WF4313/6613-Fisheries Management

Class 27– Climate change

In the news

Announcements

2 classes left…

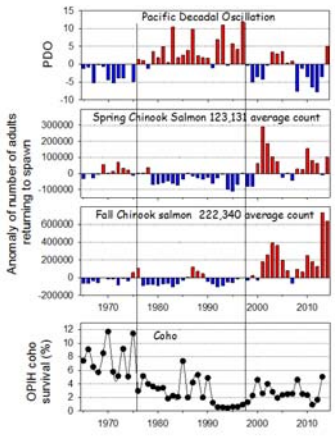
No lab-office hours

Brief presentations Nov. 28th

Final Exam December 5th @ 8am

Salmon

- Columbia stocks
- Passing Bonneville Dam



UW TODAY

January 14, 2013

Salmon runs boom, go bust over centuries

Sandra Hines

News and Information

Salmon runs are notoriously variable: strong one year, and weak the next. New research shows that the same may be true from one century to the next.

Scientists in the past 20 years have recognized that salmon stocks vary not only year to year, but also on decades-long time cycles. One example is the 30-year to 80-year booms and busts in salmon runs in Alaska and on the West Coast driven by the climate pattern known as the Pacific Decadal Oscillation.

Now work led by University of Washington researchers reveals those decadal cycles may overlay even more important, centuries-long conditions, or regimes, that influence fish productivity. Cycles lasting up to 200 years were found while examining 500-year records of salmon abundance in Southwest Alaska. Natural variations in the abundance of spawning salmon are as large those due to human harvest.

Researchers gathered sediment cores from lakes in 16 major watersheds in southwestern Alaska. ***Lauren Rogers/U of Washington***

Cycles lasting up to 200 years were found while examining 500-year records of salmon abundance in Southwest Alaska. Natural variations in the abundance of spawning salmon are as large those due to human harvest.

Take home message

Recruitment camps:

1. Climate driven
2. Spawner driven

Need both…

Minimize excessive recruit overfishing so when conditions are good recruitment can happen…

Coolwater species received most attention

Effects on predation and so on unexplored…

EFFECTS ON FISHERIES

Effects on fish and fisheries

1. Closures
2. Movement
3. Disease

Dozens of sturgeon found dead in Columbia River

Originally published July 16, 2015 at 6:56 am | Updated July 16, 2015 at 12:23 pm

Sophia Murillo of Kennewick, left, and Frank Carr of Sequim wade into the Columbia River Wednesday to check out an estimated seven-foot long dead sturgeon at the east end of Pasco's Wade Park near Road 39. Stata fish. (Bob Brawdy/Tri-City Herald) More

Washington Fish and Wildlife officials have received repeated reports of dead sturgeon this week on the Columbia River, but the exact cause of death remains a mystery.

http://www.seattletimes.com/seattle-news/dozens-of-sturgeon-found-dead-in-columbia-river/

Hoot owl closures

Heat wave spells early trouble for Montana trout

JUNE 24, 2015 BY LAURA LUNDQUIST

River levels are dropping rapidly as summer temperatures continue to climb, and both trends spell trouble for Montana's trout. As Montana Fish, Wildlife & Parks prepares for fishing closures, anglers can do some things to help fish out.

By Saturday, high temperatures are predicted to top 100 degrees and stay that way at least through Wednesday for parts of western Montana. That's 20 to 25 degrees above normal for this time of year and the extended heat wave will break records,

Hoot owl

Go fishing: Hoot owl restrictions lifted on some western Montana rivers

Longer nights and cooler water temperatures mean an end to fishing restrictions on three of western Montana's most favored trout rivers.

Montana Fish, Wildlife and Parks lifted "hoot owl" restrictions on the Bitterroot, the entire main stem of the Blackfoot and the Clark Fork, downstream of the Rock Creek confluence Wednesday.

The rivers had been under the restrictions that prohibit fishing from 2 p.m. to midnight since July 3 in an effort to reduce the impact on drought-stressed trout.

FWP's Bitterroot fisheries biologist Chris Clancy said this has been an unusual summer temperature-wise.

"On most years, you could bet money and win that peak water temperatures would appear sometime in the last week of July or first week of August," Clancy said. "This year, the temperatures peaked in late June, early July. It looked really grim for trout back then."

