Fish Conservation and Management

CONS 486

Harvest Regulations:
Sticks, carrots, honey and vinegar

A weird vegan diet, or how we must regulate fisheries?

Chapter 7 in Ross
Harvest Regulations:
Sticks, carrots, honey and vinegar

‘Speak softly and carry a big stick’ (T. Roosevelt)
But, ‘You catch more flies with honey than you do with vinegar’ (English proverb)

Will a ‘carrot motivate over a stick’?
Topics: Fisheries regulations

• Bycatch

• Harvest regulations:
  - Amount
  - Size or species

• Effort and gear regulations:
  - Fishing effort
  - Gear types
Fisheries regulations: Introduction

• Agencies need to:
  – Develop regulations
  – Enforce regulations

• Compliance necessary
  – BUT regs expensive to monitor and enforce

• Important to have users buy-in
  – Emphasize the value of sustainability

• Rec/commercial – what about subsistence?
Bycatch
Or ‘Where’s Waldo?’
Bycatch

- Capture of non-target (i.e. wrong species), undesirable, or undersized fish species or population
  - Usually legally required to release live bycatch
    - Bycatch often released dead (‘discarding’ in trawl fisheries) though with some gear can be released alive, but often do not survive

- Can occur in any fisheries sector

- Can affect various taxa
  - Inverts, herps, fish, mammals, even birds

- Bycatch biomass often exceeds that of the targeted catch
  - Mortality can be high (eg trawling)
Commercial fisheries bycatch

• In mid-90s, up to 40 million T were discarded each year in commercial fisheries (Alverson et al. 1994)
  – Approaching same levels as total aquaculture production!
  – But much less waste in past two decades: awareness, regulations, selective gears (Zeller and Pauly 2005)

• Managed using:
  – Total allowable catch (i.e., %)
  – Quota systems
  – Gear modifications/restrictions (i.e., minimum mesh sizes)
Purse seine bycatch managed via "brailing" and recovery/live wells
Turtle bycatch reduced using TED’s
Recreational catch-and-release

• Similar to bycatch in terms of regulations and motivations
  • i.e., release non-target, undesirable, undersized fish

• Mandated or voluntary releases

• Voluntary release – ethical or conservation reasons
  – contributes to the view that recreational fishing is relatively benign

• ~ 60% of recreationally captured fish are released (US Department of Commerce 2002; DFO 2003)
  – 28 billion fish caught-and-released per year!

• Release fisheries assume acceptably low mortality
  – now learning that there can be high levels of delayed mortality following release or sublethal impairments (e.g., stress that may have fitness consequences)
Harvest regulations:

Regulating amount and size of catch
Minimum size limits

Predominantly used in recreational fisheries, some use in commercial fisheries to:

1. Protect spawning potential
2. Increase population biomass
3. Produce more large individuals for future harvest
4. Predation on “coarse” prey (i.e., non desired recreationally)

- Fairly simple to impose by managers and to understand by users
- Can be resisted by commercial fishers as it is costly in time and logistically not feasible depending on gear and vessel
- Risk of overexploiting large fish
Slot Limits

• Used almost exclusively just in recreational fisheries

• Allows harvest of small and large fish while protecting medium sized

• Used to prevent or reduce the phenomenon of ‘stunting’ which prevents large bodied fish from emerging in a population

• Provides more harvest opportunities for anglers (of small bodied fish)
Largemouth Bass Slot Limit

These overpopulated bass must be "thinned out" by removing them whenever caught. This will allow the remaining small ones to begin growing faster.

These fish must be released when caught because this size bass very quickly grows to be...

Hefty, keeper-size bass which may be released or removed by the angler.
Attention Fisherman

18-24 INCH SLOT LIMIT ON LARGEMOUTH BASS

All Largemouth Bass between 18 & 24 inches total length must be immediately released and may not be in possession. The daily creel limit is 10, only one of which can be over 24 inches.

