

# Conservation

- A. Veale and M. Russello, UBC-O 2015: “Kootenay Lake West Arm shore-spawning kokanee are genetically distinct from neighboring stream-spawners ... ”
- Pragmatic reason to conserve and protect shore spawners: water temperature may remain suitable
- Significant protection measure – hydro utilities implemented in 2012, 2015, 2018 kokanee shore spawner lake level reductions (from normal) in fall, to reduce redd dewatering and stranding of embryos in spring
- Results: (report for COFAC, Andrusak and Andrusak 2013)
  - 2012 shore spawners experienced 35% dewatered redds
  - Compare to: ~80% since 2003 and 12% pre-development 1928-1932



Shore spawners from 2012

# Management - current

- Fishing regulations
- Habitat enhancement
  - Lake Nutrient Restoration
  - Spawning Channels
- **Habitat protection – e.g. fall lake level operation**
- Emergency measures for main lake
  - Supplementing kokanee
  - Predator reduction:
    - Angling
    - Direct removal

# Fall lake level operation

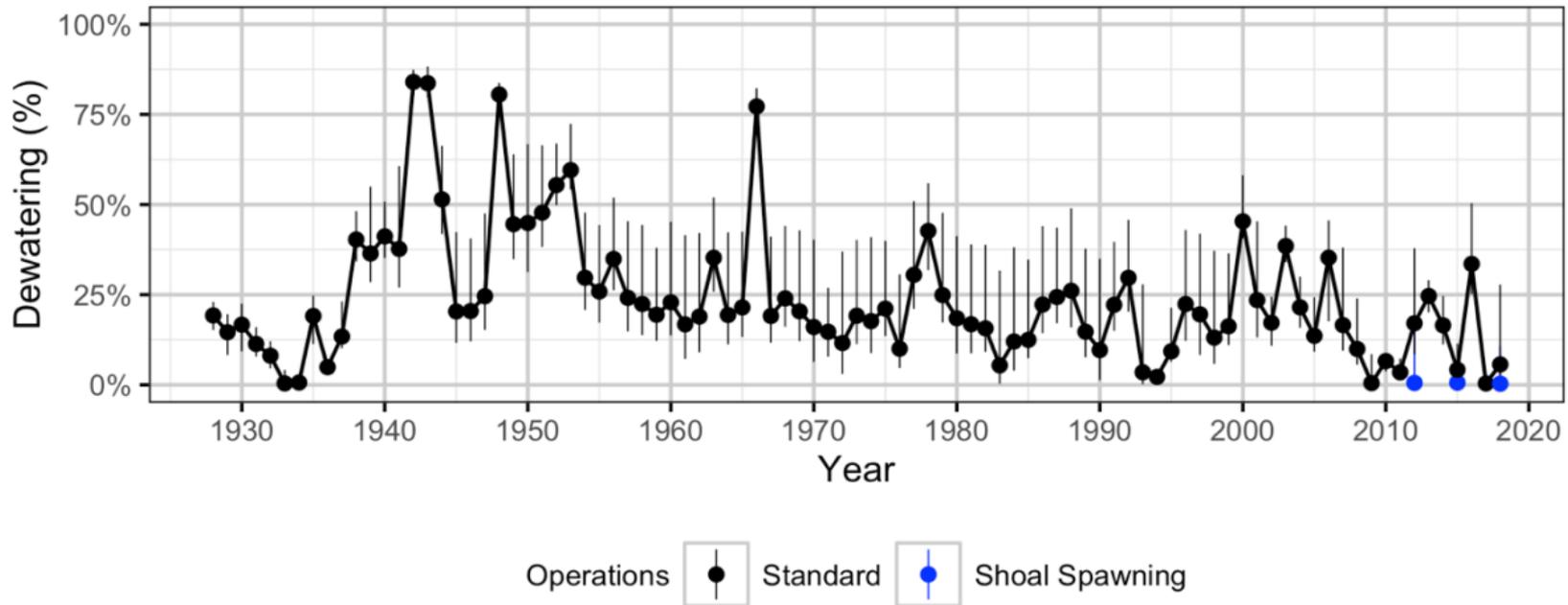


Figure 15. The estimated percent redd dewatering by year and operations with 150 days to emergence (with 95% CIs).

