DECISION ANALYSIS FOR COOK INLET BELUGA

Notes for meeting

September 25-26, 2003

ELEMENTARY FACTS

1. Population is small (<500)
2. Population has been censused since 1994
3. Population heavily harvested 1994-1998
4. Almost no reported harvest 1999-present
5. No obvious population trend since 1999
6. Historic population size very uncertain
7. Density dependence parameters unknown

COOK INLET BELUGA DECISION CONTEXT

	Present basis	?other basis?
STATUS:	N too small	Thresholds for N?
TREND:	Uncertain	Increase/Decrease?
MANAGEMENT:	Legal harvest	Other factors?

MANAGEMENT GOALS

ALJ hearing: Not delay recovery too much

MMPA and stipulations: Assure recovery

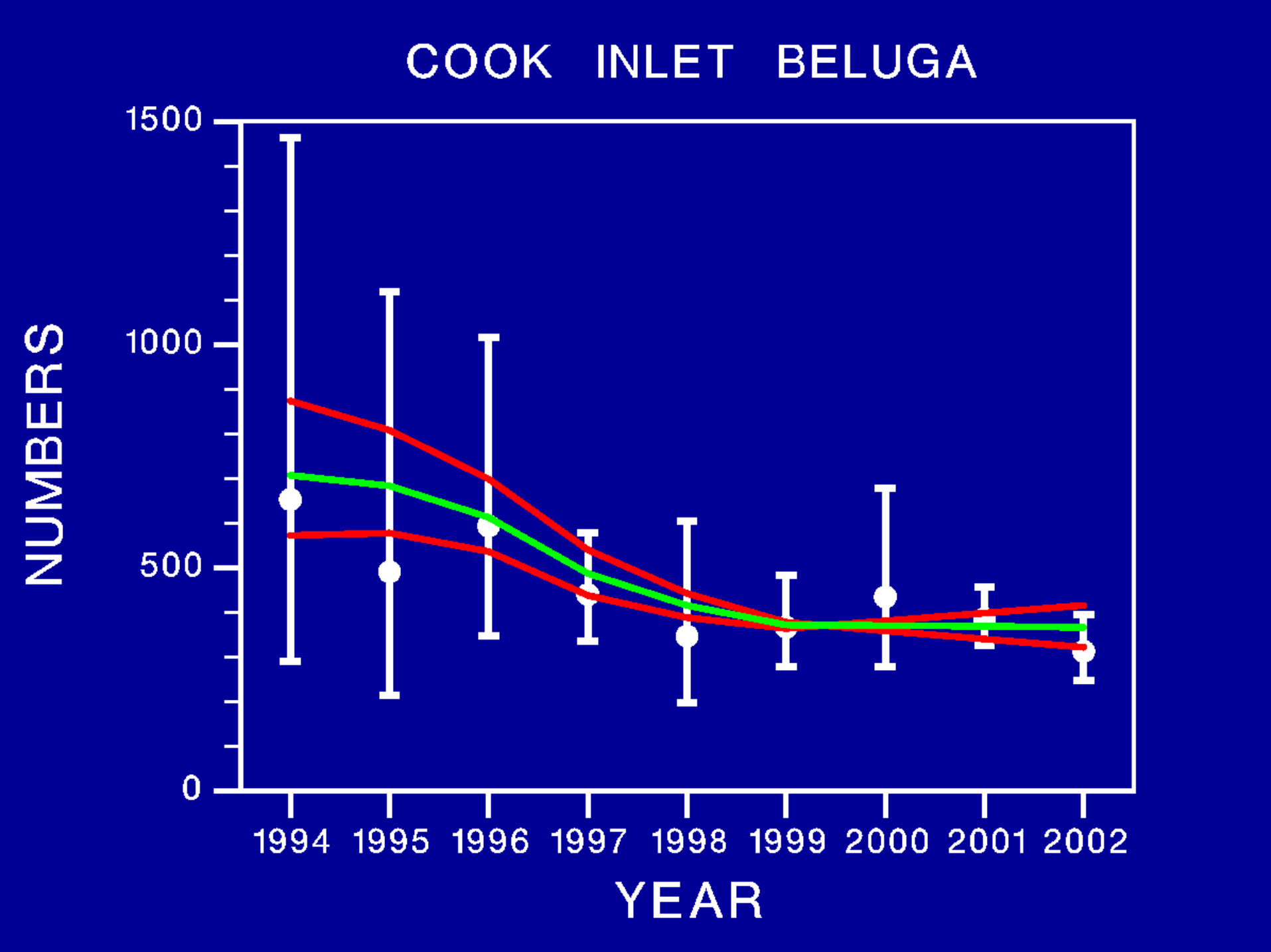
Implicit PBR: Not allow status to deteriorate

