpb ob«b`qfkd _ol^a b`lildf`^i fkqbo^`qflkp+ Mob`^rqflk^ov ^mmol^`ebp ^ob ^ipl obibs^kq ql qeb ªpefkd fkarpqov$p dl^i lc j ^fkq^fkfkd b`lkl j f`^iiv sf^_ib ªpebofbp+ Fk pl j b `^pbp) `boqfª`^qflk lc ªpebofbp molsfabp fk`bkqfsbp ql _lqe fkarpqov ^ka j ^k^db j bkq ql j ^fkq^fk ^ka f j molsb _flildf`^i molar`qfsfqv+ Mob`^rqflk^ov ^mmol^`ebp e^sb _bbk ^almqba fk kr j bolrp ªpebofbp tloia tfab ^ka ^ob fk`iraba fk drfafkd mofk`fmibp lc pbsbo^i k^qflk^i mlif`fbp ^ka fkqbok^qflk^i ^dobb j bkqp+

Glek Mfbo`b fp qeb Ab^k lc >oqp ^q Pf j lk Co^pbo Rkfsbopfqv+ Eb fp ^ipl mofk`fm^i fksbpqfd^qlo fk qeb Mol j lqfkd @l j j rkfqv B`lkl j f` Absbilm j bkq clo Clobpq*?^pba `l j j rkfqfbp obpb^o`e molgb`q _bfkd crkaba _v Clobpq Obkbt^i ?@) ^ka qeb `l* fksbpqfd^qlo fk qeb `lii^_lo^qfsb pl`f^i P`fbk`bp ^ka Erj ^kfqfbp Obpb^o`e @lrk`fi crkaba molgb`q) qeb Dblodf^ ?^pfk Crqrobp Molgb`q _^pba ^q qeb Rkfsbopfqv lc ?ofqfpe @lir j f_^+ Moflo ql _b`l j fkd qeb Ab^k lc >oqp) Ao+ Mfbo`b t^p qeb Afob`qlo lc qeb `l j j rkfqv B`lkl j f` Absbilm j bkq @bkqob ^ka @e^fo lc qeb Abm^oq j bkq lc Dbldo^mev ^q Pf j lk Co^pbo Rkfsbopfqv+ Eb fp ^ ib^afkd p`eli^o fk prpq^fk^_ib i^ka rpb) clla obplro`b ^ka `l j j rkfqv `e^kdb+

Glek Mlpq fp Molcbpplo ^ka @e^fo lc qeb Afsfpflk lc B`lildv fk qeb Abm^oq j bkq lc ?flildf`^i P`fbk`bp ^q qeb Rkfsbopfqv lc @^id^ov+ Efp obpb^o`e moldo^ j cl`rpbp lk ob`orfq j bkq avk^ j f`p lc cobpe t^qbo ªpebp) `if j ^qb f j m^`qp lk kloqebok ªpebp ^ka qeb absbilm j bkq lc nr^kqfq^qfsb qllip clo j ^k^db j bkq mlif`v ^ppbpp j bkq lc ob`ob^qflk^i ªpebofbp+

@^k^a^$p Ob`ob^qflk^i Cfpebofbp7 qeb Fksfpf_ib @lii^mpb

Glek O+ Mlpq) Afsfpflk lc B`lildv) Abm^oq j bkq lc ?flildf`^i P`fbk`bp) Rkfsbopfqv lc (@^id^ov) @^id^ov) >i_boq^ Q/K .K1+ B j ^fi7 gomlpq=r`^id^ov+`^

Cfpefkd clo ob`ob^qflk fp ^ mlmri^o ^`qfsfqv fk j ^kv m^oqp lc qeb tloia ^ka qefp ^`qfsfqv e^p iba ql qeb absbilm j bkq lc ^ pb`qlo lc pr_pq^kqf^i pl`f^i ^ka b`lkl j f` s^irb tloia tfab+ Qeb j ^fkqbk^k`b lc qefp pb`qlo abmbkap lk qeb ^_fifqv lc ^nr^qf` b`lpvpqb j p ql j ^fkq^fk ªpebov e^osbpq+ Tb ^ob `roobkqiv tfqkbppfkd qeb `lii^mpb lc j ^kv `l j j bo`f^i j ^ofkb ªpebofbp arb ql lsbo bumilfq^qflk+ Ob`ob^qflk^i ªpebofbp ^ob qvmf`^iiv sfb tba ^p afccbobkq col j `l j j bo`f^i ªpebofbp fk qe^q qebv ^ob pbic*prpq^fkfkd ^ka klq `lkqoliiba _v qeb pl`f^i ^ka b`lkl j f` clo`bp lc qeb lmbk j ^ohbq qe^q e^sb aofsbk j ^kv `l j j bo`f^i ªpebofbp ql `lii^mpb+ Ebob Fobgb`q qeb sfb t qe^q ob`ob^qflk^i ^ka `l j j bo`f^i ªpebofbp ^ob fkebobkqiv afccbobkq) ^ka ab j lkpqo^qb pbsbo^i j b`e^kfp j p qe^q `^k ^ka fkabba pelria ib^a ql `lii^mpb fk ob`ob^qflk^i ªpebofbp+ A^q^ col j clro efde molªib @^k^af^k

