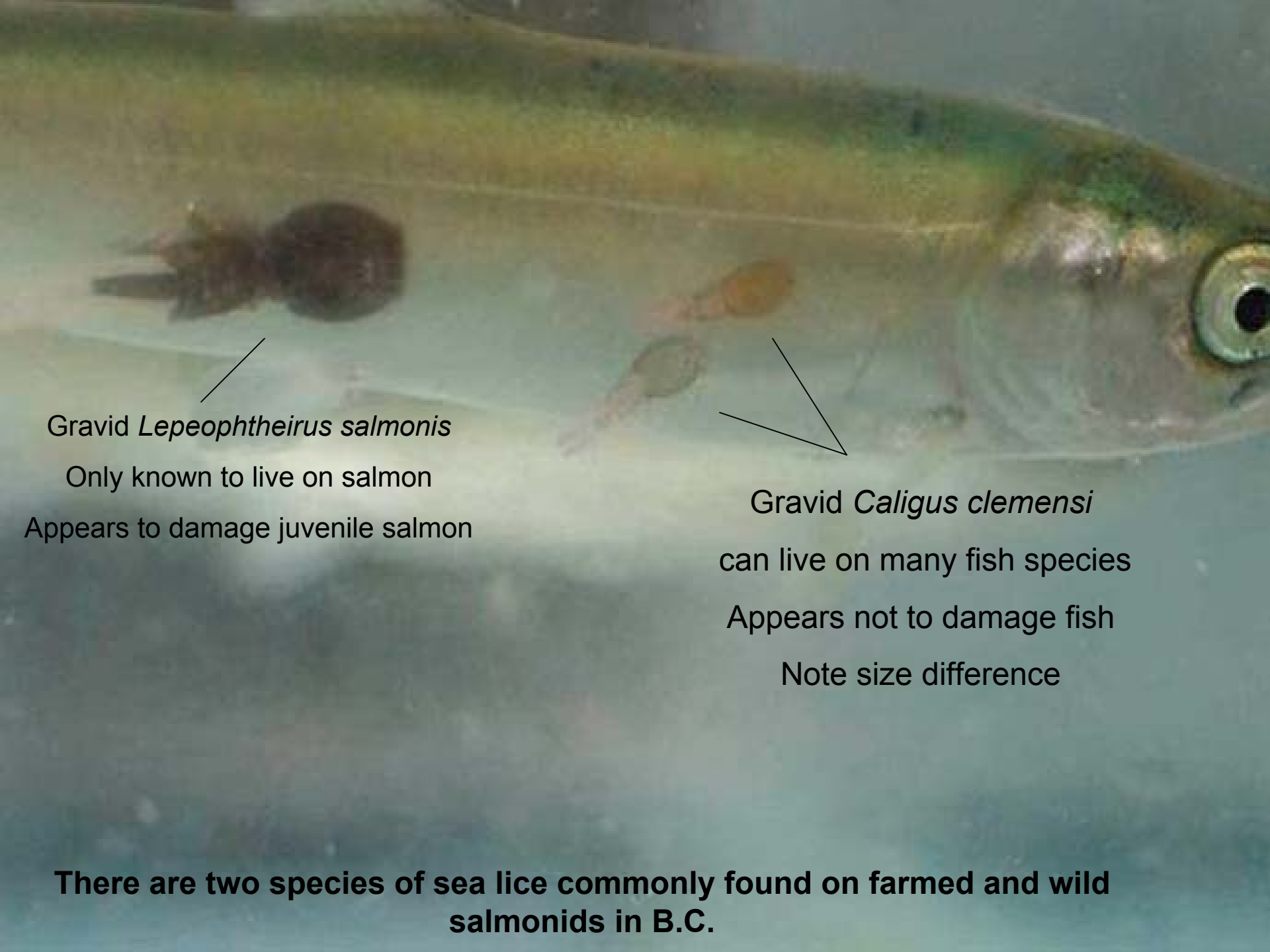


Sea lice in the eastern Pacific





Gravid *Lepeophtheirus salmonis*

Only known to live on salmon

Appears to damage juvenile salmon

Gravid *Caligus clemensi*

can live on many fish species

Appears not to damage fish

Note size difference

There are two species of sea lice commonly found on farmed and wild salmonids in B.C.

Norwegian research found a young salmon or sea trout can bear approximately 1 louse for every gram of the fish's weight.

Their smolts appear to survive 10 salmon lice

All salmonids in the Atlantic enter saltwater at a much bigger size than our pink and chum salmon

