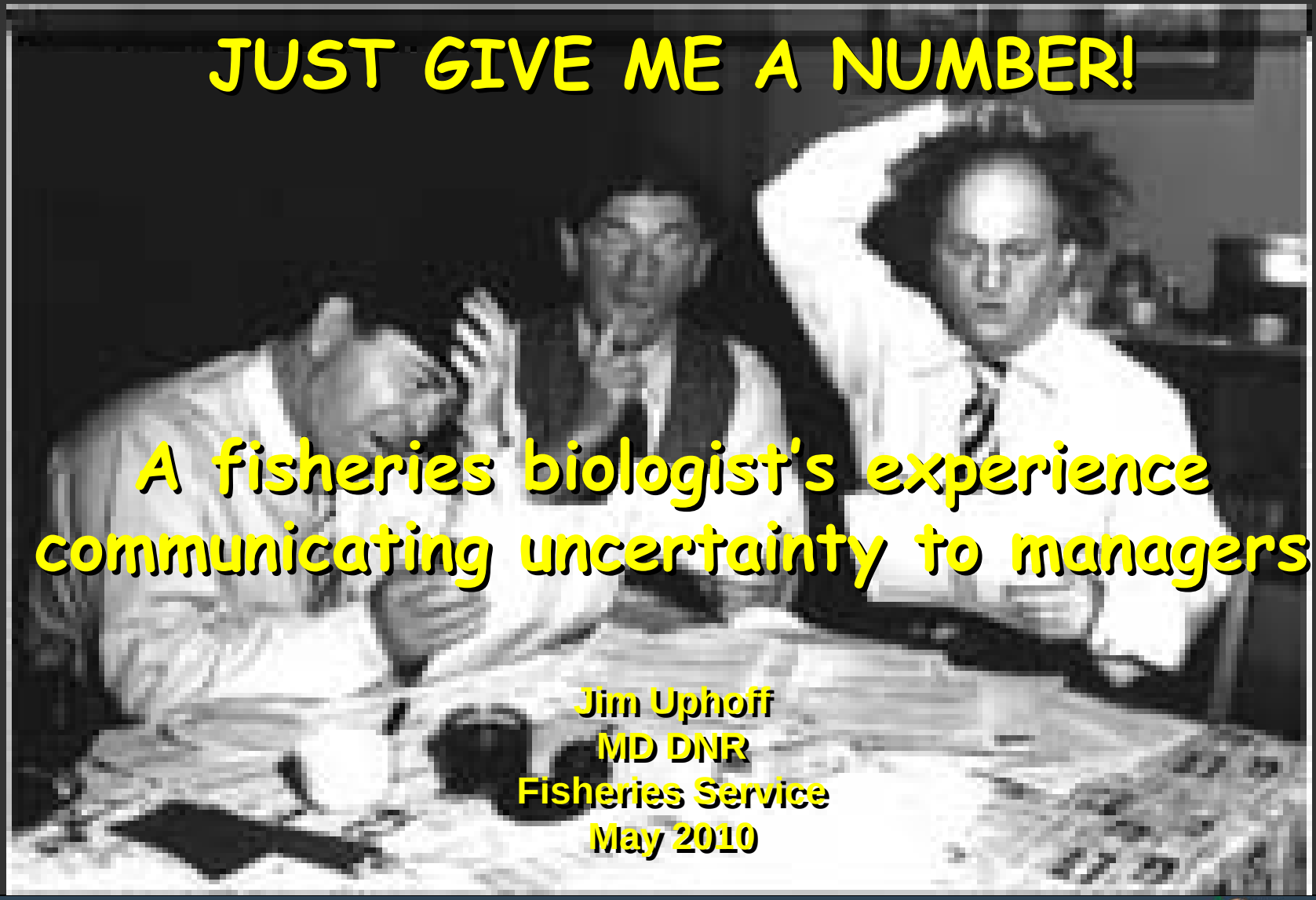
JUST GIVE ME A NUMBER!