.3

^ppbpp j bkq ^ka prpq^fk^_ib j ^k^db j bkq+ Eb _bifbsbp qeb eb^oq lc ªpebofbp fp el t ql j ^k^db e^osbpq7 ¦Qeb j ^fk qeorpq lc j v obpb^o`e fp ql ªdrob lrq el t ql abpfdk j ^k^db j bkq pvpqb j p qe^q ^ob ol_rpq fk ^k ^ob^ lc ob^iiv efde rk`boq^fkqv+´

@^k B`lpvpqb j *?^pba J^k^db j bkq P^sb qeb A^v<

@^oi T^iqbop) Cfpebofbp @bkqob) Rkfsbopfqv lc ?ofqfpe @lir j _f^) //-1 J ^fk J ^ii) S^k`lrsbo) ?@) S3Q .W1+
B j ^fi7 `+ t ^iqbop=ªpebofbp+r_`+`^

Fk qeb i^pq cb t vb^op qebob e^p _bbk ^ pmb`q^`ri^o f j molsb j bkq fk lro rkabopq^kafkd lc qolmef` ifkh^dbp fk j ^ofkb b`lpvpqb j p) qe^khp m^oqiv ql qeb b j bodbk`b lc f j molsba j labip clo qolmef` ifkh^dbp _^pba lk clo^dfkd ^obk^ qeblov+ Qebpb j labip kl t ^iil t rp ql qo^`b qeb f j m^`qp lc `l j mibu qolmef` ifkh^dbp ^ka e^_fq^q abmbkabk`fbp lk c^`qlop pr`e ^p krqofbkq rm t biifkd) ^ka `lria fk mofk`fmib molsfab qeb _^pfp clo j r`e j lob fkclo j ba ^k^ivpfp lc b`lpvpqb j *p`^ib qo^ablccp fk ªpebofbp j ^k^db j bkq+ Rkcloqrk^qbiv) qebpb j labip t fii mol_^_iv kbsbo _b rpba) _b`^rpb qebv t fii _b pbbk ^p qeob^qp _v ^k ^ploq j bkq lc sbpqba fkqbobpqp fk ªpebofbp j ^k^db j bkq fkpqfqrqflkp+ Qeb j labip rkfclo j iv mobaf`q qe^q j r`e lc qeb mr_if` fksbpq j bkq fk p^sfkd p^i j lk e^p _bbk j fpmi^``ba) fkbccb`qfsb) lo bsbk ^`qfsbiv a^kdbolrp ql ilkd* qbo j prpq^fk^_fifqv+

Obd T^qplk fp ^ pbkflo obpb^o`e cbiil t ^q qeb Cfpebofbp @bkqob ^q qeb Rkfsbopfqv lc ?ofqfpe @lir j _f^+ Ao+ T^qplk e^p bumboqfpb fk ^ o^kdb lc ªpebofbp ^ob^p fk`irafkd mbk^bfa _flildv) qo^ t i ªpebofbp) pql`h ^ppbpp j bkq ^ka `l j mrqbo j labifkd+ Eb e^p mr_ifpeba buqbkpfsbiv lk qeb pf j ri^qflk ^ka lmqf j fw^qflk lc qo^ t i ªpebofbp) ^ka lk _f^p fk rkabo t ^qbo sfpr^i `bkprp+ Fk ^aafqflk ql p`fbkqfª` glrok^ip) efp t loh lk dil_^i ªpebofbp e^p ob`bkqiv _bbk mr_ifpeba fk *Nature, La Recherché, National Geographic,* ^ka t fii pllk ^mmb^o fk *Scientific American*+ >k bumbofbk`ba b`lildf`^i j labibo) eb t ^p ^ mofk`fm^i obpb^o`ebo fk ^ pqrav lc qeb f j m^`qp lc j ^ofkb molqb`qba ^ob^p ^ka ^oqfª`f^i obbcp fk E lkd Hlkd+ Eb iba ^ qb^ j qe^q absbilmba k^qflk^i j ^ofkb _flafsbopfqv mlif`v clo Fkalkbpf^+ Eb e^p 0- vb^op lc bumbofbk`b t lohfkd fkqbok^qflk^iiv fk ªpebofbp ^ka b`lildv molgb`qp+ Ao+ T^qplk fp `roobkqiv fkslisba t fqe qeb ^`nrfpfqflk) j ^k^db j bkq) ^k^ivpfp ^ka sfpr^ifw^qflk lc dil_^i ªpebofbp a^q^ t fqe qeb]Pb^ >olrka Rp$ molgb`q+