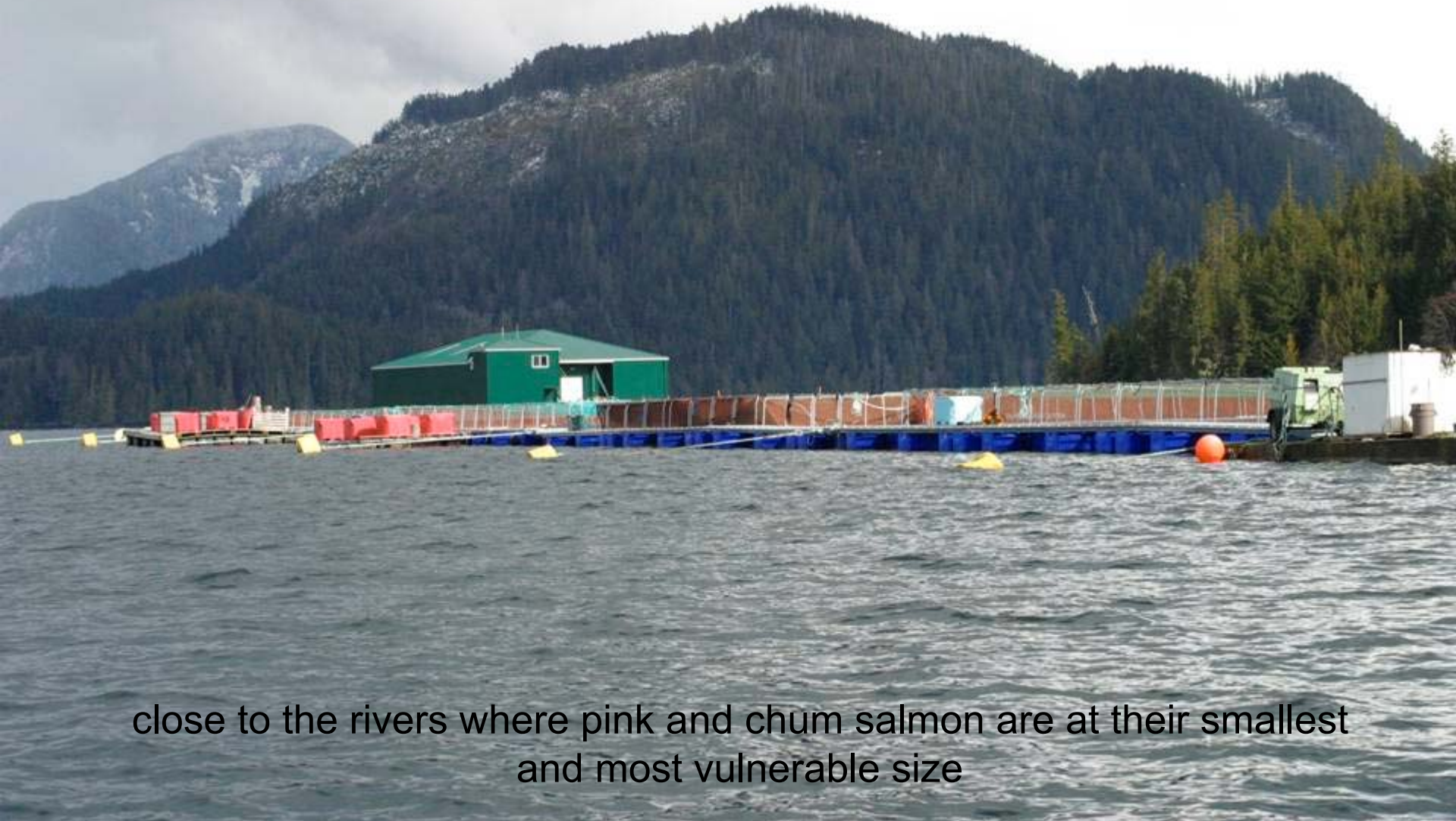


The impact of sea lice is host size dependant. The smaller the fish the fewer sea lice it can bear

All available research suggests:

At 0.3-0.4 grams pink and chum fry
are much too small to survive a single
louse

Salmon farms use nets to hold Atlantic salmon populations of 700,000 to 1.3 million fish....



close to the rivers where pink and chum salmon are at their smallest and most vulnerable size



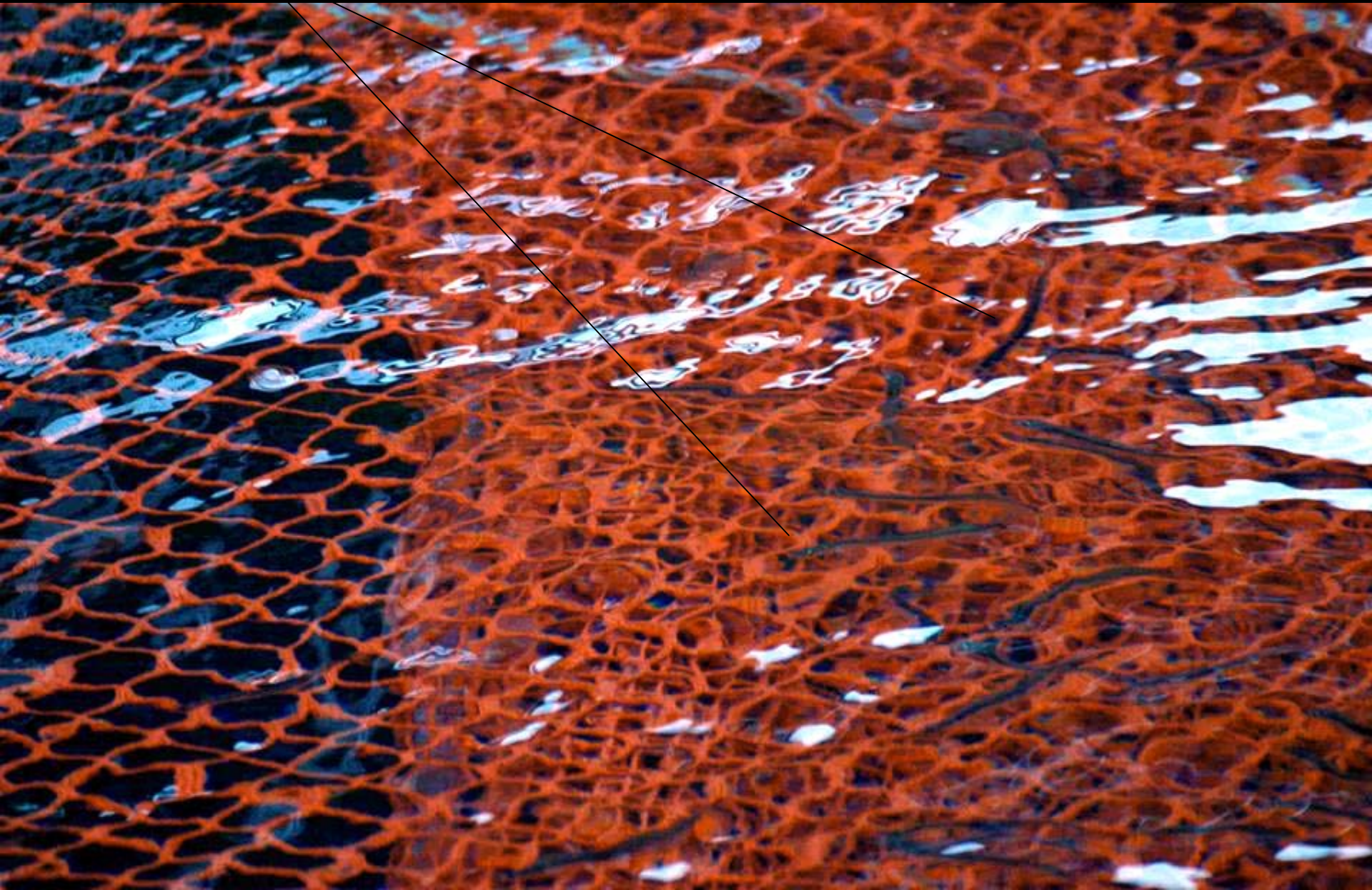
Larvae hatching from sea lice on wild adult salmon migrating into rivers infect the farm salmon in the fall

