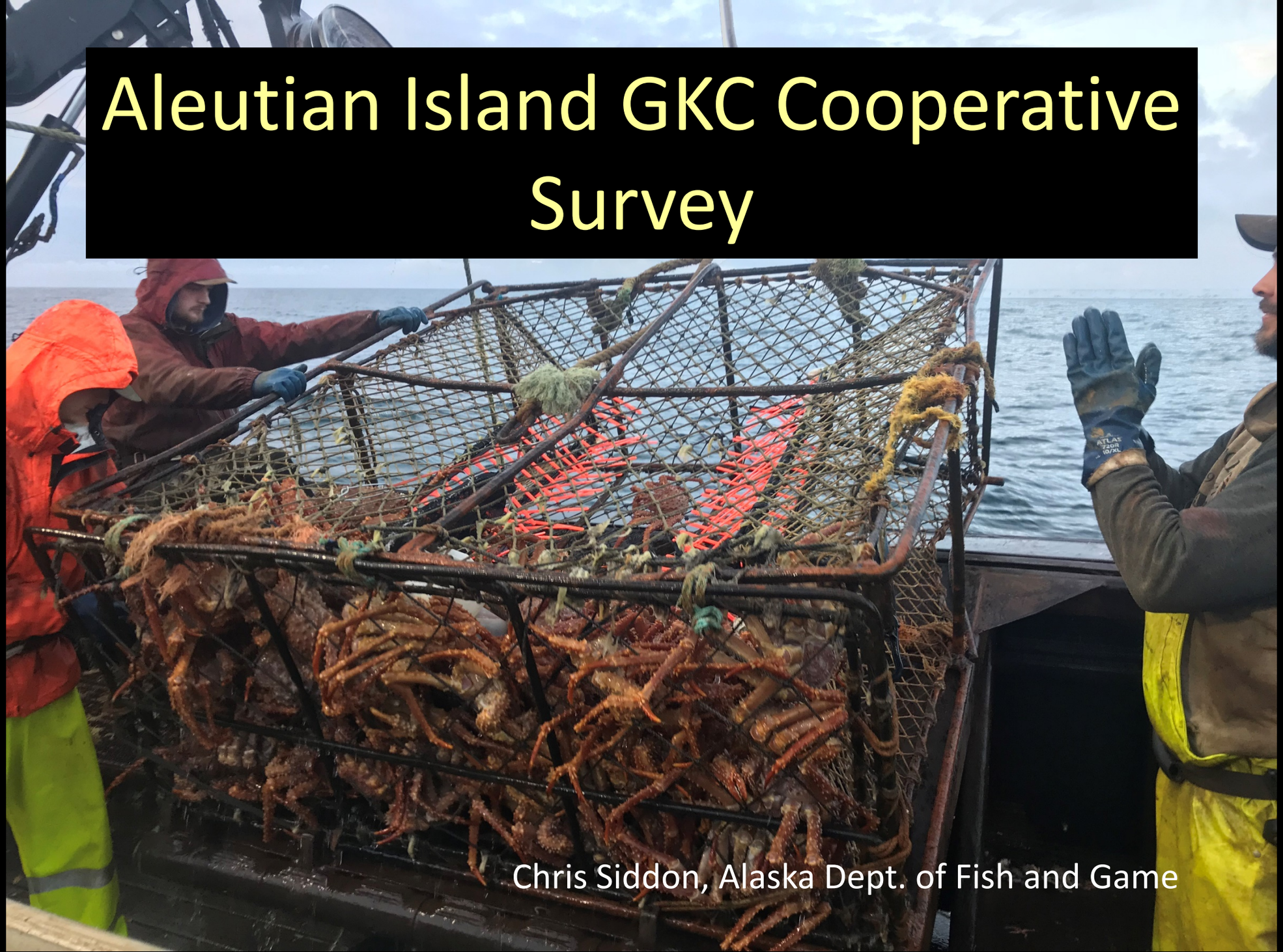
Aleutian Island GKC Cooperative Survey

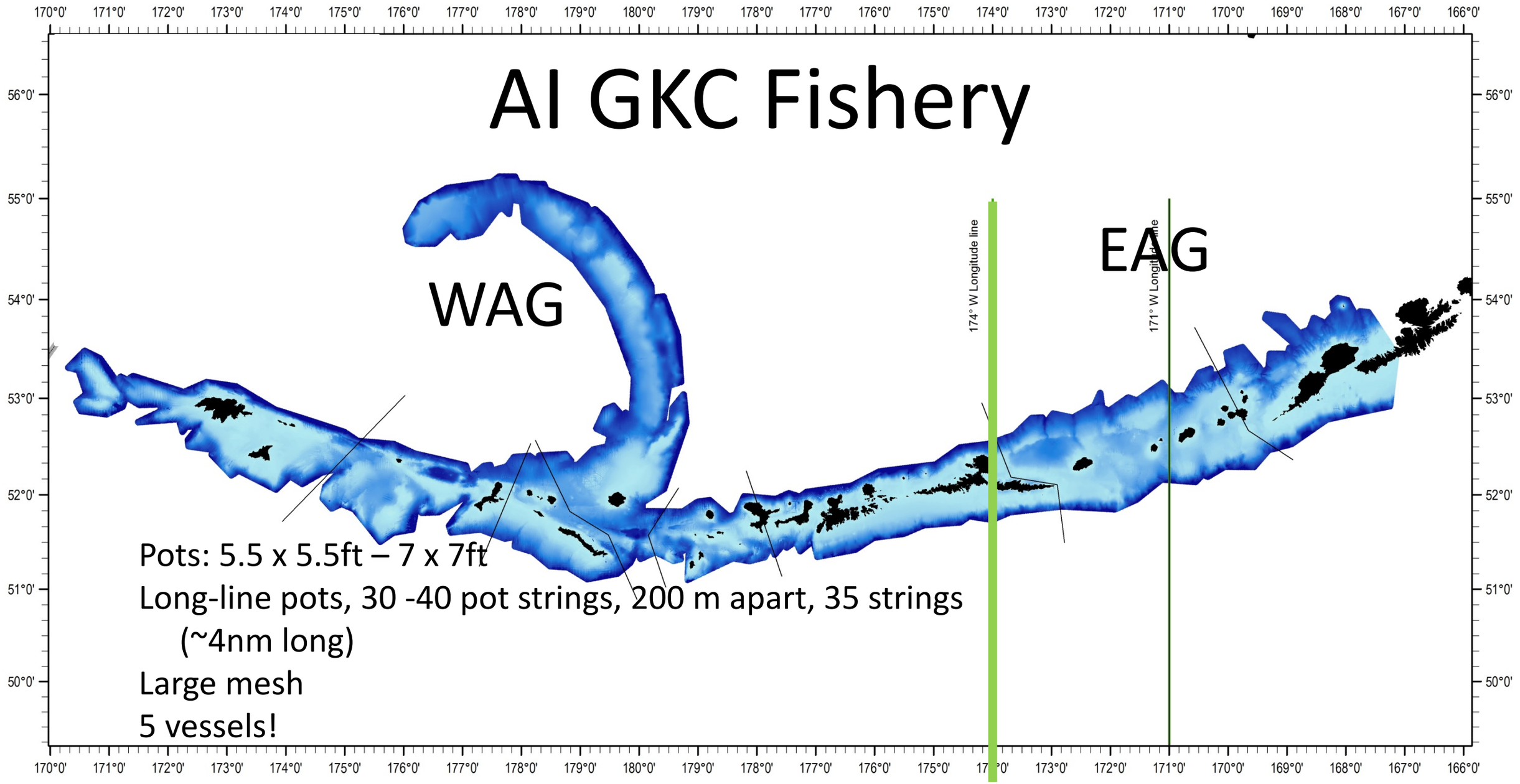


Chris Siddon, Alaska Dept. of Fish and Game

Outline

1) Background
   a. Fishery process
   b. Triennial survey
   c. Observer data
2) Cooperative Survey Design
3) A few results
4) Things to improve

AI GKC Fishery

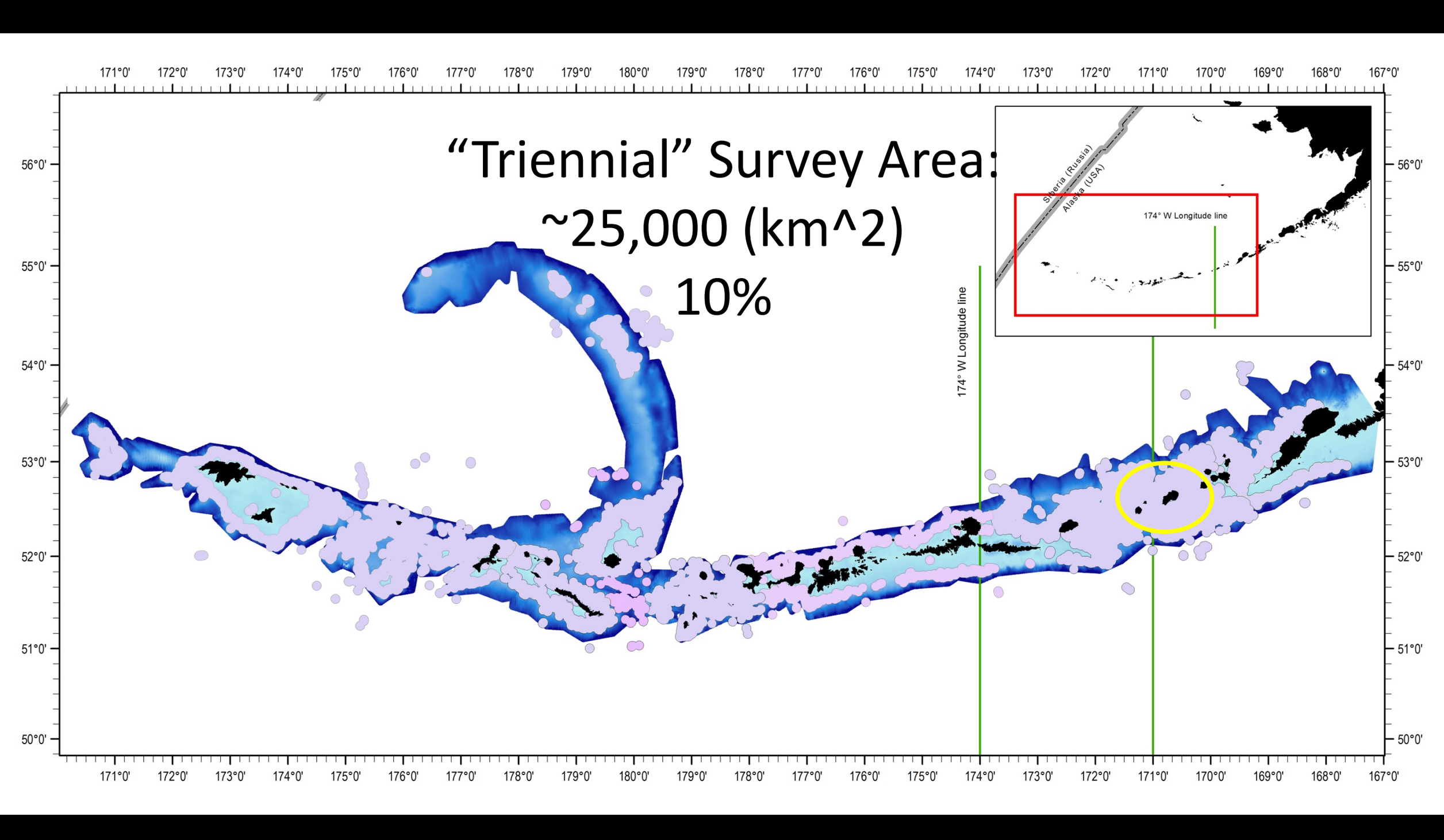


Pots: 5.5 x 5.5ft – 7 x 7ft

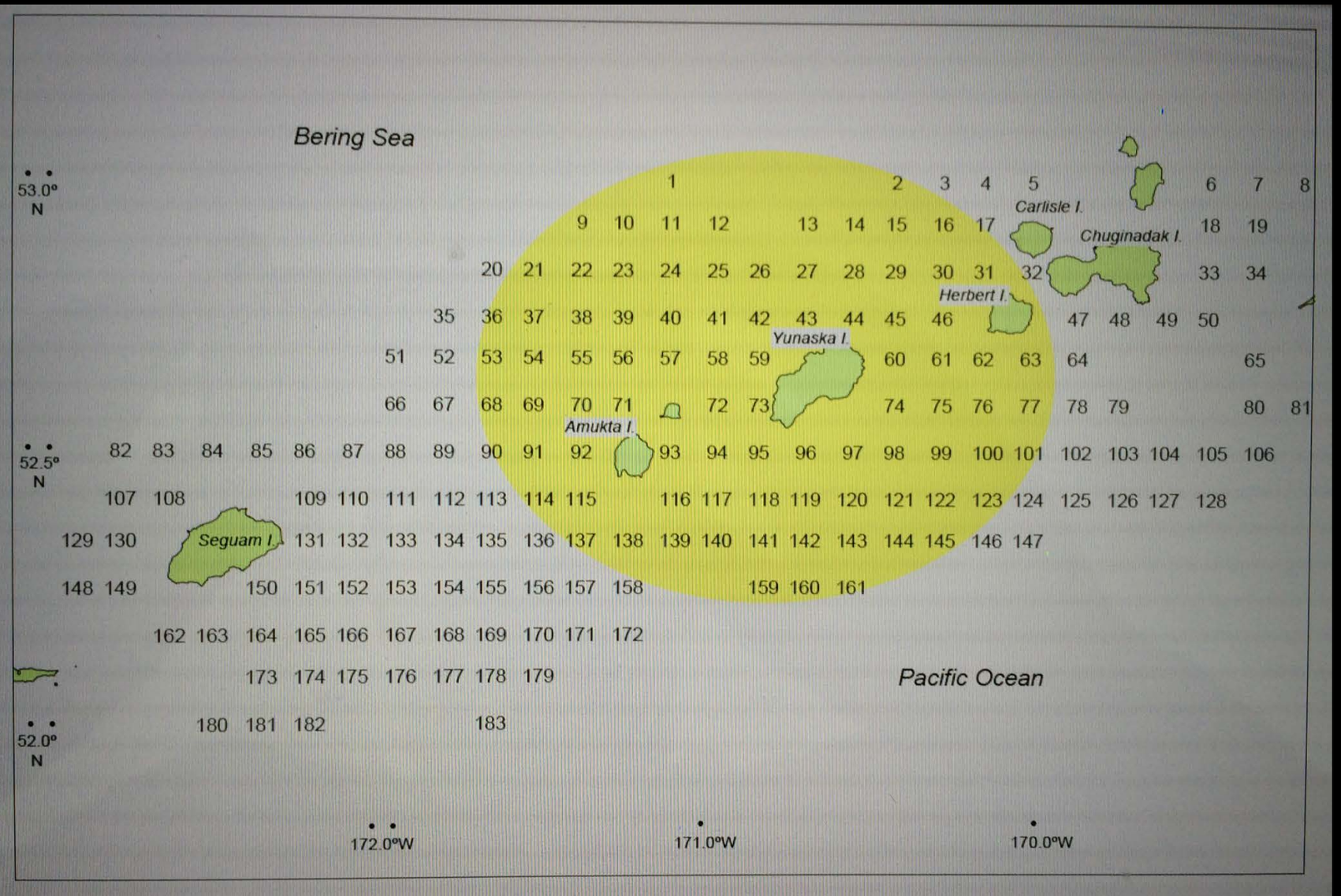
Long-line pots, 30 -40 pot strings, 200 m apart, 35 strings (~4nm long)

Large mesh

5 vessels!


“Triennial” Survey Area:
~25,000 (km^2)
10%
Siberia (Russia)
Alaska (USA)
174° W Longitude line
174° W Longitude line
171°0' 172°0' 173°0' 174°0' 175°0' 176°0' 177°0' 178°0' 179°0' 180°0' 179°0' 178°0' 177°0' 176°0' 175°0' 174°0' 173°0' 172°0' 171°0' 170°0' 169°0' 168°0' 167°0'
56°0' 55°0' 54°0' 53°0' 52°0' 51°0' 50°0'

ADF&G Triennial Survey



5nm apart
10pot strings
100fathoms apart
String ~ 0.9nm
Quantifying “all”
n = 85 (850)
Sampling area 85nm^2

Relative Index of N
Tagging (growth/mort)

ADF&G Triennial Survey

Cost:

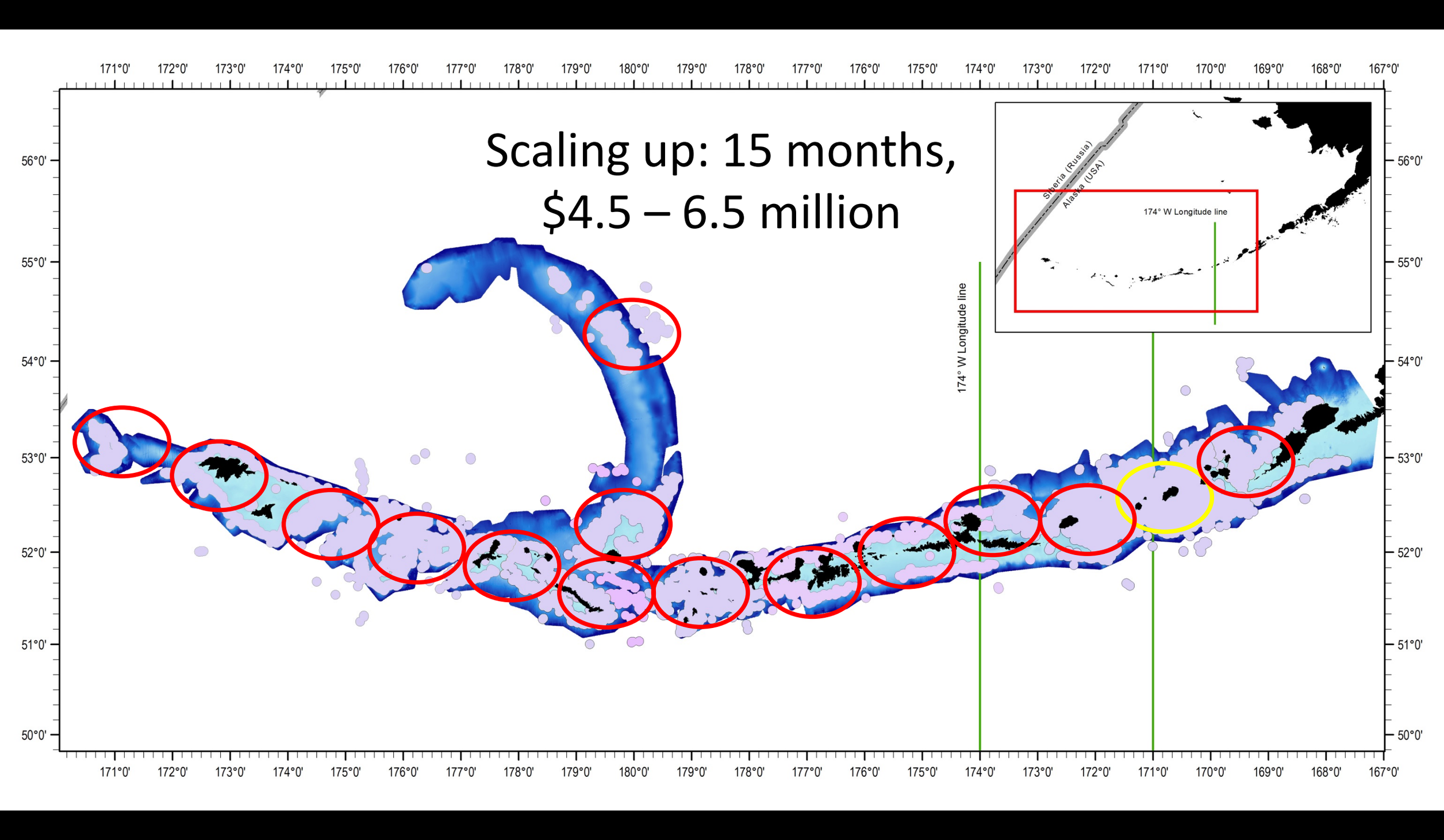
5 FB II (salary/seaduty/benefits) for 28days