Pq^qb lc qeb T loia$p Cfpebofbp

Obd T^qplk) Cfpebofbp @bkqob) Rkfsbopfqv lc ?ofqfpe @lir j _f^) //-1 J ^fk J ^ii) S^k`lrsbo) ?@) S3Q .W1+
B j ^fi7 o+ t ^qplk=ªpebofbp+r_`+`^

Ob`bkqiv t b e^sb ªk^iiv _bbk ^_ib ql mrq fkql cl`rp qeb `e^kdbp

obpqof`qba _olla pql`h lofdfkp ^ob `^obcriiv obdri^qba qeolrde
pq^qb tfab dbkbqf` ^ka m^qelildv mlif`fbp ^ka pq^qrqbp+ Qeb pq^qb$p
00 molar`qflk e^q`ebofbp ^ob j lpqiv il`^qba lk klk*^k^aol j lrp

Lp`fii^qflk fkabu& l``ro ^q pf j fi^oiv i^odb pm^qf^i p`^ibp ^ka ^ob `loobi^qba tfqe `e^kdbp fk ^ m^o^ j bqbop+ ?lqe abkpfqv*abmbkabkq b`lildf`^i fkqbo^`qflkp ^ka `e^kdfkd bksfolk j bkq^i `lkafqflkp j ^v qebobclob bumi^fk klk*pq^qflk^ofqv lc P>@O m^o^ j bqbop+

Cb^pf_fifqv lc Obfkqolar`fkd Pl`hbvb ^ka Lqebo Pmb`fbp lc M^`fª` P^i j lk fk qeb @lnrfqi^ j Obpboslfo) ?@ D^_lrov) J ^o`) Cfpebofbp ?flildfpq) IDI If j fqba) Bksfolk j bkq^i Obpb^o`e >ppl`f^qbp) 6435 Pb`lka Pqobbq) Pfakbv) ?@) S5I 0V5+ Qbi+ /2-*323*-./4+
B j ^fi7 j d^_lrov=idi+`l j

@lkpqor`qflk lc qeb 0- j bqob efde @lnrfqi^ j I^hb a^ j fk .6.1 bccb`qfsbiv _il`hba m^pp^db lc ^k^aol j lrp p^i j lk+ > cb^pf_fifqv ^ppbpp j bkq pmlkploba _v ?@ Evaol§p ?ofadb*@l^pq^i Obpqlo^qflk Moldo^ j clrka kl pboflrp f j mbaf j bkqp ql qeb obfkqolar`qflk lc pl`hbvb) `lel) pqbbieb^a ^ka ^k^aol j lrp `rqqeol^q ql qeb @lnrfqi^ j I^hb obpboslfo+ Elt bsbo) ^ kr j _bo lc _^pbifkb obpb^o`e pqrafbp tfii _b obnrfoba ql `lkªo j qeb ^ppr j mqflkp lc qeb cb^pf_fifqv ^ppbpp j bkq+ Ob*fkqolar`qflk lc

^ka P j fqe Fkibq pl`hbvb p^i j lk ob`lsbov mi^kkfkd ^ka abq^fi qeb drfabifkbp cliil tba ^ka j bqelap rpba ql mobpbosb _fl*afsbopfqv ^ka j fkf j fwb f j m^`qp lk qeb ob j ^fkfkd tfia ªpe+ Qeb pb`lka `^pb pqrav tfii obsfb t qeb fkslisb j bkq lc Nrfkp^ j E^q`ebov tfqe @^ j m_bii Ofsbo `efkllh tebob ^ s^ofbqv lc qb`ekfnrbp qe^q _ibkaba e^_fq^q obpqlo^qflk) ªpe `riqrob ^ka t^qbo rpb mi^kkfkd e^sb obpriqba fk pr``bppcri ob_rfiafkd lc qefp pql`h+

