



Selectivity Grids in the Salmon Seine Fishery of British Columbia



Project Summary

Prepared by:
J.O. Thomas & Associates Ltd.

December 2004

The Capilano Grid Concept

- The objective of the grids is to provide a safe and effective in-water mechanism for non-target and immature fish to escape unharmed from the seine net. At the same time the grids must minimize escape of the target species.
- The grids must be durable and flexible and work efficiently with the existing fishing gear and machinery.

Grid Design & Implementation

- Rectangular panels, each 20"W x 26"L with 8 to 18 openings of various shapes, sizes, materials, thicknesses, and colours.
- Grid shapes that have been tested include different sized circles, octagons, and oblong (elliptical) openings.
- Some materials that have been tested include aluminum bars, net webbing, steel rings, EPDM rubber, CIM and PVC plastics, in colours ranging from green, white, blue, black, and clear.

Grid Design & Implementation...cont'd

- Four panels are laced into the bunt: Two of one kind in the front panel and two of another kind in the middle panel.
- A catcher bag is attached to the outside of the bunt with separate chambers for each grid type being tested.
- Fish that escape through the grids, along with those that do not escape, are counted by species. Samples are measured, and their physical condition assessed to determine the effectiveness of each grid type.

Tested Grid Panels by Study Year

2004 ■ Clear PVC Circles, Oblong, Octagons,
50, 55, 90, 95 mm

■ Black EPDM Oblong,
50, 55 mm

2003 ■ Clear PVC Circles, Oblong, Octagons,
50, 55, 85, 90, 95, 105 mm;
light, medium, heavy gauge