30K/person = 150K

(150 biologist days)

Vessel charter: wanted 10K/day = 280K

Total Cost: ~430K


Scaling up: 15 months,
$4.5 – 6.5 million
Siberia (Russia)
Alaska (USA)
174° W Longitude line
174° W Longitude line
171°0'
172°0'
173°0'
174°0'
175°0'
176°0'
177°0'
178°0'
179°0'
180°0'
179°0'
178°0'
177°0'
176°0'
175°0'
174°0'
173°0'
172°0'
171°0'
170°0'
169°0'
168°0'
167°0'
56°0'
55°0'
54°0'
53°0'
52°0'
51°0'
50°0'

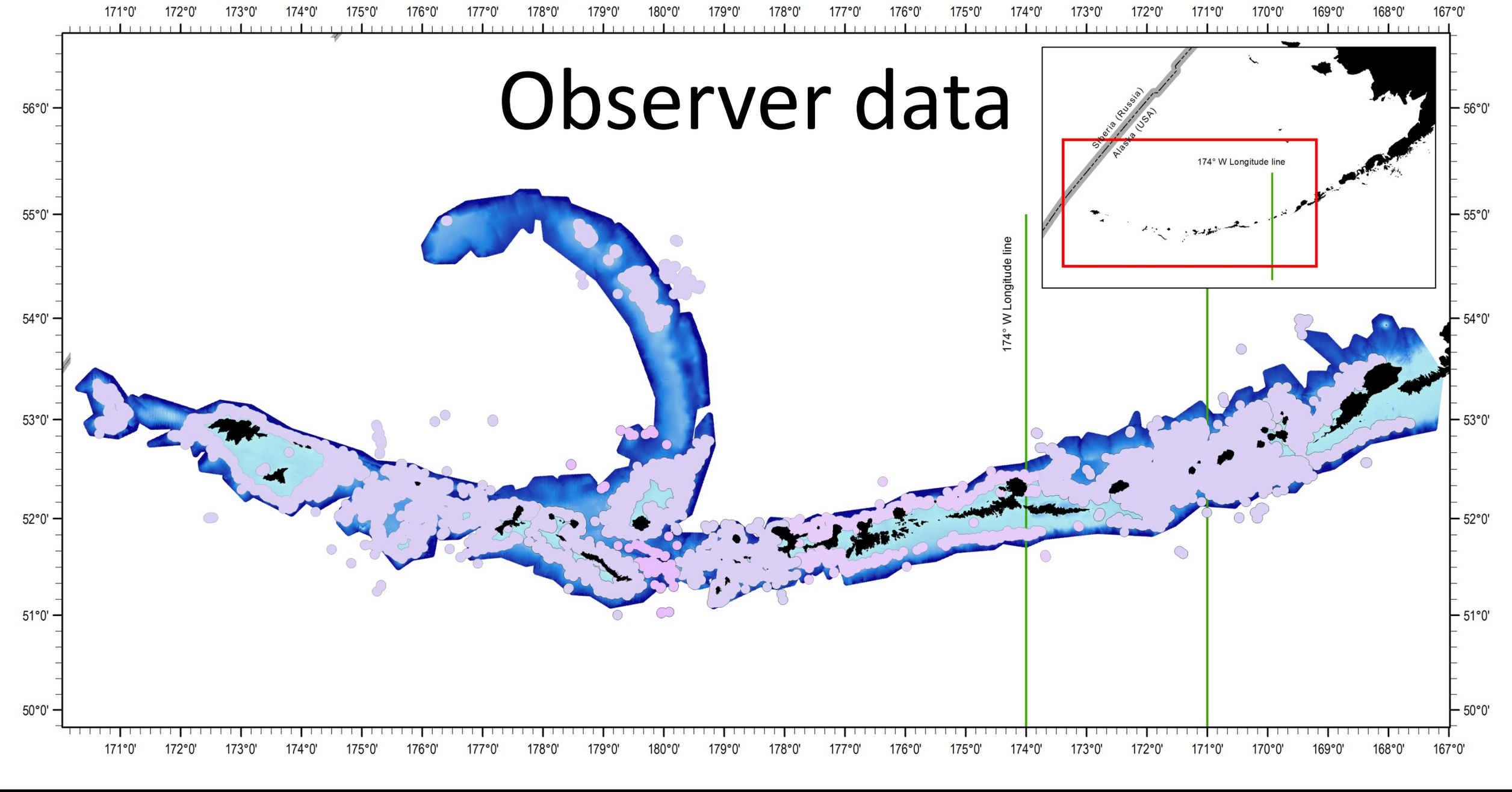
Cost due to area too great

So use next best (only) thing for index of abundance: Fishery observer data

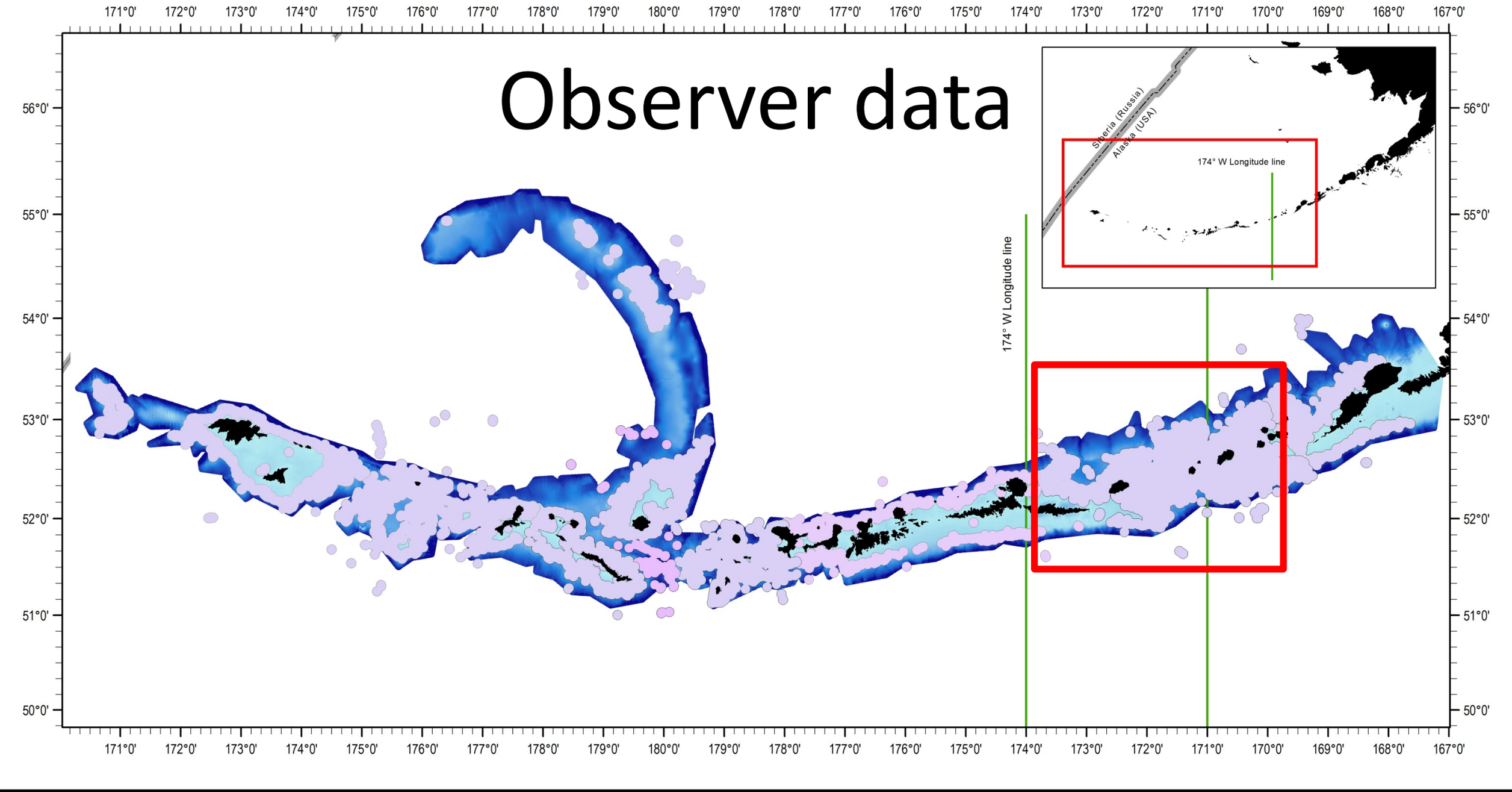
Observer data

- Fishery Dependent
  - Fishing “hotspots”
    - CPUE likely doesn’t reflect abundance!
  - Variable gear, skipper, bait, etc
- Standardized CPUE
  - Best with what we have