Errª^v*^eq Cfopq K^qflk %ECK& Bke^k`b j bkq ^ka T^qbopeba Obpqlo^qflk Bcc loqp

L`e j ^k) Pqbc^k) E r r*^v*^eq Cfopq K^qflk Cfpebofbp J ^k^dbo ?lu 4-) ?^ j ªbia) ?@) S-O . ?-+
B j ^fi7 pqbc^kl = fpi^ka+kbq

Qefoqv*ªsb ofsbop ^ka pqob^ j p ork fk qeb qo^afqflk^i qboofqlov lc qeb ECK lk qeb `bkqo^i tbpq `l^pq lc S^k`lrsbo Fpi^ka %?^ j ªbia&+ I lddfkd ibcq ifqqib lo kl ofm^of^k _rccbo ^ilkd j lpq lc qeb ªpe _b^ofkd mloqflkp lc qeb pqob^ j + Qefp obpriqba fk `e^kkbi tfabkfkd) `e^kkbi,_^kh fkpq^_fifqv) fkªiifkd lc mllip) obar`ba proc^`b «l t) ^ka ilpp lc t lla+ Lqebo c^`qlop `lkqof_rqfkd ql qeb ab`ifkb lc p^i j lk pql`hp fk`irab lsbo*ªpefkd) fk`ob^pba moba^qflk fk Bi Kfkl vb^op) dil_^i t^o j fkd bq`+ Col j .664 ql /--.) lsbo !5--)--- t^p fksbpqba %CO?@ crkafkd& fk obpqlo^qflk molgb`qp %lsbo .-- I T A pqor`qrobp) / pfab `e^kkbip) ªpe i^aabop) bq`+& fk qeb P^ofq^ ^ka Hi^k^ t^ t^qbopebap+ Fk /--/) arb ql _lqe cbabo^i ^ka molsfk`f^i dlsbok j bkq crkafkd `rqp) kl crkafkd t^p j ^ab ^s^fi^_ib clo t^qbopeba obpqlo^qflk molgb`qp+ Kbsboqebibpp) qebob fp ^q ib^pq !.+2 j fiiflk t loqe lc t^qbopeba obpqlo^qflk t loh ibcq ql `l j mibqb fk qeb P^ofq^ Ofsbo) qeb p^ j b ^ j lrkq fk qeb Hi^k^ t^ ^ka !. j fiiflk fk ^ii lqebo ofsbop ^ka pqob^ j p+

Fk `lii^_lo^qflk tfqe ACLp Kfqfk^q E^q`e]b ɔ є &

Molqb`qfkd qeb Mr_if`$p Fkqbobpq fk qeb @lkpbos^qflk lc Tfia P^i j lk fk ?ofqfpe @lir j _f^Æ> Pqo^qbdv clo qeb @lkpbos^qflk lc M^`fª` P^i j lk

Pv j fkdqlk) Hbfqe %mobpbkqbo& ^ka Di^sfk) Qboov) Pfboo^ @ir_ lc @^k^a^) ?@ @e^mqbo+
B j ^fi7 Hbfqe = pfboo^`ir__`+lod

Abpmfqb vb^op lc ^qqb j mqp) qeb cbabo^i dlsbok j bkq ob j ^fkp t fqe l rq ^ `ib^oiv*^oqf`ri^qba mlif`v obd^oafkd qeb `lkpbos^qflk lc t fia p^i j lk fk ?ofqfpe @lir j _f^+ Fk obpmlkpb ql qefp `lkqfkrfkd mlif`v s^`rr j ) qeb Pfboo^ @ir_ lc @^k^a^) ?@ @e^mqbo) fk `lkpriq^qflk t fqe pbsbo^i pbkflo Cfpebofbp ^ka L`b^kp p`fbkqfpqp ^ka hbv fkabmbkabkq p^i j lk _flildfpqp lk @^k^a^$p t bpq `l^pq) _bd^k absbilmfkd ^ _ol^a mlif`v co^ j b t loh clo qeb `lkpbos^qflk lc M^`fª` p^i j lk+