■ Black EPDM Oblong, Octagons,
50, 55, 90, 95, 100 mm

2002 ■ Clear PVC Circles, Oblong, Octagons,
50, 55, 60, 95, 100, 105 mm

2001 ■ Aluminum Bars Green, White

■ Clear PVC Circles

■ EPDM Circles & Oblong,
White, Black, Blue, Green

2000 ■ Aluminum Bars Green, White

■ Clear PVC Circles, Oblong

■ EPDM Black Circles

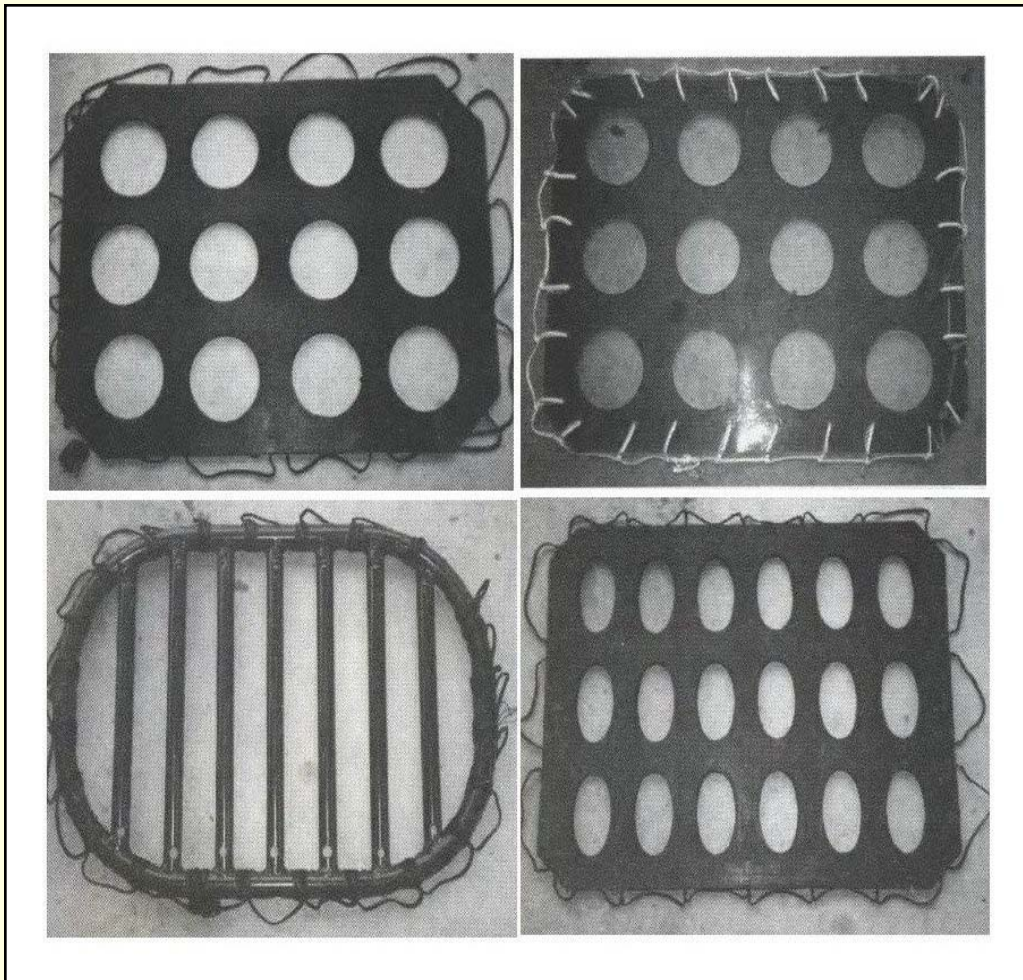
■ CIM White Circles

■ Mesh 4 1/2" Circles

1999 ■ Aluminum Bars

■ Opaque plastic circles

Examples of Grid Panels



Capilano Fishing Ltd.

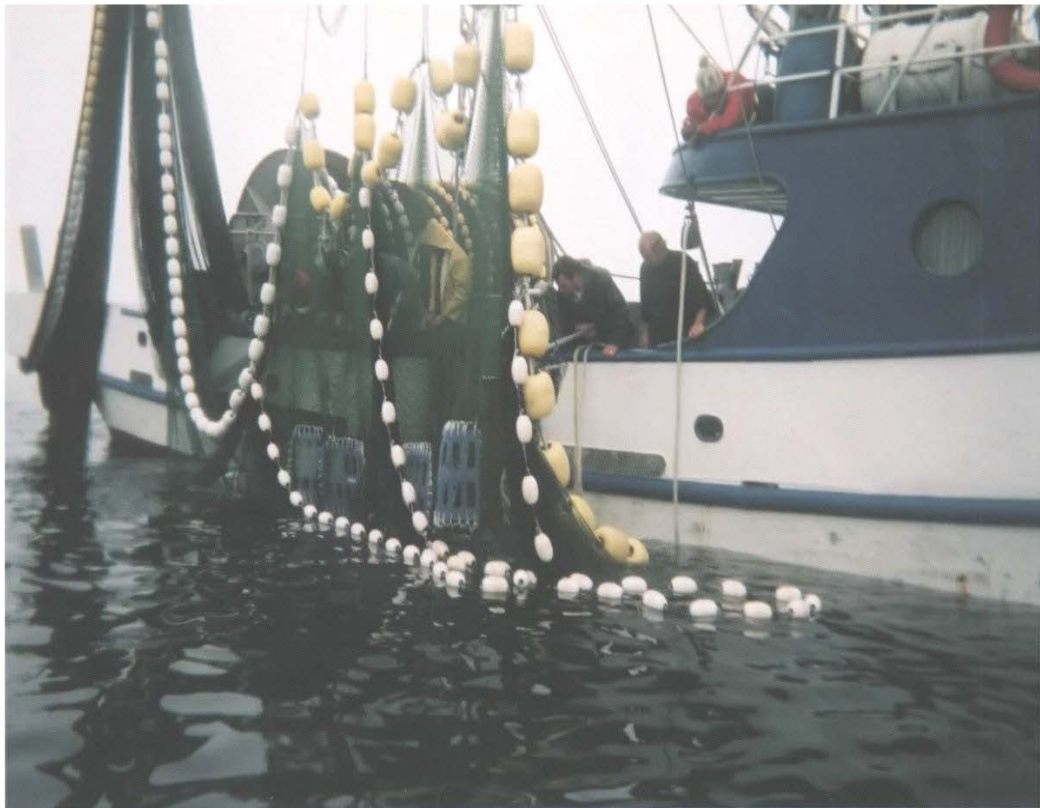
A bird's-eye view of grids and catch...