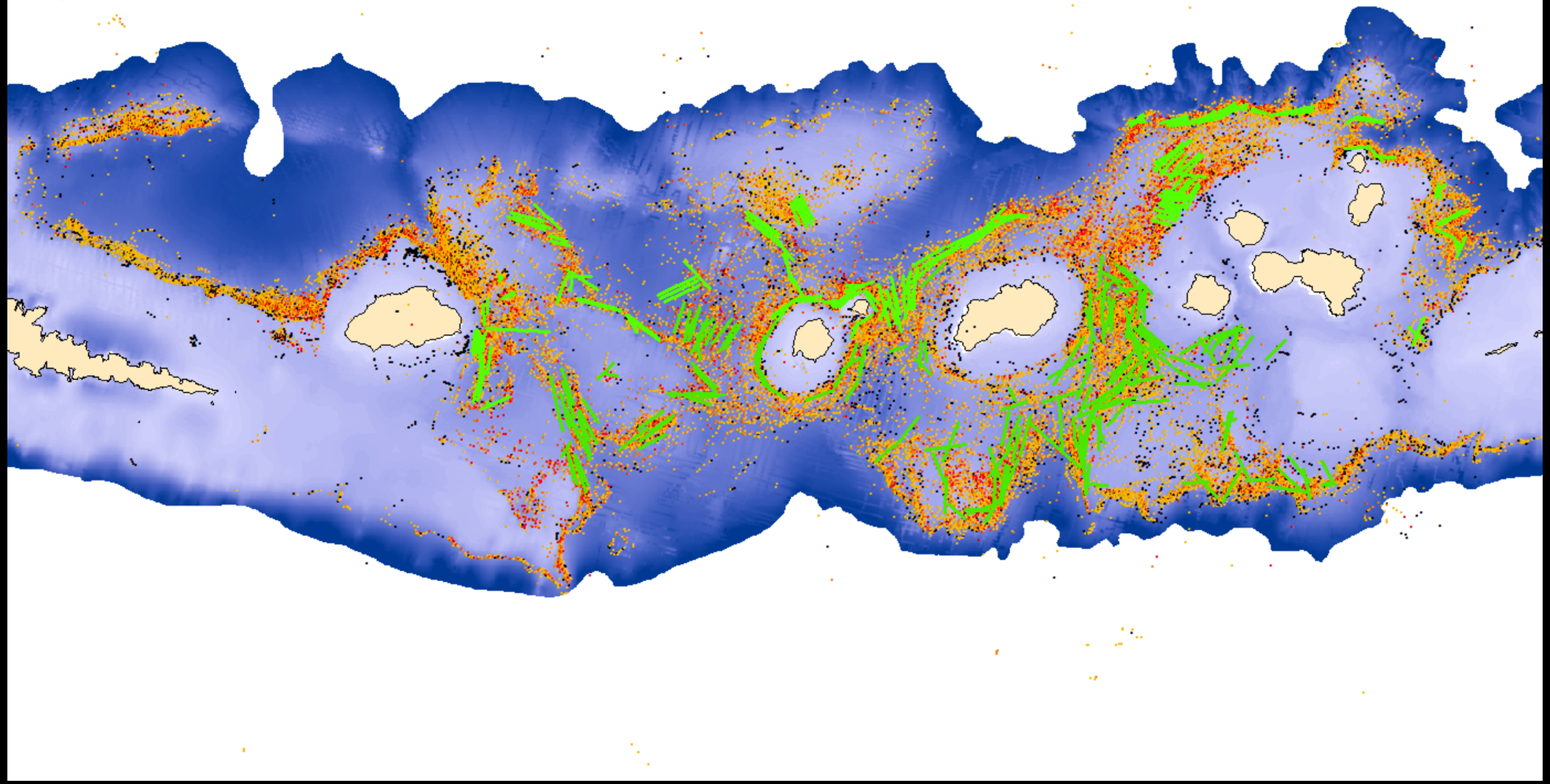
Observer data



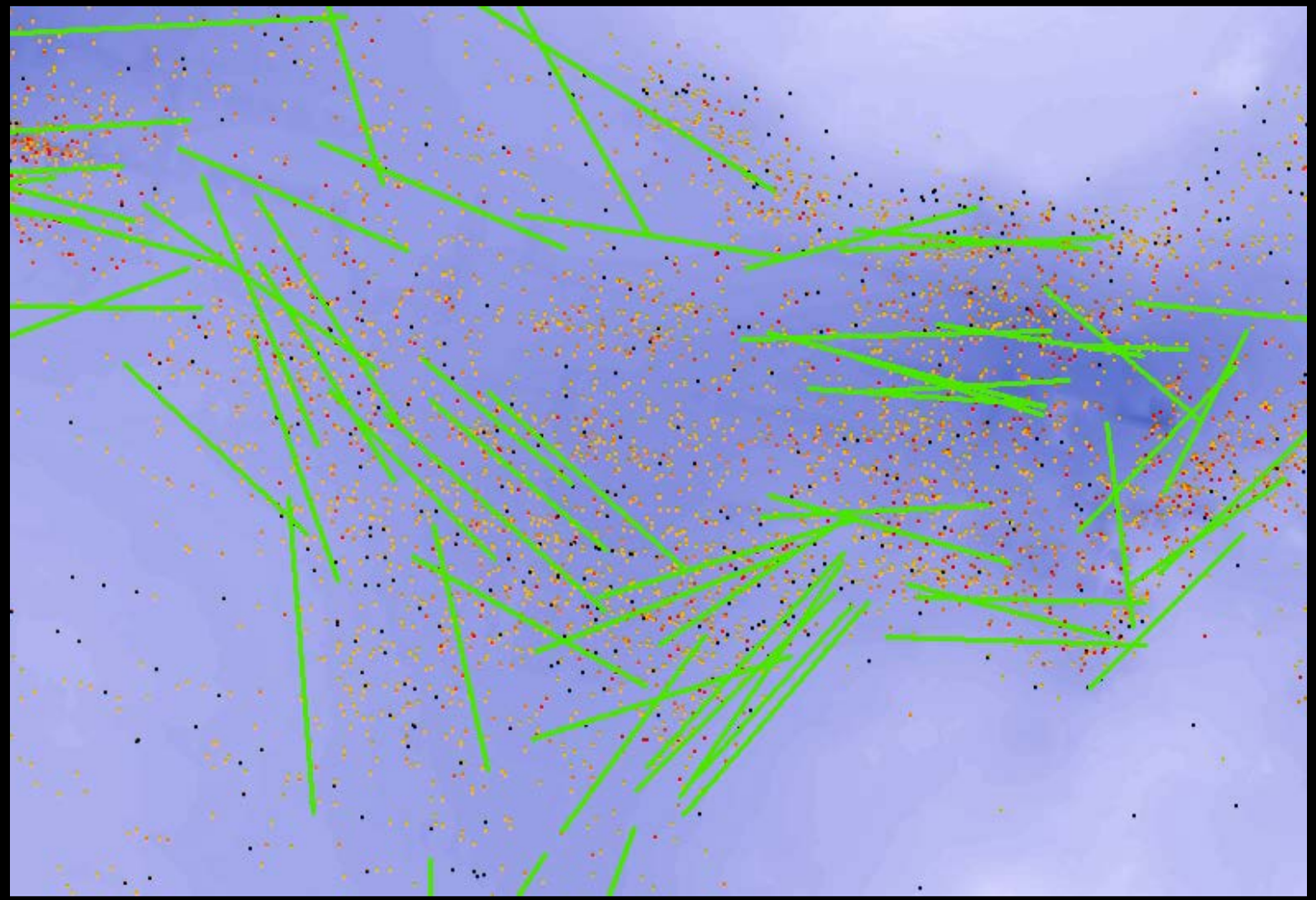
Observer data



Hyperstability / Spatial Extent



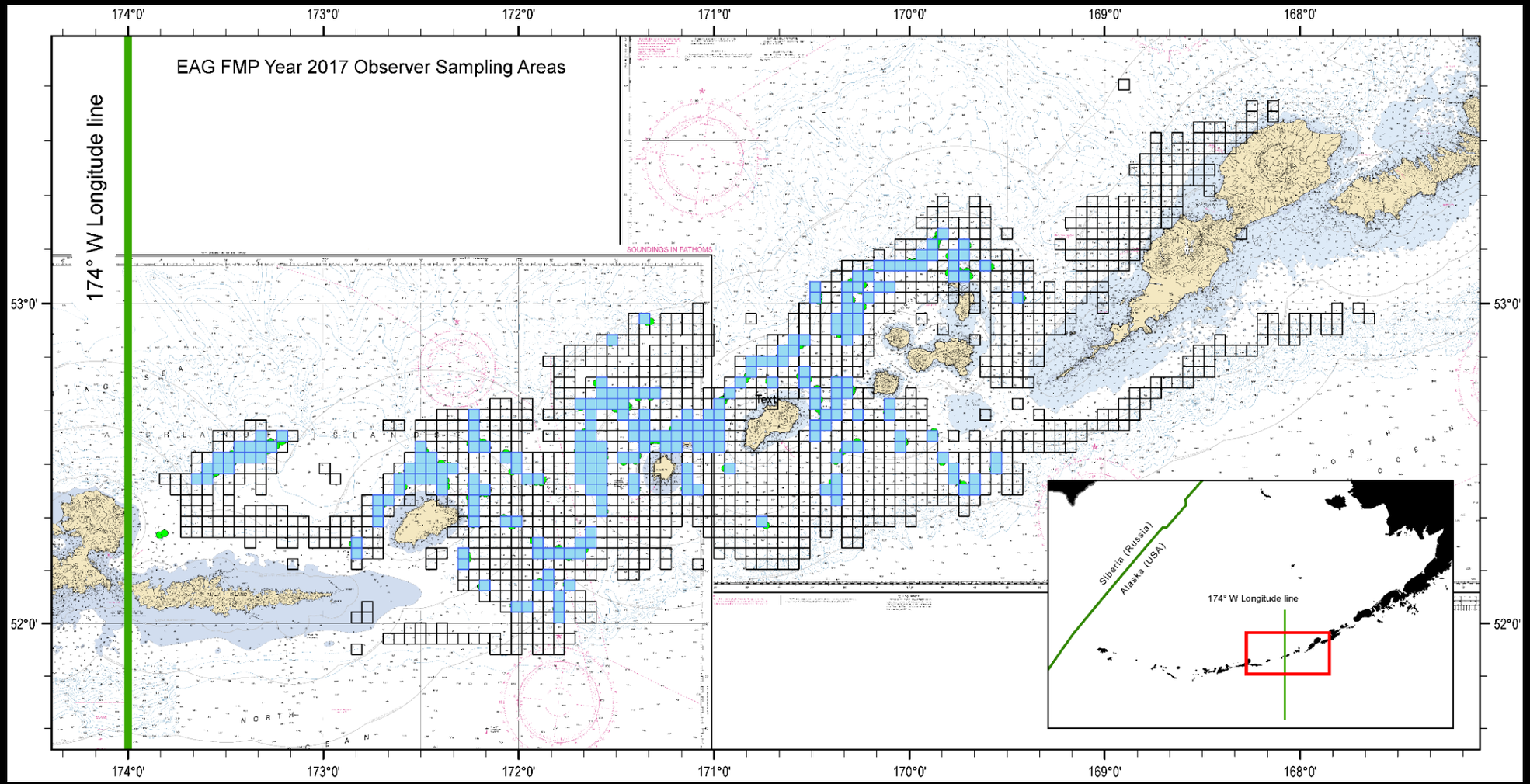
String locations

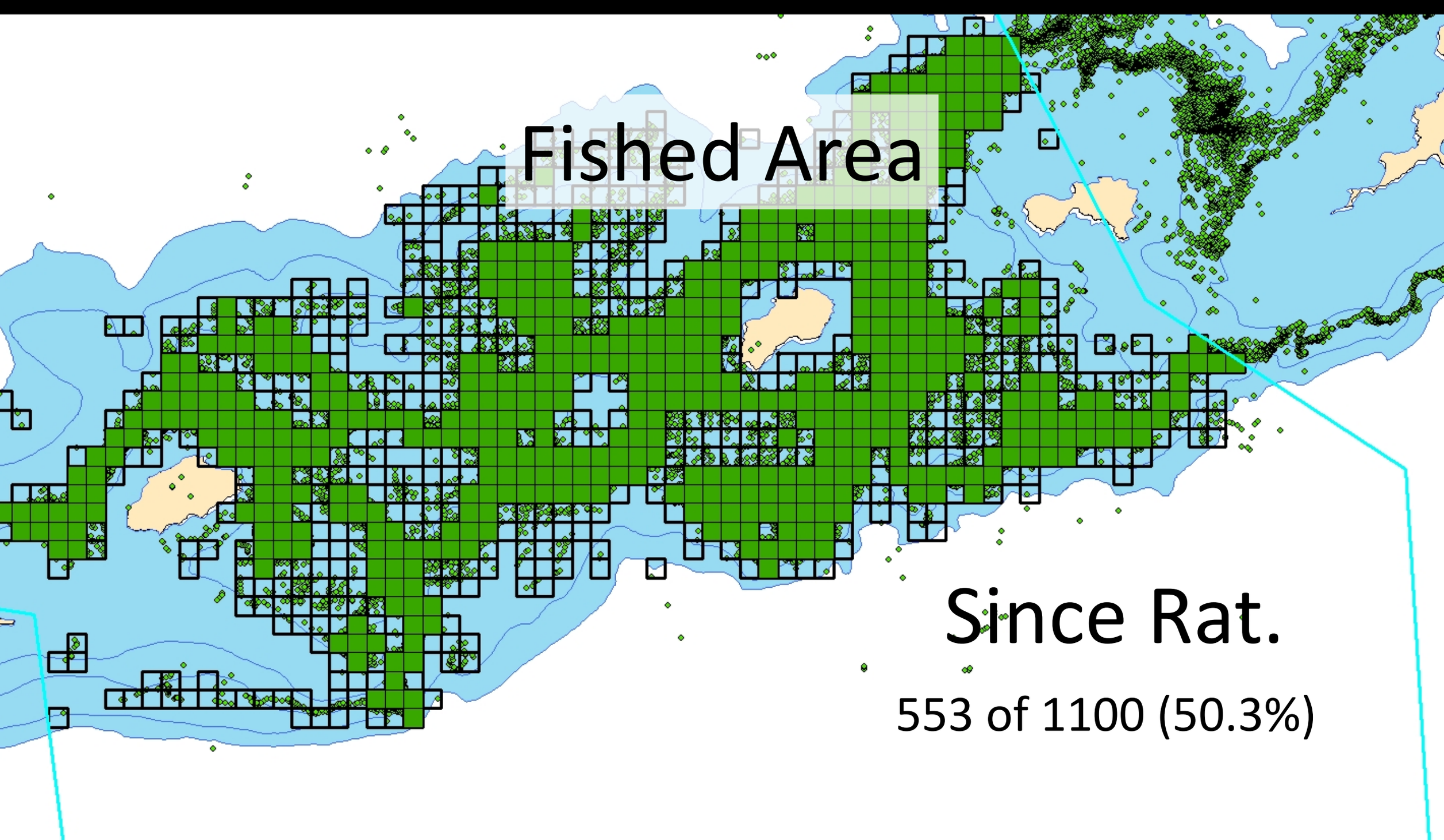


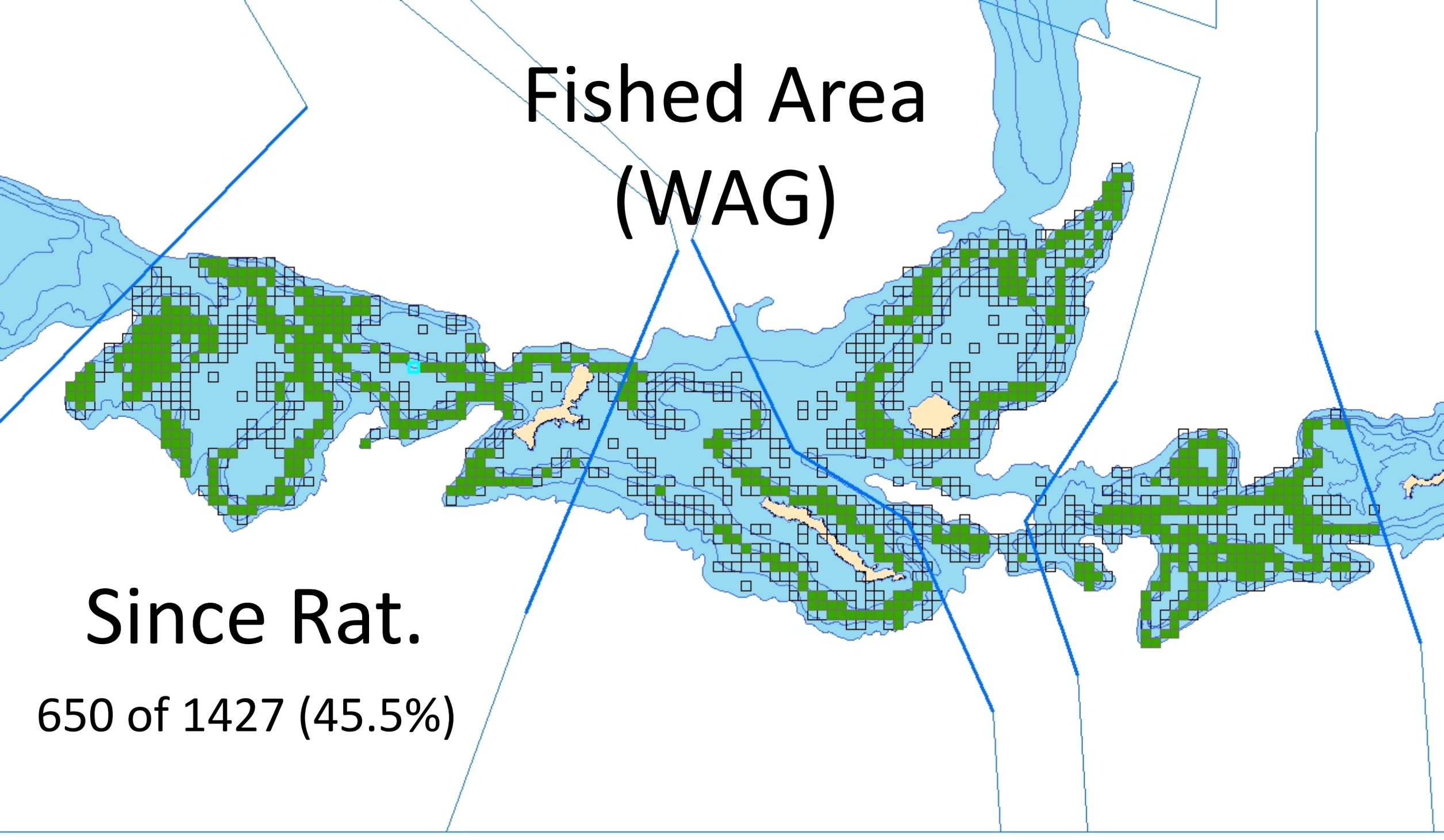
High overlap:
Confirms issue of
Non-independence

n ≠ 400
CVs biased low

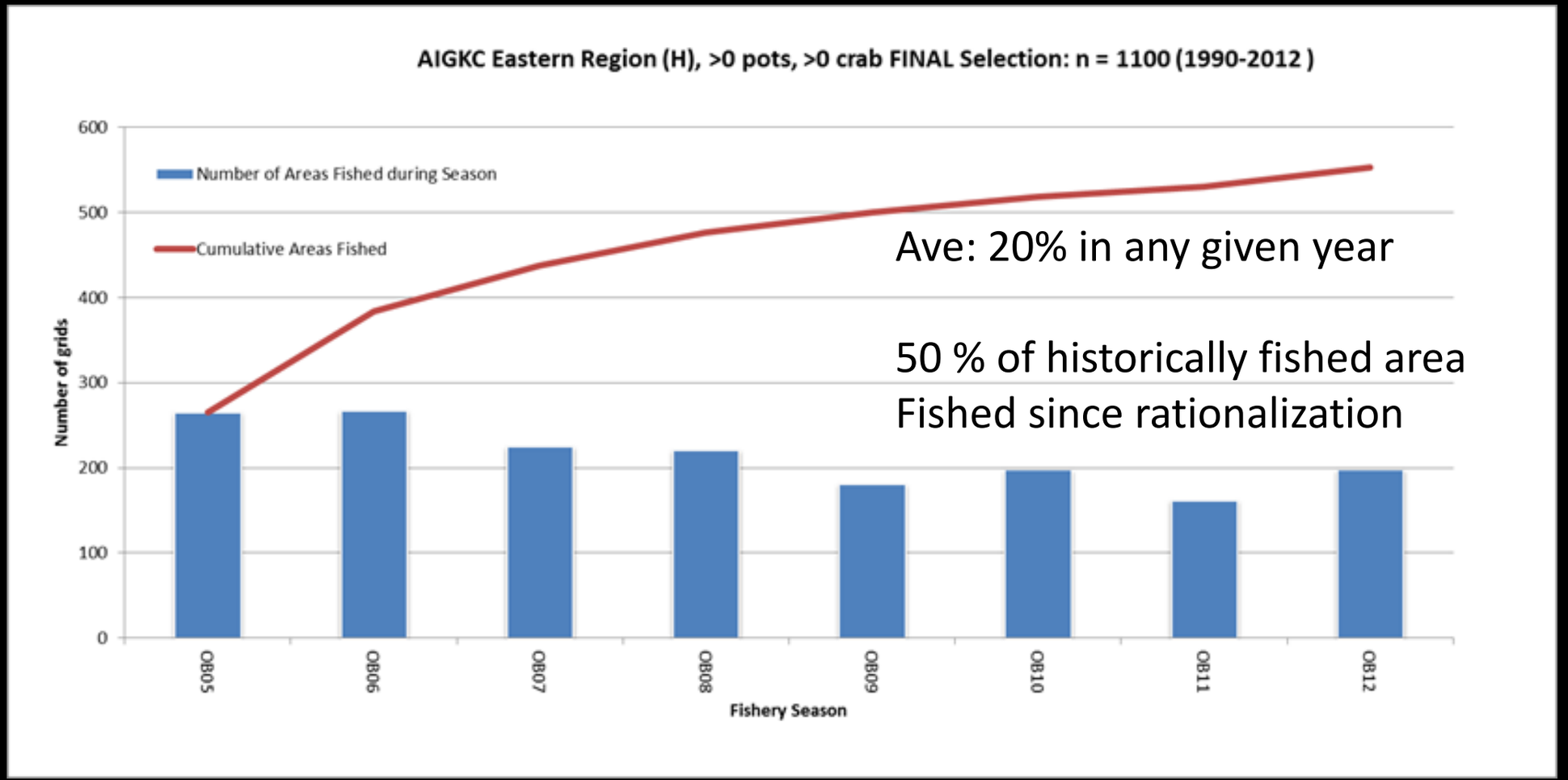
Fished Area


EAG FMP Year 2017 Observer Sampling Areas
174° W Longitude line
174°0'
173°0'
172°0'
171°0'
170°0'
169°0'
168°0'
53°0'
52°0'
SOUNDINGS IN FATHOMS
Text
BERING SEA
ALEUTIAN ISLANDS
NORTH PACIFIC OCEAN
NORTHERN PACIFIC OCEAN
Siberia (Russia)
Alaska (USA)
174° W Longitude line


Fished Area
Since Rat.
553 of 1100 (50.3%)

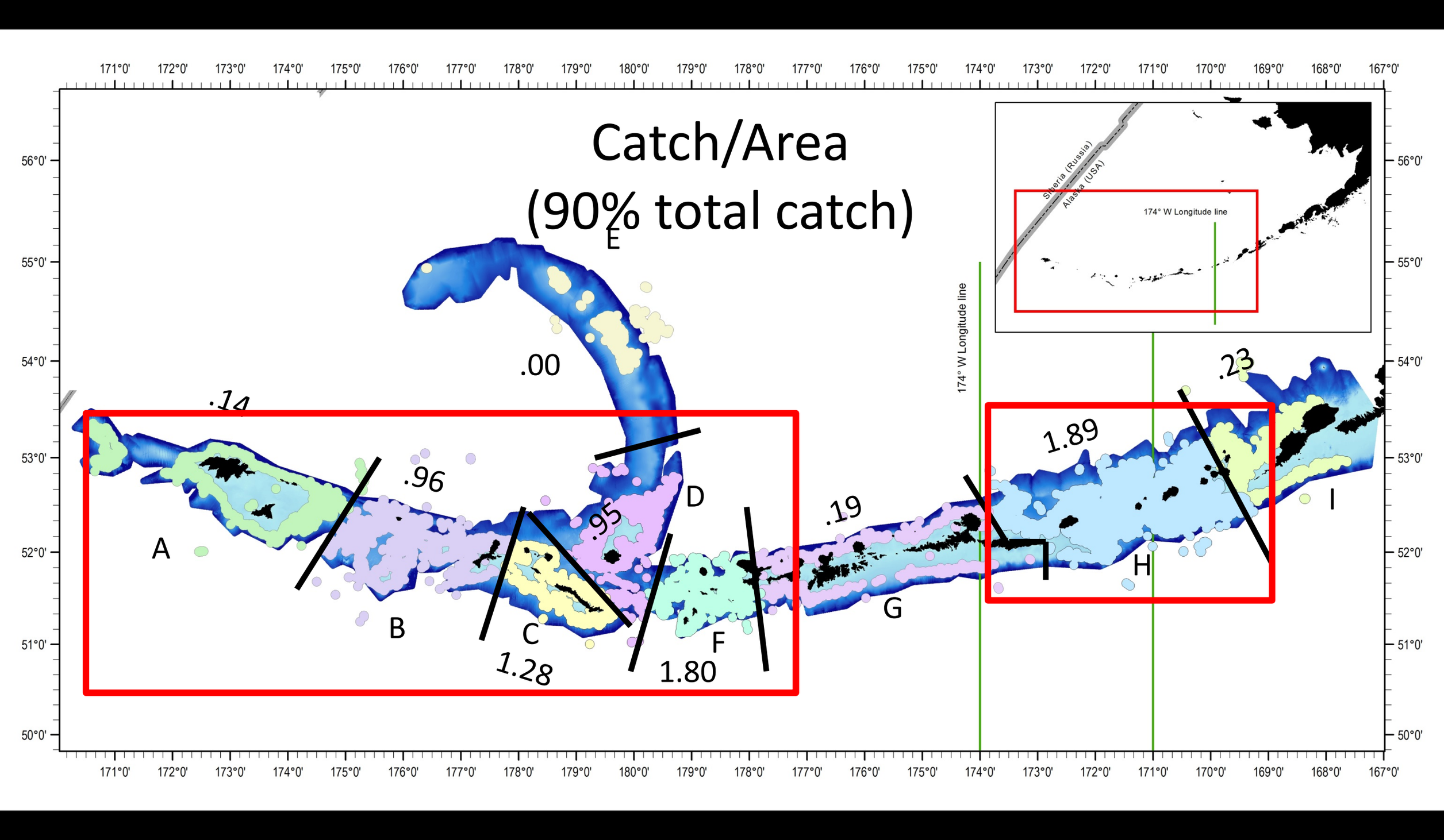

Fished Area
(WAG)
Since Rat.
650 of 1427 (45.5%)

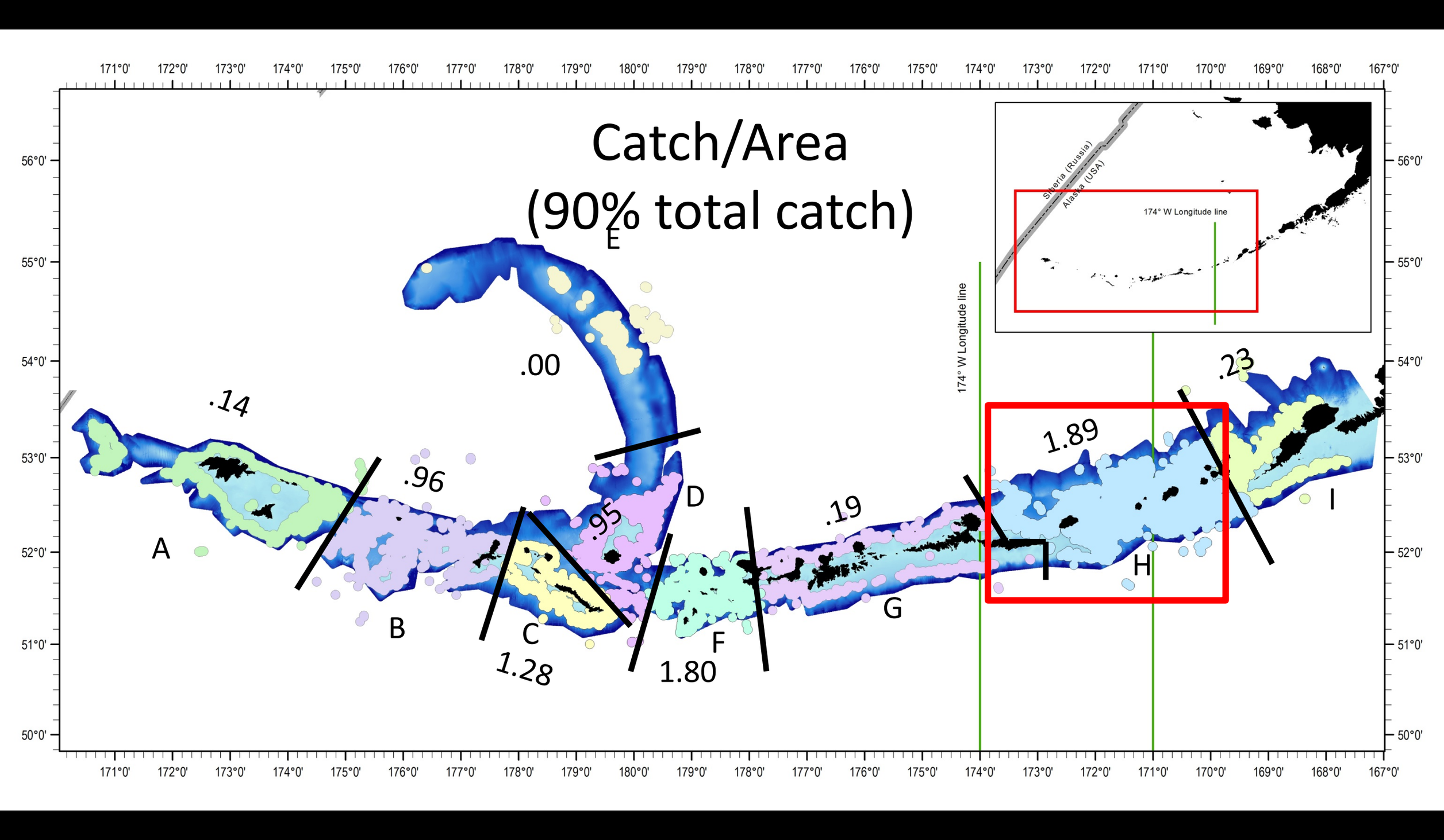
Fished Area


AIGKC Eastern Region (H), >0 pots, >0 crab FINAL Selection: n = 1100 (1990-2012)
Number of Areas Fished during Season
Cumulative Areas Fished
Number of grids
600
500
400
300
200
100
0
OB05
OB06
OB07
OB08
OB09
OB10
OB11
OB12
Fishery Season
Ave: 20% in any given year
50 % of historically fished area
Fished since rationalization

Cooperative Survey?