In the natural system sea lice die in freshwater over the winter, by spring the majority of sea lice which traveled inshore on spawning salmon are gone.



Today the sea lice passed to farm salmon reproduce all winter. By spring billions of larval lice occur near the rivers where there should be none

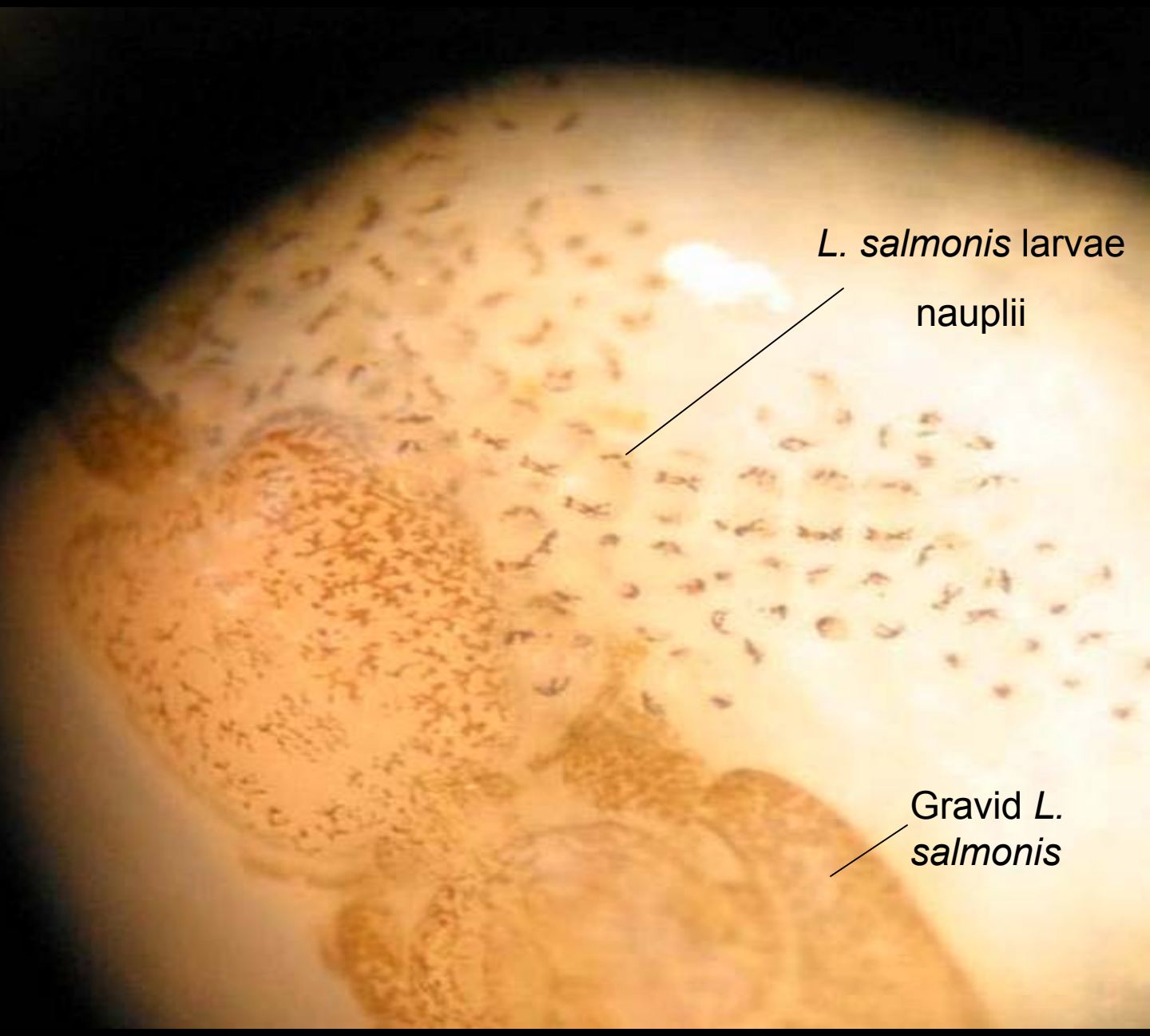
If these capelin can pass through a freshly painted net, sea lice larvae almost certainly can too (Watson Cove, Tribune Channel)




Sea lice hatch from egg-string (tails), while the mother louse remains on the fish, the babies are cast adrift for 1-2 weeks

