NOAA FISHERIES

NEFSC

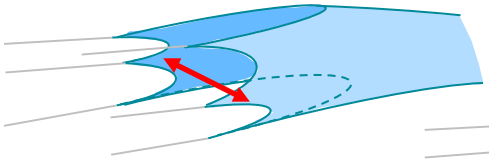
Wingspread: The Motivation, The Experiment, The (Preliminary) Results

Northeast Trawl Advisory Panel Meeting

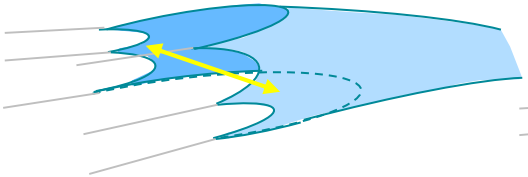
November 21, 2019

Motivation

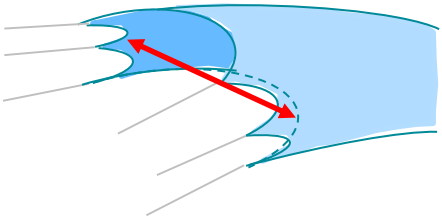
- **Standard calculation of index estimates assumes:**
  - All tows sample average area swept
  - All tows have consistent fishing efficiency
- **Concern that FSV Henry B. Bigelow gear does not perform equally across all tows**
- **Wing spread varies with depth, presumably as follows:**



