

WF4313-Fisheries Management

Lecture 29 Fisheries & Evolution

Announcements

0 class left...

Briefs Due By Final Exam

Final Exam December 5th @ 8am

Grades on BB

THE FINAL COUNTDOWN

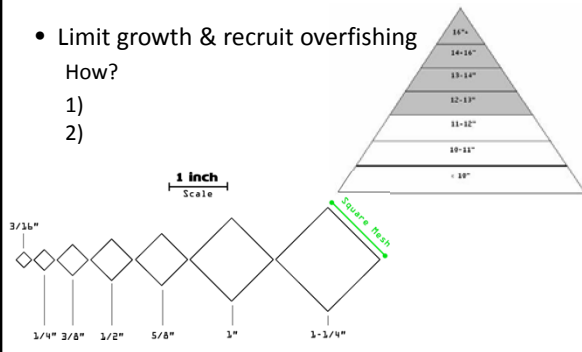


Catch process

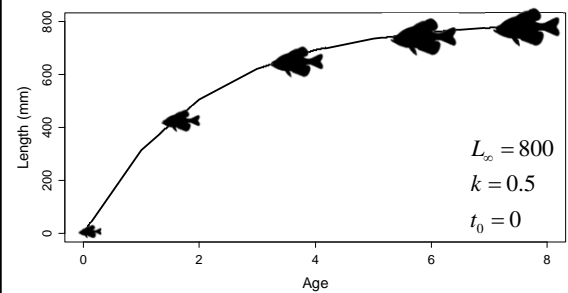
- Limit growth & recruit overfishing

How?

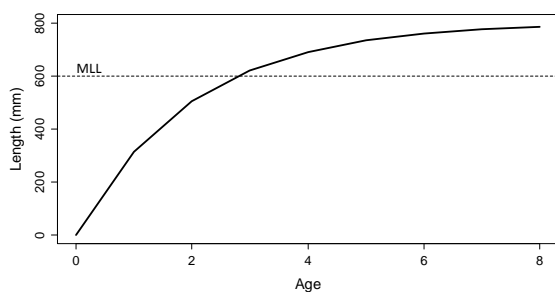
- 1)
- 2)



Population growth



Population growth



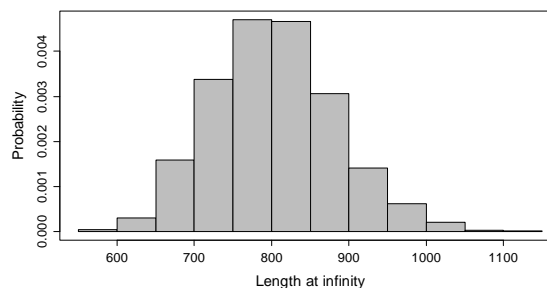
Population versus individuals



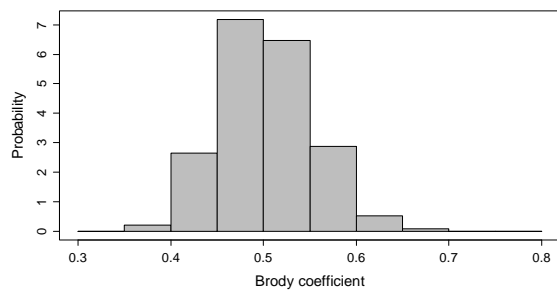
A population...

- 5000 individuals
- Variable
 - Length at infinity: expected 800 mm
 - Brody growth coefficient : expected 0.5
 - Natural mortality: 0.3
 - Fishing mortality: 0.2