A fisheries biologist's experience communicating uncertainty to managers

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May 2010

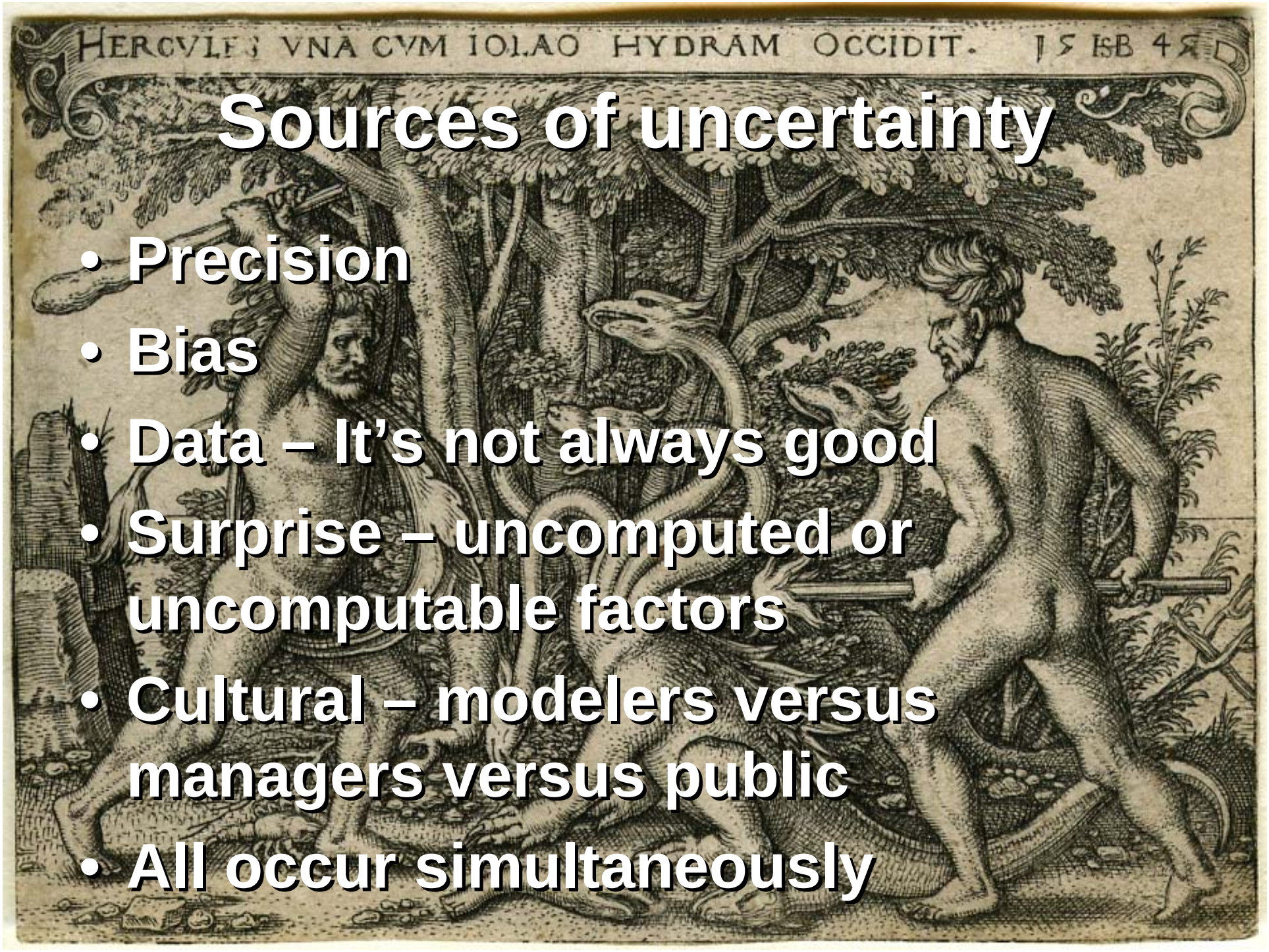
Just give me a number!

What we have here is failure to communicate!

- Public concerned about certainty & not appreciative of models
- Model uncertainty can be complex
- Manager has to understand & balance
- Simplify uncertainty portrayal but don't lose the meaning

Fisheries Management Modeling Generalities

- Use one big model fit to data to get the “right” answer
- Usually age structured & complex
- Fishing explains changes because natural mortality / ecosystem assumed constant
- Judge status by a few reference points (fishing mortality, spawning stock size & recruitment)
- Process built around peer-review approved models
- Approach limits exploration of alternative explanations and concerns