Under spread
at **shallow** stations

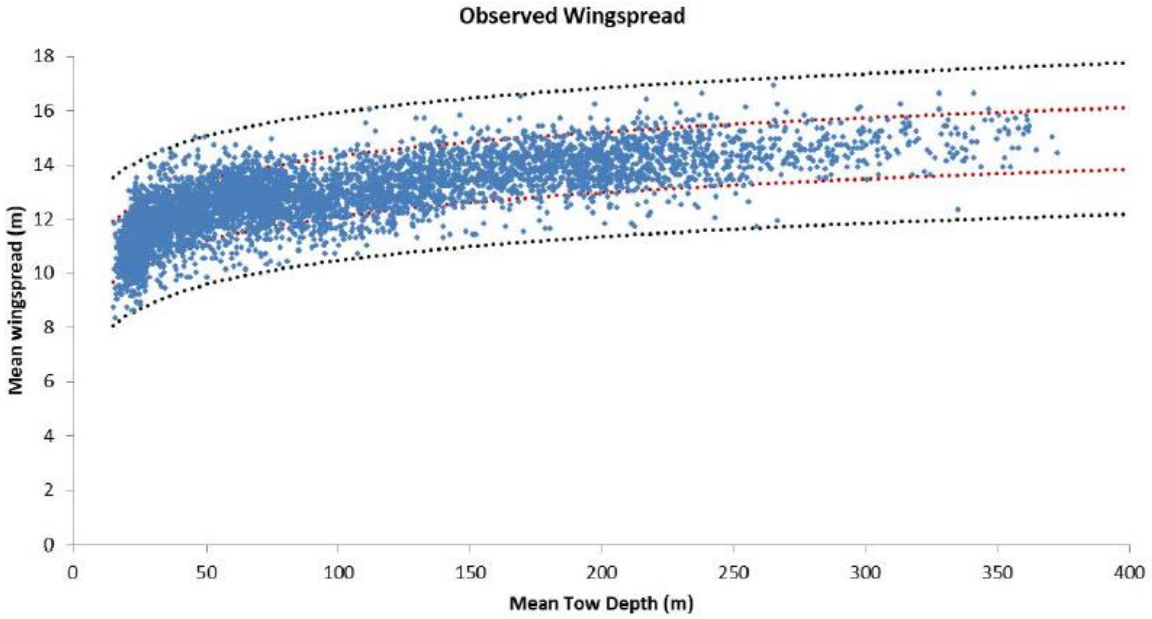


Optimal spread
at **intermediate** depth



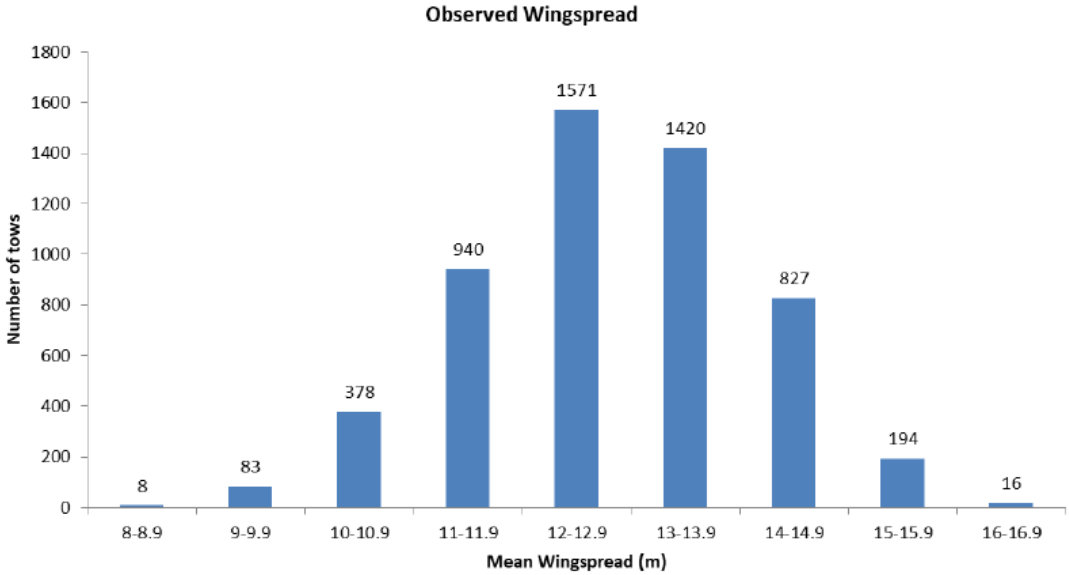
Over spread
at **deep** stations

Motivation



- 2009-2017 valid Bottom Trawl Survey tows (*FSV Henry B. Bigelow*)
- Within black dotted lines = “acceptable” tow
- Within red dotted lines = “optimal” tow

Motivation

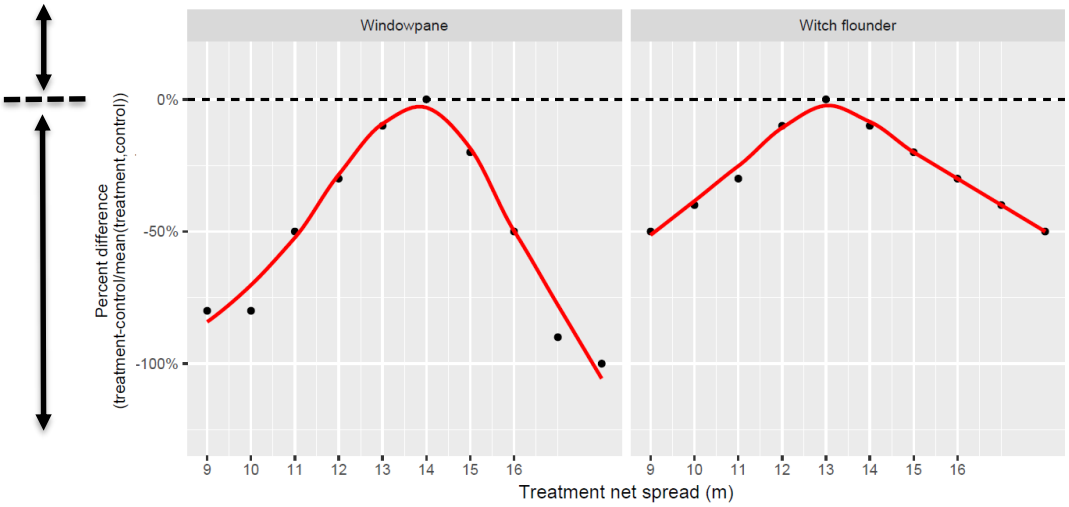


- **2009-2017 valid Bottom Trawl Survey tows (*FSV Henry B. Bigelow*)**

Hypothesis

0-100% = under/overspread net catches **more** than "optimal" net

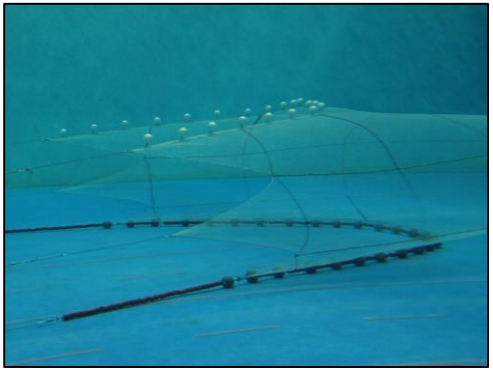
-100-0% = under/overspread net catches **less** than "optimal" net