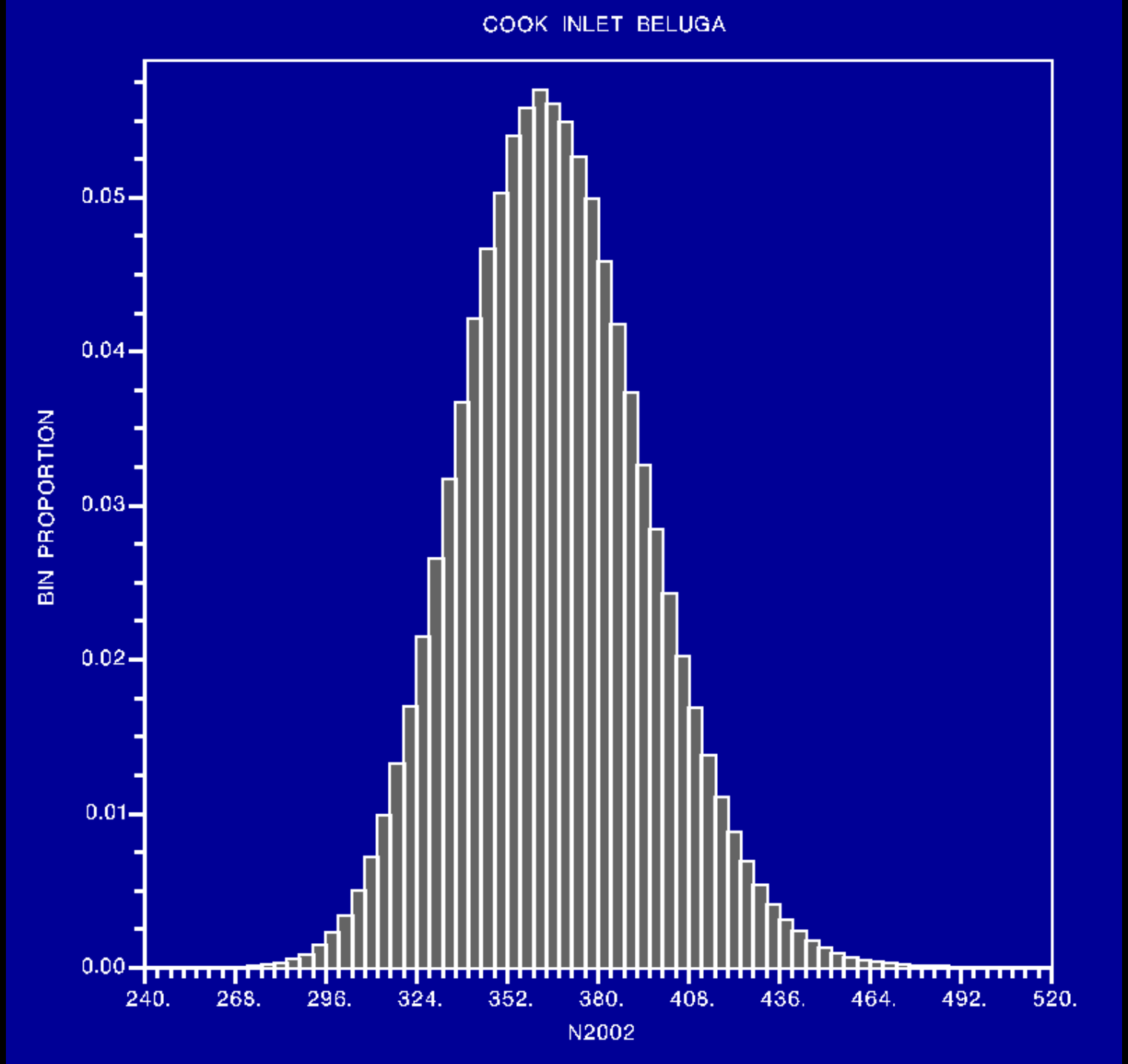
GROWTH PARAMETERS UNKNOWN

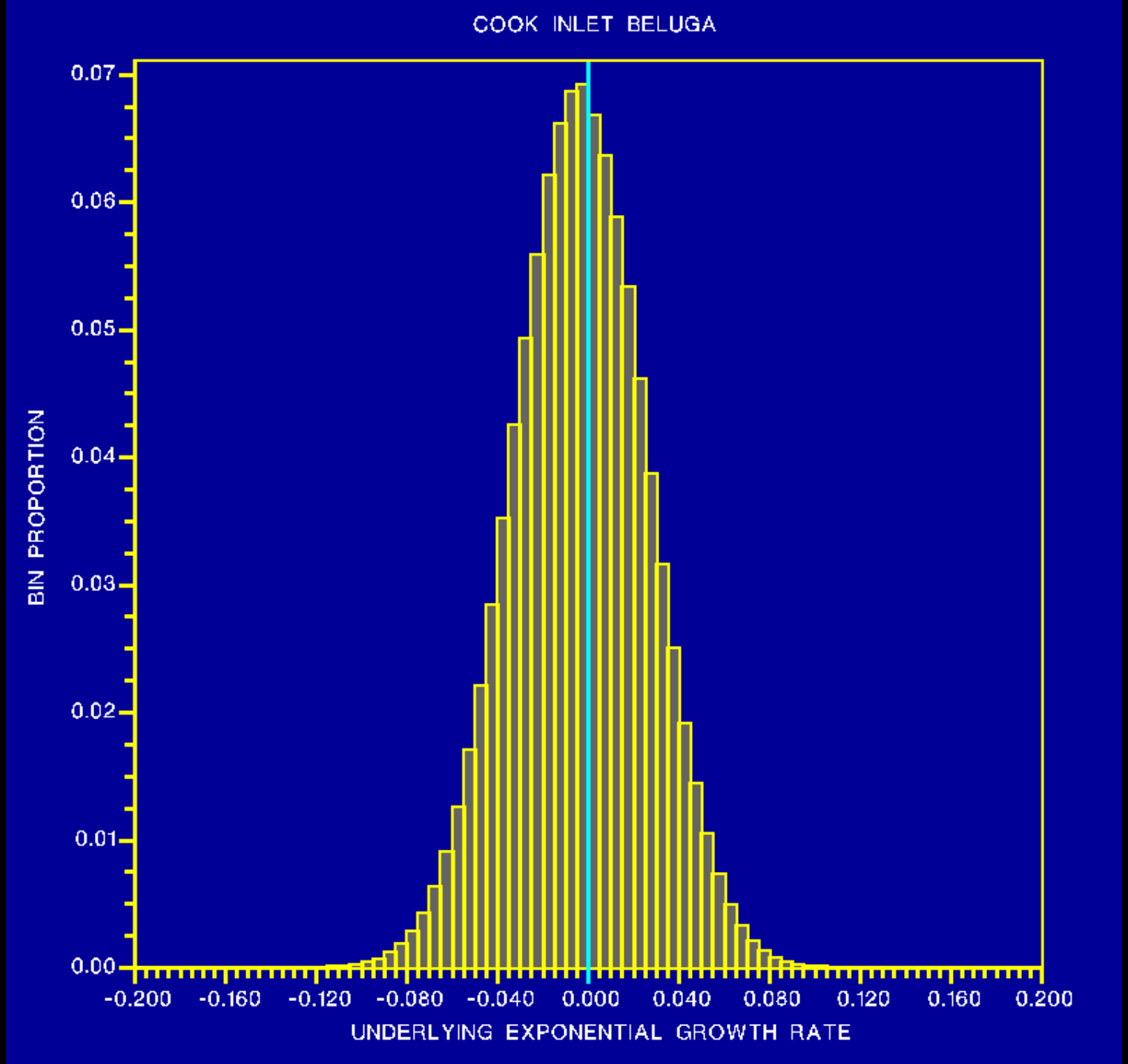
Q: WHAT IS UNDERLYING LEGAL-HARVEST-CORRECTED

RECENT GROWTH RATE?

$$N(t+1) = N(t) \times Exp(r) - H(t)$$


COOK INLET BELUGA
1500
1000
500
0
NUMBERS
1994
1995
1996
1997
1998
1999
2000
2001
2002
YEAR


COOK INLET BELUGA
BIN PROPORTION
0.05
0.04
0.03
0.02
0.01
0.00
240.
268.
296.
324.
352.
380.
408.
436.
464.
492.
520.
N2002


COOK INLET BELUGA
BIN PROPORTION
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.200
-0.160
-0.120
-0.080
-0.040
0.000
0.040
0.080
0.120
0.160
0.200
UNDERLYING EXPONENTIAL GROWTH RATE

NOMINAL RESULTS

90%: -0.0525 > R > 0.0425

Probability that population will decline with zero legal harvest is 55%

Probability that legal-harvest-corrected growth rate is abnormally low is 79%

Probability that Rmax is lower than assumed in modeling from 2002 is 91%

INTERPRETATION

Bad data?

Bad luck?

Something besides reported harvest is depressing the population growth?

DECISION ANALYSIS

Decision alternatives (actions)

Costs of outcomes (including mistakes)

Choose to minimize expected cost
(cost x probability)

GOAL: NOT ALLOW DECLINE