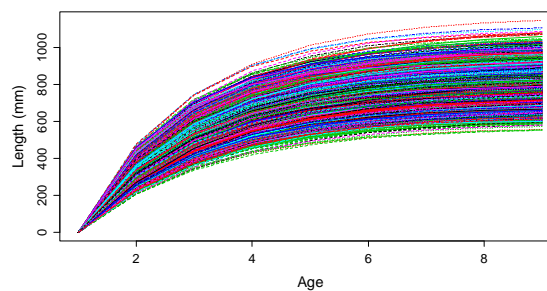
Individual variability



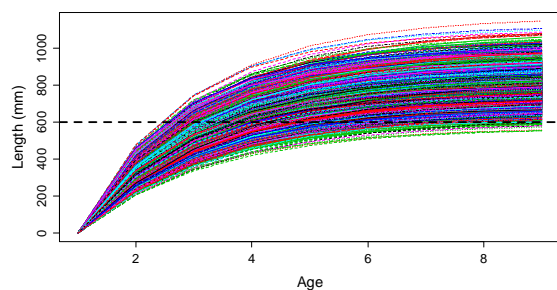
Individual variability



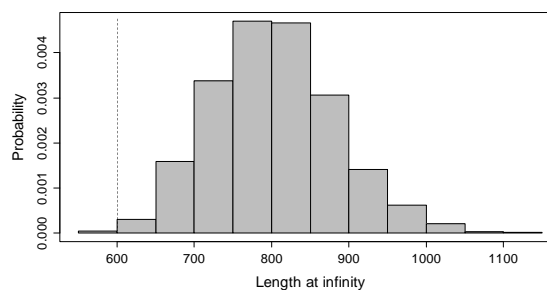
Individual growth



Size selective harvest

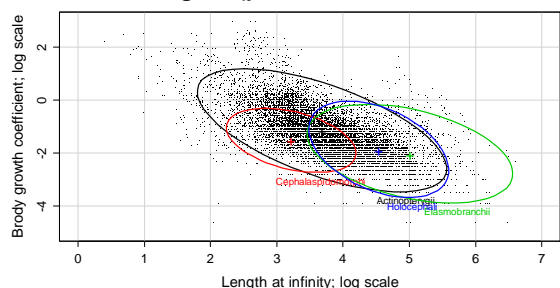


Individual variability

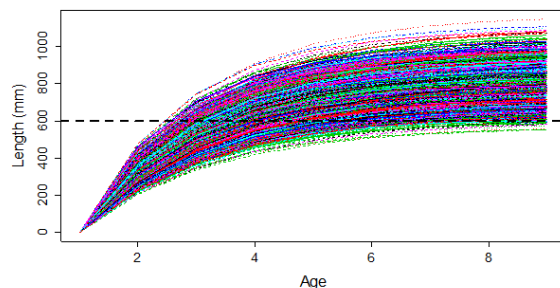


Relationship of L_∞ and k

- Inversely related,
- Fish with larger L_∞ have a lower k



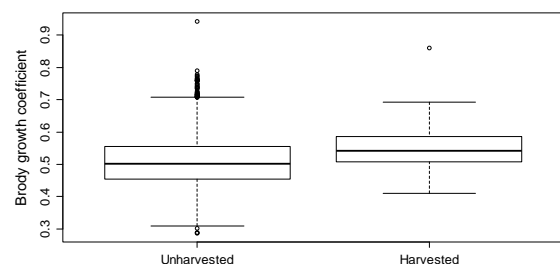
What can happen to population?



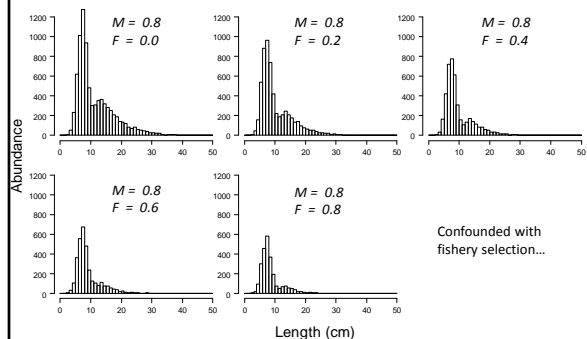
Harvest process...



Harvest process...



Size structure and fishing



Increased fishing and size?

- Mean size decrease with increased fishing mortality
- What is the effect of fishery induced selection?
- How do you tease them apart?

NEWS

Trawling makes for skinny flatfish

11 December 2014, by Tom Westhead

Trawling the seabed doesn't just remove some of the fishes living there: it also makes some of the survivors thinner and less healthy by forcing them to use more energy finding less nutritious food.

That's the conclusion of a new paper published in *Proceedings of the Royal Society B*, based on the work of Dr Andrew Frederick Johnson undertaken while studying for his PhD at Bangor University.

'We already knew that some species of bottom-dwelling fish in trawled areas were skinnier than those elsewhere, but until now it was assumed this was because they couldn't find enough food and went hungry,' he says.