Some timely rains and periodic breaks in the heat made a difference this summer for the Bitterroot River.

"It really didn't turn out all that badly this year," Clancy said.

The state begins to consider instituting "hoot owl" restrictions when water temperatures go over 72 degrees for three consecutive days. Temperatures need to drop below 70 degrees for the same amount of time before the restrictions are withdrawn.

While the upper reaches of the Bitterroot remained cooler due to releases from Painted Rock Reservoir this summer, Clancy said the river downstream of Hamilton started hitting 73 degrees in late June.

In the same time period, water temperatures rose to 76 degrees in the lower reaches of the Bitterroot River near Missoula.

"Trout really don't like 70-degree water all that well," Clancy said.

The preferred water temperature for rainbow and brown trout is around 55 to 65 degrees. Temperatures in the mid-60s are stressful to native bull and westslope cutthroat trout.

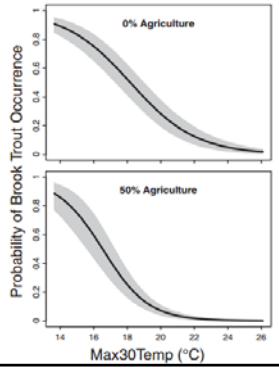
Movement

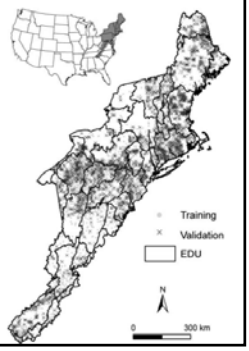
Warmer waters shake up Shore fishing

Within stream networks

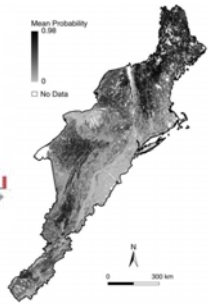
- Move towards cooler water, if available…