Figs. 15 and 16. Thorley, J.L. 2019. WEST ARM KOKANEE SHOAL SPAWNING 2019 THE PERCENTAGE OF DEWATERED REDDS OF SHOAL SPAWNING KOKANEE (ONCORHYNCHUS NERKA) IN THE WEST ARM OF KOOTENAY LAKE UNDER HISTORICAL, CURRENT AND ALTERNATIVE OPERATIONS. Prepared for: FortisBC, Castlegar, B.C.

# Fall lake level operation

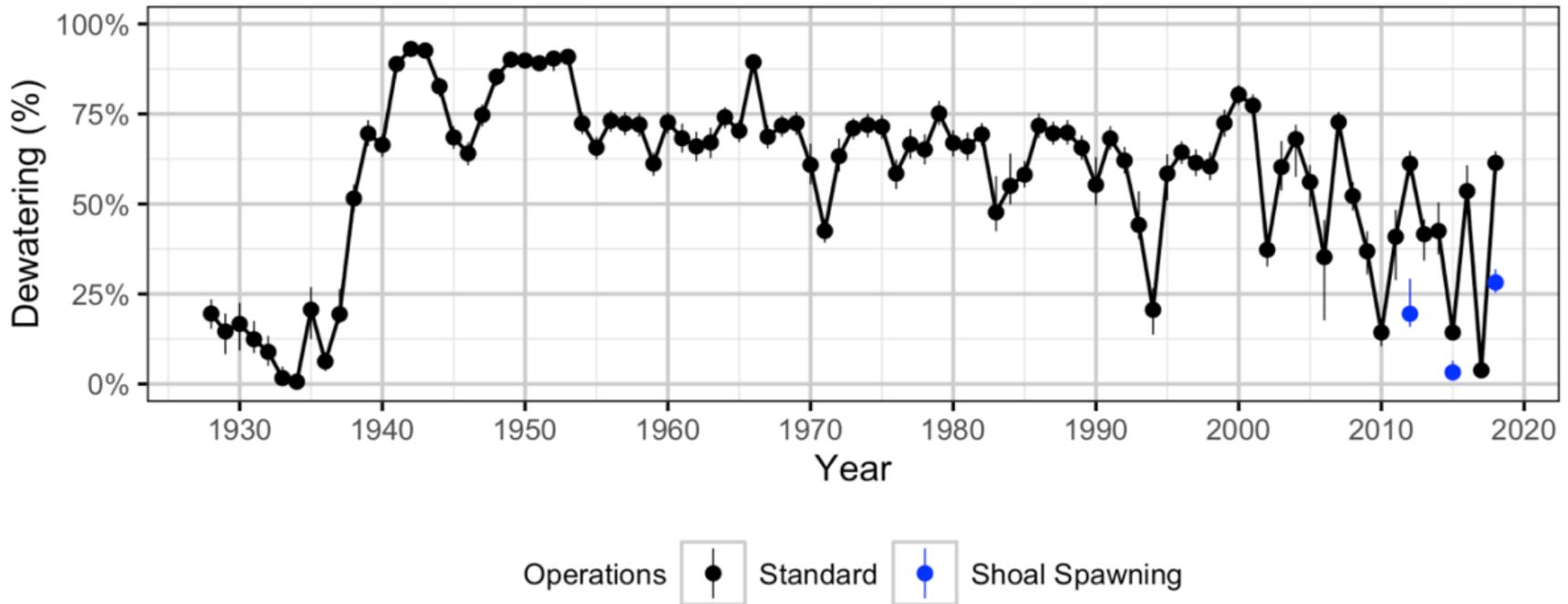


Figure 16. The estimated percent redd dewatering by year and operations with emergence on (or after) March 31st (with 95% CIs).