Johnson's work sampling fish in the Irish Sea on Bangor University's research vessel *Prince Madog* shows that's not true: the stomachs of fish in trawled areas are as full as elsewhere, but they're full of different and less nutritious prey that the fish have to put more energy into finding. For instance, a fish with a bellyful of shellfish may feel full, but a lot of their meal is shell with no nutritional value. Much better to fill up on juicy worms – but these suffer more from the effects of trawling.

Subject Areas: behaviour, ecology, environmental science

Keywords: fishing marks, bottom trawl fishing, diet analysis, foraging behaviour, predator-prey interactions, ecosystem-based fisheries management

DOI: 10.1098/rspb.2014.2266

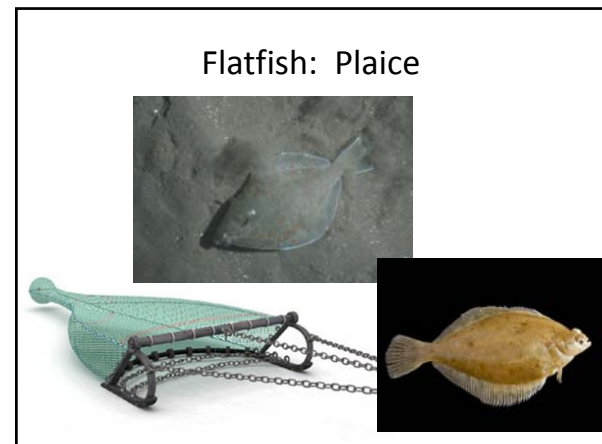
Effects of bottom trawling on fish foraging and feeding

Andrew Frederick Johnson¹, Gaila Gantil², Stuart Bees Jenkins¹, Ian Grant Hildink and Hilary Hall¹

¹ School of Biosciences, Bangor University, Bangor, Gwynedd LL57 2UW, UK
² School of Life Sciences, Bangor University, Bangor, Gwynedd LL57 2UW, UK

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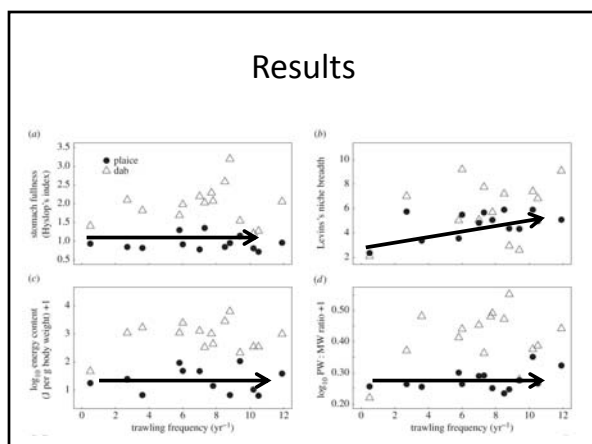
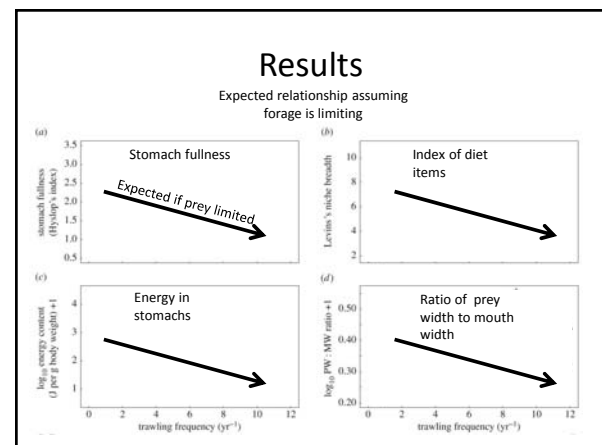
The effects of bottom trawling on benthic communities include reduction of biomass, diversity and body size. These changes may negatively affect prey availability for demersal fishes, potentially leading to reduced food intake, body condition and yield of fishes in commercially trawled areas. Here, the effect of trawling on the prey availability and diet of two commercially important flatfish species, plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*), was investigated over a trawling intensity gradient in the Irish Sea. Previous work in this area has shown that trawling negatively affects the condition of plaice but not of dab. This study showed that reductions in food prey availability did not result in reduced feeding of fish, as trawling frequency increased, both fish and prey biomass declined, such that the ratio of fish to prey remained unchanged. Consequently, even at frequently trawled sites with low prey biomass, both plaice and dab maintained overall levels of stomach fullness and gut energy contents. However, dietary shifts in plaice towards energy-poor prey were more evident when prey species were analysed individually. This, together with a potential decrease in foraging efficiency due to low prey densities, was seen as the most plausible cause for the reduced body condition observed. Understanding the relationship between trawling, benthos, impacts, fish foraging and resultant body condition is an important step in developing ecosystem management measures for future management strategies in bottom trawl fisheries.