L. salmonis larvae
nauplii

Gravid *L. salmonis*

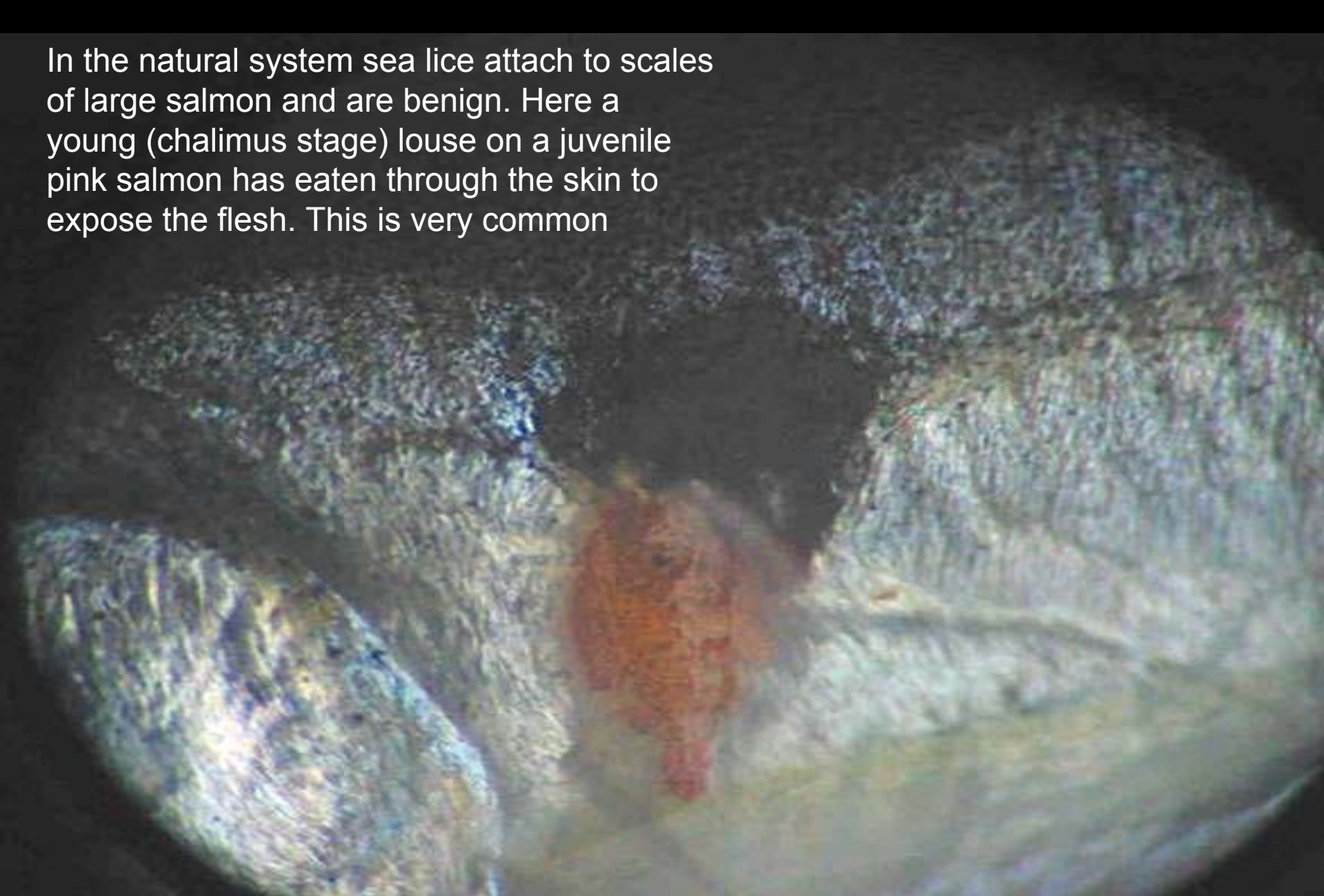




Free-swimming Nauplii molt into copepodids, that can now grab onto a salmon. When you find lots of copepodids, you are near lots of mother lice

Photo by Corey Peet

In the natural system sea lice attach to scales of large salmon and are benign. Here a young (chalimus stage) louse on a juvenile pink salmon has eaten through the skin to expose the flesh. This is very common



Here is what I have learned

The CANADIAN FIELD-NATURALIST

Published by THE OTTAWA FIELD-NATURALISTS' CLUB, Ottawa, Canada



This study was the first to report *L. salmonis*, the salmon louse, on juvenile Pacific salmon.

98% of this run never returned.

(Morton and Williams 2004)

We found more lice near farms with adult fish than near farms with smolts and even fewer where there were no farms



L. salmonis Abundance per Fish

40
30
20
10
0

no

smolt

yes

Exposure Category



This study found virtually no sea lice near Prince Rupert, Rivers Inlet, Smith Inlet, a few lice near the salmon farms in Bella Bella and many lice in the Broughton Archipelago.

Where there were salmon farms, there were sea lice and no where else

Sea lice (*Lepeophtheirus salmonis*) infection rates on juvenile pink (*Oncorhynchus gorbuscha*) and chum (*Oncorhynchus keta*) salmon in the nearshore marine environment of British Columbia, Canada

Alexandra Morton, Richard Routledge, Corey Peet, and Aleria Ladwig

Abstract: This study compared sea lice (*Lepeophtheirus salmonis*) infestation rates on juvenile pink (*Oncorhynchus gorbuscha*) and chum (*Oncorhynchus keta*) salmon in five nearshore areas of the British Columbia coast selected on the basis of proximity to salmon farms. A 10-week study in the Broughton Archipelago found sea lice were 8.8 times more abundant on wild fish near farms holding adult salmon and 5.0 times more abundant on wild fish near farms holding smolts than in areas distant from salmon farms. We found that 90% of juvenile pink and chum salmon sampled near salmon farms in the Broughton Archipelago were infected with more than 1.6 lice (g host mass)⁻¹, a proposed lethal limit when the lice reach mobile stages. Sea lice abundance was near zero in all areas without salmon farms. Salinity and temperature differences could not account for the higher infestation rates near the fish farms. The most immature life stages dominated the lice population throughout the study, suggesting the source of lice was a stationary, local salmonid population. No such wild population could be identified. The evidence from this control-impact study points to a relationship between salmon farms and sea lice on adjacent, wild, juvenile salmon.