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# Fall lake level operation

“The current results indicate that shoal spawning operations have substantial benefits. If emergence occurs after 150 days (February 1st to March 22nd) then redd dewatering in 2012, 2015 and 2018 was estimated to have been **less than < 1%** (although the 95% CIs include 5%). Alternatively, if emergence occurs on (or after) March 31st then redd dewatering was estimated to be between **3 and 30% but less than ½ the levels without shoal spawning operations.**”

# Shore spawner enhancement

- Prevent spawning in locations too shallow for survival (fall shore spawner lake level operation, preventive fencing)
- attract kokanee to safer spawning depths
  - New attractive habitat Friends of Kootenay Lake project 2019
  - or reconfigure current spawning sites to be deeper (recontouring to be 30 – 40 cm deeper)
- Salvage in spring (relocate or rewater, various methods)

# 2015-18 Main Lake Kokanee Supplementation



- 20 million eggs – fall transplants
- 900 thousand spring fry released

# Kokanee Spawning Channels

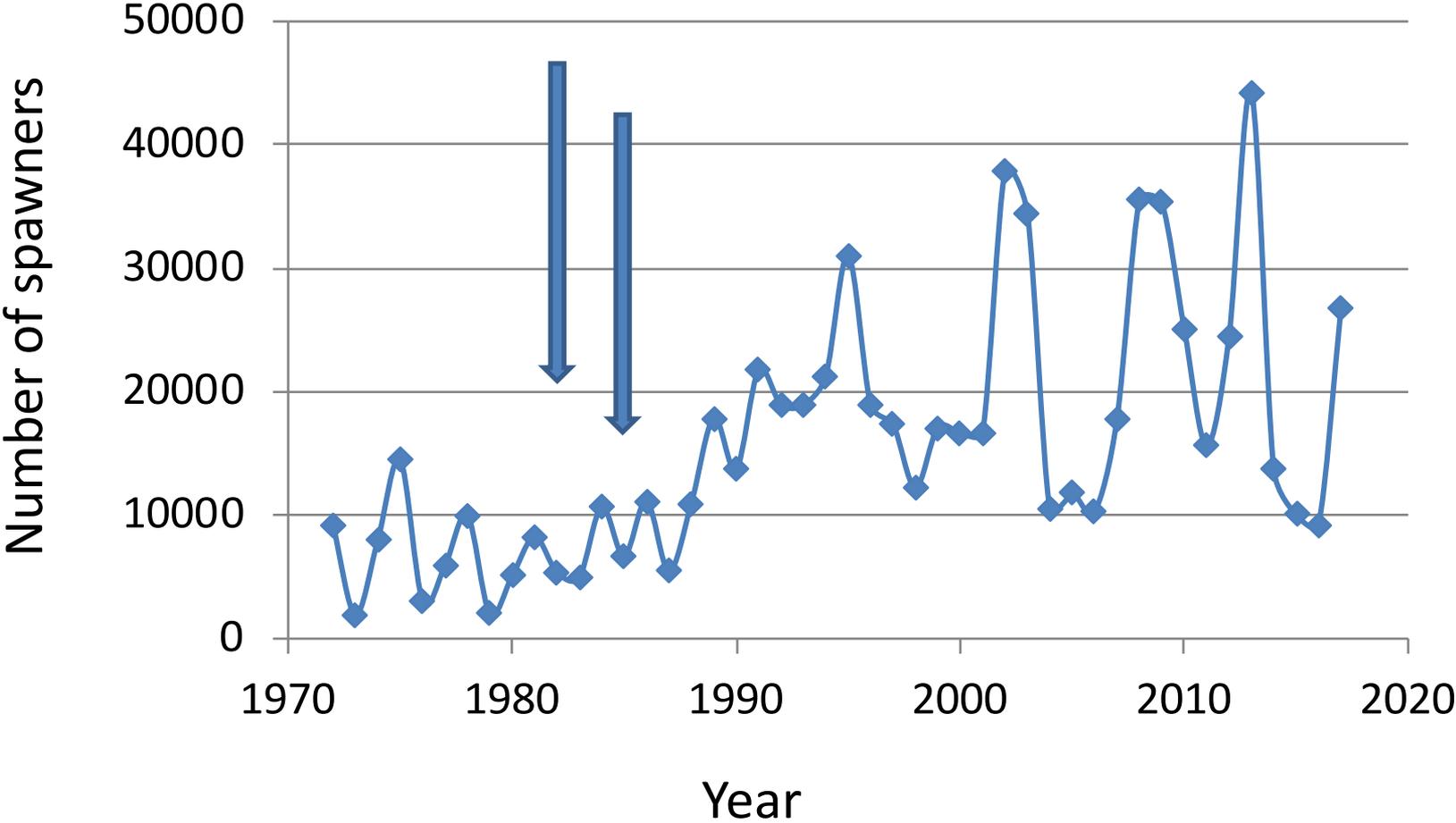
- Kokanee Creek, Redfish Creek and Meadow Creek
- Provide reliable spawning habitat for kokanee – we are able to control gravel size, clean annually, and deliver clean water
- Compensate for habitat impacts from humans over the last century (water control, riparian vegetation, food supply, etc)
- Increase the egg incubation capacity and survival of eggs (from 5% to 80%)
- Significant benefits for anglers and the ecosystem