Brook trout

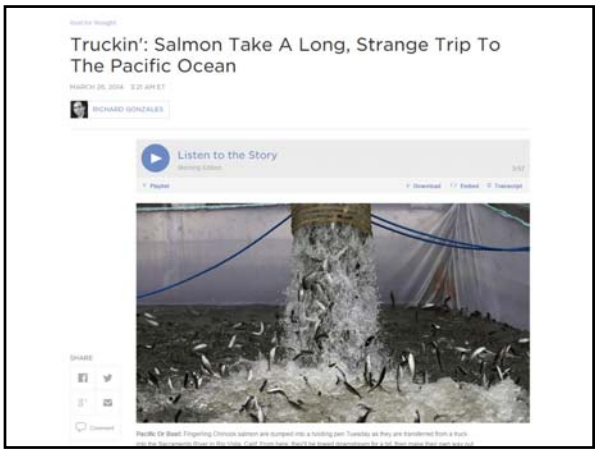




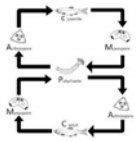
Effect on fisherman



Transport thermal barriers



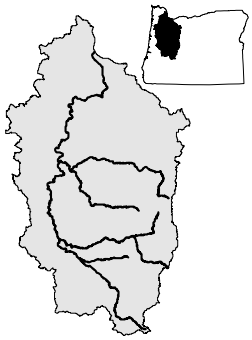
Disease



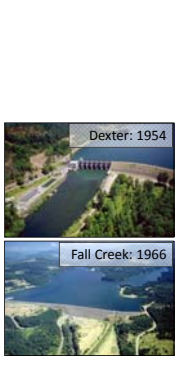
Willamette basin spring Chinook

Anadromous species of conservation need

-Threatened status 1999
- Anthropogenic modifications



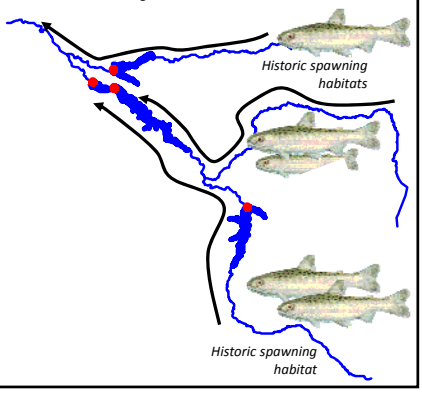
Limited natural reproduction



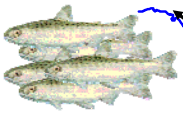
www.nwd-wc.usace.army.mil

Natural production

Natural production

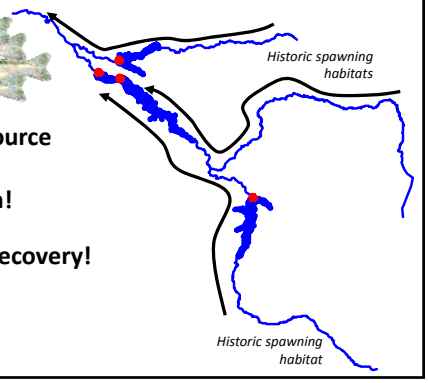


Natural production

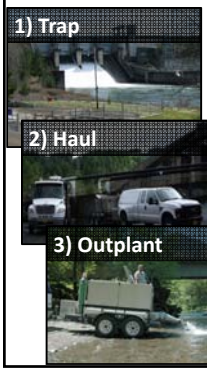


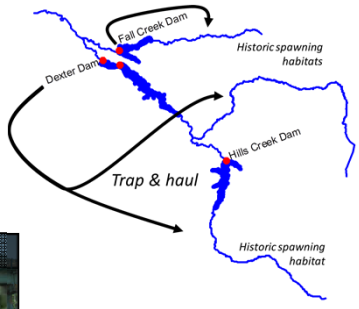
Another source of natural production!

Key to recovery!



Reintroduction above dams



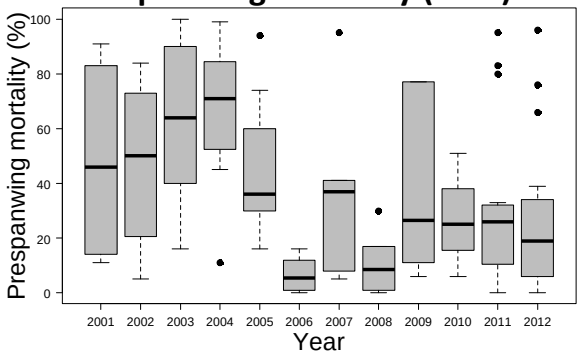


Problem: Prespawn mortality (PSM)

In excess of 90% in some years

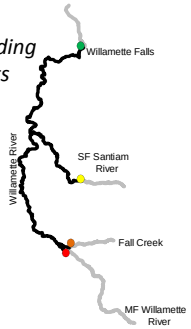
—*Temperature*

Prespawning mortality (PSM)