- Under and overspread is less efficient (catches less) than "optimal" net
- Values based on input from industry members
- No available experiments/data to inform relationships

Experiments

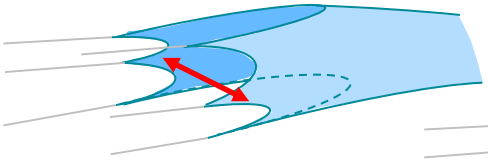
- **July 2019: Flume Tank Experiments**
  - Observe NEFSC survey net performance at different wing spreads
- **August 2019: Door testing on the NOAA Ship Henry B. Bigelow**
  - Assess performance of NEFSC survey net using different doors
- **September 2019: Field Experiments on F/V Karen Elizabeth**
  - Assess the catchability of four groundfish species at a range of wing spreads and depths (14 days at sea)



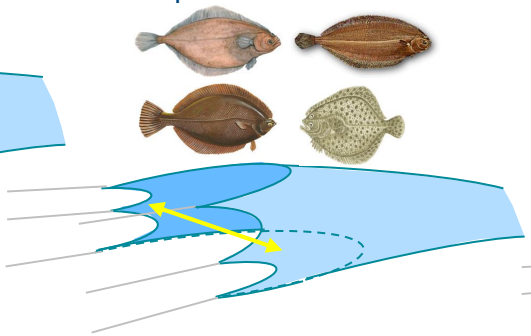
F/V Karen Elizabeth Experiment

Objectives:

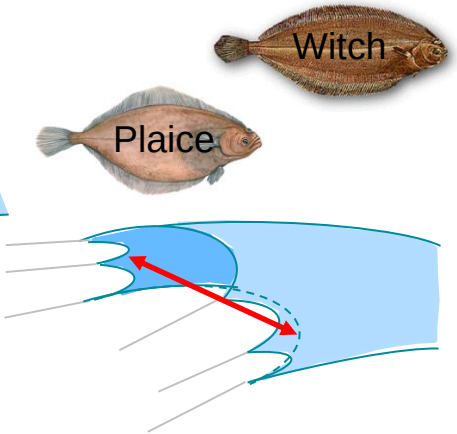
- Quantify species and length-specific efficiency of the NEFSC bottom trawl survey gear at various wingspreads compared to “optimal” (12.99m)
- Target Species:
  - **Northern/Deeper:** Witch flounder and American plaice
  - **Southern/Shallower**: Windowpane flounder and Winter flounder



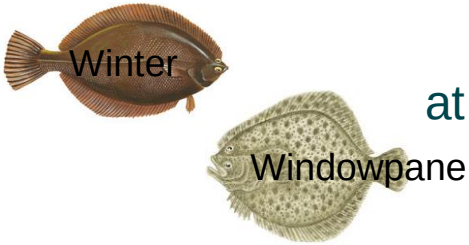
Under spread
at **shallow** stations



Optimal spread
at **intermediate** depth



Over spread
at **deep** stations



F/V Karen Elizabeth Experiment

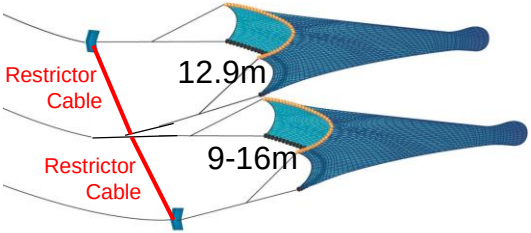
Methods:

- 14 sea days chartered on the F/V Karen Elizabeth (Captain Chris Roebuck)
  - **Northern (Deep) Leg 1**: September 12-19
    - Targeted witch flounder and American plaice
    - Science Crew: Dominique St. Amand (CRB), Jack Wilson (CRB), Tyler Pavlowich (OCB), Calvin Alexander (CRB), Chris Parkins (RI DEM/NTAP)
  - **Leg 1 Analysis**:
    - Andy Jones (CRB), Dave Richardson (OCB)
  - **Southern (Shallow) Leg 2**: September 23-28
    - Targeted windowpane flounder and winter flounder
    - Science Crew: Paul Kostovick (ESB), Dominique St. Amand (CRB), Giovanni Gianesin (CRB), Jack Wilson (CRB), Jill Price (PBB)