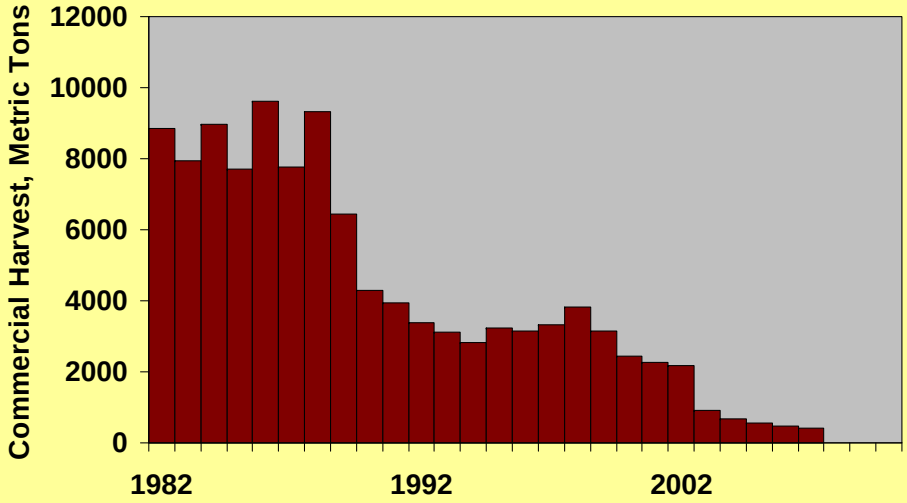


Sources of uncertainty

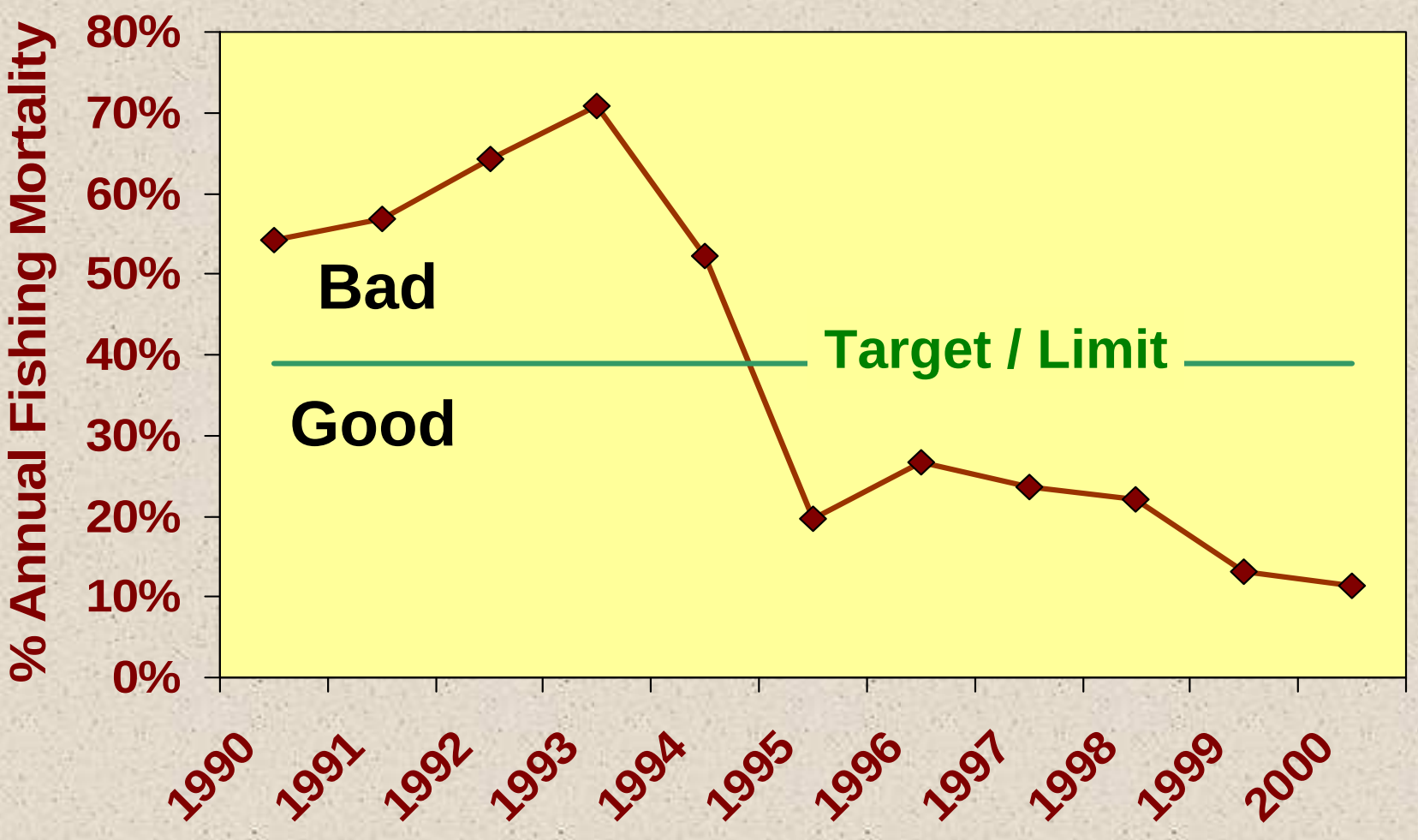
- Precision
- Bias
- Data – It's not always good
- Surprise – uncomputed or uncomputable factors
- Cultural – modelers versus managers versus public
- All occur simultaneously

Examples from weakfish assessments. Talk isn't about fish, it's about people.

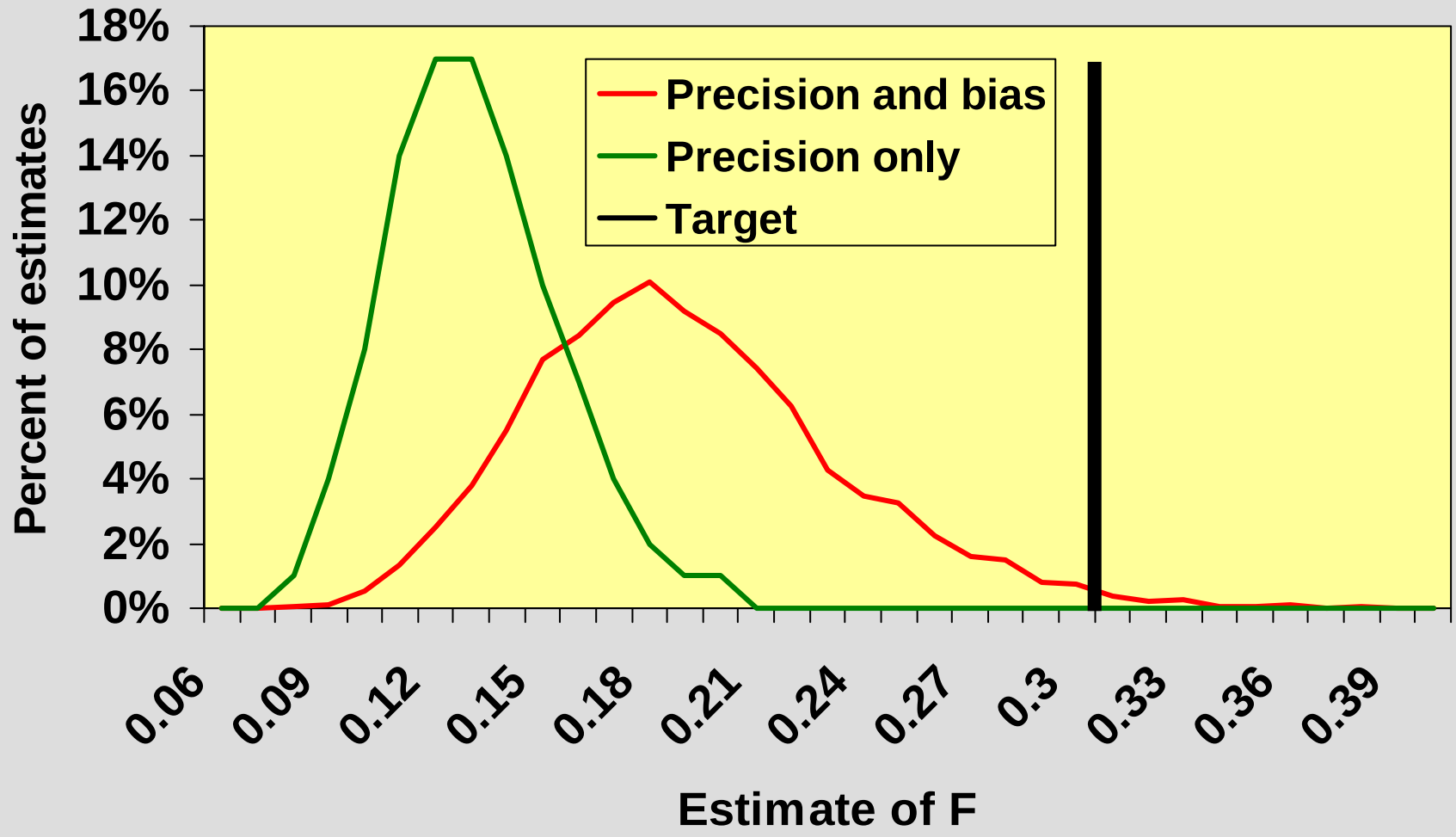
- 1999 – Conventional assessment – overfished
- 2002 – Update very positive, but not right
- 2004 – New assessment starts
- 2005 – Conventional = nonsense; search for alternative explanations
- 2006 – Rise in M makes most sense but fails review
- 2009 – Rising M version passes review