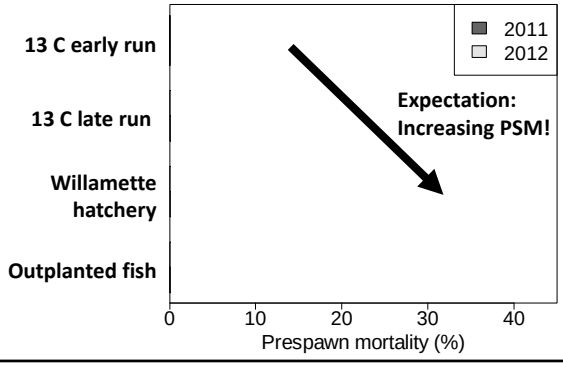


Holding in cool pathogen free water

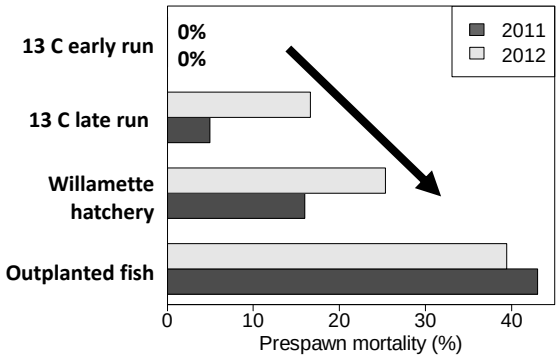
Annual holding experiments at ~ 13C



PSM and thermal exposure



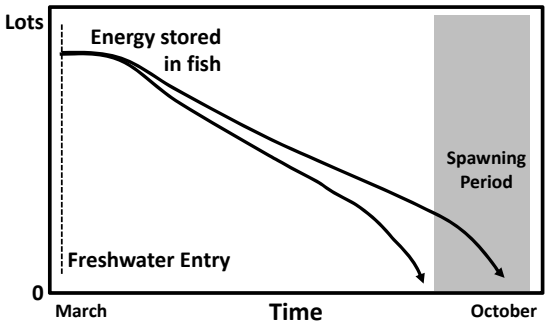
PSM and thermal exposure



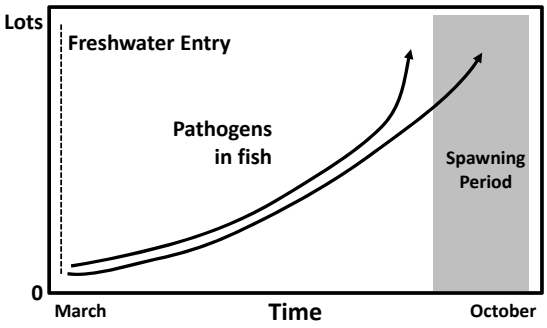
Something we are wrestling with

CLIMATE CHANGE & MANAGEMENT

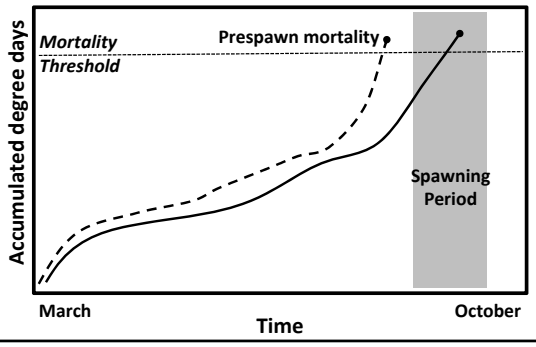
Race against time



Race against time



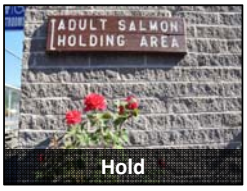
Race against time



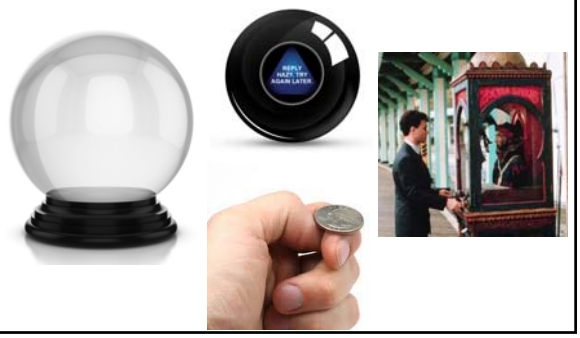
Example management alternatives

Hypothesized to reduce PSM

1. Trap → outplant: prioritize brood stock
2. Trap → outplant: proportional allocation
3. Trap, hold @ hatchery →outplant



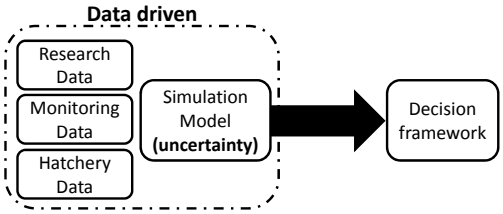
How do we decide?



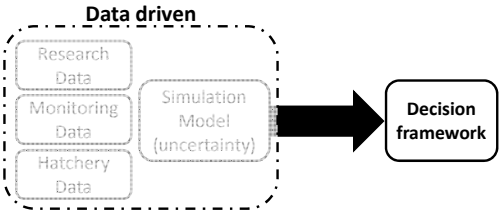
A decision framework

Structured decision making approach

1. **Simulation model**
2. **Decision model**



How do we decide?



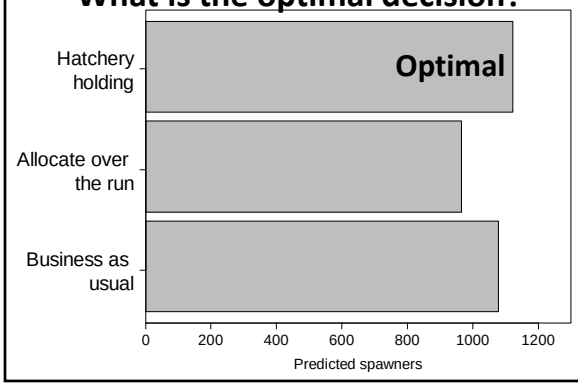
What are decision models?