Jim Thomas

A bird's-eye view of target fish retained in the inner bunt and different grids being tested. Smaller coho and jack chinook have been allowed to escape through the grids into catcher bags. The retained and escaped fish are then counted and measured to assess selectivity of each grid tested.

Another view from the water...

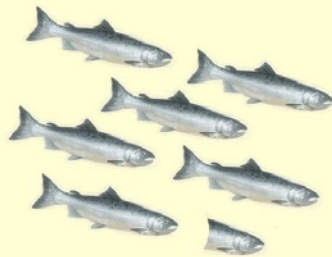


Jim Thomas

Catcher bags holding escaped fish during sampling. Target species have been brailled or dipnetted out of bunt. Note grid panels just above the waterline.

Mean Number of Coho Escapes as a Result of Using Grids

For every **10** coho
encountered
an average of



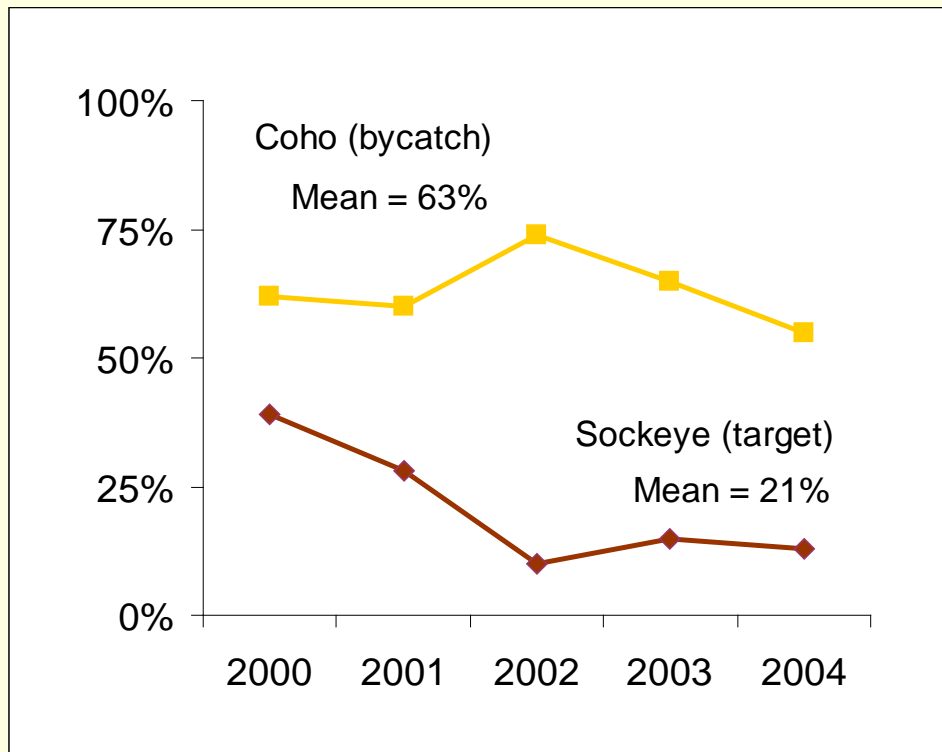
6.5
escaped
through grids



3.5
did not
escape

Source: Seine Selectivity Grid Study: 2000-2003, all fisheries

Percent Escapement Through Grids of Bycatch Species (Coho) vs. Target Species (Sockeye) by Study Year

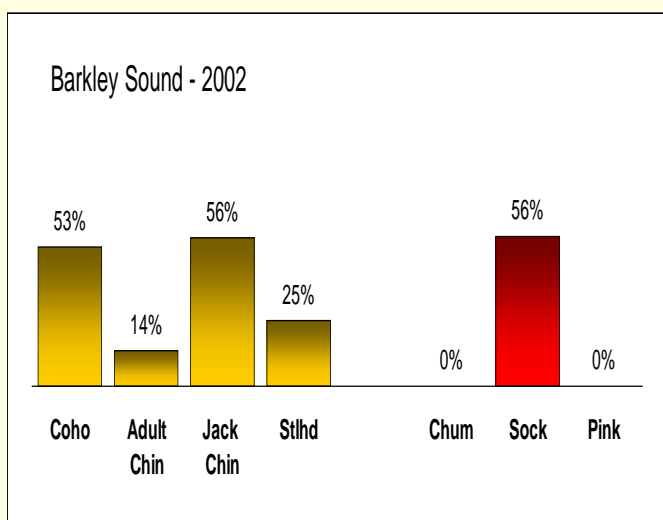


Source data: 2000 - 2004 Grid Study, all fisheries.