Model point estimates treated as target and limit in 1995-1996 plans. Ignored “risk” due to variability and bias

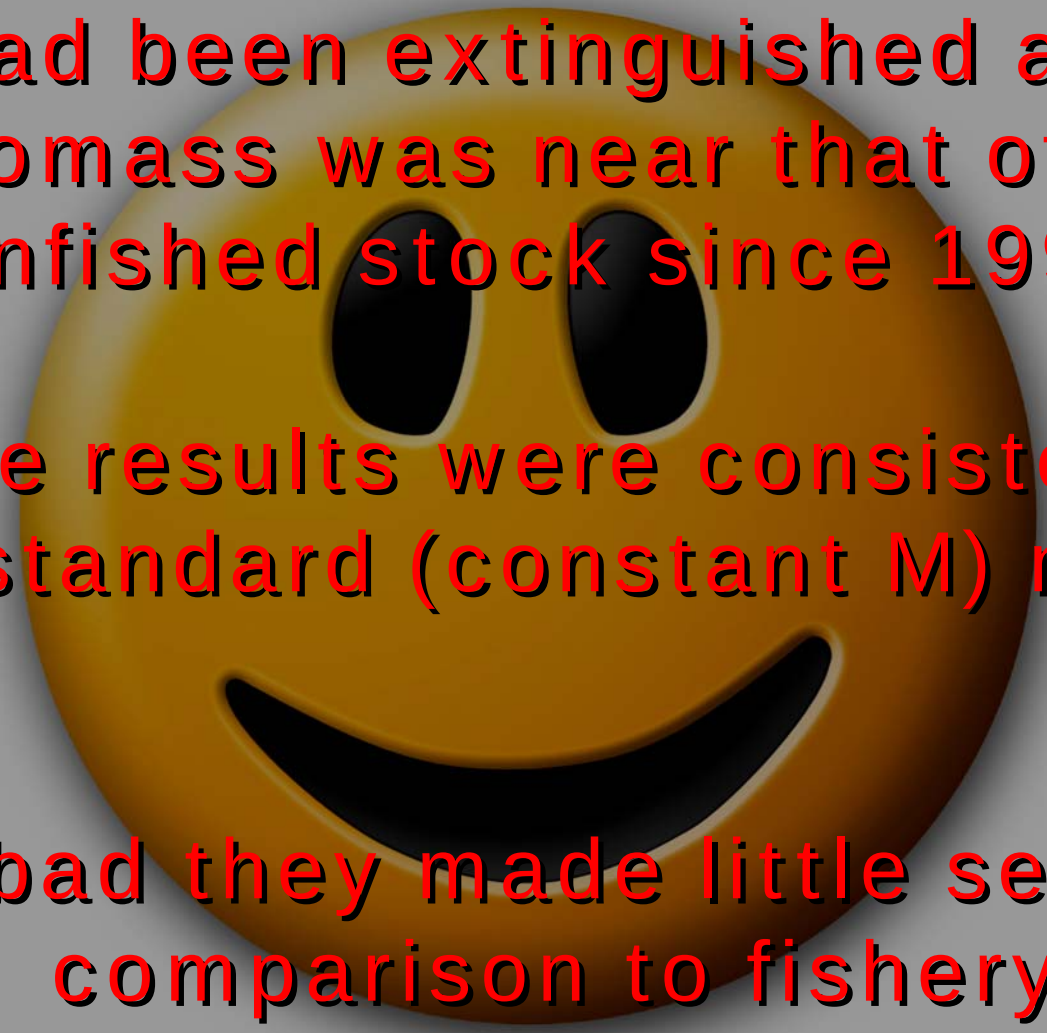


2002 plan has targets and limits. Takes into account precision and bias.