F/V Karen Elizabeth Experiment

Approach:

- Experiment conducted using twin-trawl rig on F/V Karen Elizabeth
- Used two identical NEFSC survey trawls with rockhopper
- Used F/V Karen Elizabeth's doors
  - Large to ensure spreading force
- Maintained 12.99m wingspread with one trawl, changed wingspread of other trawl
  - Used restrictor cables to define spread
  - Net mensuration system used to measure achieved wing spread
  - Varied spread over a continuous range rather than fixed spreads (maintained consistent spread within a tow)
    - Allows data to be analyzed as continuous model to estimate efficiency at any spread



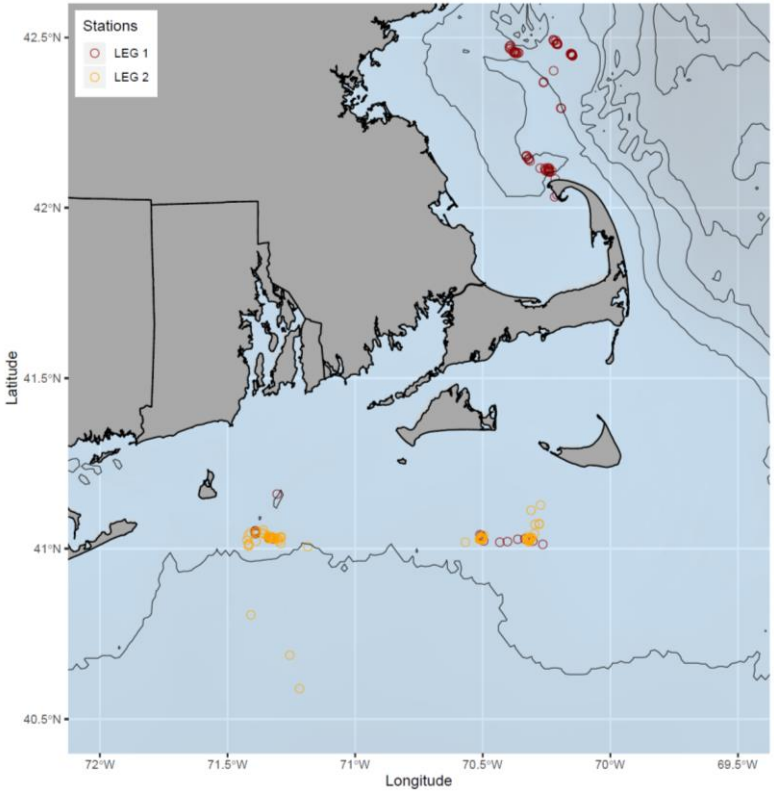
F/V Karen Elizabeth Experiment

Approach:

- **Towing Protocols**
  - NEFSC standard speed and duration
    - 20 minute tows
    - 3.0 kts tow speed
  - 20min on-bottom tow duration
  - Captain recommended scope ratio to ensure target spread
  - 24hr operations (day and night)

F/V Karen Elizabeth Experiment: Results

- **170** paired tows
- **32,068 kg** of fish sampled
- **Main Species**:
  - **American plaice**
  - Black sea bass
  - Butterfish
  - Haddock
  - Monkfish
  - Red hake
  - Scup
  - Summer flounder
  - **Winter flounder**
  - **Windowpane flounder**
  - **Witch flounder**
  - Yellowtail flounder



F/V Karen Elizabeth Experiment: Results

Count of positive stations for each species at each net width

Where both nets caught each species

Species	Treatment net widths (m)								Total
	9	10	11	12	13	14	15	16	
American plaice	3	8	8	8	11	3	6	3	50
Black sea bass	13	11	15	11	13	5	0	0	68
Butterfish	16	13	23	12	21	7	0	0	92
Goosefish	4	9	14	8	10	5	6	3	59
Haddock	3	6	7	7	8	2	6	2	41
Red hake	3	10	9	10	15	5	6	3	61
Scup	14	9	17	11	15	6	0	0	72
Summer flounder	14	11	19	12	17	5	0	0	78
Windowpane	13	9	18	10	15	6	0	0	71
Winter flounder	12	18	22	17	24	8	0	0	101
Witch flounder	3	7	8	7	8	3	5	3	44
Yellowtail flounder	5	10	10	10	15	6	0	1	57

Counts represent totals after 25 non-representative stations were removed from the data set

"Representative tows": Control net spread 12.5m-13.5m,
Full 20 minute fishing time with no obstructions