BASS

18 " RELEASE 24 "

Tennessee Wildlife Resources Agency
Slot limits

• Assumes **density dependent** body growth

• Small fish selected out through harvest
  – Reduces competition allowing rapid growth into a larger size class which can be protected
  – Ultimately enables production of large fish which can then also be harvested

• Difficult to implement because anglers prefer to catch larger fish
  – Won’t work if anglers won’t harvest smaller fish
Small bass that must be harvested
Large bass that can be harvested
Catch Limits

• Daily catch (possession) quotas
  – ‘Creel’ in recreational fishery
  – ‘Daily trip limits’ in commercial fishery

• Managers must be able to predict annual fishing pressure which can be difficult in recreational fishing
  – E.g., potential # of anglers & fishing effort

• In BC, recreational creel set by region
  – E.g., Vancouver Island: 4 rainbow trout, 20 yellow perch
2013 - 2015
FRESHWATER
FISHING REGULATIONS SYNOPSIS
EFFECTIVE APRIL 1, 2013 THROUGH MARCH 31, 2015

- 2 Year Synopsis, Keep This Guide Until 2015
- Free Family Fishing for Tidal and Non-Tidal Waters, Fathers Day Weekend, see www.bcfamilyfishing.com
- Buy your fishing licence online at www.fishing.gov.bc.ca/
- Find the online Fishing Synopsis and in-season regulation changes at www.env.gov.bc.ca/fw/fish/regulations

Ministry of Forests, Lands and Natural Resource Operations
2013–2015 British Columbia Tidal Waters
Sport Fishing Guide

Freshwater Salmon on reverse >

Get your B.C. Tidal Waters Licence online:
www.ops2.pac.dfo-mpo.gc.ca/nrls-nidpp/index-eng.cfm

Follow us on Twitter! @sportfishingbc
Tidal Water Boundaries

Sport fishing licences and fishing regulations are different for tidal waters and freshwater fishing. Know your boundaries.
Annual catch quotas: Recreational

- **In recreational fisheries:** a pre-determined number of fish per species per year

  - E.g. in B.C., 10 adult hatchery steelhead trout regardless of how many anglers are fishing that year
Annual catch quotas: Commercial

- **In commercial fisheries:** fishery closes once a pre-determined total annual quota is reached

- Efficient gears: e.g. **Purse seines**
  - Strait of Georgia herring roe fishery used to be this way, with quotas being reached in a single day!
  - Leaves vessel and crew only briefly employed and forced to sell catch at this time
  - May not be best for cost/benefit

- Inefficient gears: e.g. **Trawls**
  - Collect significant amounts of by-catch, impossible to live release bycatch
  - If bycatch quota is reached, the target fishery often must stop despite not reaching primary quota
Difficult/impossible to release bycatch alive from some gears - eg gill nets and trawls
Even if released, or escape, from gill nets, wounds can have delayed or fitness consequences.

Escaped/recaptured 400 km later

Gill net scars

Fungus development

Human released from net
Beach seines have the potential to release bycatch alive but it depends on how they are used (eg fish density, net depth)
Recreational catch-and-release

• Very common in N.A. recreational fisheries
  – Can be optional or mandatory
  – Compliance is generally high

• Illegal in some European fisheries!
  – Stay ‘tuna’d’ for our seminar series

• Possible to maintain “unexploited” size distribution
  – Avoids stunting, generates high catch rates
  – I.e., all the fun without the guilt!

• Assumption that released fish will have high survival
  – Mortality can be higher than you expect!
  – Angler behaviour & education is important
Escapement targets & surplus

- In commercial fisheries: fish not required for spawning can be harvested
  - recall super fun lecture on Ricker curve & surplus production

- Quotas differ based on gear types & location
  - e.g., seiner, trollers, gillnetters in BC salmon fishery

- Requires good in-season knowledge of stock and recruit sizes and ability
  - need to be able to stop fisheries instantly if escapement targets not likely to be met
  - e.g., BC’s sockeye, pink salmon fisheries
Fisheries closures

• Used in both recreational and commercial fisheries

• Prevent exploitation at some critical phase
  – e.g., seasonal closures for spawning areas; bass
  – e.g., high temperature fisheries closures; salmon/trout

• In commercial fisheries, used in conjunction with escapement target management
  – must close fisheries if escapement targets can’t be met

• Freshwater or Marine Protected Areas (MPAs) create spatial closures
  – limit access or fishing effort in key locations
  – can have problems (international boundaries, buffer zones are heavily targeted)
Harvest regulations:

Regulating effort or gear
Limit fisheries effort

In recreational fishing:

1. Number of simultaneous fishing *rods* can be regulated
   - although limiting to one rod may simply encourage someone to increase individual effort

2. **Time** of day can be regulated; no night fishing

3. **Access** to a lake could be regulated
   - e.g., Post et al. 2002
   - private lakes throughout Europe
   - MPAs & sanctuaries
Limit fisheries effort

In commercial fisheries:

• Use Individual Transferrable Quotas (ITQs)
  – Create a group of fishers that will participate.
  – Establish a ‘Total Allowable Catch’ (TAC)
  – Quota shares of the TAC allocated to individuals
  – Can be bought, sold or leased
Limit fisheries effort: ITQs

• Some fisheries require ITQs only to be transferred to members within same fleet
  – can result in few boats fishing as years progress
    • few crews involved so less competition
  – greater flexibility: can fish when demand is highest or operation costs are lowest
    • income is spread out longer than with normal quotas

• Can result in limited access to fishery
  – fishery resources controlled by only a few individuals
  – becomes a ‘private fishery’ which non-members may object to
ITQs successful in B.C. Pacific halibut fisheries
Limit gear efficiency or prohibit some gears

In *recreational fisheries*:

- Prohibit live bait, roe, or scented lures/flies
- Can restrict use of treble hooks or barbed hooks
Barbed vs barbless hooks:
- limits capture efficiency
- has fish welfare and ethical considerations
• Standard “J” hooks vs circle hooks
• Good example of changing gear efficiency to enhance survival of hooked and/or released fish
Red drum (*Sciaenops ocellatus*) popular recreational fish in Eastern U.S.
Red drum have pharyngeal teeth

Favored food are crabs which they swallow and crush with these teeth. Hooks get swallowed deep and can perforate throat which is right next to the heart.
J hooks often pierce the heart and cause the fish to bleed out into the cavity. Fish that break off from a capture event with the hook lodged in the mouth, or that are released after capture, may look fine briefly but will die hours later due to this bleeding effect. The use of circle hooks prevents this because they do not hook into the back teeth area, and instead hook on the edge of the lip.
Limit gear efficiency or prohibit some gears

In commercial fisheries:

• Mesh-size regulations
  – e.g. make the mesh on gill nets or trawls larger to allow escape of some fish
  – this also helps make them less efficient for by-catch

• Prohibiting use or modifying certain gears
  – e.g., trolling rather than gill nets; seining rather than trawling
  – e.g., turtle exclusion devices on shrimp trawls
Note the different sizes of gill net mesh on these two spools.
Integrated use of these tactics

Nothing is ever easy:

– regulations continually being revised and updated; region-specific

– fisheries management uses multiple tactics for a given region or species!

– e.g., B.C. freshwater recreational fisheries managers use many tactics
Limit gear efficiency
Prohibition of gear
Daily catch quota
Minimum size limits
Catch and release
Seasonal closure
Daily catch and
Annual catch quotas

**REGION 1- Vancouver Island**

**REGIONAL REGULATIONS**

**GENERAL RESTRICTIONS**
- Single barbless hook: must be used in all streams of Region 1, all year.
- Bait ban applies to all streams at Region 1, all year, with some important exceptions. Check the Tables.

**REGIONAL DAILY CATCH QUOTAS**
(See tables for exceptions)

- **Trout**: 4, not more than 1 over 50 cm (2 hatchery steelhead over 50 cm allowed)
  - 2 from streams (must be hatchery)
  - And you must release:
    - All wild trout and wild steelhead from streams
    - All char (includes Dolly Varden; see centre page Freshwater Fish of B.C.)

**Seasonal closure**

- Stocked Lake or Stream (not all stocked lakes listed, see p.56)
- CW: Classified Waters Licence required to fish Class I or Class II waters, see p.6
- Including tributaries
- Wheelchair Accessible
- Age Restricted Waters

**POSSESSION QUOTAS**
- Possession quotas = 2 daily quotas

**ANNUAL CATCH QUOTAS**
- Annual catch quota for all B.C.: 10 steelhead per licence year (only hatchery steelhead may be retained in B.C.)