Résumé : Notre étude compare les taux d'infestation des poux de mer (*Lepeophtheirus salmonis*) chez le saumon rose (*Oncorhynchus gorbuscha*) et le saumon keta (*Oncorhynchus keta*) dans cinq régions côtières de la Colombie-Britannique, choisies à cause de la proximité d'élevages de saumons. Une recherche de 10 semaines dans l'archipel de Broughton révèle que les poux de mer sont 8,8 fois plus abondants chez les poissons sauvages à proximité d'élevages contenant des saumons adultes et 5,0 fois plus abondants aux environs d'élevages contenant des saumonneaux que dans les zones situées loin des élevages de saumons. Quatre-vingt-dix pour cent des jeunes saumons roses et keta échantillonnés près des élevages de saumon dans l'archipel de Broughton portent des infestations supérieures à 1,6 poux (g de masse de l'hôte)⁻¹, une limite que nous considérons létale lorsque les poux atteignent les stades mobiles. Les densités de poux de mer sont presque nulles dans toutes les régions sans élevage de saumons. Les différences de salinité et de température n'expliquent pas les taux plus élevés d'infestation à proximité des élevages. Ce sont les stades les plus immatures qui dominent dans la population au cours de l'étude, ce qui laisse croire que la source des poux est une population locale et stationnaire de salmonidés. Nous n'avons trouvé aucune population sauvage qui possède de telles caractéristiques. Les données de notre étude de type témoin-impact indiquent qu'il existe une relation entre les élevages de saumon et les poux de mer qui parasitent les jeunes saumons sauvages des régions adjacentes.

[Traduit par la Rédaction]

Introduction

The sea louse *Lepeophtheirus salmonis* is a common salmonid-specific caligid ectoparasite in the Northern Hemisphere. Salmon examined on the high seas are commonly infected with low numbers of adult *L. salmonis* (Nagasawa et

al. 1993). Pink (*Oncorhynchus gorbuscha*) and chum (*Oncorhynchus keta*) salmon 20–79 cm (fork length) were the most heavily infected; 91.8% prevalence and 5.83 lice fish⁻¹ mean intensity for pink salmon and 15.9% prevalence and 2.28 lice fish⁻¹ mean intensity for chum salmon (Nagasawa 1987; Nagasawa et al. 1993). The scarcity of im-

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This study reports when
salmon farms are stocked,
there are many sea lice,
when the farms are fallow
there are few lice

See following graphs

Temporal patterns of sea lice infestation on wild Pacific
salmon in relation to the fallowing of Atlantic salmon
farms

in press

- Morton, Routledge and Williams

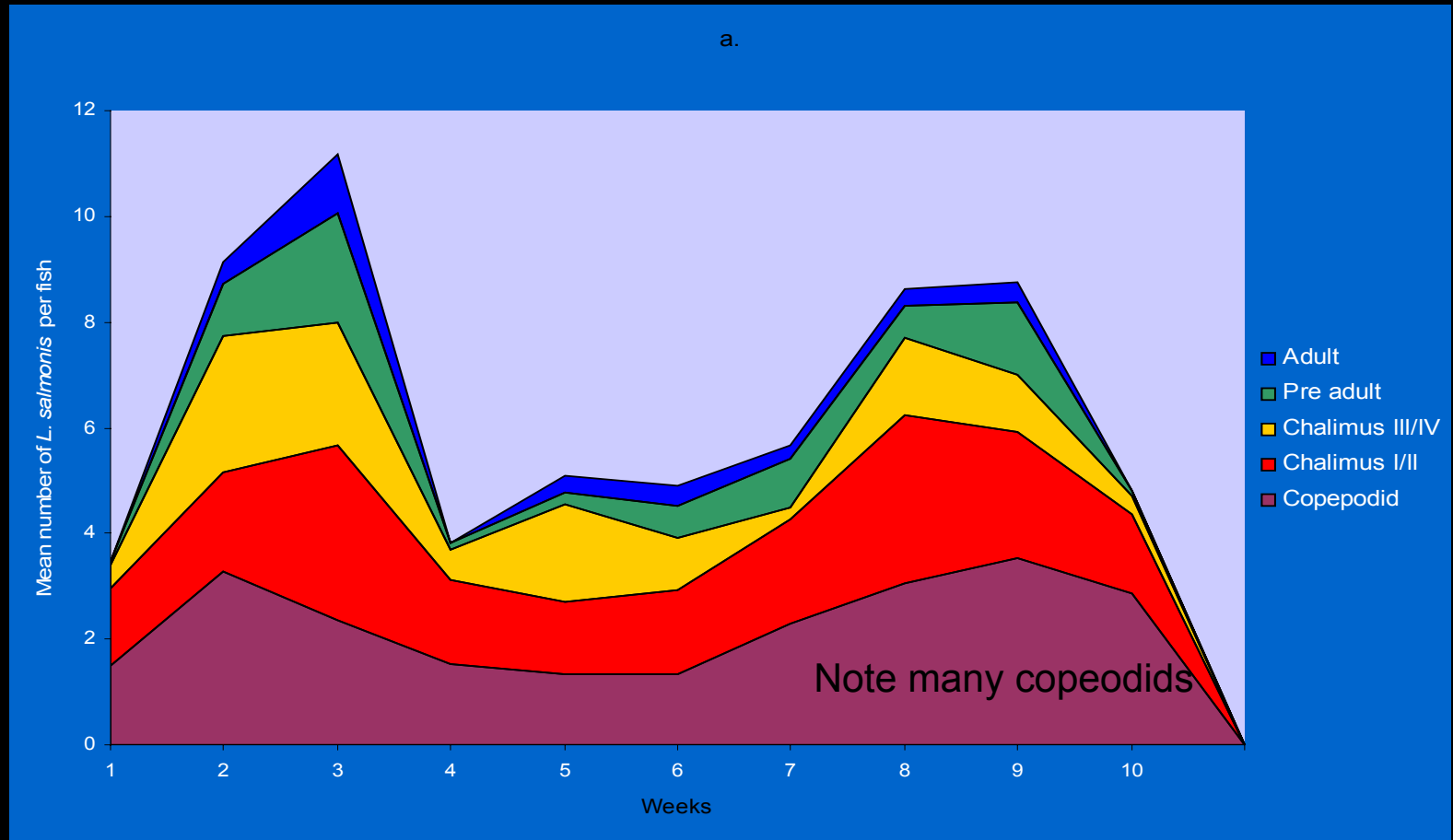
Running head: Fallowing salmon farms reduces sea lice