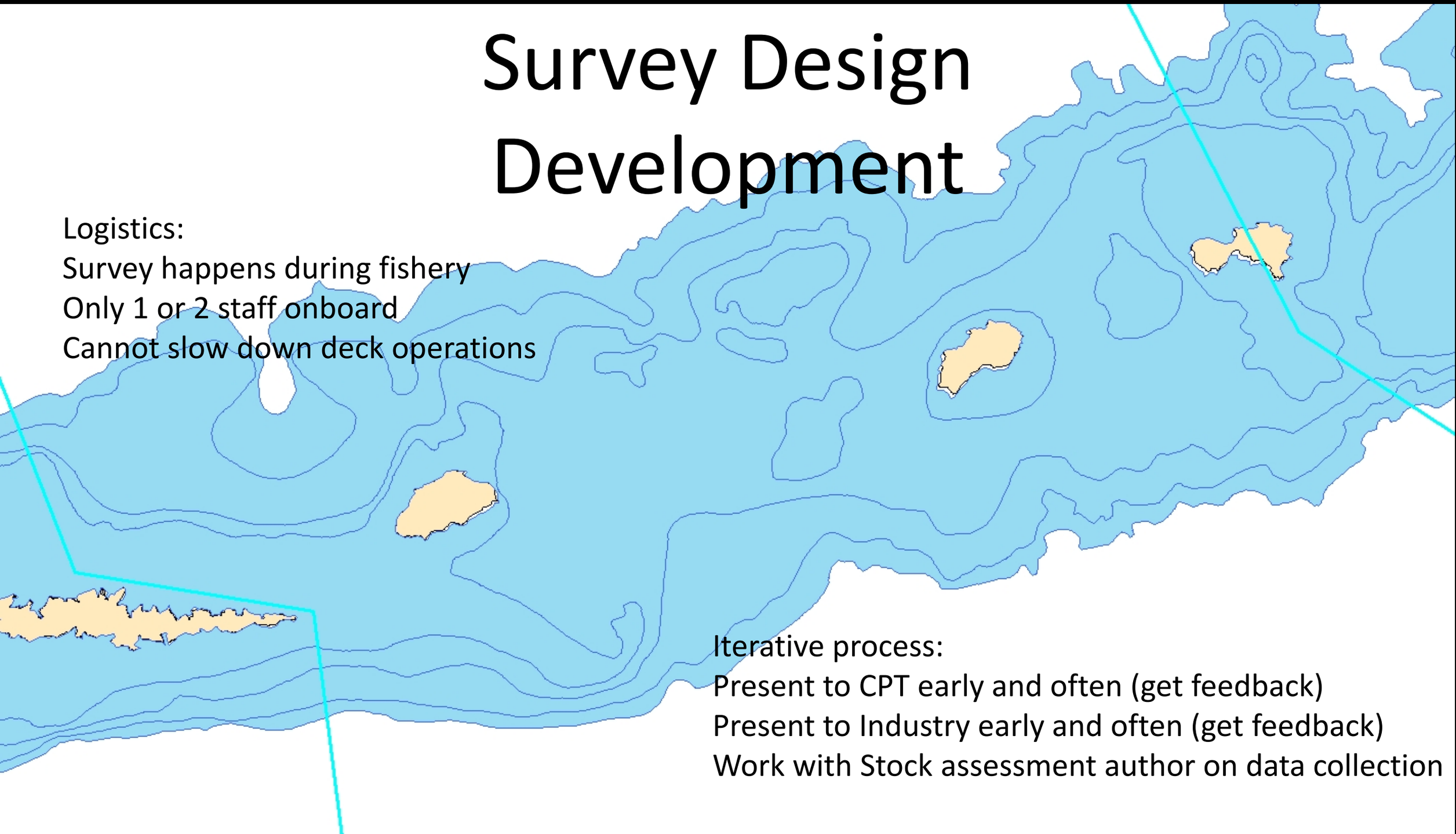
Improve spatial extent
Reduce potential for hyperstability
Provide consistent data long-term
Cost effective


Catch/Area
(90% total catch)
Siberia (Russia)
Alaska (USA)
174° W Longitude line
174° W Longitude line
.14
.96
.00
.95
1.28
1.80
.19
1.89
.23
A
B
C
D
E
F
G
H
I
171°0'
172°0'
173°0'
174°0'
175°0'
176°0'
177°0'
178°0'
179°0'
180°0'
56°0'
55°0'
54°0'
53°0'
52°0'
51°0'
50°0'


Catch/Area
(90% total catch)
Siberia (Russia)
Alaska (USA)
174° W Longitude line
174° W Longitude line
A
B
C
D
E
F
G
H
I
.14
.96
1.28
.95
.00
1.80
.19
1.89
.23
171°0'
172°0'
173°0'
174°0'
175°0'
176°0'
177°0'
178°0'
179°0'
180°0'
56°0'
55°0'
54°0'
53°0'
52°0'
51°0'
50°0'

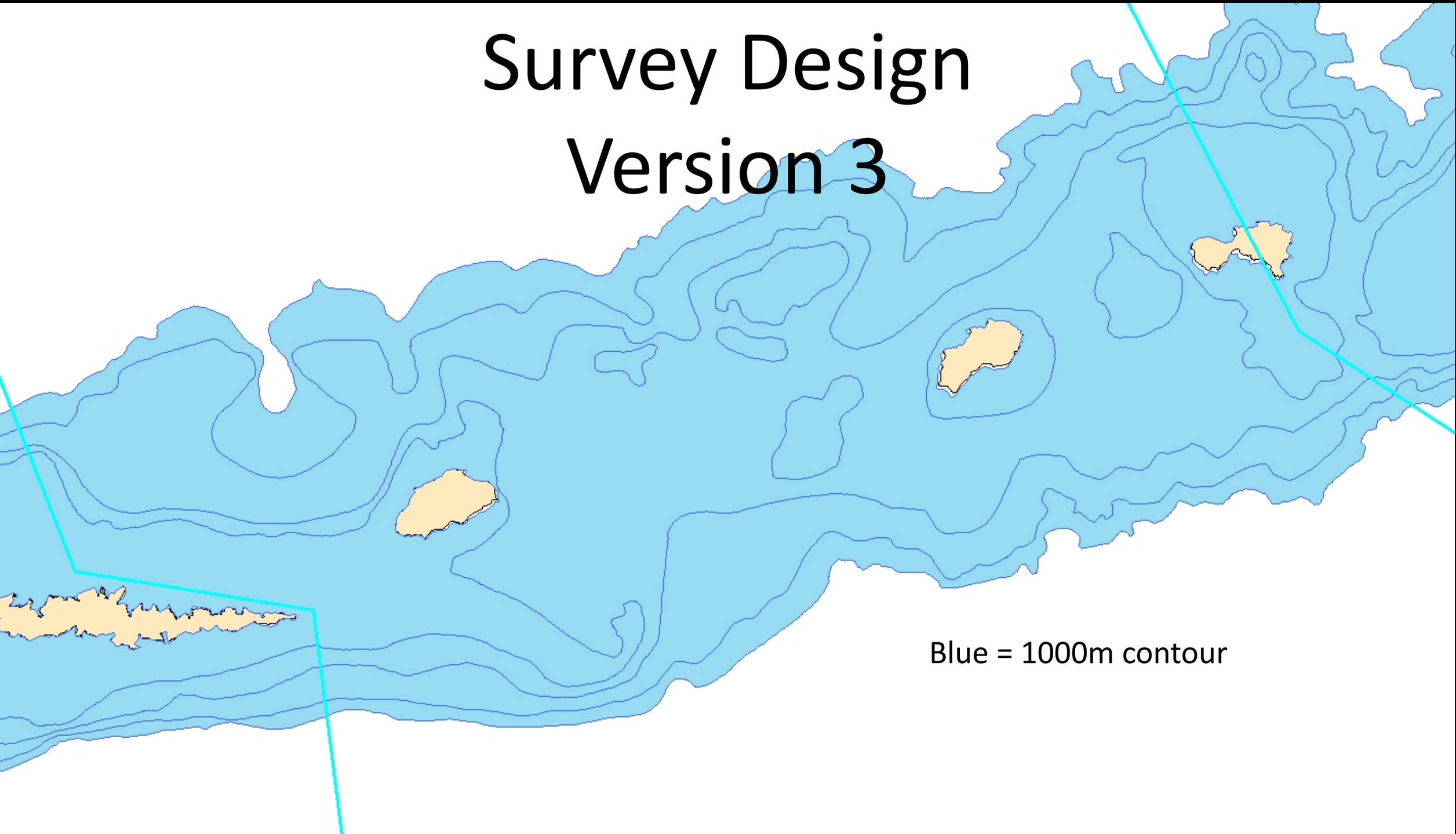
Survey Design Development

Logistics:
Survey happens during fishery
Only 1 or 2 staff onboard
Cannot slow down deck operations

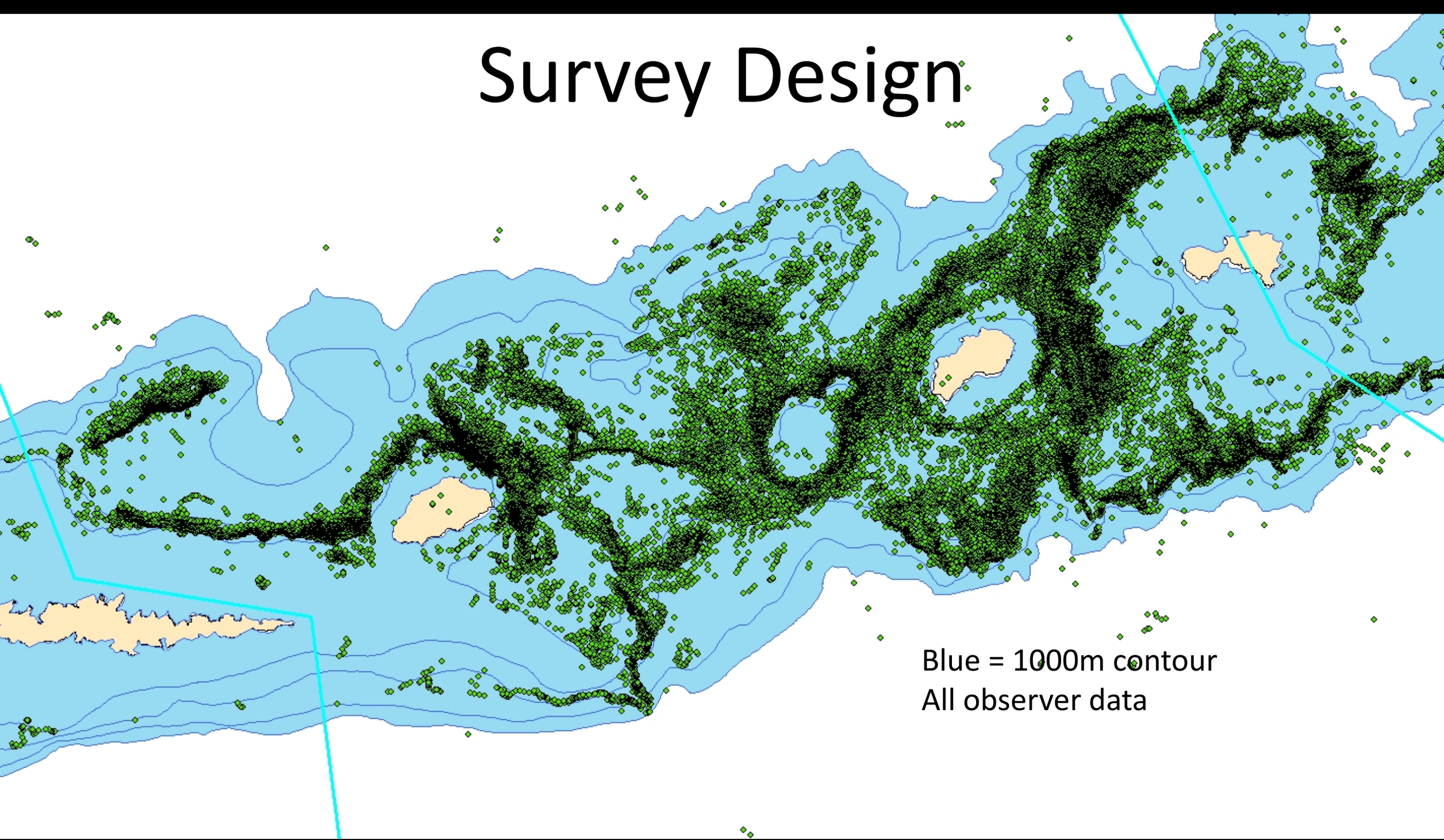


Iterative process:
Present to CPT early and often (get feedback)
Present to Industry early and often (get feedback)
Work with Stock assessment author on data collection