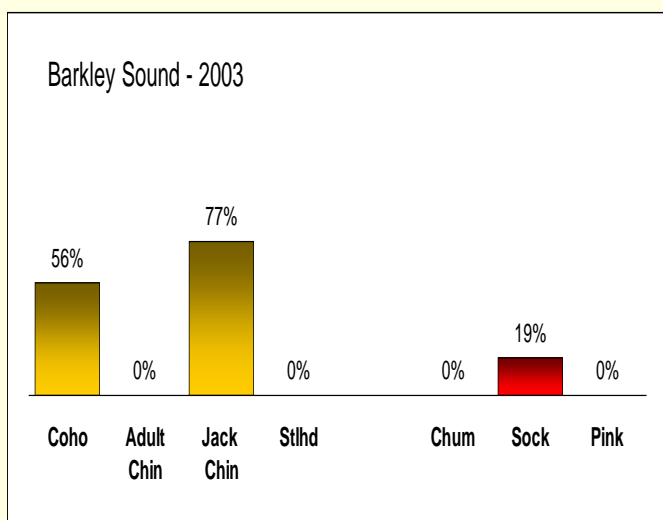
Bycatch Species vs. Target Species

Escapement through Grids:

Barkley Sound, 2002 vs. 2003.



Jack chinook and coho escapes through grids have been good during tests in the Barkley Sound sockeye fishery. However, target sockeye stocks in this fishery are relatively small in size and pose special challenges to reduce grid escapes of these fish.



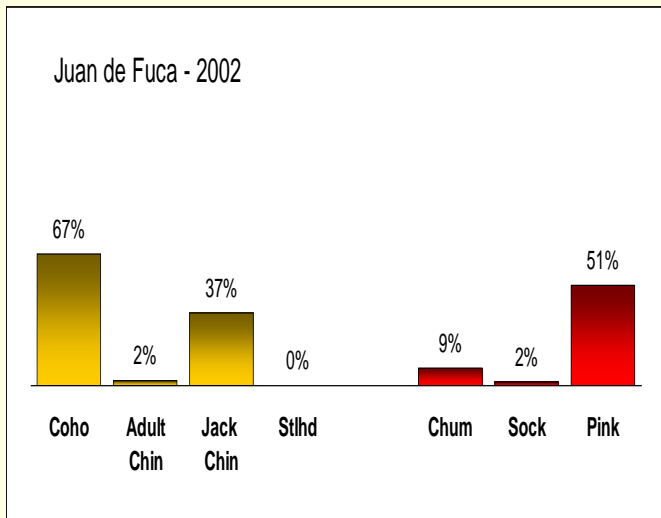
In an effort to reduce escapes of sockeye in Barkley Sound, grid aperture sizes were reduced in 2003. Coho and jack chinook escapes remained good and sockeye escapes were reduced by more than 65% over the previous year.

Note: Chum and pink are not usually present in the Barkley Sound fishery.

Bycatch Species vs. Target Species

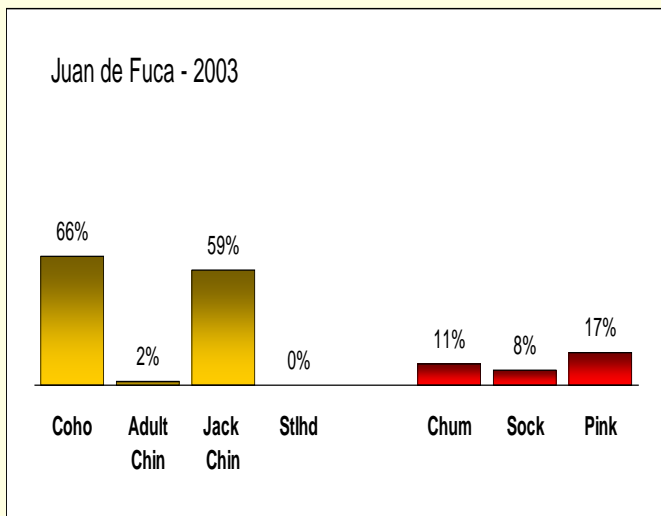
Escapement through Grids:

Juan de Fuca, 2002 vs. 2003



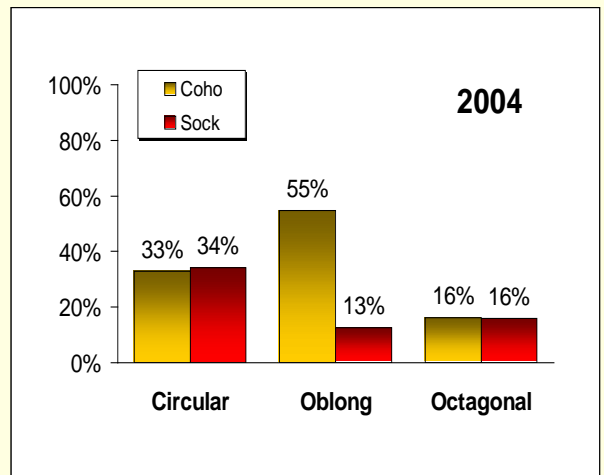
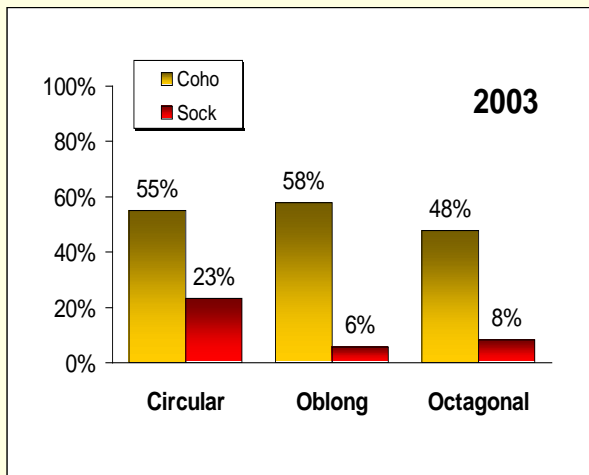
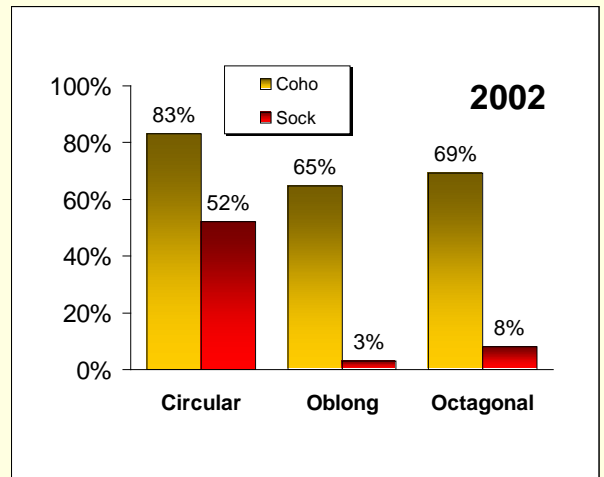
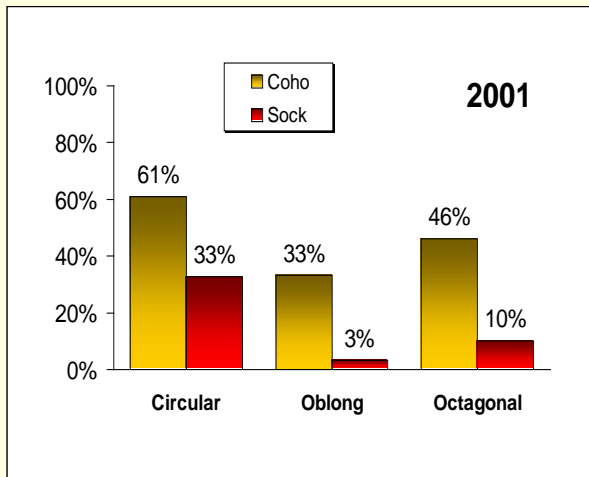
Grids tested in Juan de Fuca Strait in 2002 had very good juvenile coho and jack chinook escapes and virtually no sockeye escapes.