# Kokanee Spawning Channels - Seasons

1. Fall – count fish in channel, collect biological data
2. Winter – flow maintenance, ice control
3. Spring – sample to estimate number of fry leaving spawning channels
4. Summer – clean gravel in channel for egg incubation



# Kokanee Spawning Channels – West Arm Results



# Management in Future

- Uncertainty of climate change, many possible effects on temperature and precipitation
- Kokanee are a cool water fish, e.g. fry upper lethal temperature is 22°C, but spawners **much** less tolerant.
- On Kootenay Lake pre-spawning mortality increases from 0% to 25-50% as stream temperatures increase from 10°C to > 13°C
- Expect more cons than pros, for kokanee

# Possible climate change impact – an example

- Stream temperature increases depend on
  - groundwater influence (deep groundwater is cooler)
  - Precipitation - more rain instead of snow
  - Shading
  - Shorter ice free periods on lakes
- Actions
  - Shore spawner conservation and enhancement
  - Riparian vegetation protection for shade
  - High elevation storage and fall release
  - Underground cooling, ice (stop-gap)?

# Summary

- Kokanee are a unique species with an interesting history of colonization and adaptation in Kootenay Lake
- Healthy kokanee populations provide benefits to people, but also have wide ranging ecosystem benefits
- 2019 status mixed (extinct to stable)
- Current management addressing current issues
- Future management will need to adapt to new issues such as uncertain but inevitable long term habitat changes.
- Adaptation will likely require existing and new technical tools at the local level, for Kootenay Lake kokanee



# Acknowledgement – Gary Munro

## FISHERIES PROJECT NOTICE

**PLEASE DO NOT  
DISTURB**

This project involves kokanee enumeration and biological sampling for comparison to a spawning channel located at Redfish Creek. It will allow more precise determination of adult numbers and fry production next spring. Fish will only be held temporarily as the holding pen is emptied each morning over the course of the run.