By 2004, models indicated that F had been extinguished and biomass was near that of an unfished stock since 1996.

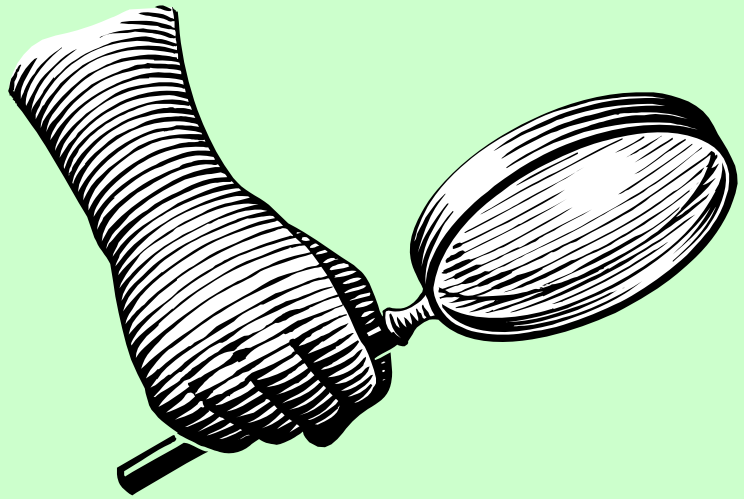
These results were consistent for any standard (constant M) model.



Too bad they made little sense in comparison to fishery performance.

By 2004, conventional “big model” approach fails and hypothesis testing approach evolves

- Overfishing becomes a hypothesis
- Added hypotheses such as predation, diet, forage, & climate
- Empirical – information on other factors
- Statistical – correlation and regression
- Modeling
  - Multiple models
  - Simple for exploration
  - Contrast to conventional
  - Ground-truth to data

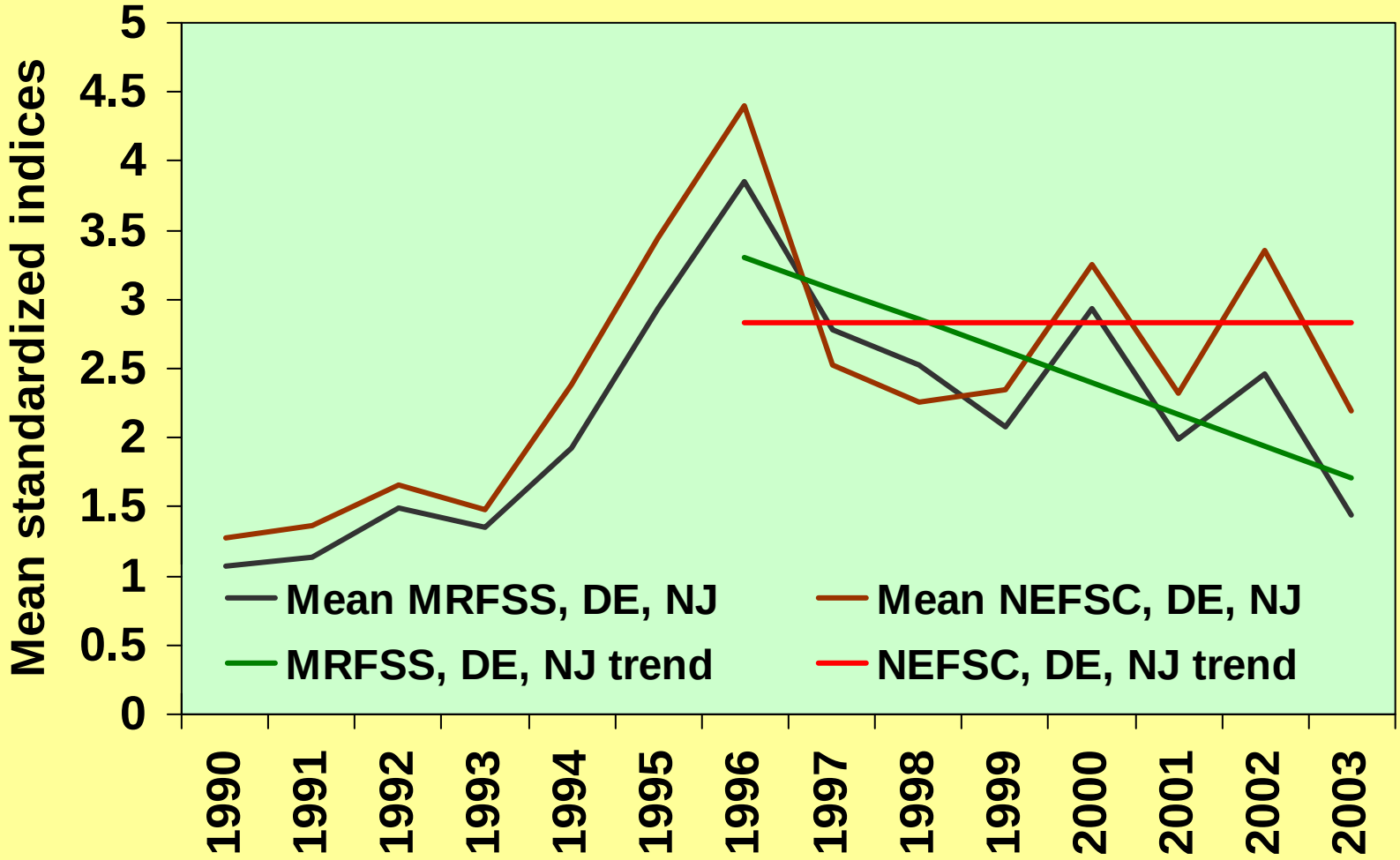


2006 review rejected alternative explanation (increasing M). Concluded data was flawed & shortcomings could not be overcome with a "better" model.