Smaller sized pink salmon pose challenges for pink targetted fisheries in this region however.

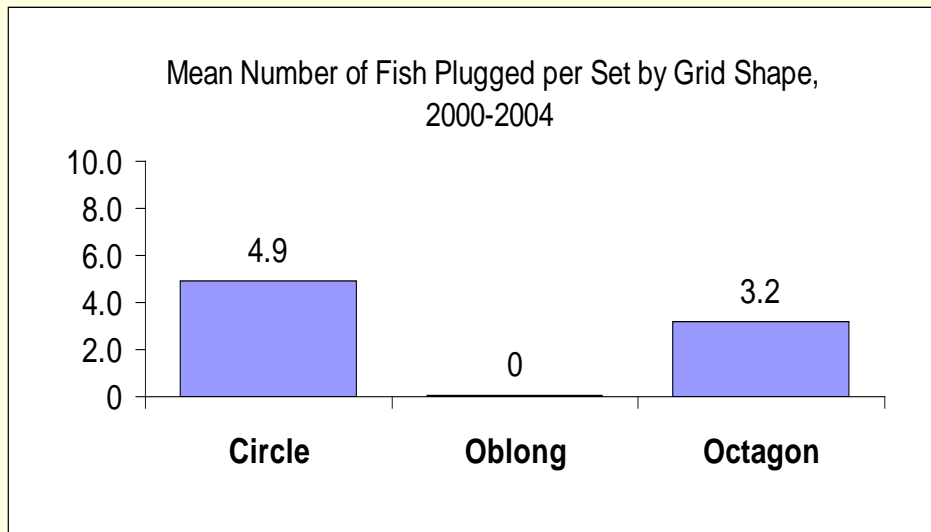


In 2003, smaller circle and octagon grids helped to minimize escapes of pink salmon substantially. A small increase in sockeye escapes was noted, however coho and jack chinook bycatch escapes remained high.

Percent Escapement of Coho and Sockeye by Grid Shape: 2001-2004



Mean Number of Fish Plugged (per set) in Grids, by Grid Shape, 2000-2004



Mean Size of Sockeye that Escaped through Grids Compared to Sockeye Retained *

Escaped through Grids



85 mm grids

Mean Length

482 mm



90-95 mm grids

534 mm

Retained



569 mm

* Source: Barkley Sound Seine Grid Study, 2003

What We've Learned...

- *Selectivity grids are a useful tool* in increasing escapement (and survival) of juvenile coho and jack chinook encountered in salmon seine fisheries.
- The *size of the grid openings* as they relate to the unique species and size mixtures (target vs. bycatch) in each fishery *is critical*. Shape, material, and colour of grids are secondary factors.
- *Grids work best* in fisheries *where bycatch species are small* (< 55 cm in length) and target species are relatively large (> 55 cm in length).

What We've Learned...cont'd

- *Clear, flexible PVC panels are the easiest* to work with and have achieved very good results when compared to other materials.
- A variety of *extrinsic factors* such as fish behaviour, number of fish caught, sea conditions, position of grids in the bunt, bunt web size, and fishing experience with the gear *can affect grid performance*.

Challenges...

- *Successful grid implementation* in commercial fisheries *needs to be tailored* to the unique mixtures of species and fish size distributions in each fishery.
- More data comparing different opening sizes using identical materials and shapes is needed to be able to recommend *optimal grid opening size* (or range of sizes) *for each fishery*.
- Experimentation with *smaller mesh sizes, knotless webbing* and *lacing* techniques *in the bunt* to avoid gilling of smaller sized bycatch and target species.

Challenges...cont'd

- *Gaining acceptance* by DFO and fishermen as a viable selectivity tool for management and conservation in mixed species/stock and non-retention fisheries.



Selectivity Grids in the Salmon Seine Fishery of British Columbia



Summary of the 2004 Grid Study

Prepared by:
J.O. Thomas & Associates Ltd.

December 2004

2004 Objectives

- Expand grid use to new vessels to assess learning curve and net/grid compatibility with different vessel deck lengths.
- Implement small mesh, knotless web bunt.
- Compare grid vessel catch success with non-grid vessel fishery in Juan de Fuca Strait.
- Test utility of pink and chum sorting in the Central Coast.
- Test new, larger grid panel and compare with conventional grid panel.