*Alexandra Morton, Raincoast Research, no street,
Simoom Sound, B.C., V0P 1S0, Richard Routledge,
Department of Statistics and Actuarial Science, Simon
Fraser University

Rob Williams, Raincoast Conservation Society, Pearse
Island, B.C., V0N 1A0, Canada

2002

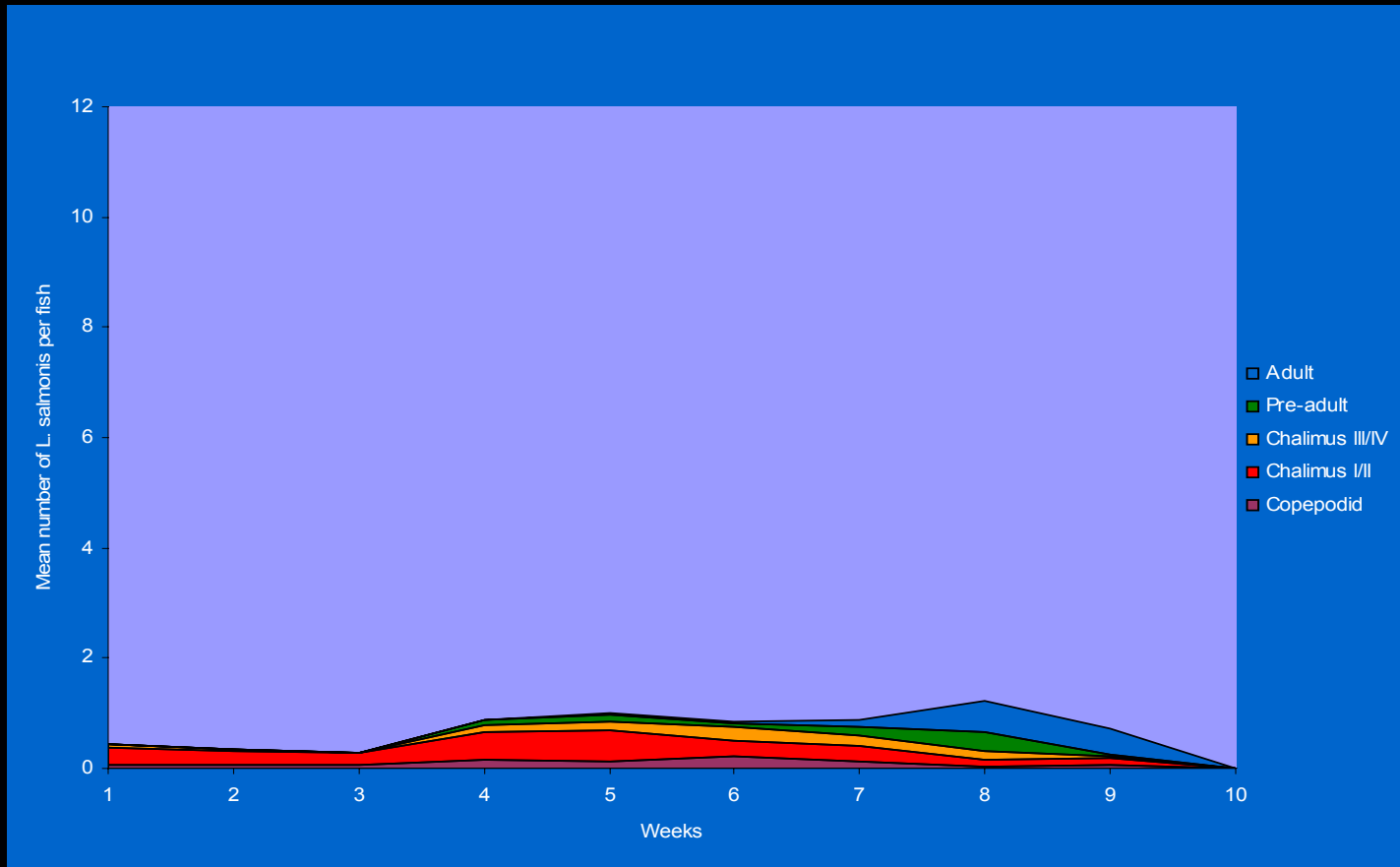
mean number of lice per pink or chum,
each color is a different age louse, blue is oldest