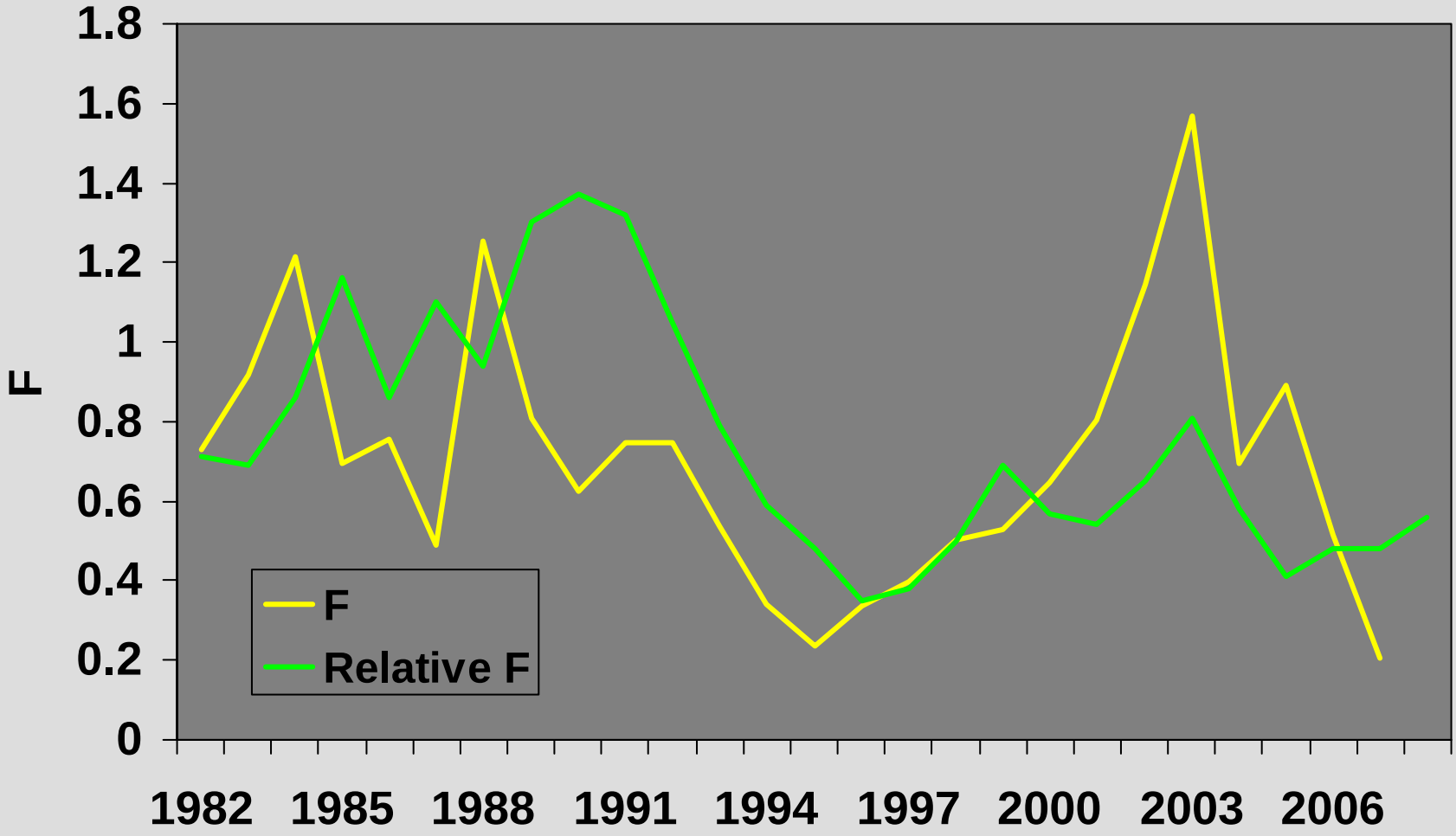
- **We partially agreed, but paraphrased Donald Rumsfeld:**

"We have to assess with the data we have and not the data we want."