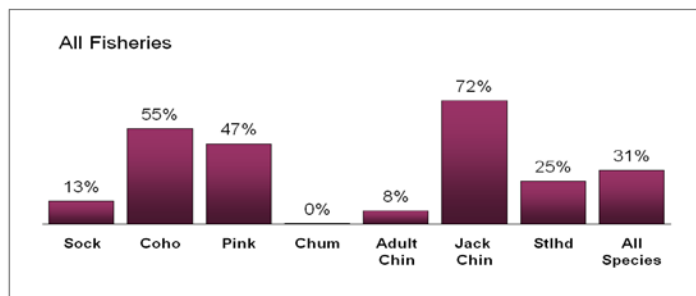
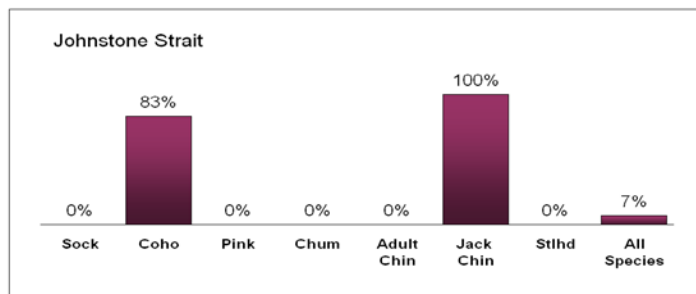
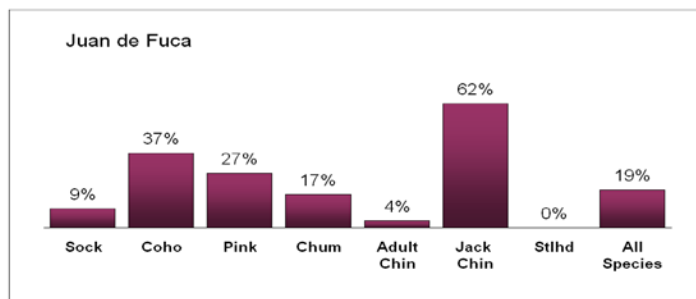
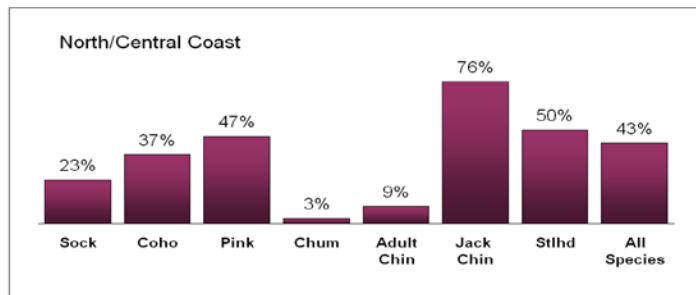
2004 Results

- A total of five seines tested grids in three regional fisheries. A total of 23,422 salmon were encountered:

Sockeye	2,377
Coho	1,233
Pink	12,391
Chum	6,638
Lg Chinook	105
Jack Chinook	680
Steelhead	8

- Grid escape rates varied by vessel, species and fishery.
- Size data was collected from more than 5,000 fish to determine length, depth, and width correlated between fish that escaped, were retained and those plugged in a grid.

Percent Escapement of Fish Through Grids by Fishery and Species, 2004



2004 Results...cont'd

New Vessel Integration:

- Western Freedom, Nita Maria and Royal Mariner fished with grids for the first time in 2004.
- Each vessel and crew experimented with different techniques for fleeting and brailing to adapt to optimal grid alignment.
- Relatively short time to experiment a challenge to evaluate “best fit” for grid and bunt configuration with different sized vessels.

