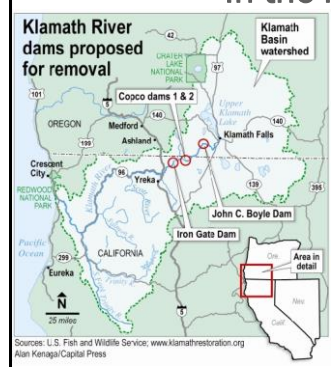
WF4133-Fisheries Science

Class 21 – Culture fisheries

Housekeeping

- Exam 2 40% done
- Lab Monday-Optional E-Fishing will send out sign up
- April 22: First draft due in word format, Presentation overview, reports will be returned with comments within 48hrs** Suggest sending before
- April 24 group presentations
- Final draft due May 4th

In the news



In the news

San Francisco Chronicle

Salmon season to be cut short in fisheries along California coast

By Tara Duggan | April 21, 2017 | Updated: April 21, 2017 3:59pm

The official word is out: California will have a very short chinook salmon season this year.

Because of historically low numbers of adult chinook salmon in the ocean -- a lingering effect of the drought -- West Coast fishery managers decided to severely restrict the upcoming California commercial salmon season. The decision was announced Tuesday at a meeting of the Pacific Fishery Management Council in Sacramento.

California's commercial salmon season will be open in different parts of the coast during different chunks of the normal season.

It will begin in May and June in the area from Pigeon Point in San Mateo County south to the Mexico border. Later in the summer, the area that includes San Francisco Bay, between Pigeon Point and Point Arena in Mendocino County, will be open for most of August and September, with a smaller section of the coast also open for part of October.

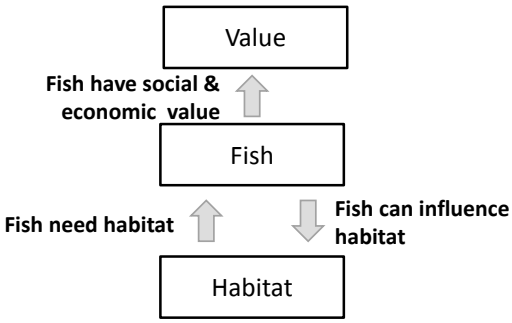
Farther north, the coastline between Point Arena and Horse Mountain (Humboldt County) will be open only in September, with a 3,000-fish quota.

RELATED

California likely to shorten chinook salmon season

http://www.sfchronicle.com/food/article/Salmon-season-to-be-cut-short-in-fisheries-along-11066365.php#photo-12700473

The big picture



Habitat & hatcheries

- Hatchery production used to mitigate or enhance populations for harvest, recovery, or commercial.

Hatchery types

Hatchery types

1. Commercial: profitable source of protein
2. Research: optimize hatchery practices
3. Enhancement: provide fish for additional fishing opportunity
4. Conservation: population recovery

Research

- Focus on optimizing growth
- Minimizing cost
- Minimizing environmental impacts
  - Diploidy
  - Triploidy
- Maximizing return to creel

Super Catchable Trout?

Enhancement

- "Enhance" fishing opportunities
- 2 types
  - Put & grow
  - Put & take

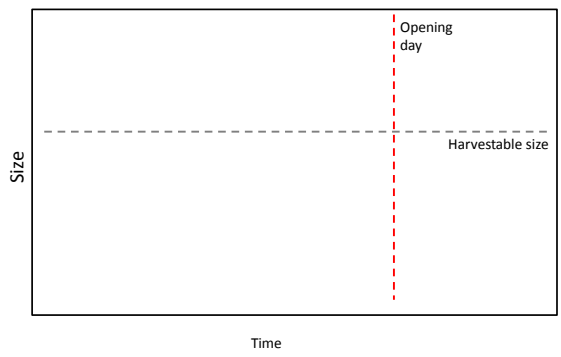
Stocking types

1. Put & grow- fish are stocked at a small size & allowed to grow to harvestable size
   - assumes fish will survive & grow
2. Put & take- fish are raised to harvest size and stocked
   - assumes fish will be harvested

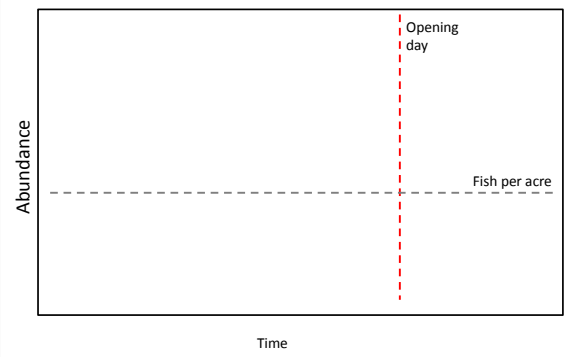
Put & grow-

- Need to understand
  1) Growth- need to understand how long it will take stocked fish to get to harvestable size
  2) Survival- need to know how many to stock to have sufficient
  3) Carrying capacity

Suppose…



Suppose…



Stocking objectives

1. How many fish

2.What size by expected harvest time

Stocking tables

- How many fish to stock & when given:
  1) growth
  2) survival
  3) habitat
- One of the first: Embody 1927