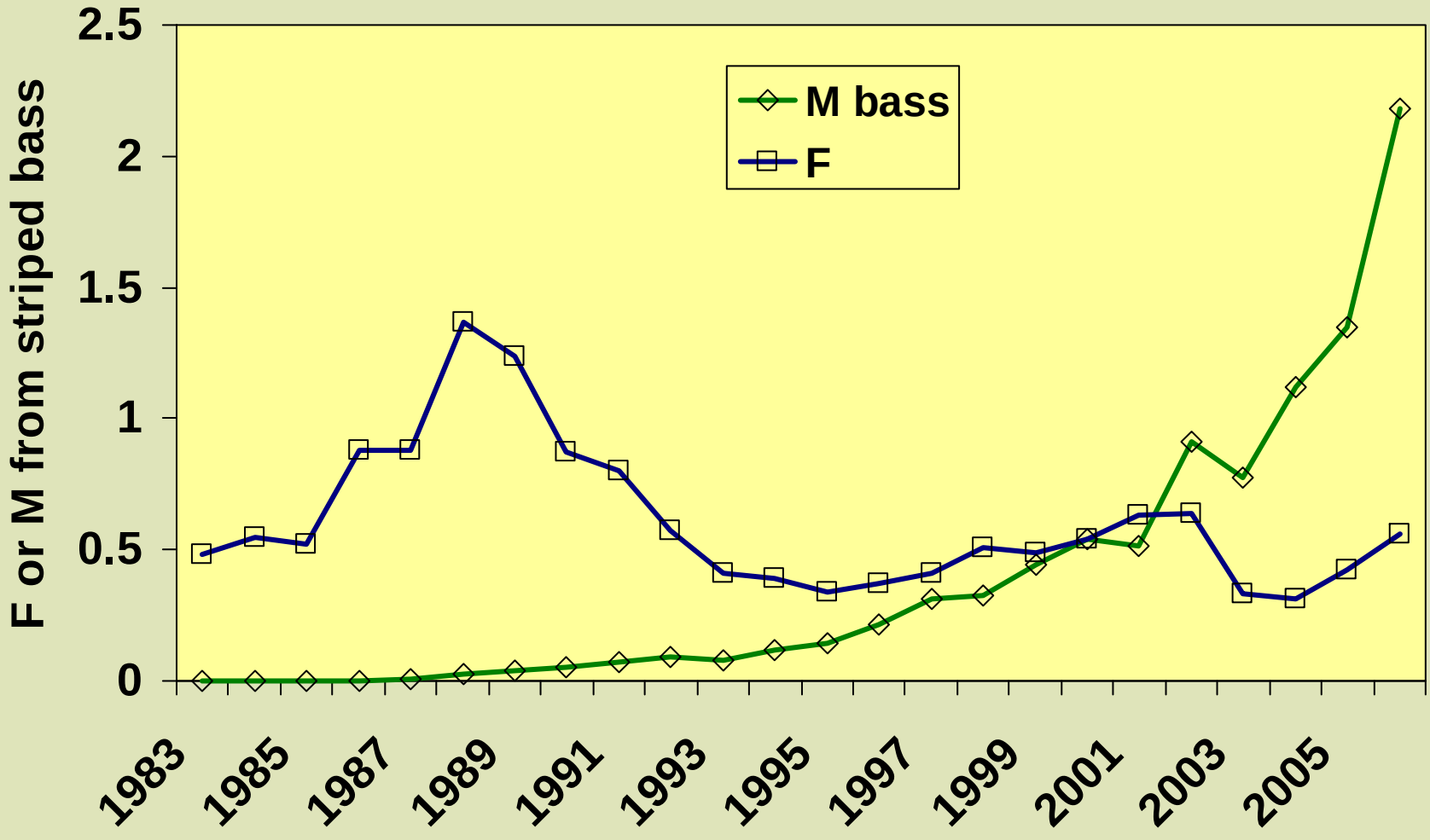
DATA: Very different view of recent trend depending on indices. Indices screened for precision, accuracy, coherency, and consistency. Some rejected or revised.



Surprise: F from conventional model ground-truthed to relative F estimated from landings / indices



SURPRISE: Estimates of F and M. M developed from covariates (striped bass and menhaden) & modest "new" model (part of broader exploration)



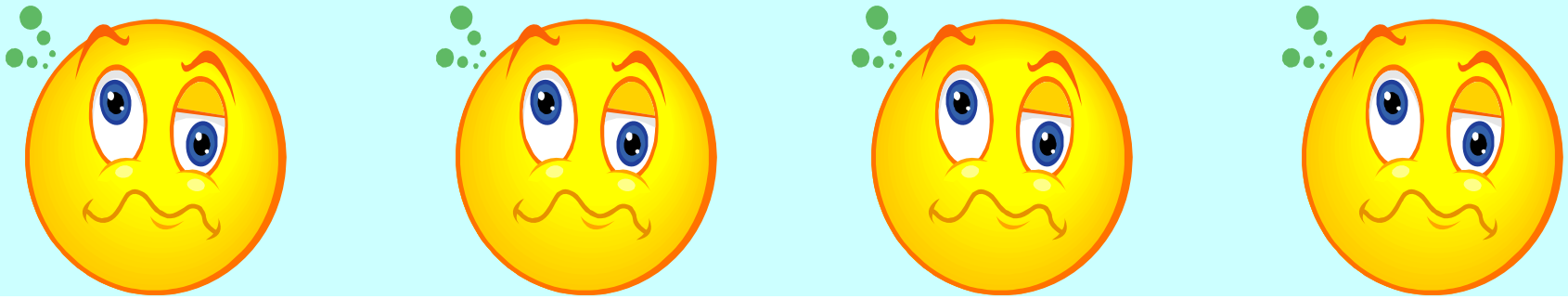
CULTURAL: Natural mortality couldn't rise! Discards (F) rose!

If "uncounted" commercial discards were responsible for decline, they were huge, undetected, and resulted from increased regulations.

How will more regulation, short of stopping fishing on all species, stem a decline created by regulation?

CULTURAL: Assessment findings versus action (May 2010).