2004 Results...cont'd

Small Mesh, Knotless Bunt:

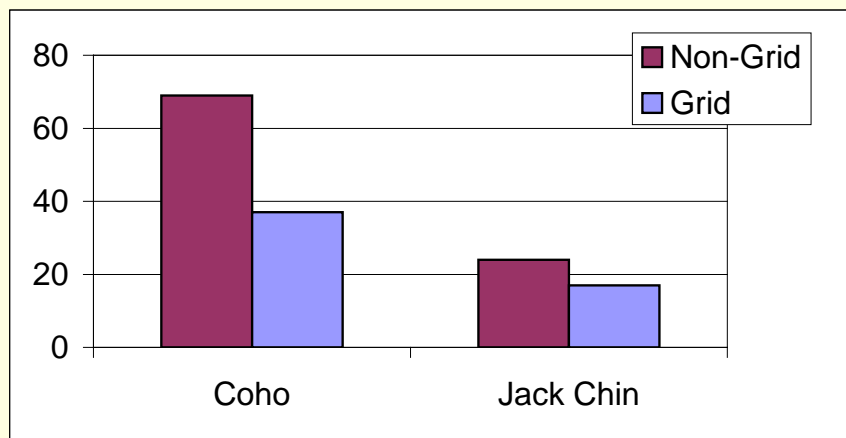
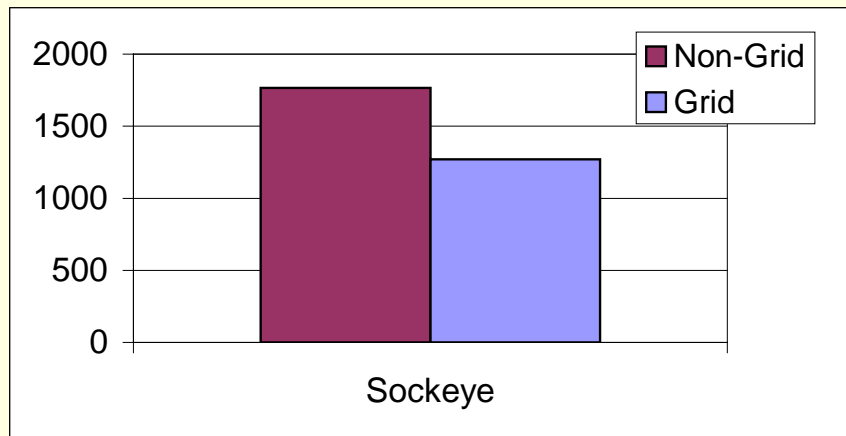
- Smaller mesh (60 and 65 mm) knotless webbing was tested to reduce the gilling of small salmon observed when using 70 and 100 mm web (fleet standards).
- Knotless webbing was tested to observe effects on overall salmon scale loss.
- Minimal (< 2%) gilling of juvenile chinook and coho was encountered with the small mesh web. This is a substantive finding in Juan de Fuca Strait given the wide array of fish sizes present in this fishery.

2004 Results...cont'd

Grid/Non-Grid Catch Comparison:

- On July 28/29, 2004, 5 seines fished under scientific licence in Area 20.
- Two of the vessels (Nita Maria & Royal Mariner) fished with grids but without catcher bags.
- Comparable vessel catch per effort was observed for sockeye while the grid-equipped vessels expressed reduced catches of coho and juvenile chinook.

Comparison of Catch between Grid and Non-Grid Vessels in Area 20, July 28/29, 2004



2004 Results...cont'd

Pink/Chum Sorting:

- Chum conservation concerns in the Central Coast can coincide with abundant returns of pink salmon.
- Grids offer a means of escaping pink salmon to a catcher bag system for harvest, while allowing the retention of chum in the seine for subsequent release.
- Using 50 and 55 mm oblong grids escaped 46% of the pink while retaining 97% of the chum.

2004 Results...cont'd

Larger Dimension PVC Grid Panel:

- Tests were conducted on a 6 foot long grid to explore the capability of this larger grid for vessel handling and escape comparison with the conventional size grid.
- This grid was found to work well physically and escape coho and chinook effectively.

Beach set to test strength of new, larger grid panels...



Jim Thomas

Beach sets were conducted during 2004 to assess the strength of new, larger grid panels. Grids maintained integrity and showed no signs of stress damage.

Escapement from new, large grid panels compared to standard grid panels...



Jim Thomas

The two photos above were taken from the same set. The uppermost photo shows the number of fish that escaped through grids in the new, larger grid panel. The lower photo shows the number of fish that escaped through the standard sized grid panel.