Actions:

If declining -- more protection?

If not declining -- status quo?

If increasing enough-- increase quota?

Costs:

Declining, but chose status quo?

Not declining, chose more protection?

MINIMIZE EXPECTED COST

Actions: More protection (+)

Status quo (o)

Costs: Declining, chose status quo F(o)

Not declining, more protection F(+)

Probabilities: p(+)

p(o)

EXPECTED COST

Actions: More protection (+)

Status quo (o)

Costs: Declining, chose status quo F(o)

Not declining, more protection F(+)

Probabilities: p(+)

p(o)

Expected cost: (+) F(+) x p(o)

(o) F(o) x p(+)

THRESHOLD: INDIFFERENCE

Expected cost: (+) $F(+) \times p(o)$

(o) $F(o) \times p(+)$

Equal expected costs:

$$F(+) \times p(o) = F(o) \times p(+)$$

Critical p(+): $p(+) = F(+)/[F(+)+F(-)]$

CRITICAL P FOR ACTION

Probability of decline > Cost ratio

$$\frac{C_{\text{mistaken protection}}}{C_{\text{mistaken protection}} + C_{\text{mistaken status quo}}}$$

DECISION RULE TEMPLATE

I. If more than 5% probability of more than 25% delay in time to recovery -- more protection

II. If more than x% probability that population trend since 1999 is a not an increase -- more protection