**DAILY & ANNUAL CATCH QUOTAS FOR SALMON**
- Please refer to the NOTICE on page 4 for Salmon Regulations.

**WILD ORIGIN TROUT**
- Adipose present

**HATCHERY ORIGIN TROUT**
- Healed scar in place of adipose fin

**WILD TROUT RELEASE ALL STREAMS REGULATION**

Anglers note there is a region wide regulation requiring the release of all wild origin trout in streams. This regulation allows only hatchery origin trout in streams to be harvested, except where prohibited by water specific regulation. In Region 1, stream hatchery origin trout can be distinguished from wild origin trout by the presence of a healed scar in place of the adipose fin. Please note, this regulation does not apply to lakes.

For more information please contact regional fisheries staff at (250) 751-3100.
Note how we manage Non-native ‘invader’ species.

Bass were illegally planted but they are now managed like a native in that they are protecting spawning potential – if they wanted to get rid of them like the province used to attempt to do, you would harvest the males from nests during spawning.

Note that the illegally introduced perch are not treated so kindly, as its ok to kill a lot of them every day, all year long.
<table>
<thead>
<tr>
<th>MANAGEMENT UNIT</th>
<th>EXCEPTIONS TO THE REGIONAL REGULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADAM RIVER</strong> (except Eve River)</td>
<td>Artificial fly only above Eve River, to Highway 19 bridge</td>
</tr>
<tr>
<td><strong>AMHUTI RIVER</strong></td>
<td>Class II water Apr 1 - Oct 31. Steelhead Stamp mandatory Apr 1-June 30</td>
</tr>
<tr>
<td><strong>ALICE LAKE</strong></td>
<td>Trout daily quota = 2</td>
</tr>
<tr>
<td><strong>AVON LAKE</strong></td>
<td>Closed all year from upper falls downstream 1 km to Bear River logging road bridge 3 km from tidewater</td>
</tr>
<tr>
<td><strong>AVONLAKE CUSUMUS CREEK</strong></td>
<td>No fishing from mouth to falls about 4 km upstream. Dec 1-May 31</td>
</tr>
<tr>
<td><strong>AVERHOVEN LAKE</strong> (in the Wilbran Creek watershed)</td>
<td>Artificial fly only, barbless, single barbless hook</td>
</tr>
<tr>
<td><strong>BAINBRIDGE LAKE</strong></td>
<td>Trout and kokanee release. Unseasoned lake approx. 7 km W/SW of Mr. Wallman</td>
</tr>
<tr>
<td><strong>ANILIER LAKE</strong></td>
<td>No powered boats</td>
</tr>
<tr>
<td><strong>ARCTURUS RIVER</strong></td>
<td>No fishing above the boundary signs at the bridge crossing approximately 7 km from the mouth. Nov 1-Apr 30</td>
</tr>
<tr>
<td><strong>ASH RIVER</strong></td>
<td>No fishing from Dickson falls downstream 3 km to signs</td>
</tr>
<tr>
<td><strong>BAINBRIDGE LAKE</strong></td>
<td>No angling from boats. Age restriction (see page 5 in the Provincial Regulations)</td>
</tr>
<tr>
<td><strong>BEAR LAKE</strong></td>
<td>Sea bulldog</td>
</tr>
<tr>
<td><strong>BEAR RIVER</strong></td>
<td>See Anilier Creek.</td>
</tr>
<tr>
<td><strong>BEAVERS LAKE</strong></td>
<td>Fly fishing only. Age restriction (see page 5 in the Provincial Regulations)</td>
</tr>
<tr>
<td><strong>BEECH CREEK</strong></td>
<td>Sea Puget Sound</td>
</tr>
<tr>
<td><strong>BIG SPRUCE RIVER</strong></td>
<td>Cross river. Age restriction (see page 5 in the Provincial Regulations)</td>
</tr>
<tr>
<td><strong>BIGNESS CREEK</strong></td>
<td>No powered boats</td>