This cohort of pink salmon collapsed by 87%

2003

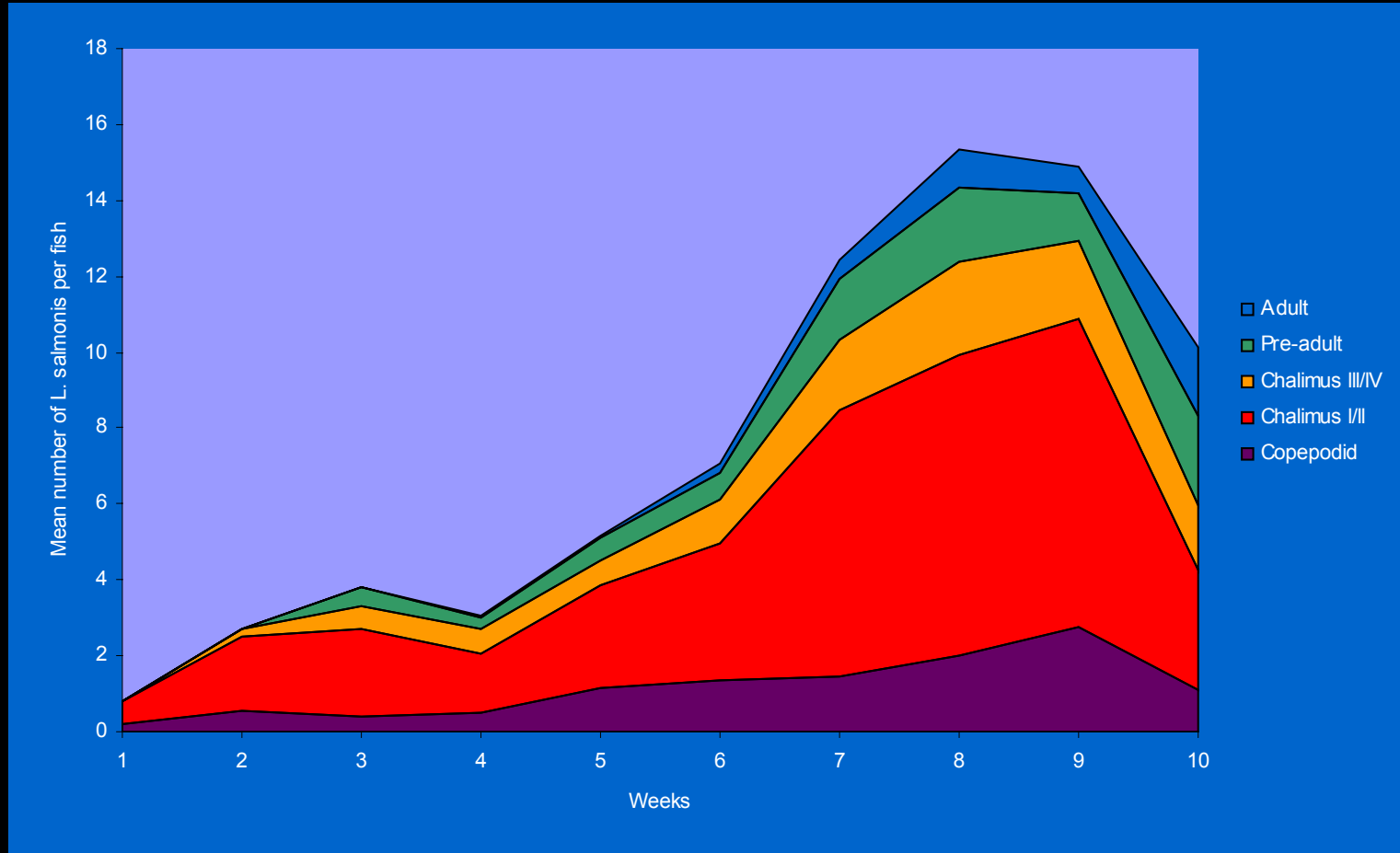
The farms on the major fry out-migration route were followed
(*Provincial pink salmon action plan*)



The number of lice per fish collapsed and this cohort (last fall) rebounded

2004

The fallowed farms were restocked



If sea lice are the problem I don't see how we will see these fish this fall

Glendale, Kakweikan, Ahta, Viner Wakeman, Kingcome

This study held
lice-infested and lice-free pinks and chums
for observation in barrels



The lice - infested fish died at a significantly higher rate
than the lice -free fish

Even as the infected fry fed aggressively, they withered and died...



barrel #2
Jun. 7, 2003
0830

and it did not take many lice to kill them

Sea lice on juvenile salmon

are a very serious matter

This chum fry has an infection which is both mature, with gravid females, and continuous, with newly settled juvenile lice on ventral side



This fish will not survive



I don't study coho or Chinook smolts, but I see many like this trying to return to freshwater

Just like the lice infested sea trout in Scotland and Ireland

Juvenile pink and chum salmon are too small for sea lice



The **good** news is salmon farmers don't need sea lice either

The **difficult** news is we *cannot* place sea lice feedlots where wild salmon weigh less than **1 gram** if we want wild salmon

drugs can not solve this

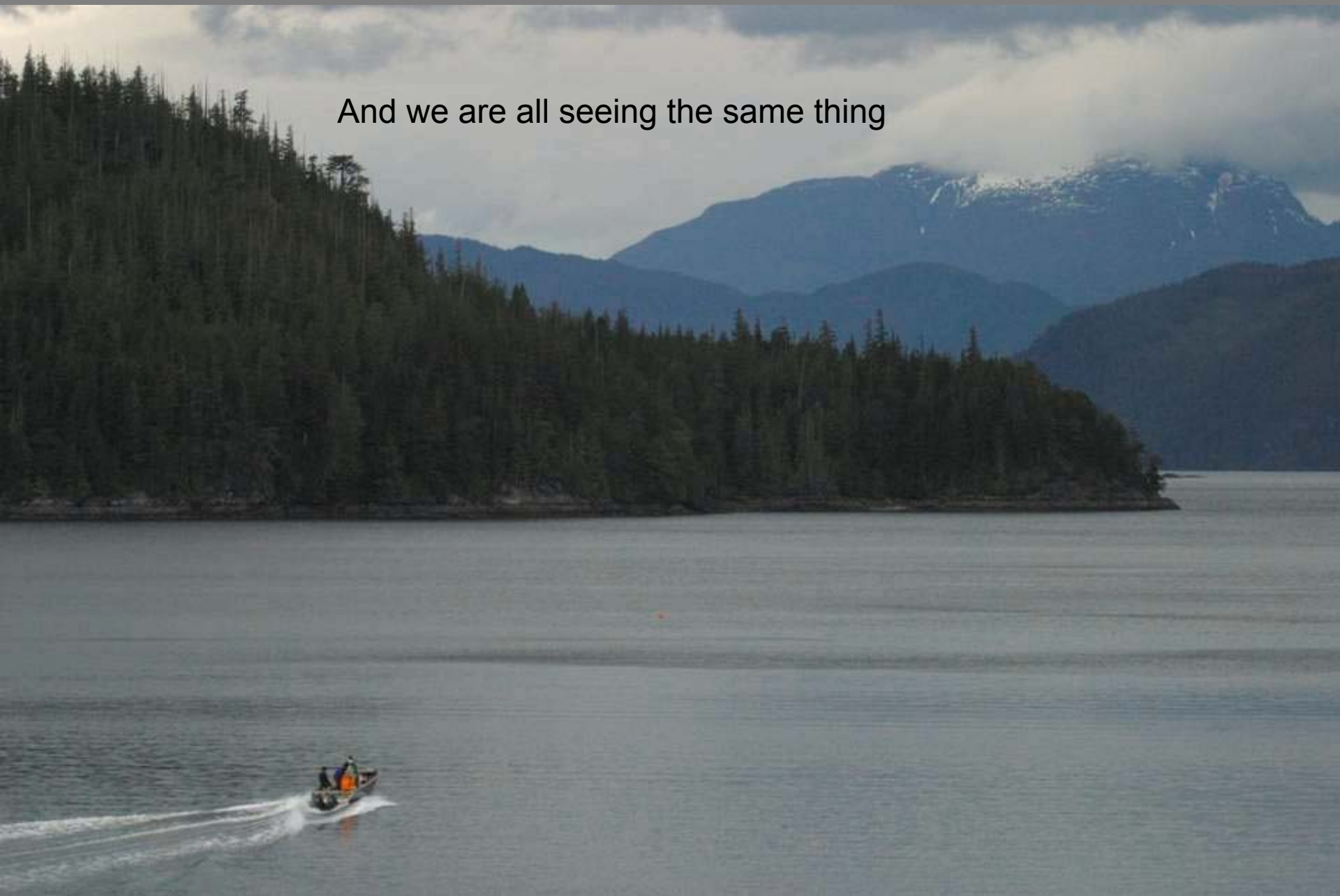
The **answer** is keep the two separated