N.E. Irish Sea

'We already knew that some species of bottom-dwelling fish in trawled areas were skinnier than those elsewhere, but until now it was assumed this was because they couldn't find enough food and went hungry,' he says.

Read more at: <http://phys.org/news/2014-12-trawling-skinny-flatfish.html#jCp>



Other selection considerations

Large fast growing fish

- Fecundity
- Maturity
- Other traits...

One major question... are traits heritable?

Super Catchable Trout?



Unnatural selection

- Spring chinook return to the Imnaha
- June to September

North American Journal of Fisheries Management 28(10):156, 2008
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DOI: 10.1111/j.1549-8691.2008.01511.x

[Article]

Run Timing, Spawning Timing, and Spawning Distribution of Hatchery- and Natural-Origin Spring Chinook Salmon in the Imnaha River, Oregon

TIMOTHY L. HOFFMANN,* RICHARD W. CAMMACH, KATHRYN A. PETERSON, AND PATRICK J. KOSHY
Oregon Department of Fish and Wildlife, Northwest Oregon Fisheries Research and Development,
201 Badgley Hall, Eastern Oregon University, La Grande, Oregon 97850, USA

Abstract.—We evaluated 15 years (1990–2005) of weir collection and spawning ground survey data to examine differences in run timing, spawn timing, and spawning distribution between naturally and hatchery-reared Chinook salmon (*Oncorhynchus tshawytscha*) in the Imnaha River, Oregon, and to look for changes in

Study area

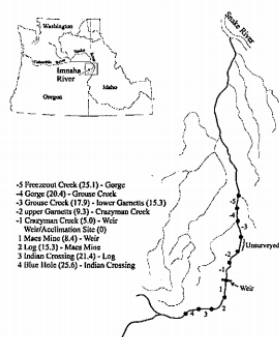


FIGURE 2.—Map of the Imnaha River, Oregon, with study reaches and boundaries (boundary locations are designated as RKM above or below the weir site at which hatchery spawned Chinook salmon were acclimated before release).

Process



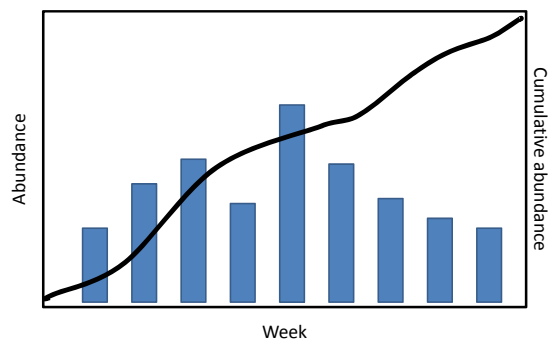
Spawning run:
Week 23-37
June – mid September

Objectives
- Get sufficient number
of fish to meet hatchery
quotas

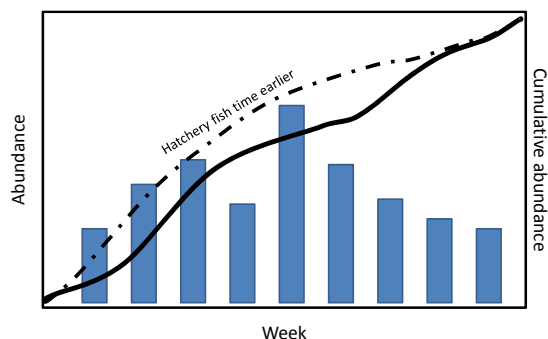
Spawning



Expectation: no selection effect

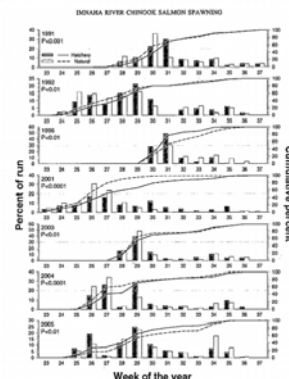


Expectation: selection effect

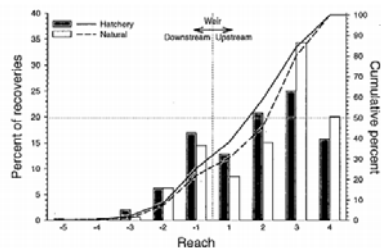


Hatchery effects?