- **Assessment: High M gives management little leverage for recovery by decreasing F**
- **Plan: Reduce fishing mortality**
- **Assessment: Rising M reflects important food web issues**
- **???? No process for this problem - yet**



What is the life of a manager like?

- Manager is generalist (one-man band)
- Multiple issues at same time
- Limited time
- Information has to be straight-forward
- Too much detail difficult to handle
- Management process important & streamlines
- Everyone is a critic!

Cultural: Complex, age-structured model will work next time – just collect more data.

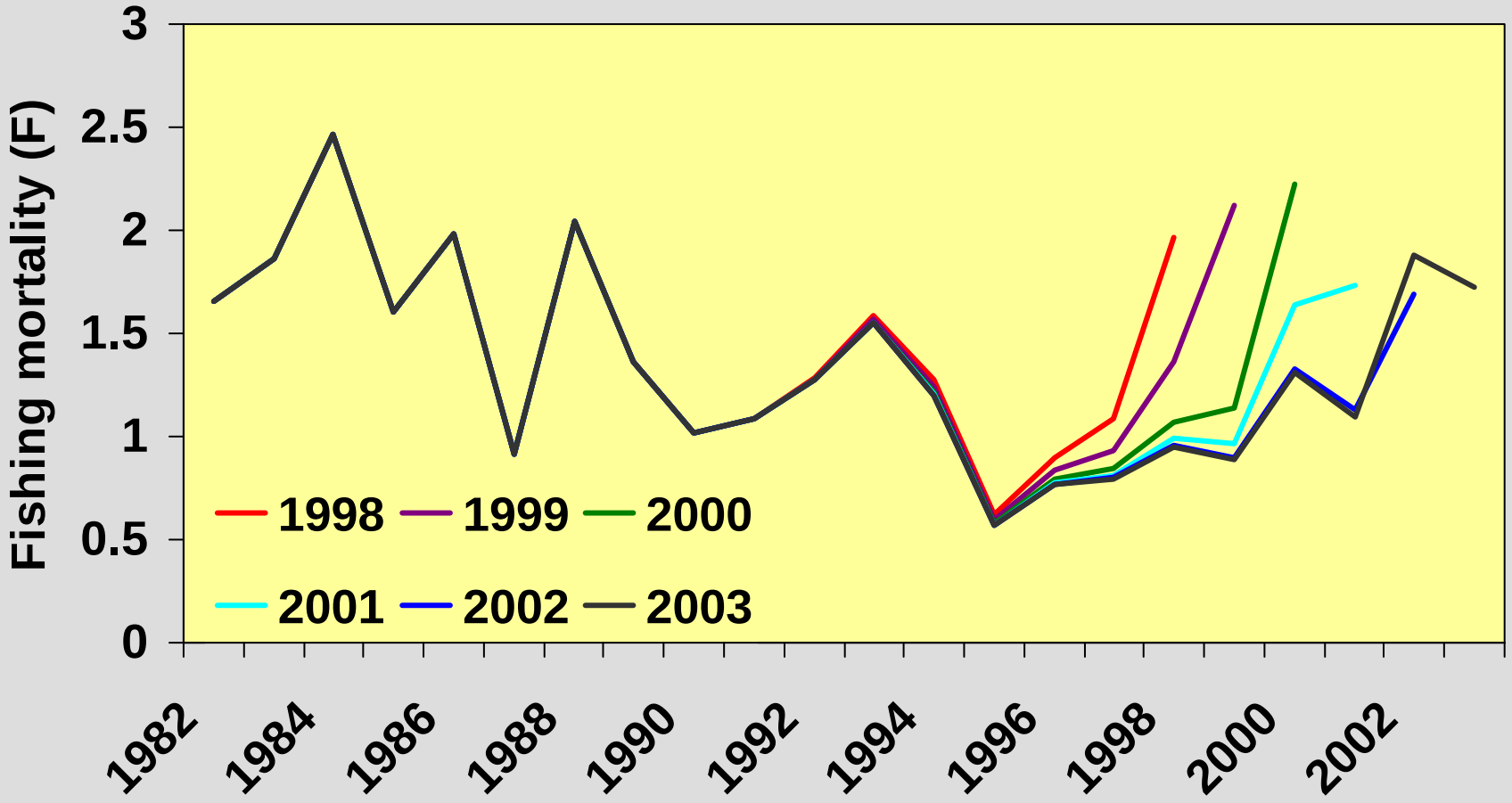
CULTURAL: Five points of complete technical agreement in 2006 did not convince managers because assessment did not pass review

- Stock is in decline
- Total mortality is increasing
- Not much evidence of overfishing
- Something other than F is going on
- Strong circumstantial evidence of increasing M

Managers balance very conflicting attitudes about models

Model is	According to	Because it
Useless	Fishermen	Is always wrong
TRUTH	Management process	Tells us everything
Should be useful thought experiments	Me	Provides insight but be skeptical

BIAS: Retrospective trend of F from what was our standard model. Great for past. Current advice too pessimistic (leads to unneeded harvest cuts); adjustment not straightforward.



Definitions – science and government use abbreviations and jargon, but this may alienate constituents & make manager's job more difficult

- F = Fishing mortality
- M = Natural mortality
- Z = Total mortality or F + M
- All instantaneous rates
- Reference points = status indicators; targets and limits

CULTURAL: What it took.
2009 - 1st ASMFC assessment to conclude natural mortality caused decline instead of fishing & pass peer-review!