Closed containment

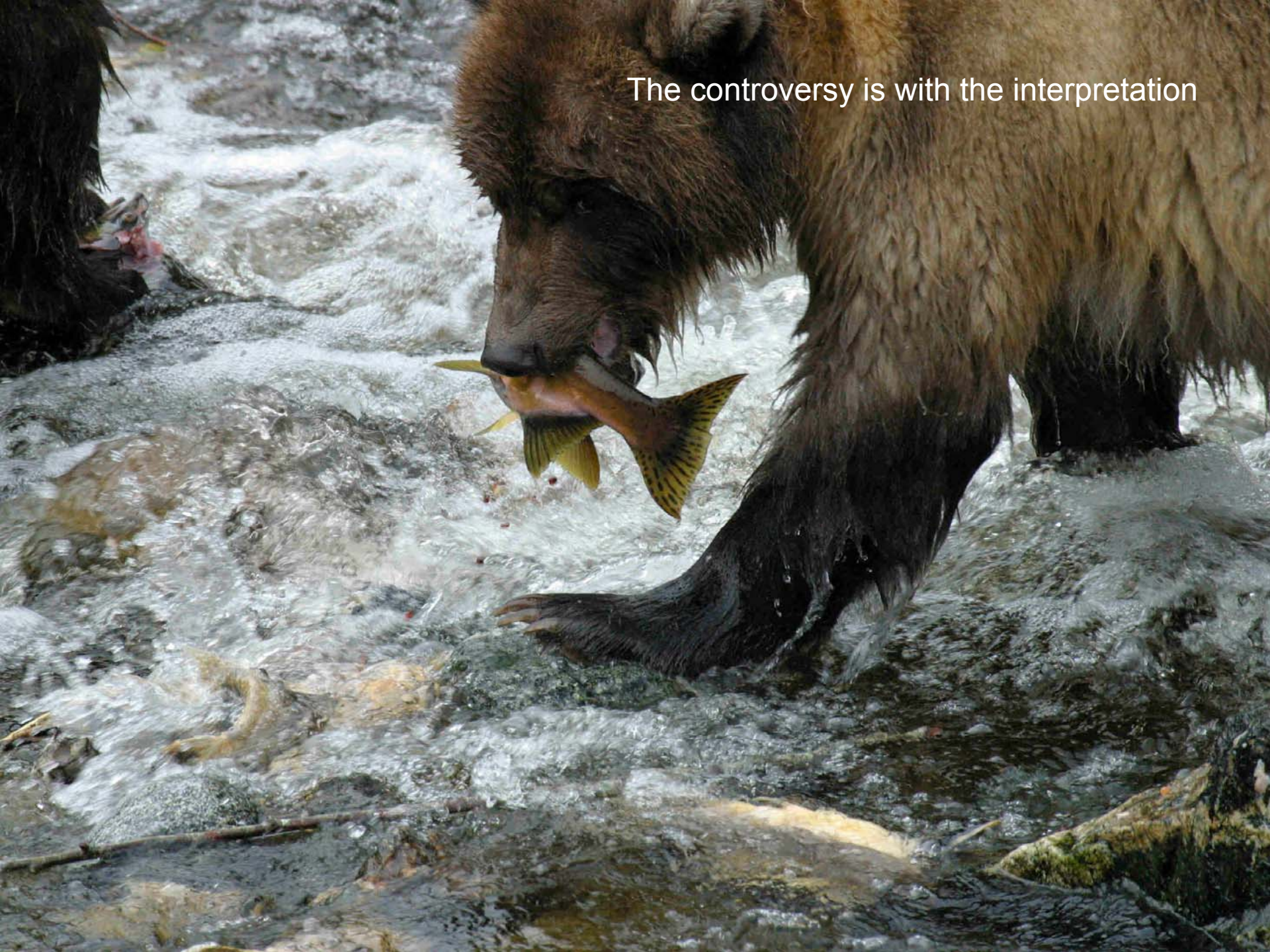
It is important to note that there are now several different teams working on sea lice



And we are all seeing the same thing



The controversy is with the interpretation



Sea lice are real

For more information or a tour

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