</tr>
<tr>
<td><strong>BLACK CREEK</strong></td>
<td>No fishing Dec 1-May 31</td>
</tr>
<tr>
<td><strong>BOGET-AN LAKE</strong></td>
<td>No powered boats</td>
</tr>
<tr>
<td><strong>BLACKWATER LAKE</strong></td>
<td>Trout daily quota = 2</td>
</tr>
<tr>
<td><strong>BONANZA LAKE</strong></td>
<td>No trout over 50 cm, bait bar, single barbless hook.</td>
</tr>
<tr>
<td><strong>BOOT LAKE</strong></td>
<td>Trout daily quota = 2. Bait bar, single barbless hook.</td>
</tr>
<tr>
<td><strong>BRANT LAKE</strong></td>
<td>Speed restriction on parts (60 km/h)</td>
</tr>
<tr>
<td><strong>BRAINWATER RIVER</strong></td>
<td>Sea Portage River.</td>
</tr>
<tr>
<td><strong>BUCKLAKE'S TRIBUTARIES</strong></td>
<td>Fly fishing only. Except, Thekwood Creek is closed all year.</td>
</tr>
<tr>
<td><strong>Lower Campbell Lake's Tributaries</strong></td>
<td>No fishing Feb 1-July 10 including Campbell River between Strathcona Dam and (lower) Campbell Lake</td>
</tr>
<tr>
<td><strong>CAMPBELL RIVER</strong></td>
<td>Closed all year between Elk Falls and John Hart Dam Power Station</td>
</tr>
<tr>
<td><strong>Carnation Creek</strong></td>
<td>No fishing from the boundary sign at the end of Maple Street downstream to the boundary sign at the cement block. Aug 1-Oct 31</td>
</tr>
<tr>
<td><strong>CATTLE CREEK</strong></td>
<td>No fishing from the boundary sign at the end of Maple Street downstream to the boundary sign at the cement block. Aug 1-Oct 31</td>
</tr>
<tr>
<td><strong>CHIMA NUVAS CREEK</strong></td>
<td>No fishing from the boundary sign at the end of Maple Street downstream to the boundary sign at the cement block. Aug 1-Oct 31</td>
</tr>
<tr>
<td><strong>CHICAGO LAKE</strong></td>
<td>Electric motors only.</td>
</tr>
<tr>
<td><strong>CLAVIS ELLIOTT LAKE</strong></td>
<td>Closed all year.</td>
</tr>
<tr>
<td><strong>CLOVER LAKE</strong></td>
<td>Electric motors only.</td>
</tr>
<tr>
<td><strong>COCHRANE LAKE</strong></td>
<td>Closed all year.</td>
</tr>
<tr>
<td><strong>CLEWES RIVER</strong></td>
<td>No fishing above the West Main logging road bridge (about 7.5 km upstream of the Highway 11 bridge). Dec 1-May 31</td>
</tr>
<tr>
<td><strong>DOLLYMITZ RIVER</strong></td>
<td>No powered boats.</td>
</tr>
<tr>
<td><strong>DOLOMITZ LAKE</strong></td>
<td>No Mussel trout under 30 cm or over 50 cm. Bait bar and single barbless hook.</td>
</tr>
<tr>
<td><strong>DORSO CREEK</strong></td>
<td>Closed all year.</td>
</tr>
<tr>
<td><strong>COURTENAY RIVER</strong></td>
<td>Solely open Oct 1-Nov 30. Speed restriction on part B (8 km/h).</td>
</tr>
<tr>
<td><strong>DOUGLAS CREEK</strong></td>
<td>Closed all year.</td>
</tr>
<tr>
<td><strong>COWICHAN LAKE</strong></td>
<td>No fishing Nov 1-Apr 30. Sat. and Sun. single barbless hook, Nov 15-Apr 30. Speed restriction on parts B (8 km/h). Speed restriction within 50 m of shore.</td>
</tr>
</tbody>
</table>

**NOTE:** No lake or stream is NFT (non-fishable), except the Boundary River upstream (see page 11) and the Boundary River (adjoining) also applies.
An example from northern BC. Whole different assemblage of species

Note that yellow perch is native here, and the daily catch quotas are much smaller.
Up next...

• Managing habitat and biotic communities,

• or, ‘Building better bedrooms and kitchens for fish and their friends!’