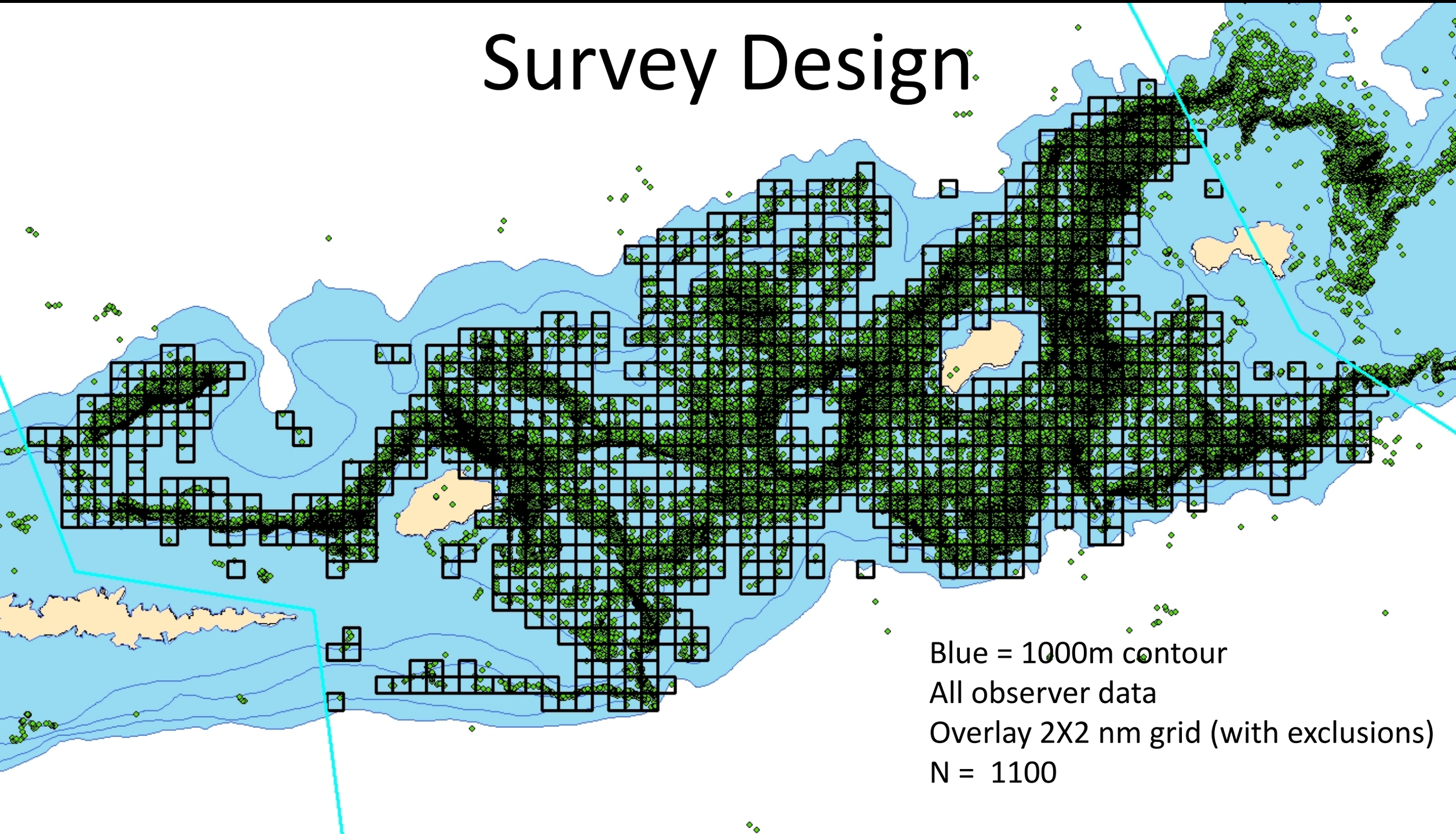
Survey Design Version 3



Survey Design

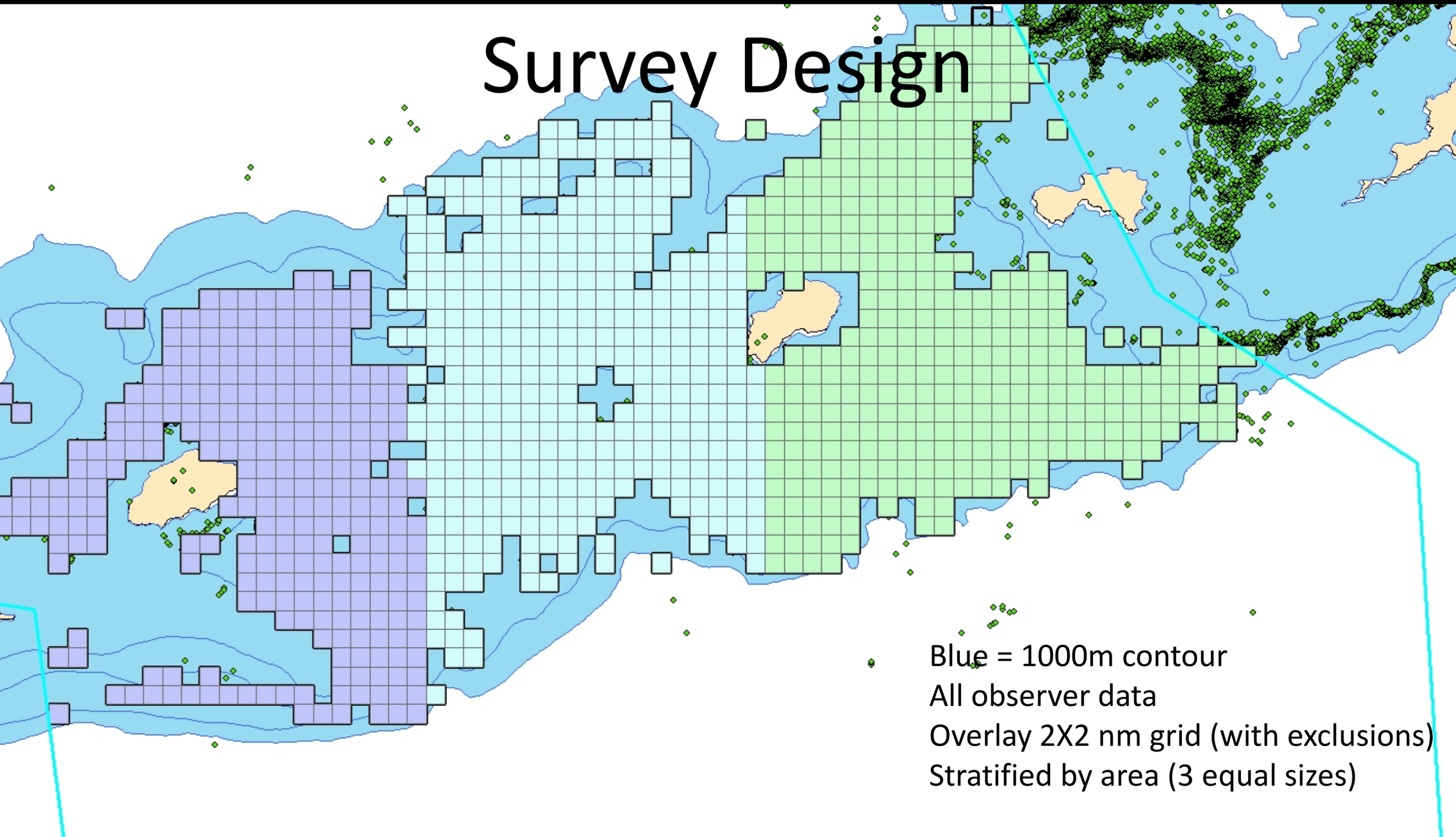


Survey Design



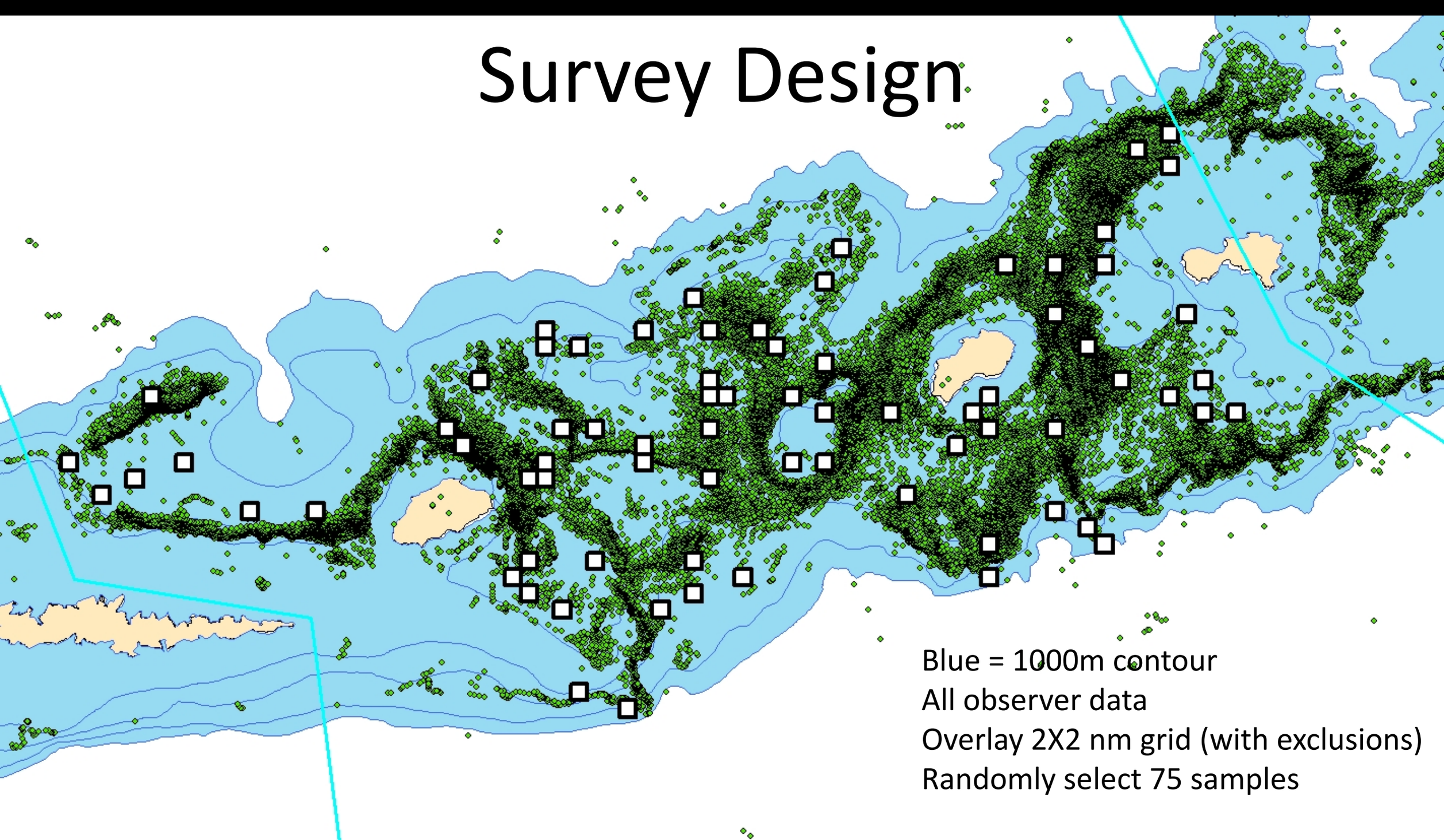
Blue = 1000m contour
All observer data
Overlay 2X2 nm grid (with exclusions)
N = 1100

Survey Design



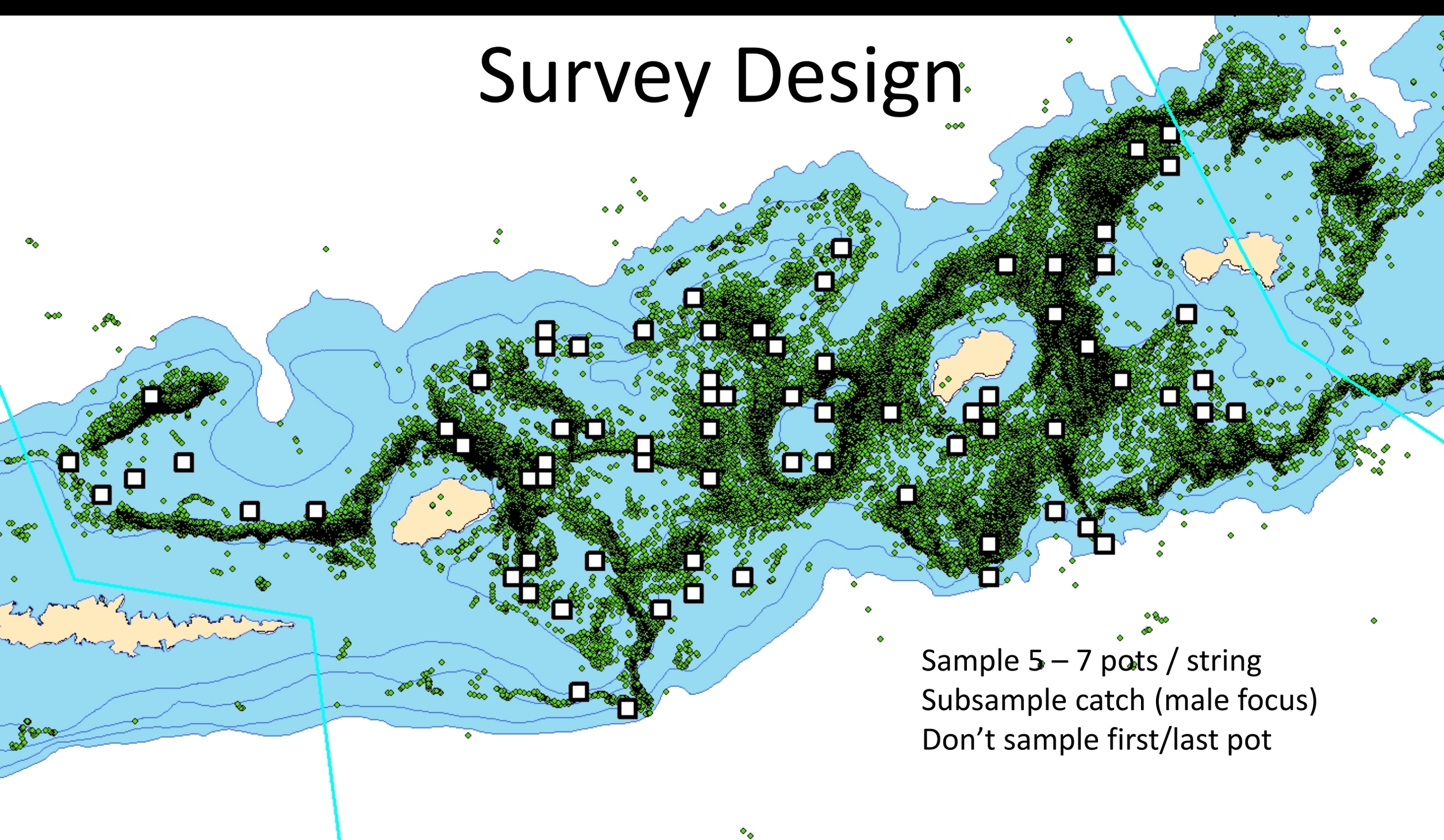
Blue = 1000m contour
All observer data
Overlay 2X2 nm grid (with exclusions)
Stratified by area (3 equal sizes)

Survey Design

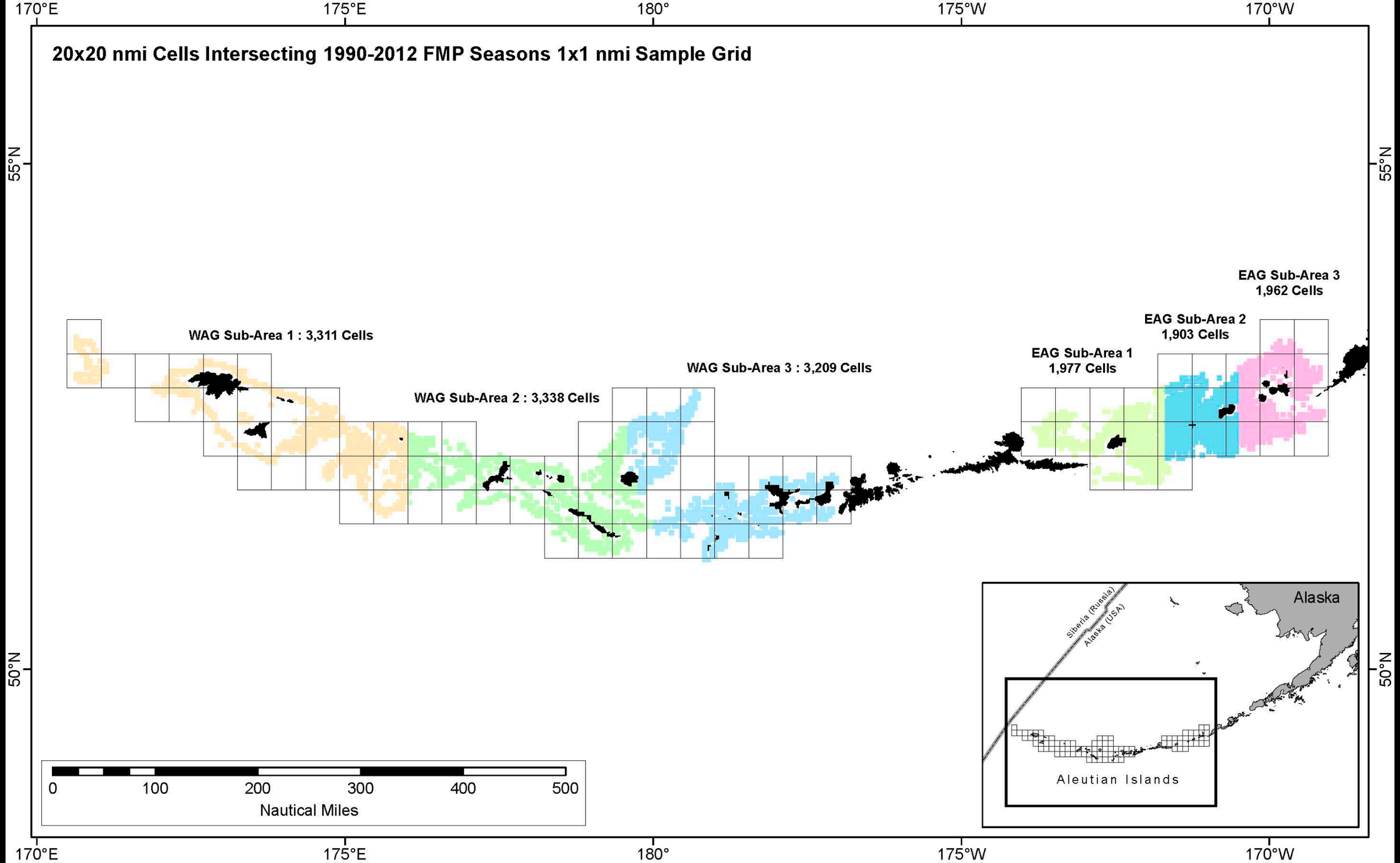


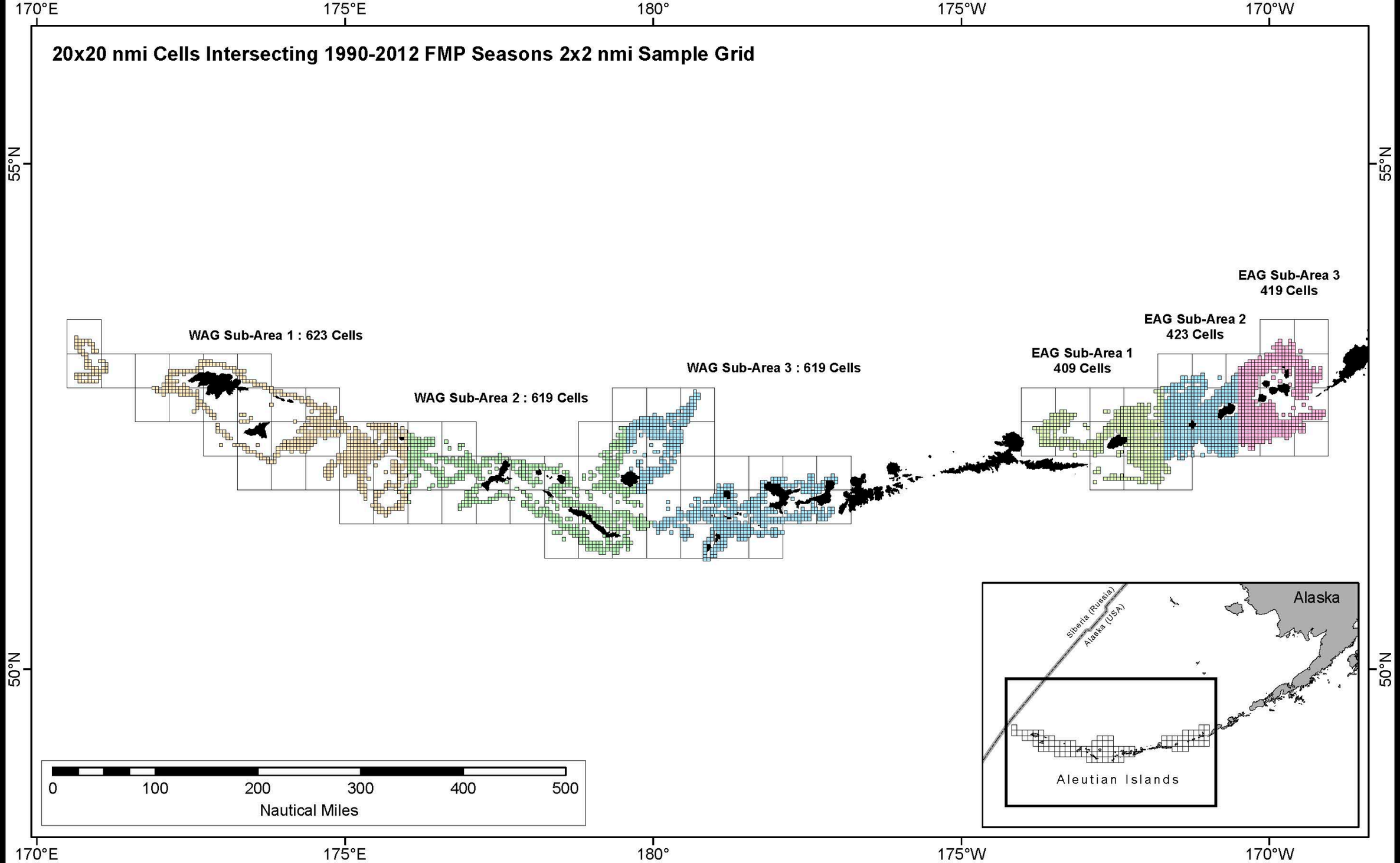
Blue = 1000m contour
All observer data
Overlay 2X2 nm grid (with exclusions)
Randomly select 75 samples

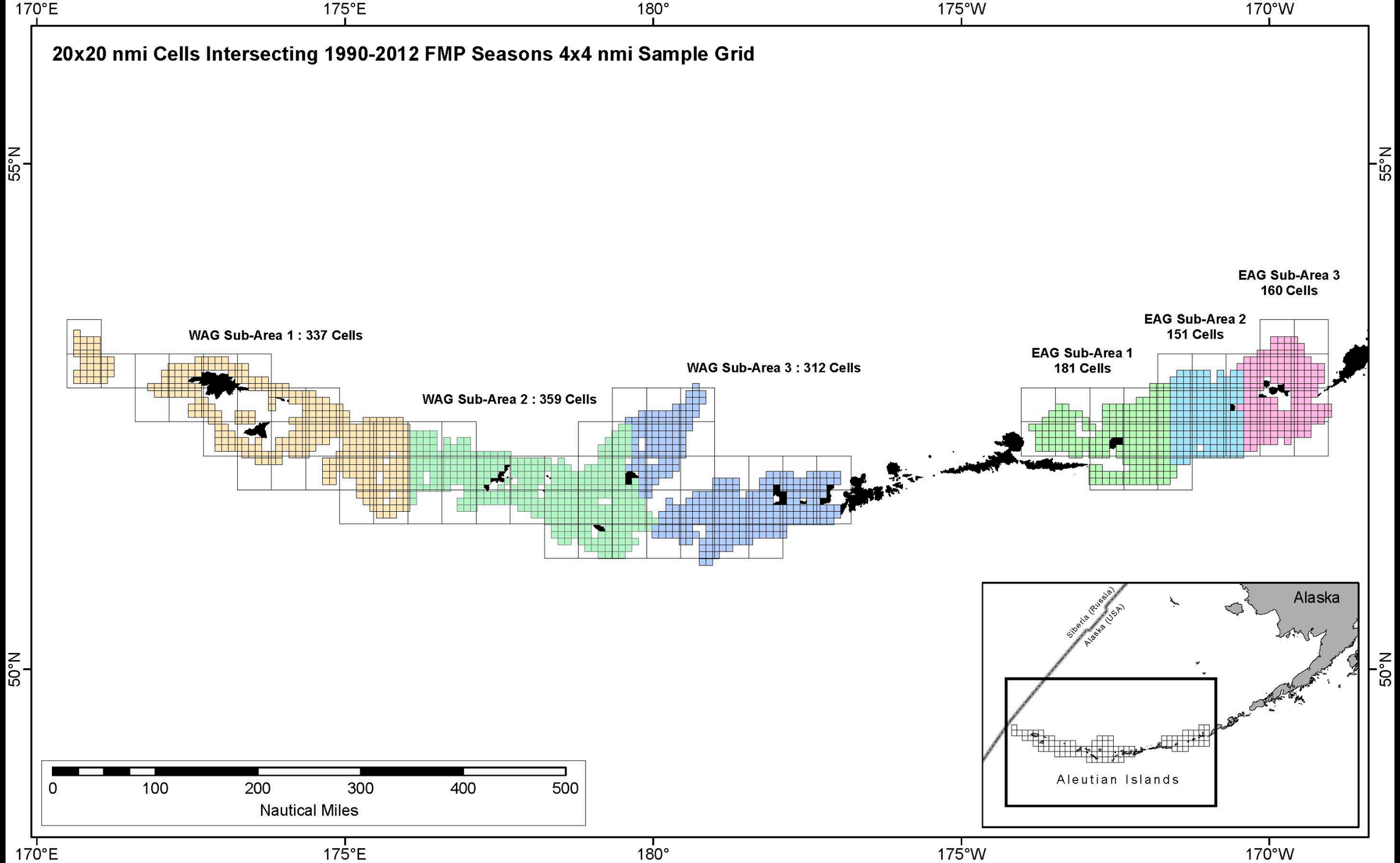
Survey Design



Sample 5 – 7 pots / string
Subsample catch (male focus)
Don’t sample first/last pot