Embody's stocking tables

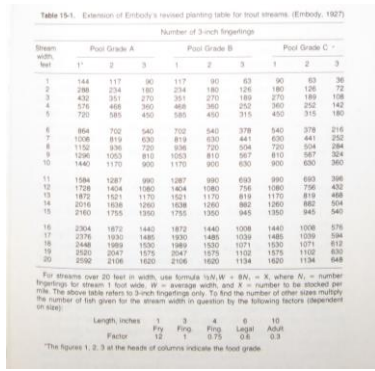


Table 15-1. Extension of Embody's revised planting table for trout streams. (Embody, 1927)

Number of 3-inch fingerlings

Stream width, feet	Pool Grade A			Pool Grade B			Pool Grade C*		
	1*	2	3	1	2	3	1	2	3
1	144	117	90	117	90	63	90	63	36
2	288	234	180	234	180	126	180	126	72
3	432	351	270	351	270	189	270	189	108
4	576	468	360	468	360	252	360	252	142
5	720	585	450	585	450	315	450	315	180
6	864	702	540	702	540	378	540	378	216
7	1008	819	630	819	630	441	630	441	252
8	1152	936	720	936	720	504	720	504	284
9	1296	1053	810	1053	810	567	810	567	324
10	1440	1170	900	1170	900	630	900	630	360
11	1584	1287	990	1287	990	693	990	693	396
12	1728	1404	1080	1404	1080	756	1080	756	432
13	1872	1521	1170	1521	1170	819	1170	819	468
14	2016	1638	1260	1638	1260	882	1260	882	504
15	2160	1755	1350	1755	1350	945	1350	945	540
16	2304	1872	1440	1872	1440	1008	1440	1008	576
17	2376	1930	1485	1930	1485	1039	1485	1039	594
18	2448	1989	1530	1989	1530	1071	1530	1071	612
19	2520	2047	1575	2047	1575	1102	1575	1102	630
20	2592	2106	1620	2106	1620	1134	1620	1134	648

For streams over 20 feet in width, use formula $\frac{1}{3}N_1W_1 = 8N_2 = X$, where N_1 = number fingerlings for stream 1 foot wide, W = average width, and X = number to be stocked per mile. The above table refers to 3-inch fingerlings only. To find the number of other sizes multiply the number of fish given for the stream width in question by the following factors (dependent on size):

Length, inches	1	3	4	6	10
	Fry	Frg.	Frg.	Legal	Adult
Factor	12	1	0.75	0.6	0.3

*The figures 1, 2, 3 at the heads of columns indicate the food grade.

A formal approach

Estimate the number of fish to plant to get a desired mean density

$$\bar{N} = N_0 \cdot \frac{A}{Z}$$

where

$\bar{N}$ = Mean population density

N_0 = Initial population density

A = Annual survival ($A = e^{-Z-F}$)

Z = Instantaneous mortality

An example

Suppose we have a 100 acre lake & desire to have a 300 hatchery origin fish per acre next year

- Instantaneous mortality (Z) is 0.6
- Fishing mortality (F) is 0.2

Need to determine A

A = exp(-Z-F)

A = exp(-0.4)

A = 0.45

An example

$$\bar{N} = N_0 \cdot \frac{A}{Z}$$

$$300 = N_0 \cdot \frac{0.45}{0.6}$$

$$300 \cdot \frac{0.6}{0.45} = N_0 \cdot \frac{0.45}{0.6} \cdot \frac{0.6}{0.45}$$

$$300 \cdot \frac{0.6}{0.45} = N_0$$

$$399 = N_0$$

Need to stock 399 fish per acre

A formal approach

- Estimate the number of fish to plant to get a desired mean density or biomass

$$\bar{P} = P_0 \cdot \frac{e^{g-Z} - 1}{g - Z}$$

where

$\bar{P}$ = Mean biomass

P_0 = Initial biomass

g = Instananeous growth rate

Z = Instananeous mortality rate

An example

Suppose we have a 100 hectare lake & desire to have a 75 kg per hectare hatchery origin fish per acre next year

- Instantaneous mortality (Z) is 1.39
- Instantaneous growth (g) is 1.61

How much to stock

$$\bar{P} = P_0 \cdot \frac{e^{g-Z} - 1}{g - Z}$$

$$75 = P_0 \cdot \frac{e^{1.61-1.39} - 1}{1.61 - 1.39}$$

$$75 = P_0 \cdot 1.118$$

$$\frac{75}{1.118} = P_0$$

$$67.1 = P_0$$

If a fry weighs 45 grams then you need to stock 1491 fry per hectare (67.1/0.045)

Stocking sport of forage fish?

- Walleye stocking in Spirit Lake, Iowa
- Managed for walleye
- Spirit Lake: about 10,000 sac fry/ha stocked
- Predation of stocked fish sustain artificially high adult walleye densities

Consumption Dynamics of the Adult Piscivorous Fish Community in Spirit Lake, Iowa

State of the science

- Selecting for desirable traits (e.g., super catchables)
- Hybridization with native fish
- Hybrids
- Sterilization- triploidy
- Return to creel
- Lunkers- strains with increased growth
- Stocking strategies & systems