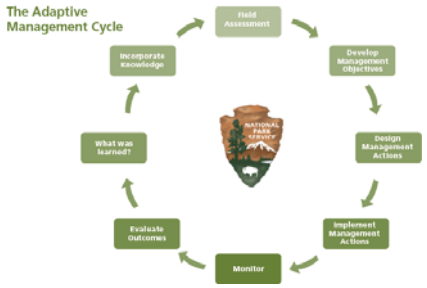
Focus on <u>decision</u>

1. <u>Optimal</u> decision
2. Account for <u>uncertainty</u>
3. Sensitivity of decision
4. Inform Research & Monitoring

An example

What is the optimal decision?





Management, uncertainty, & learning

Adaptive resource management?

*"**Learning by doing**, and adapting based on what's learned"*

*"Management in the face of uncertainty, with a focus on the **reduction of that uncertainty**"*

*"Management that recognizes uncertainty in its consequences and seeks **to improve understanding**, so as to **improve decision making.**"*

A special case of SDM

Learning by doing…

…reduction of uncertainty…

…to improve understanding…

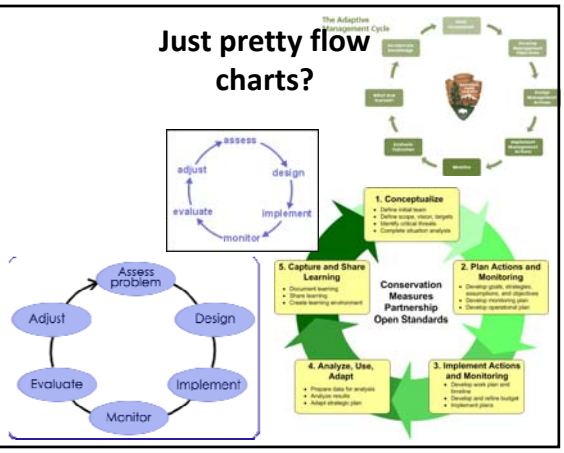
Need a **recurrent** application of management actions over time (or space) to:

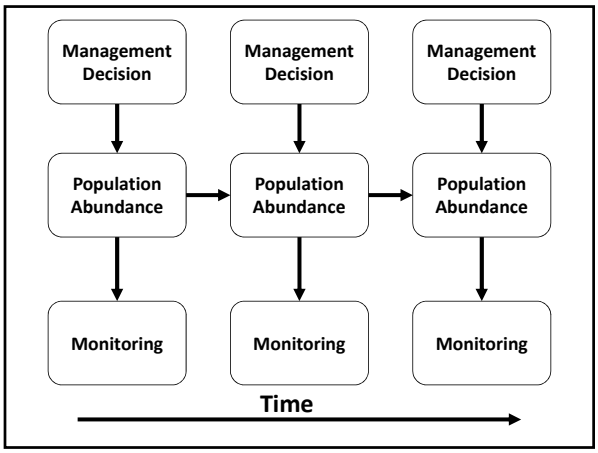
- Learn by doing,
- Improve understanding
- Reduce uncertainty

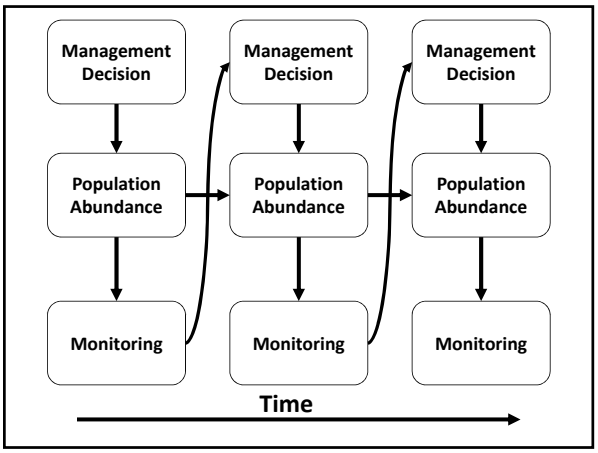
Uncertainty has to be high!