Qeb obpriq t ^p qeb obmloq) ¦Molqb`qfkd qeb Mr_if` Fkqbobpq fk qeb @lkpbos^qflk lc P^i j lk fk ?ofqfpe @lir j _f^7 > Pqo^qbdv clo qeb @lkpbos^qflk lc M^`fª` P^i j lk+Ğ ӟ ̣ ʌ ! meb ɥ ẅ k+bmkqfk ¦Mo Ł ̏Ω " b^ @ir_ lc @^k^a^)

ml pqbo ^_pqo^`qp

F j m^`q lc Al j bpqf`^qflk lk Dol t qe ^ka ?be^sflro lc @lel P^i j lk %Lk`loevk`erp hfprq`e&

**S^kabopqbbk Qv j `erh) T+ B+** %mobpbkqbo&) Abm^oq j bkq lc Wl lildv) Rkfsbopfqv lc ?ofqfpe @lir j _f^) S^k`lrsbo) ?@) S3Q .W1+ Qbi+ 3-1+333+15-/+ C^u 3-1+333+15-2+
B j ^fi7 qv j `erh=wllildv+r_`+`^

@+ ?f^df) Abm^oq j bkq lc Cfpebofbp ^ka L`b^kp) Tbpq S^k`lrsbo I^_lo^qlov) 1.3- J ^ofkb Aofsb) Tbpq S^k`lrsbo) ?@) S4S .K3+ Qbi+ 3-1+333+5664+ C^u+ 3-1+333+15-2+
B j ^fi7 _f^df`=m^`+acl* j ml+d`+`^

O+B+ T fqeibo) Abm^oq j bkq lc Cfpebofbp ^ka L`b^kp) M^`fª` ?flildf`^i Pq^qflk) 0.6- E^ j j lka ?^v Ol^a) K^k^f j l) ?@) S6Q 3K4+ Qbi+ /2-+423+4.15+ C^u+ /2-+423+4-20+
B j ^fi7 tfqeiboo=m^`+acl* j ml+d`+`^

O+ E+ Absifk) Abm^oq j bkq lc Cfpebofbp ^ka L`b^kp) Tbpq S^k`lrsbo I^_lo^qlov) 1.3- J ^ofkb Aofsb) Tbpq S^k`lrsbo) ?@) S4S .K3+ Qbi+ 3-1+333+46/3+ C^u+ 3-1+333+0164+
B j ^fi7 absifko=m^`+acl* j ml+d`+`^

Pbsbo^i `lel p^i j lk `olppbp tbob ob^oba ql bke^k`b `roobkq rkabopq^kafkd lc el t dbkbqf` s^of^_fifqv obi^qbp ql _be^sflro^i ^ka mevpflildf`^i afccbobk`bp _bq tbbk pil t*dol tfkd ^ka c^pq* dol tfkd pqo^fkp lc ªpe+ @olppbp o^kdfkd col j mrob al j bpqf` ql mrob tfia tbob ob^oba ^p el j ldbklrp dolrmp %^ pfkdib c^ j fiv mbo dolrm& ^ka ^p clro ebqboldbklrp dolrmp %.2 ªpe col j b^`e c^ j fiv&+ Qtl ebqboldbklrp dolrmp tbob ob^oba rkabo `riqrob `lkafqflkp ^ka tbob cba ql p^qf^qflk) ^ka qtl tbob ob^oba rkabo pb j f*k^qro^i `lkafqflkp tfqe ^k bkof`eba bksfolk j bkq ^ka if j fqba clla obplro`bp+ >cqbo pfu j lkqep lc dol tqe) qeb j b^k pfwb lc qeb `olppbp fk`ob^pba tfqe ^k fk`ob^pb fk qeb molmloqflk lc al j bpqf` dbkbp fk qeb dbklqvmb+ Qeb al j bpqf` dbklqvmb molar`ba bsbk i^odbo ªpe fk qeb ebqboldbklrp dolrm rkabo `riqrob `lkafqflkp) el tbsbo qeb obi^qfsb afccbobk`bp _bq tbbk al j bpqf` ^ka tfia ªpe tbob obar`ba fk qeb ebqboldbklrp dolrmp dol tk rkabo pb j f*k^qro^i `lkafqflkp+ Mobif j fk^ov pqrafbp fkaf`^qb qe^q ^kqf*moba^qlo _be^sflro fp obar`ba tfqe ^k fk`ob^pb fk al j bpqf` `lkqof_rqflk ql qeb dbklqvmb+ L``roobk`b lc ?HA tfqefk qeb mob*p j liq ªpe ab j lkpqo^qba qe^q qeb al j bpqf` ªpe tbob j lob prp`bmqf_ib ql j loq^ifqv col j qefp afpb^pb+

> P^ j mib lc Obmloqp col j qeb