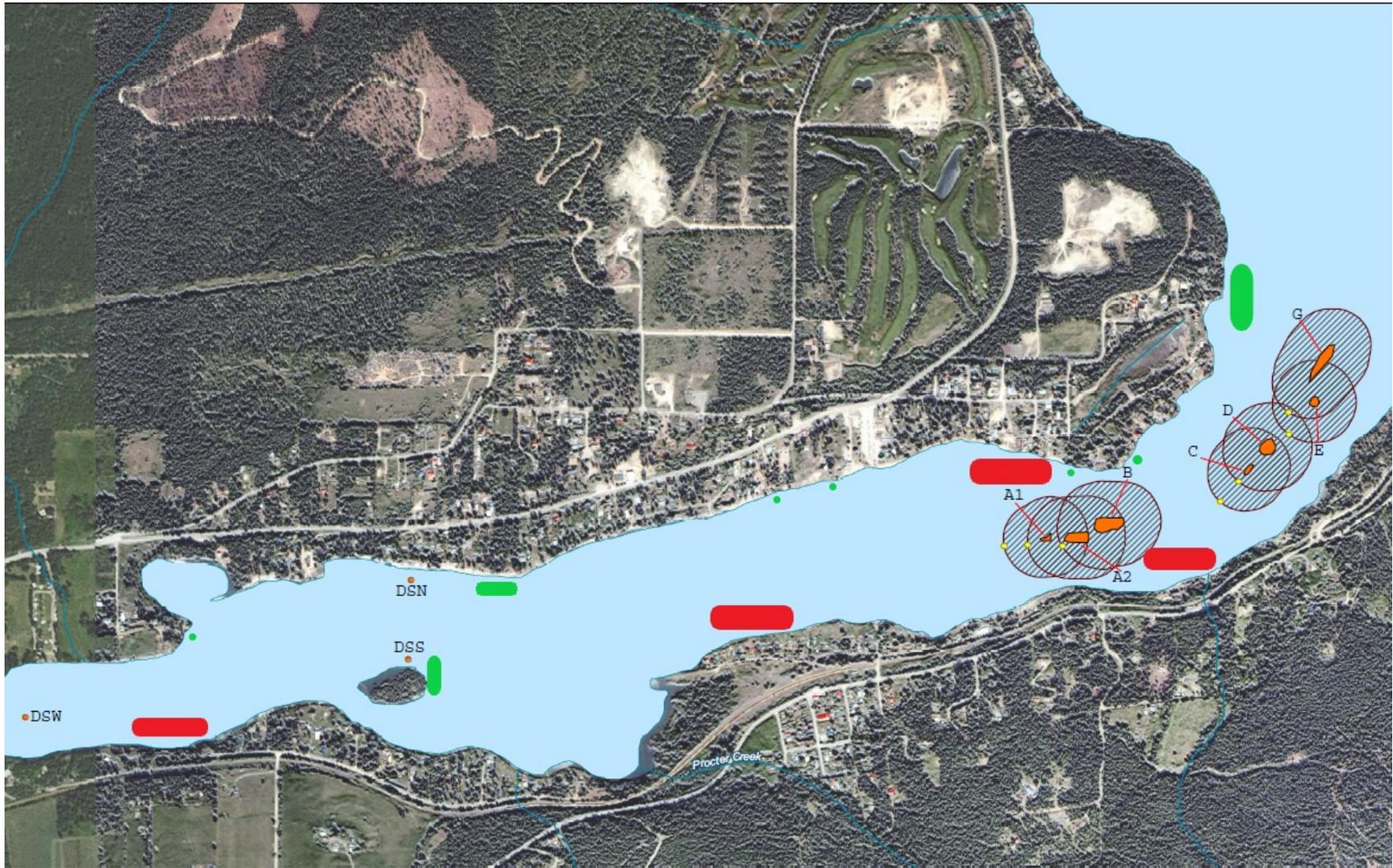
For further information contact the  
Environmental Stewardship Division at 606-254-2211