20x20 nmi Cells Intersecting 1990-2012 FMP Seasons 1x1 nmi Sample Grid
170°E
175°E
180°
175°W
170°W
55°N
50°N
WAG Sub-Area 1 : 3,311 Cells
WAG Sub-Area 2 : 3,338 Cells
WAG Sub-Area 3 : 3,209 Cells
EAG Sub-Area 1
1,977 Cells
EAG Sub-Area 2
1,903 Cells
EAG Sub-Area 3
1,962 Cells
0
100
200
300
400
500
Nautical Miles
Alaska
Siberia (Russia)
Alaska (USA)
Aleutian Islands


20x20 nmi Cells Intersecting 1990-2012 FMP Seasons 2x2 nmi Sample Grid
170°E
175°E
180°
175°W
170°W
55°N
50°N
WAG Sub-Area 1 : 623 Cells
WAG Sub-Area 2 : 619 Cells
WAG Sub-Area 3 : 619 Cells
EAG Sub-Area 1
409 Cells
EAG Sub-Area 2
423 Cells
EAG Sub-Area 3
419 Cells
0
100
200
300
400
500
Nautical Miles
Alaska
Siberia (Russia)
Alaska (USA)
Aleutian Islands


20x20 nmi Cells Intersecting 1990-2012 FMP Seasons 4x4 nmi Sample Grid
170°E
175°E
180°
175°W
170°W
55°N
50°N
WAG Sub-Area 1 : 337 Cells
WAG Sub-Area 2 : 359 Cells
WAG Sub-Area 3 : 312 Cells
EAG Sub-Area 1
181 Cells
EAG Sub-Area 2
151 Cells
EAG Sub-Area 3
160 Cells
0
100
200
300
400
500
Nautical Miles
Alaska
Siberia (Russia)
Alaska (USA)
Aleutian Islands

Survey station sizes

Area	EAG (#)	WAG(#)	Total (#)	Total Area (nm^2)
1 x 1nm:	5,842	9,858	15,700	15,700
1.5x1.5nm:	1,879	4,927	6,806	15,314
2 x 2nm:	1,251	1,861	3,112	12,448
3 x 3 nm:	811	1,583	2,394	21,546
4 x 4nm:	492	1,004	1,496	23,936
20 x 20nm:	28	68	96	38,400

2 x 2nm best compromise between scale of fishing gear, accuracy of defining habitat, and number of possible stations.

Results

Covers 95% of historical fishing grounds
Stratified, 2-stage design (data are independent)
Skippers/crew impressed with staff

Early Results

Cost:

5 ADFG(salary/seaduty/benefits/travel) for 14days

~1K/person/day = 70K

Fleet:

Increased fuel cost: TBD

Increased time/effort to catch TAC: TBD

Early Results

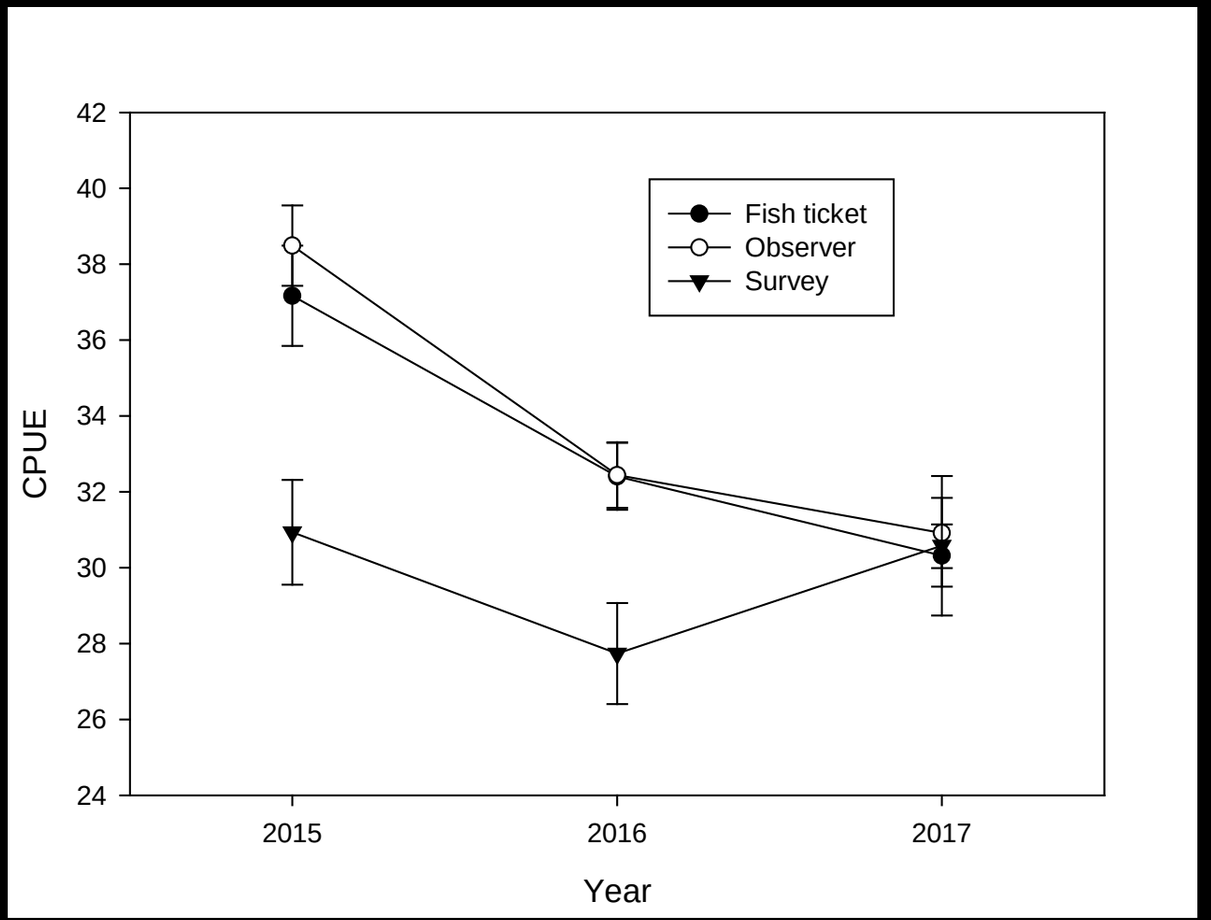
Logistically feasible to due Coop survey

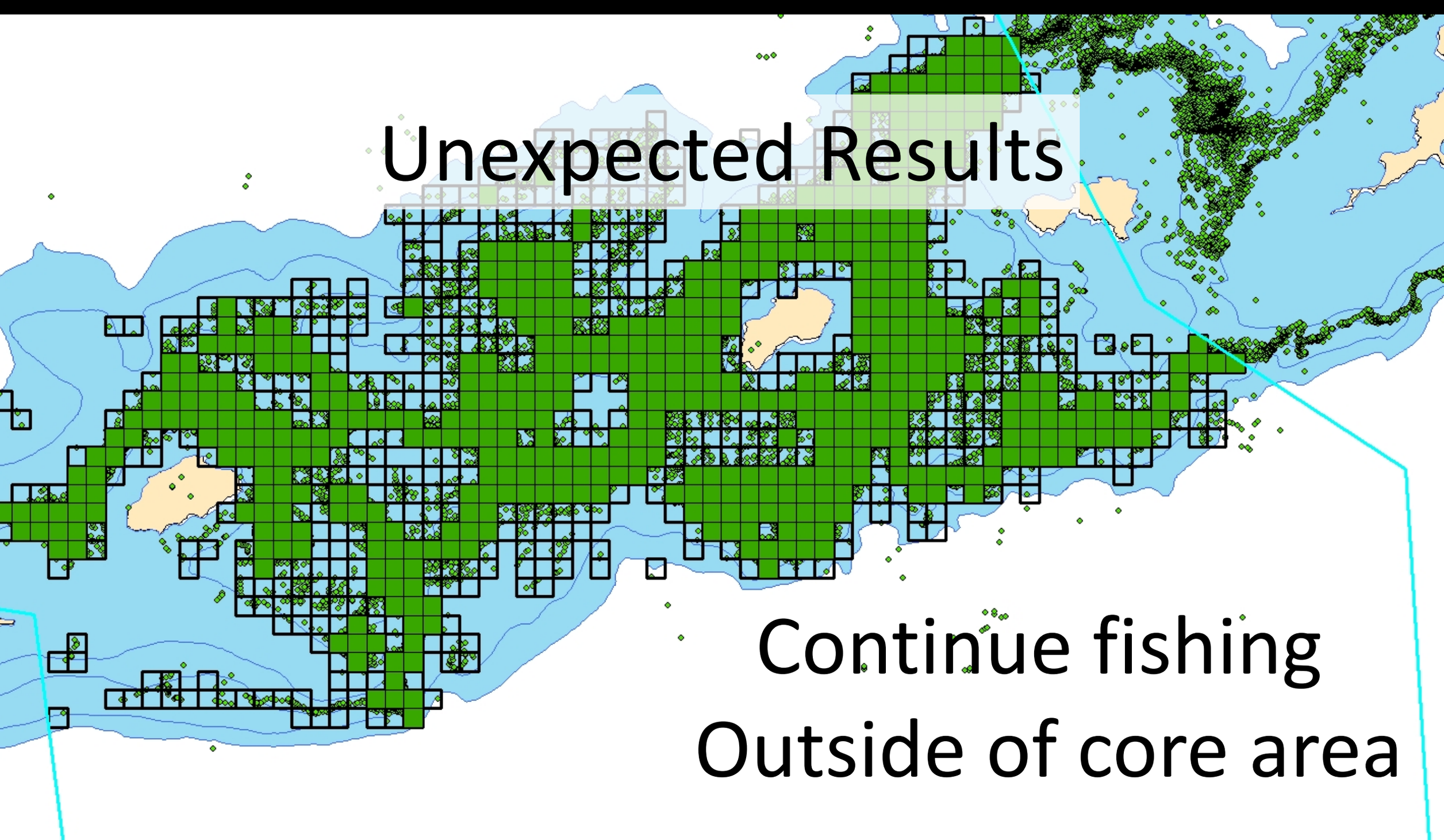
Industry, NRC, ADF&G

Cost effective

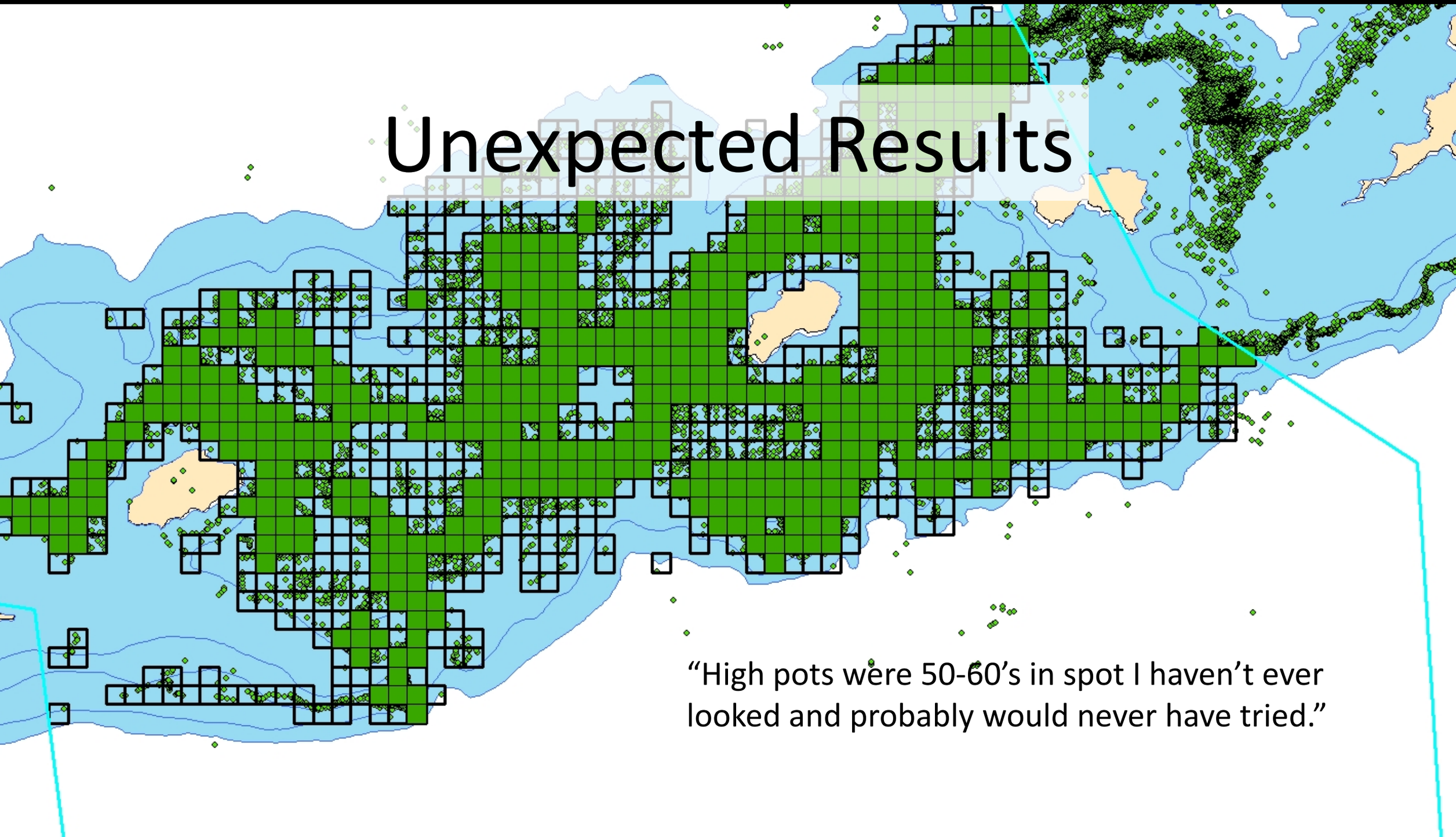
(150 – 200K to survey EAG + WAG)

Survey CPUE

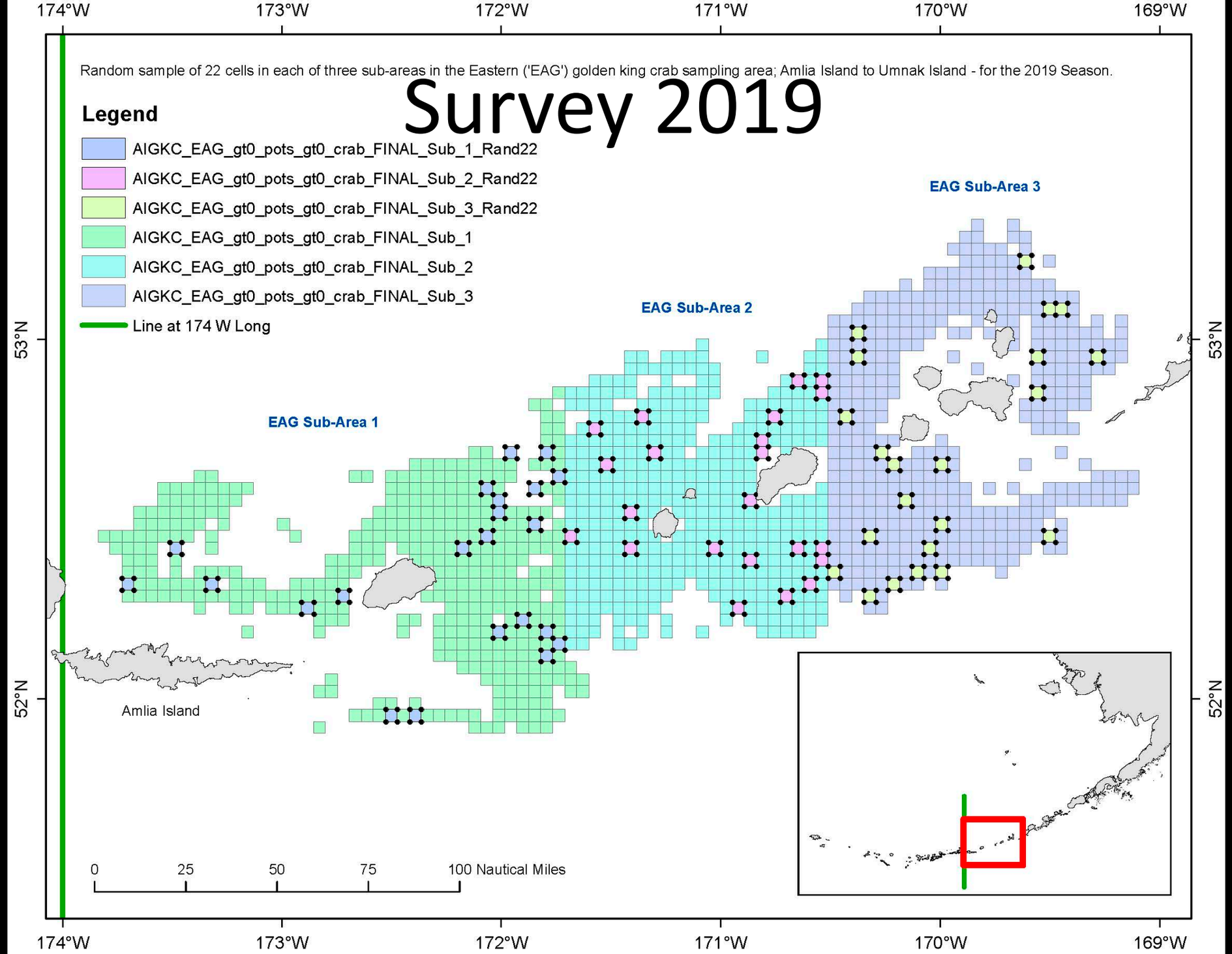

42
40
38
36
34
32
30
28
26
24
CPUE
2015
2016
2017
Year
Fish ticket
Observer
Survey