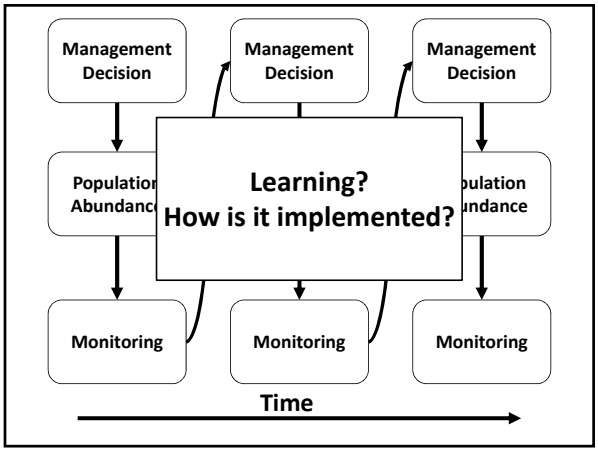
Without uncertainty we cannot learn

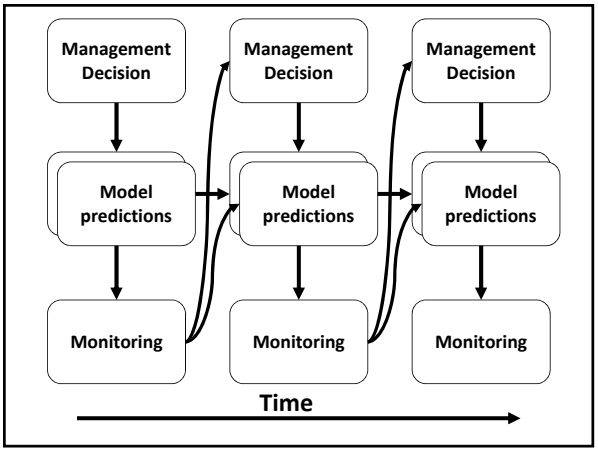
Just pretty flow charts?




Management Decision
Management Decision
Management Decision
Population Abundance
Population Abundance
Population Abundance
Monitoring
Monitoring
Monitoring
Time


Management Decision
Management Decision
Management Decision
Population Abundance
Population Abundance
Population Abundance
Monitoring
Monitoring
Monitoring
Time


Management Decision
Management Decision
Management Decision
Learning?
How is it implemented?
Monitoring
Monitoring
Monitoring
Time


Management Decision
Management Decision
Management Decision
Model predictions
Model predictions
Model predictions
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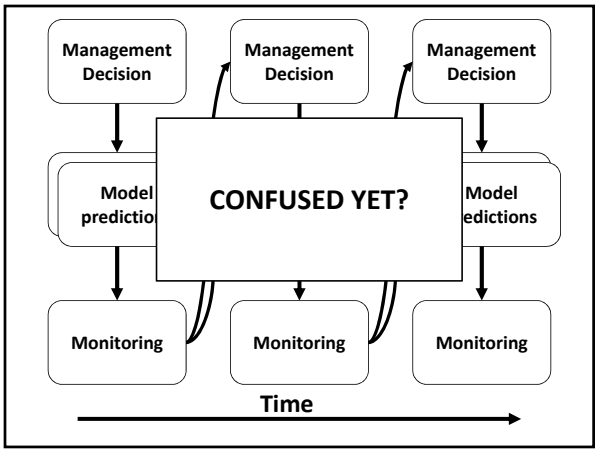
Monitoring
Monitoring
Time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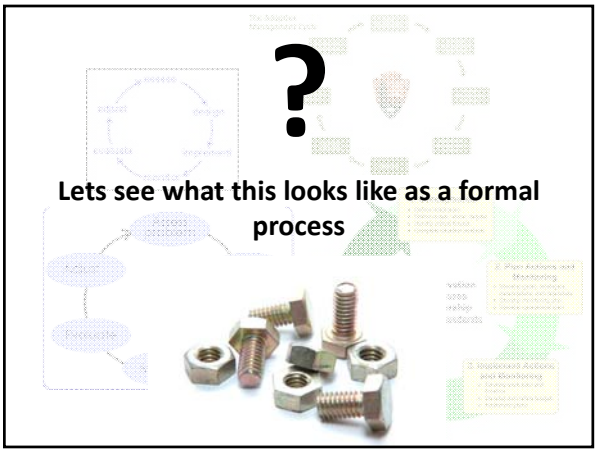
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Lets see what this looks like as a formal process