Kootenay Lake Kokanee Questions



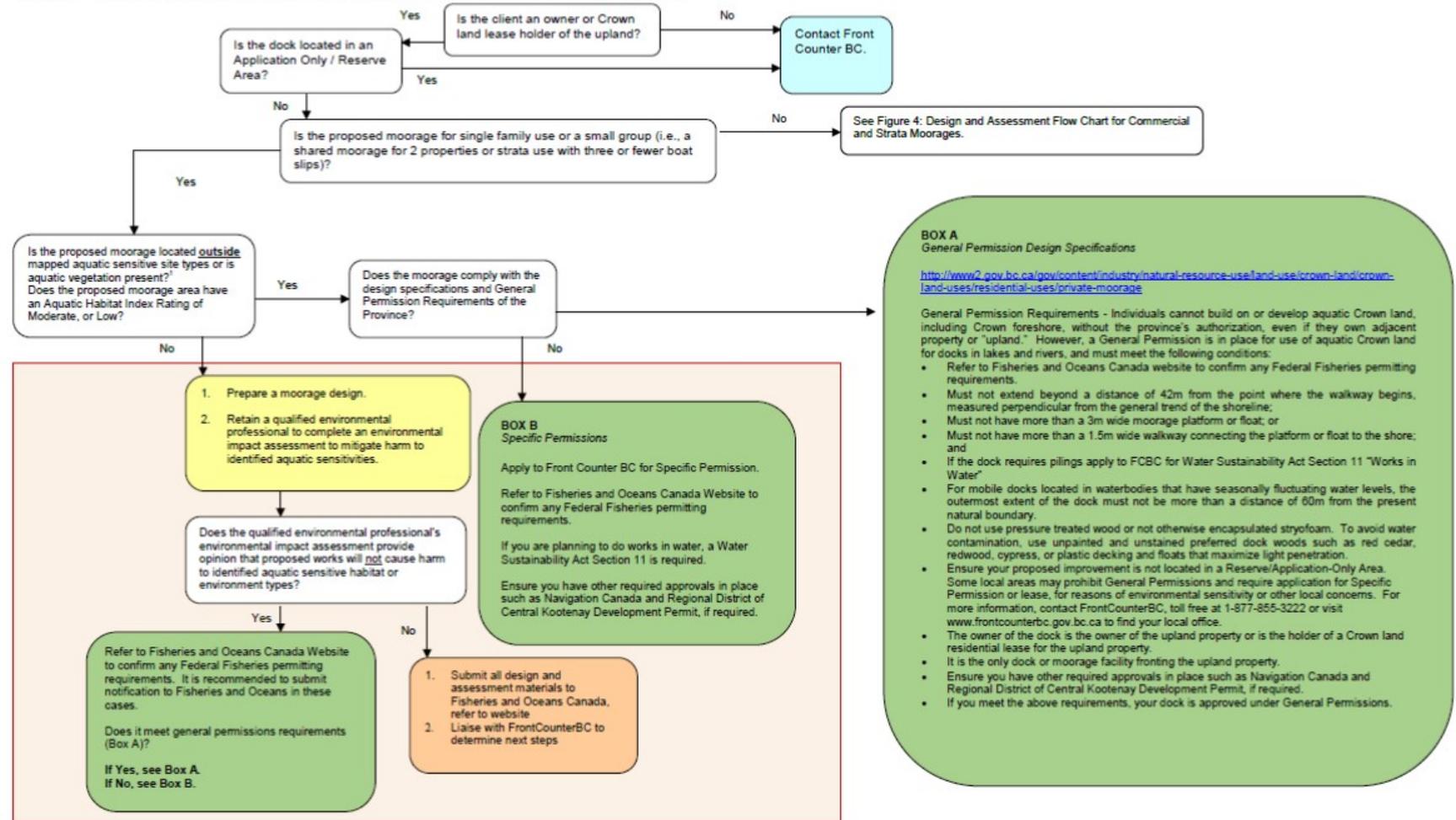


# Dredging



# Docks

Figure 3 Design and Assessment Flow Chart for New Private Moorage on the Kootenay Lake System



<sup>1</sup> Sensitive aquatic or aquatic site types are identified on the maps. The specific aquatic site sensitivity is found in the Foreshore Inventory and Mapping Report (see Schleppe and Cormano, 2012) and includes known or potential kokanee spawning areas, identified critical sturgeon habitat, and/or a high salmonid juvenile rearing

Proponents should contact FrontCounterBC for the most up to date application or permitting process for both general and specific permissions.

# Kootenay Lake Kokanee Status – IHN Virus

- Infectious hematopoietic necrosis virus (IHN) found for the first time in adult kokanee spawners at Meadow Creek in 2013 and each year since
- West Arm stream spawners also infected
- Kokanee fry samples 2014 and Gerrard spawners testing indicated no viral infection
- Potential sources; migrating animal (e.g. birds), present in the past but undetected, introduced by a person/boat, or other possibilities.
- Disease (e.g. IHN virus) and parasites are rarely a major factor that affect wild population status- likely the case for Kootenay Lake:
  - no significant fish kills identified (2013 event, likely small impact -?)
  - adults have spawned successfully despite infection
  - egg to fry survival has remained normal (IHN typically kills fry)
  - levels of infected kokanee declining
  - rainbow trout not currently infected
- **IHN virus is not harmful to people**, and can't transfer to people by either touching or eating infected fish.

# Kootenay Lake Kokanee Status – IHN Virus

- There is no practical way of completely controlling disease in wild fish populations
- We can limit virus at spawning channels where we have some control, and where practical
  - carcass removal
  - flushing
  - summer drying
  - kokanee testing will continue annually