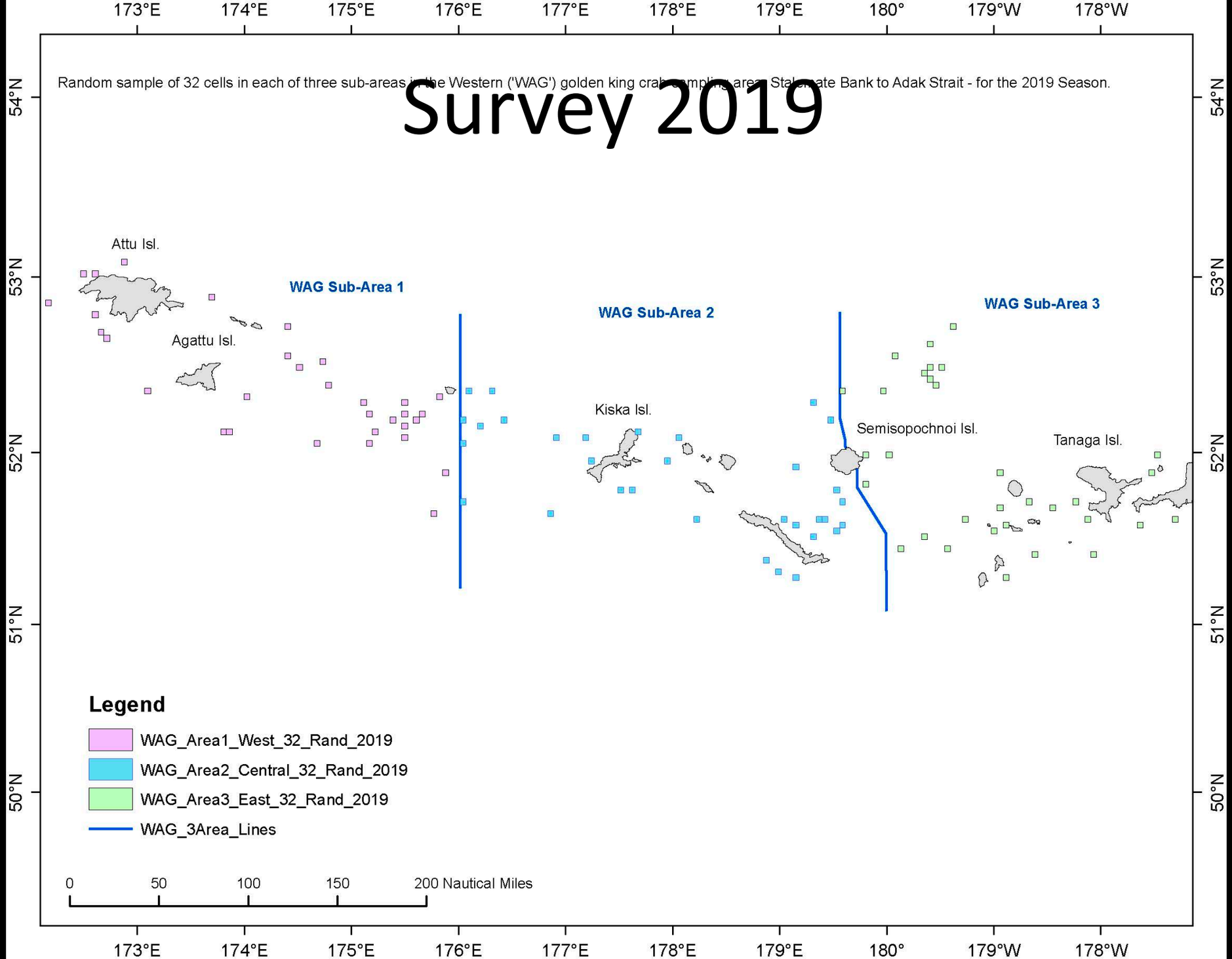

Unexpected Results
Continue fishing
Outside of core area

Unexpected Results



"High pots were 50-60's in spot I haven't ever looked and probably would never have tried."


Random sample of 22 cells in each of three sub-areas in the Eastern ('EAG') golden king crab sampling area; Amlia Island to Umnak Island - for the 2019 Season.
Survey 2019
Legend
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_1_Rand22
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_2_Rand22
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_3_Rand22
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_1
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_2
AIGKC_EAG_gt0_pots_gt0_crab_FINAL_Sub_3
Line at 174 W Long
EAG Sub-Area 1
EAG Sub-Area 2
EAG Sub-Area 3
Amlia Island
174°W
173°W
172°W
171°W
170°W
169°W
53°N
52°N
0
25
50
75
100 Nautical Miles


Random sample of 32 cells in each of three sub-areas in the Western ('WAG') golden king crab sampling area - Stalemate Bank to Adak Strait - for the 2019 Season.
Survey 2019
173°E
174°E
175°E
176°E
177°E
178°E
179°E
180°
179°W
178°W
54°N
53°N
52°N
51°N
50°N
Attu Isl.
Agattu Isl.
WAG Sub-Area 1
WAG Sub-Area 2
WAG Sub-Area 3
Kiska Isl.
Semisopochnoi Isl.
Tanaga Isl.
Legend
WAG_Area1_West_32_Rand_2019
WAG_Area2_Central_32_Rand_2019
WAG_Area3_East_32_Rand_2019
WAG_3Area_Lines
0
50
100
150
200 Nautical Miles

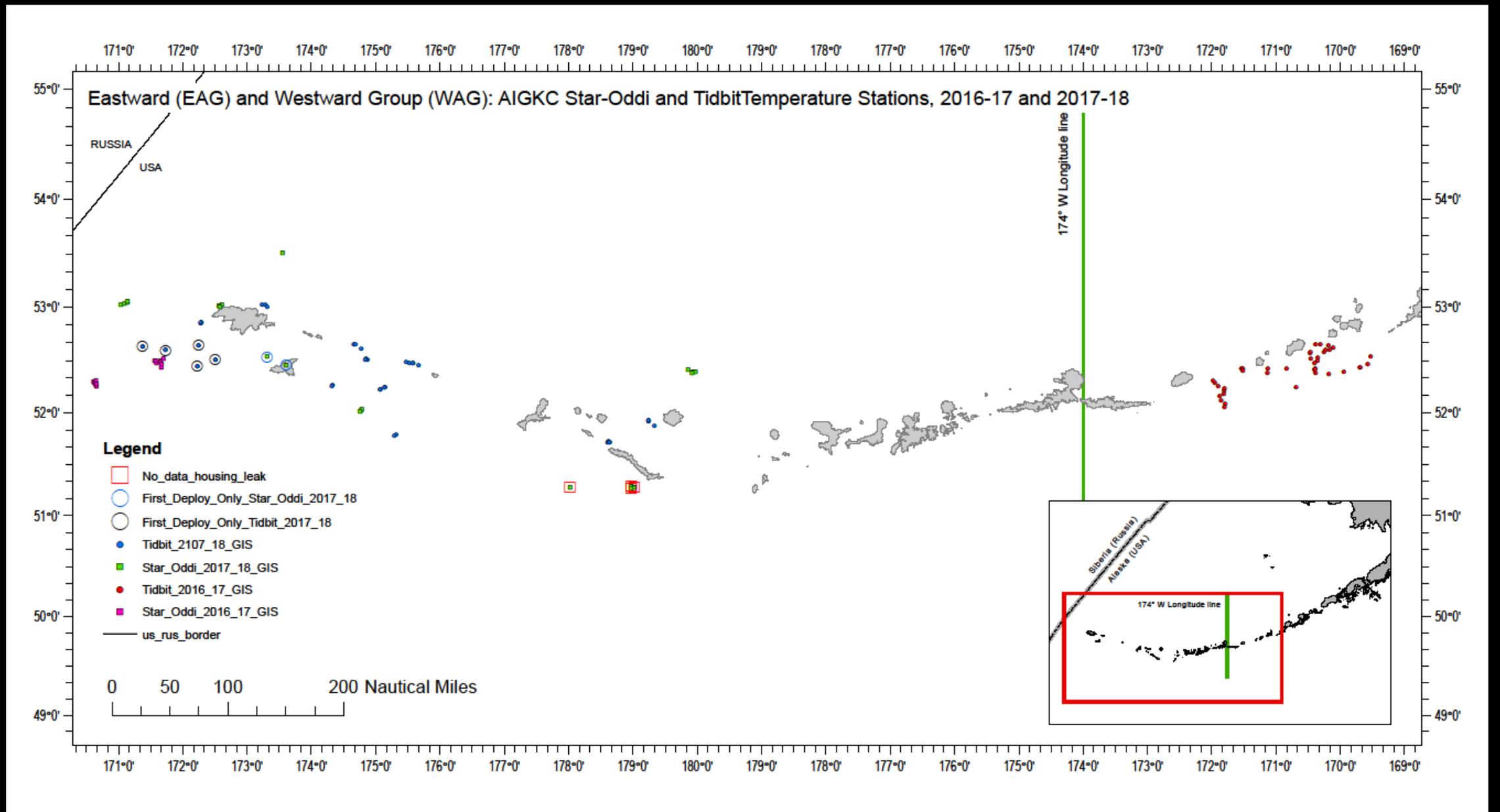
Next Steps

Full debrief with skippers and staff
(improve efficiencies)
Examine within and among string variability
(sample size estimates)
Explore better stratification options
(Skipper, Habitat, Effort)
Initiate in WAG
How/when to integrate into SA
Long-term funding source
Incorporate small-mesh pots

Next Steps

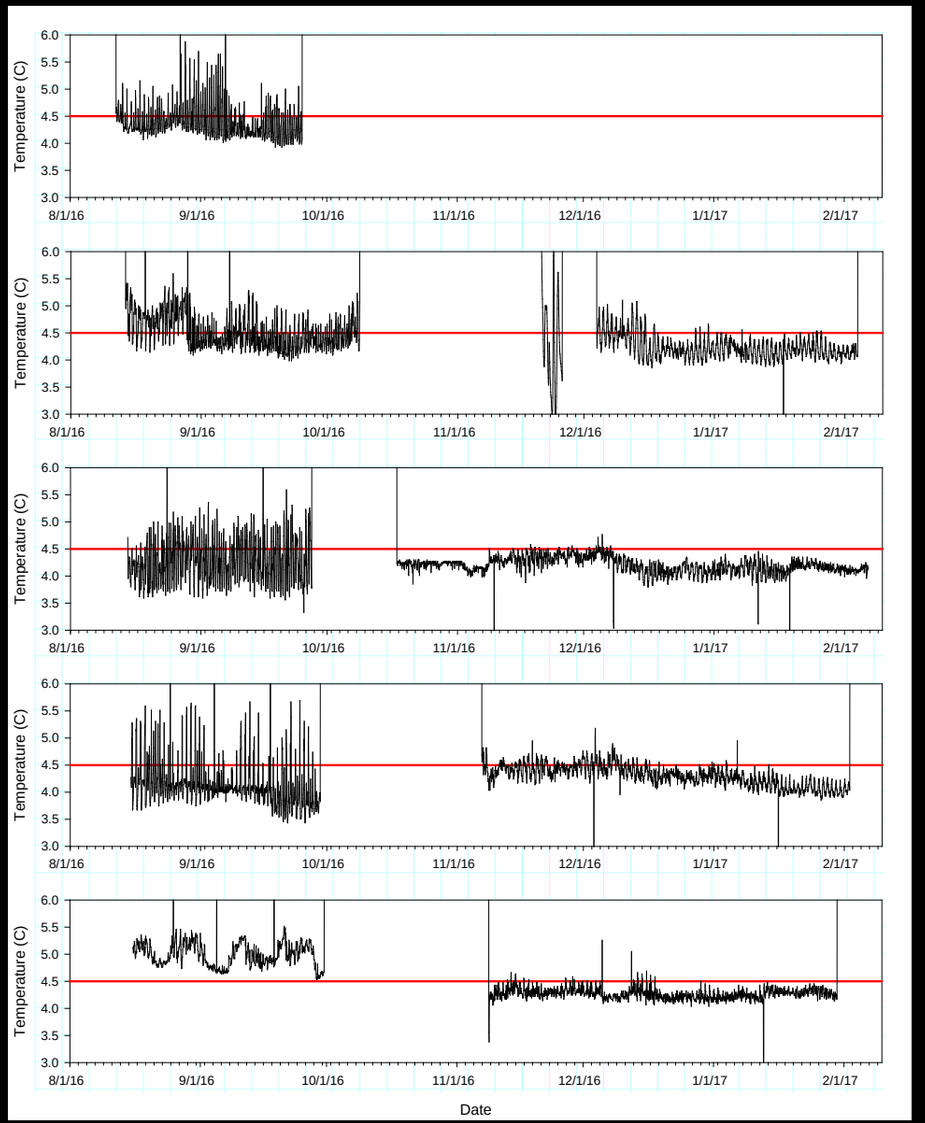
~~Full debrief with skippers and staff~~
~~(improve efficiencies)~~
~~Examine within and among string variability~~
~~(sample size estimates)~~
Explore better stratification options
(Skipper, Habitat, Effort)
~~Initiate in WAG~~
~~How/when to integrate into SA~~
~~Long-term funding source~~
~~Incorporate small-mesh pots~~

Temperature



Temperature

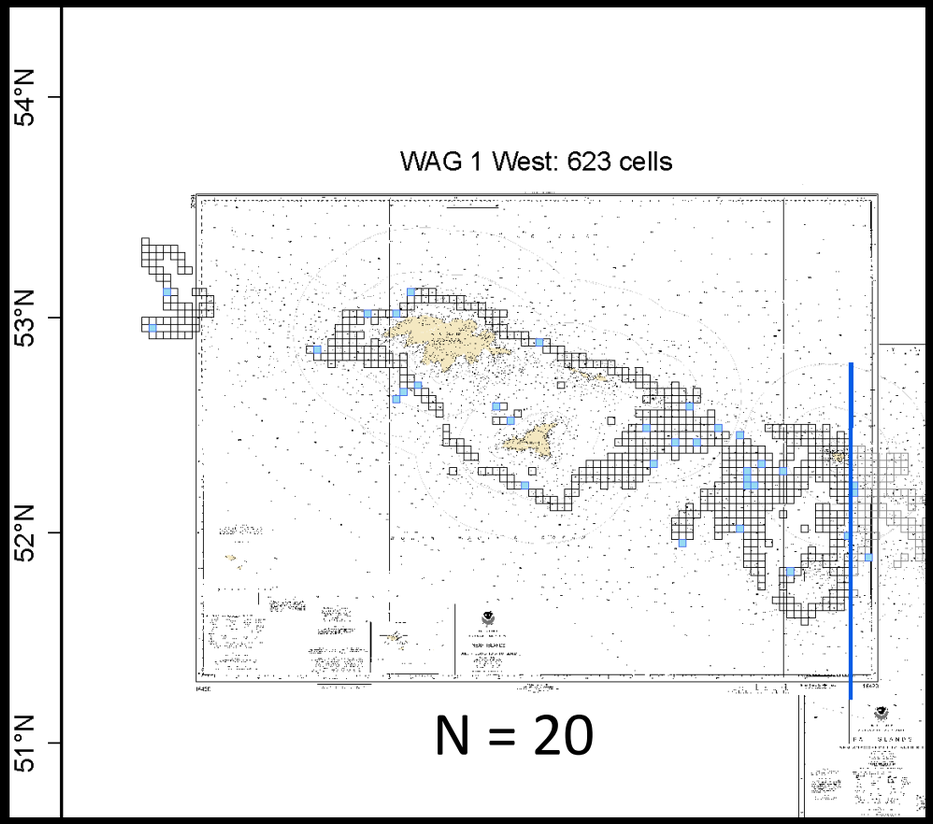
EAG



WAG

Large escape mesh: great for bycatch, bad for survey data

Pilot WAG survey 2018



Next Steps 2

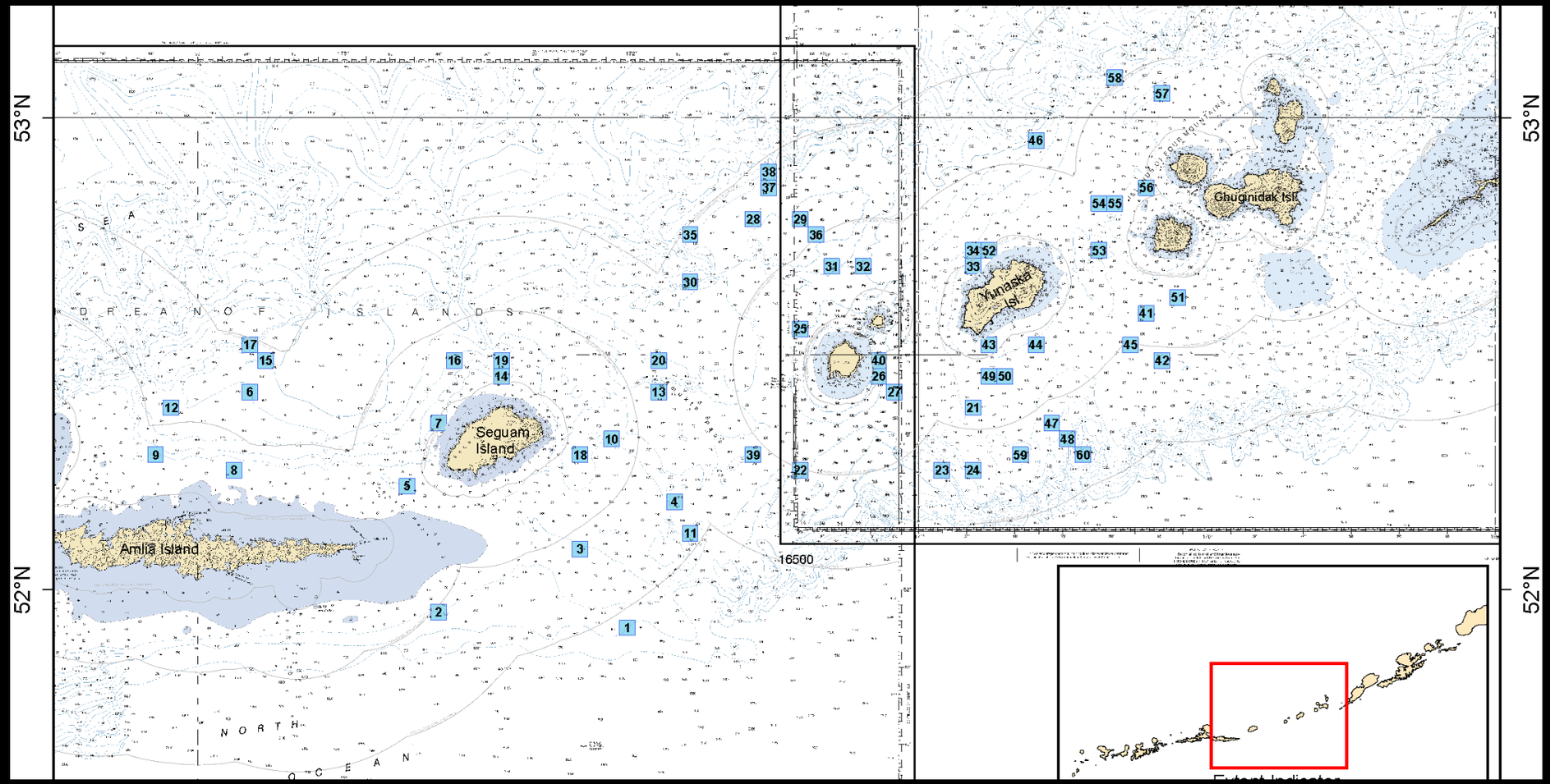
How do we ensure long-term commitment?

Currently, everyone is onboard! But in a decade?