- In some years, hatchery fish arrived earlier
- In others natural origin fish returned earlier
- Below wier



Consequences above wier



What about environmental drivers

- Can exhibit strong effects on phenology
 - Fish return earlier in warmer years
 - Fish spawn earlier
 - So on...

Is fishery selection just environmental selection, or do they both occur?

Environmental vs fishery effects?

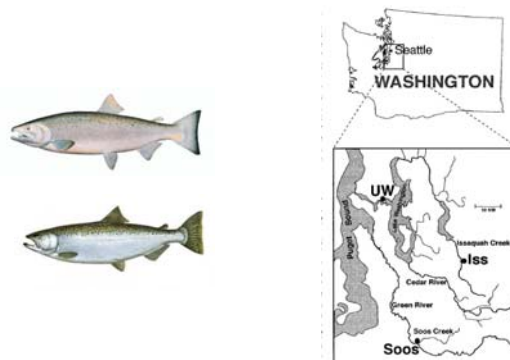
Transactions of the American Fisheries Society 131:591–598, 2002
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Artificial Selection and Environmental Change: Countervailing Factors Affecting the Timing of Spawning by Coho and Chinook Salmon

THOMAS P. QUINN,* JERAMIE A. PETERSON, VINCENT F. GALLUCCI,
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*School of Aquatic and Fishery Sciences,
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Seattle, Washington 98195, USA*

Study area and species



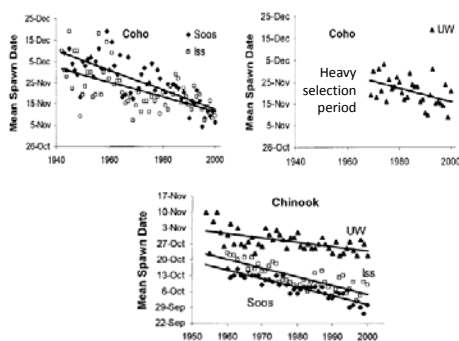
What did they do?

- U. Washington hatchery- selective practices from 1953-1972.
 - Early maturation age, rapid growth, fecundity, survival of offspring
- No selection post 1972
- Compared U. Washington hatchery returns with WDFW hatcheries (Soos & Issaquah)

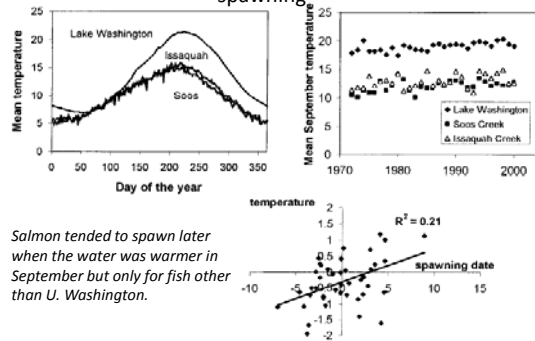
Study objectives

1. Test the hypothesis that the timing of spawning by coho and chinook salmon has become earlier since the 1950s,
2. Determine whether timing patterns are consistent with salmon avoidance of warm temperatures during spawning,
3. Compare the spawning timing of chinook and coho salmon populations

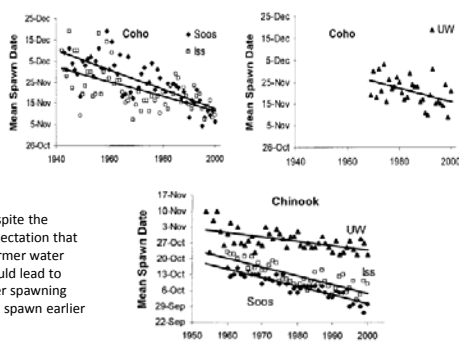
Timing of spawning by coho and chinook salmon has become earlier since the 1950s



Determine whether timing patterns are consistent with salmon avoidance of warm temperatures during spawning



compare the spawning timing of chinook and coho salmon populations



Despite the expectation that warmer water would lead to later spawning fish spawn earlier