Proposed (and co-agreed upon) incentives:

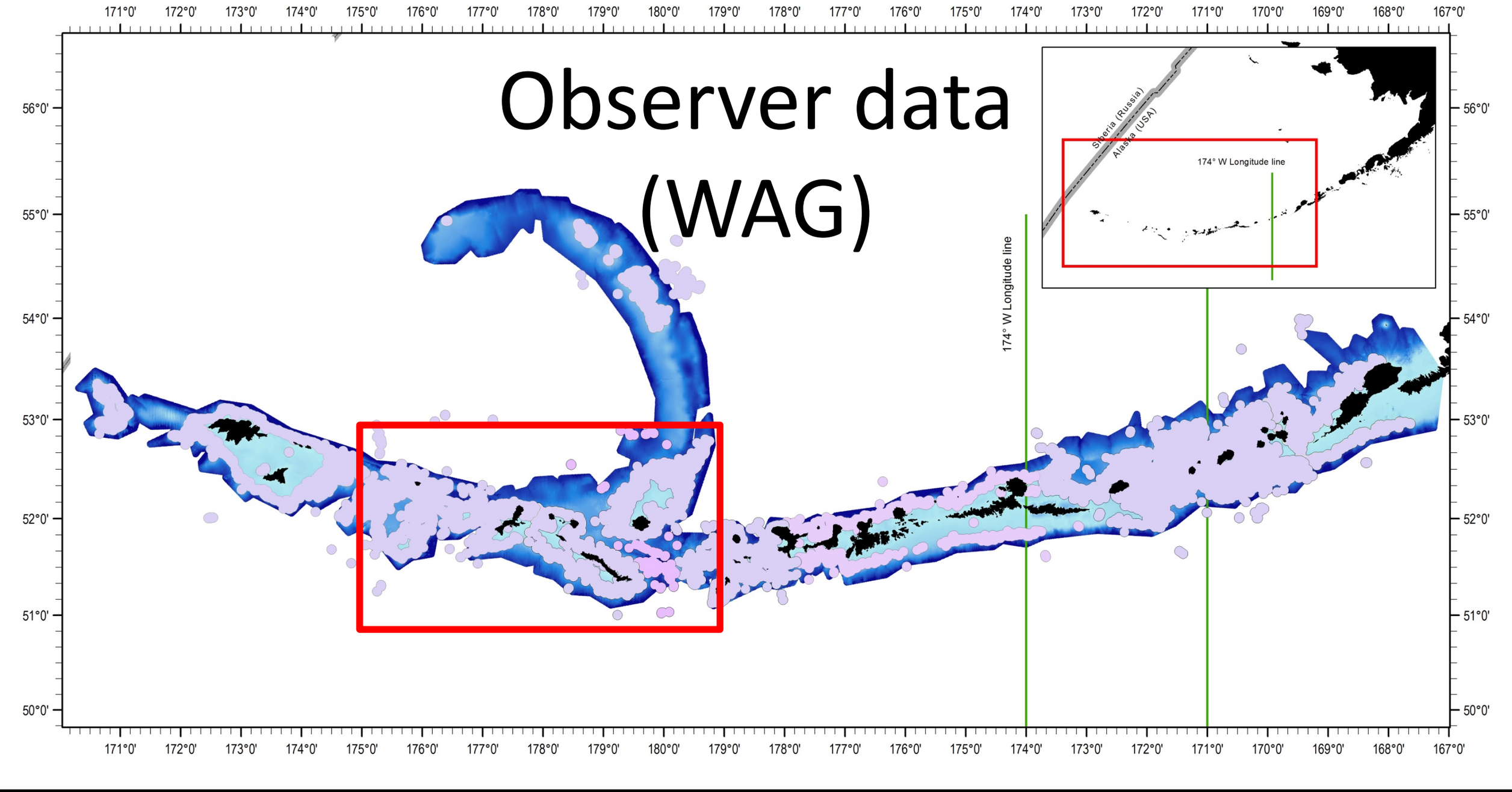
1) Earlier start date of fishery if doing survey
2) Direct TAC reduction if no survey

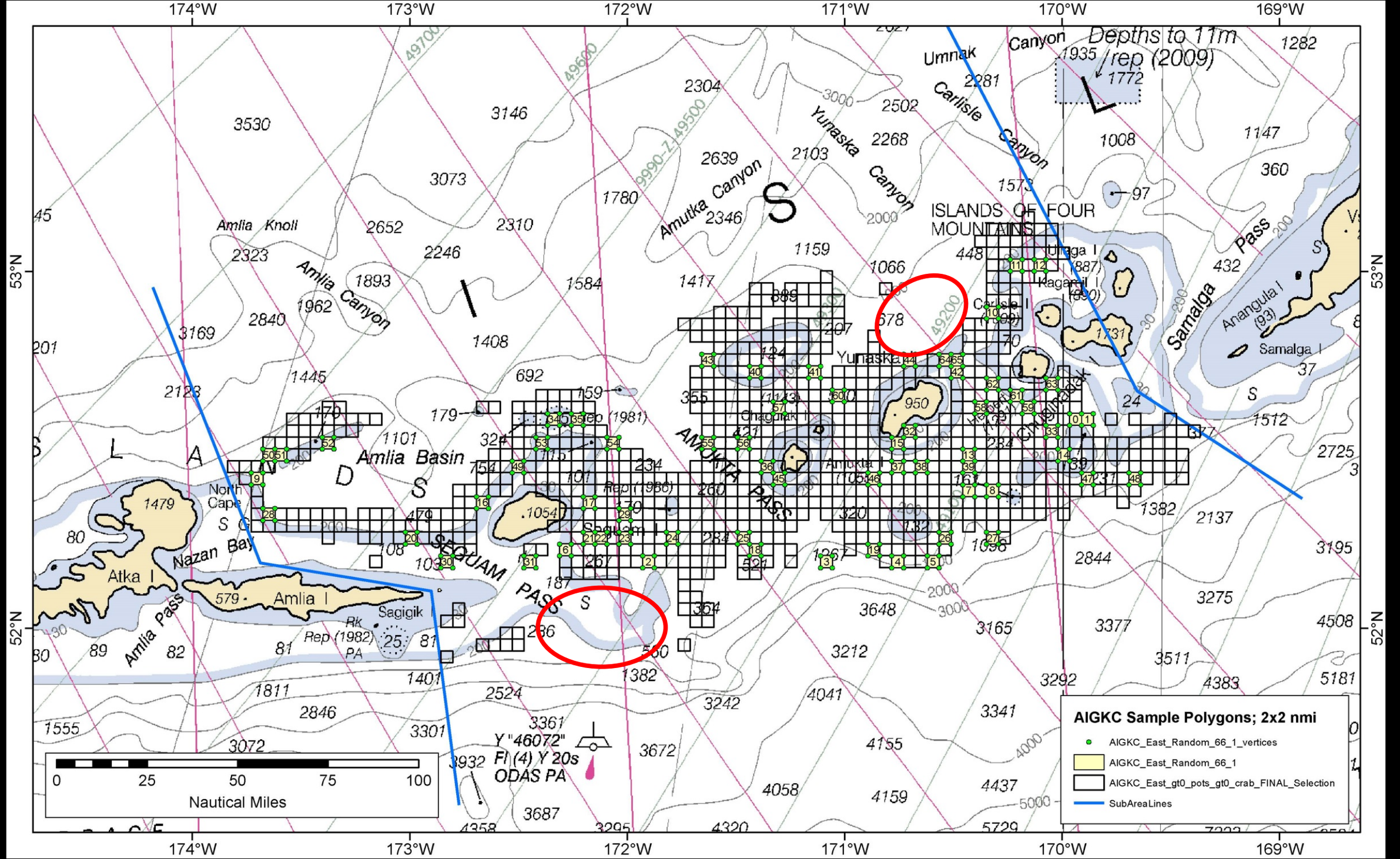
Survey Plans 2019

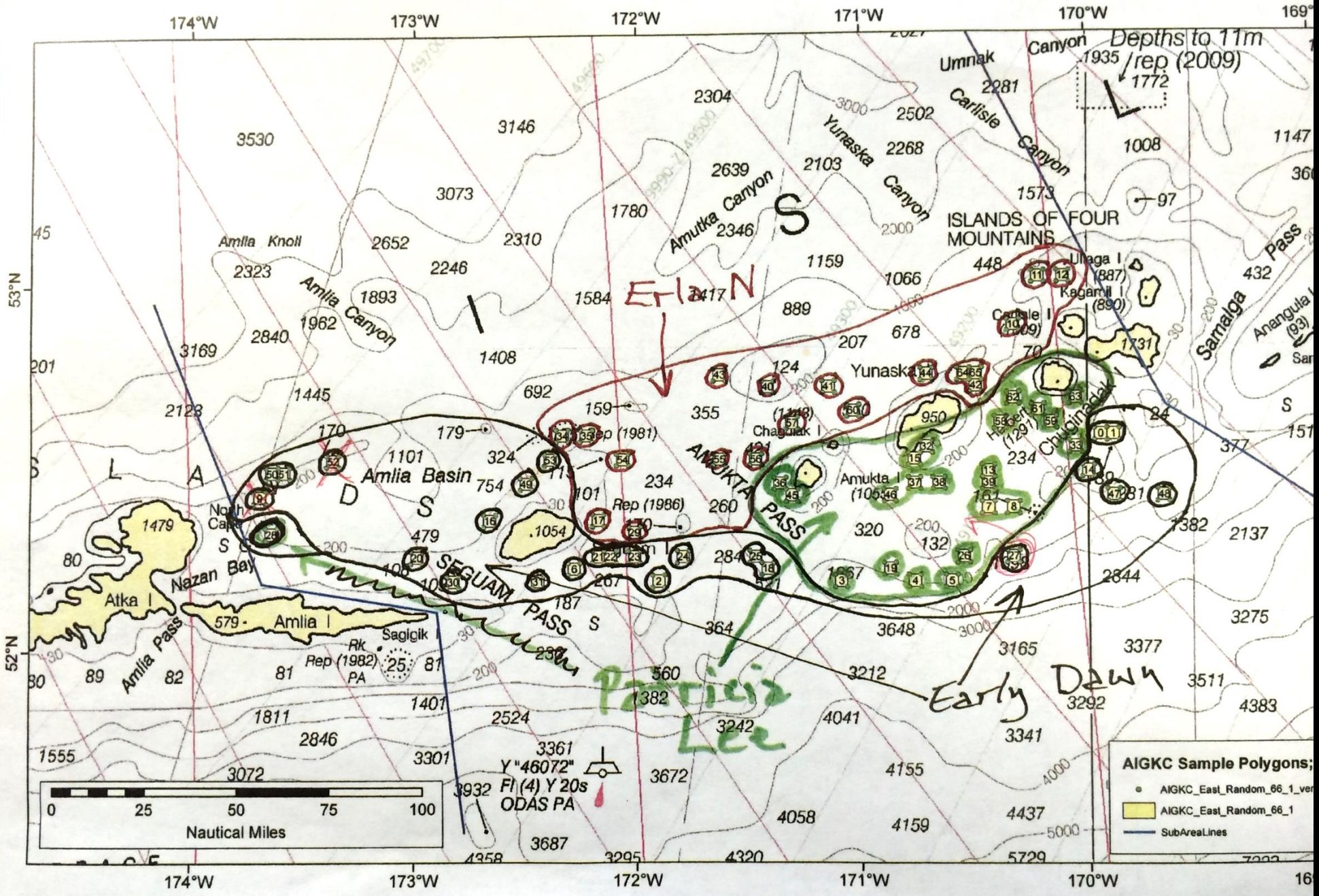


Chris Siddon, Alaska Dept. of Fish and Game

Observer data (WAG)




174°W
173°W
172°W
171°W
170°W
169°W
53°N
52°N
Depths to 11m
rep (2009)
Umnak Canyon
Carlisle Canyon
Yunaska Canyon
Amutka Canyon
Amlia Canyon
Amlia Knoll
Amlia Basin
ISLANDS OF FOUR MOUNTAINS
Samalga Pass
Anangula I (93)
Samalga I
Yunaska I
Chagulak I
Amutka I (1054)
Carlisle I (1509)
Kagamil I (890)
Uliaga I (887)
AMUKTA PASS
SKOJUAM PASS
Amlia Pass
North Cape
Nazan Bay
Atka I
Amlia I
Sagigik
Rk
Rep (1982)
PA
Rep (1981)
Rep (1966)
Y "46072"
Fl (4) Y 20s
ODAS PA
0
25
50
75
100
Nautical Miles
AIGKC Sample Polygons; 2x2 nmi
AIGKC_East_Random_66_1_vertices
AIGKC_East_Random_66_1
AIGKC_East_gt0_pots_gt0_crab_FINAL_Selection
SubAreaLines


174°W
173°W
172°W
171°W
170°W
53°N
52°N
Depths to 11m
/rep (2009)
Umnak Canyon
Carlisle Canyon
Yunaska Canyon
Amutka Canyon
Amlia Canyon
ISLANDS OF FOUR MOUNTAINS
Amlia Knoll
Amlia Basin
AMUKTA PASS
SEGUAM PASS
Amutka I
Yunaska I
Chagulak I
Ulaga I
Kagamil I
Carlisle I
Samalga Pass
Chuginadak
Nazan Bay
Atka I
Amlia I
Amlia Pass
Sagigik
Rk
Rep (1982)
PA
Rep (1981)
Rep (1986)
Rep (1991)
Rep (2009)
Erla N
Patricia Lee
Early Dawn
ODAS PA
Y "46072"
Fl (4) Y 20s
0
25
50
75
100
Nautical Miles
AIGKC Sample Polygons;
AIGKC_East_Random_66_1_ver
AIGKC_East_Random_66_1
SubAreaLines

Reality

High Trawl areas excluded

n = 66 (22/vessel)

Erla N modified (shortened) strings in non-core areas

Runs 50 pot strings.

Other requirements

Do not slow down normal deck operations!

n = 66 (22/vessel)

Erla N modified (shortened) strings in non-core areas

Runs 50 pot strings.

Aleutian Island GKC

"Stock Assessment" and regulations were based on average historical catch (~6 million lbs).

Triennial Survey, Fishery observer data:

Not consistent, potentially biased

Population model uses observer data

Potential bias due to observer data

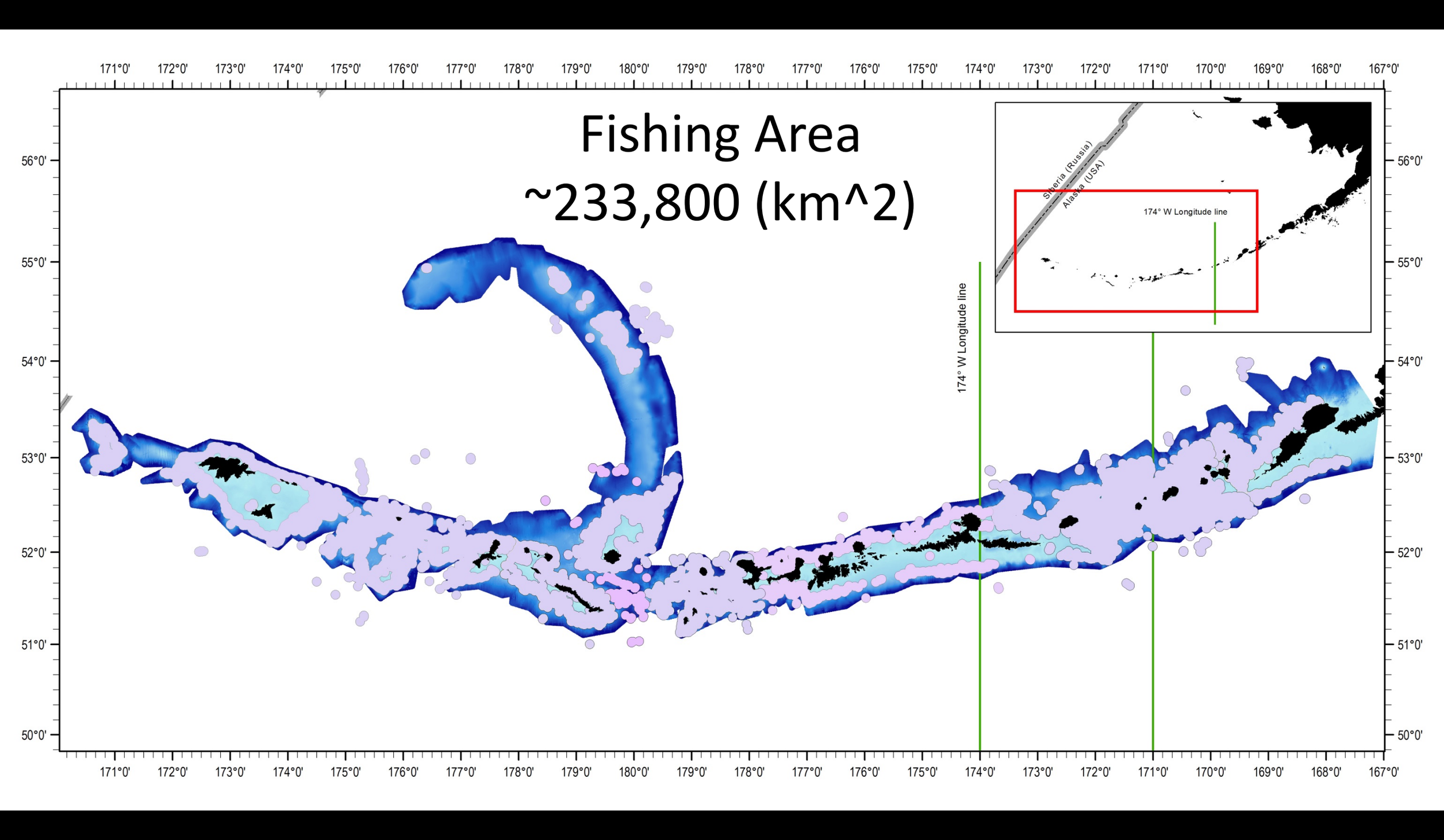
Can we Design a Cooperative survey?

(Consistent and unbiased survey)

Direct consequence

Scenario	Tier	$MMB_{35\%}$	Current MMB	MMB/ $MMB_{35\%}$	F_{OFL}	Recruitment Years to define $MMB_{35\%}$	$F_{35\%}$	OFL	ABC (P*=0.49)	ABC (0.75*OFL)
EAG17_0	3a	15.332	25.474	1.66	0.64	1987–2012	0.64	8.637	8.601	6.478
EAG17_0a	3a	15.590	25.611	1.64	0.62	1987–2012	0.62	8.780	8.732	6.585
EAG17_0b	3a	14.979	22.949	1.53	0.65	1987–2012	0.65	7.529	7.492	5.646
EAG17_0c	3a	15.633	25.869	1.65	0.62	1987–2012	0.62	8.920	8.872	6.690
EAG17_0d	3a	14.745	17.986	1.22	0.64	1987–2012	0.64	5.469	5.435	4.102
EAG17_0e	3a	15.462	25.045	1.62	0.64	1987–2012	0.64	8.761	8.725	6.570
EAG17_0f	3a	15.312	25.340	1.65	0.64	1987–2012	0.64	8.581	8.545	6.436
May2017Sc9	3a	15.539	20.515	1.32	0.75	1987–2012	0.75	9.890	9.852	7.417

If Buffer gets changed from 25% to 20%, then ABC would be 6.86
Not a huge deal in EAG, but would likely be in WAG.


Fishing Area
~233,800 (km^2)
Siberia (Russia)
Alaska (USA)
174° W Longitude line
174° W Longitude line
171°0'
172°0'
173°0'
174°0'
175°0'
176°0'
177°0'
178°0'
179°0'
180°0'
179°0'
178°0'
177°0'
176°0'
175°0'
174°0'
173°0'
172°0'
171°0'
170°0'
169°0'
168°0'
167°0'
56°0'
55°0'
54°0'
53°0'
52°0'
51°0'
50°0'

Data summary

Year	Obs. Pots	Obs. Crab
2015	478	33,365
2016	617	40,610
2017	589	37,441

Data summary

Year	Obs. Pots	Obs. Crab	Survey Pots	Survey Crab
2015	478	33,365	365	17,236
2016	617	40,610	328	18,640
2017	589	37,441	230	12,894