F/V Karen Elizabeth Experiment: Results

Metrics for Karen Elizabeth 2019 Study

Means for each net spread are show

Treatment Width (m)	Average Control Catch (kg)	Average Treatment Catch (kg)
9	146.2	118.3
10	130.9	109.4
11	177.5	161.5
12	235.2	216.1
13	224.6	238.6
14	189.3	200.4
15	188.3	223.8
16	189.1	288.6

F/V Karen Elizabeth Experiment: Results

Species catch weights for each net width

Weights are summed kilograms for both nets

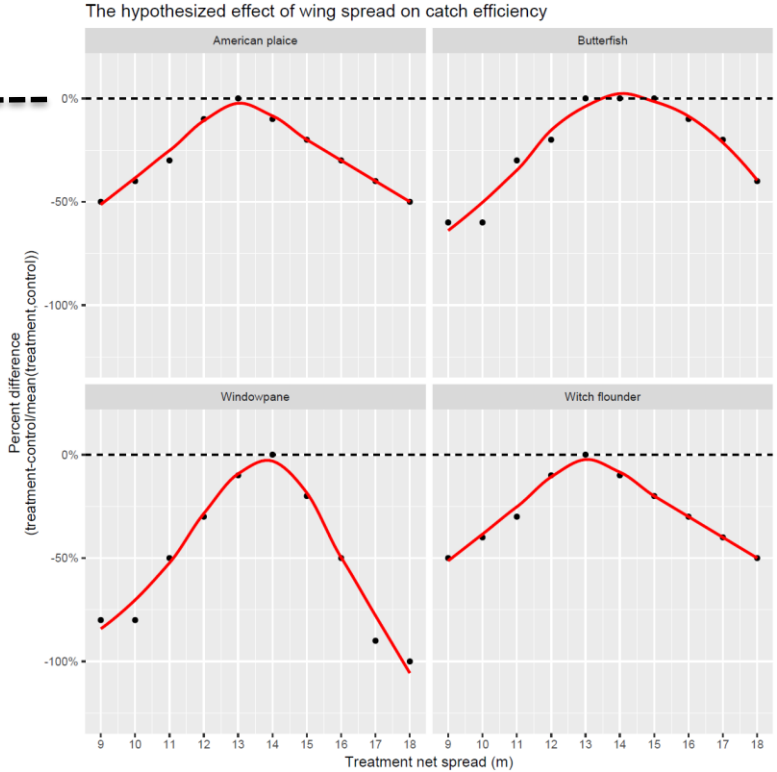
Species	Treatment net widths (m)								Total
	9	10	11	12	13	14	15	16	
American plaice	18.2	99.6	88.5	67.2	152.0	21.7	50.0	78.5	575.6
Black sea bass	154.6	105.3	217.8	131.5	156.8	56.7	0.0	0.0	822.6
Butterfish	417.9	238.2	435.7	2,365.8	3,383.5	228.6	0.0	0.0	7,069.6
Goosefish	41.1	110.9	373.4	347.2	399.5	172.4	776.8	265.9	2,487.3
Haddock	658.6	886.9	889.4	1,556.5	1,752.6	13.1	67.3	27.1	5,851.5
Red hake	372.6	483.4	1,057.5	871.3	1,204.4	182.9	444.4	223.9	4,840.4
Scup	359.5	122.5	836.1	511.0	685.2	517.8	0.0	0.0	3,032.1
Summer flounder	401.8	250.6	533.0	425.6	710.3	250.1	0.0	0.0	2,571.5
Windowpane	37.1	19.1	72.1	50.2	50.0	24.5	0.0	0.0	252.9
Winter flounder	153.9	160.6	178.3	232.9	233.9	70.2	0.0	0.0	1,029.7
Witch flounder	12.1	52.2	279.2	202.0	346.4	86.9	850.7	316.3	2,145.8
Yellowtail flounder	93.9	392.1	138.0	242.9	266.1	255.6	0.0	1.2	1,389.9
Weight totals (kg)	2,721.39	2,921.34	5,099.01	7,003.86	9,340.74	1,880.56	2,189.19	912.90	32,068.98

Weights represent totals after 25 non-representative stations were removed from the data set

What We Expected

0-100% = under/overspread net catches **more** than “optimal” net

-100-0% = under/overspread net catches **less** than “optimal” net



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- Values based on input from industry members

F/V Karen Elizabeth Experiment: Results

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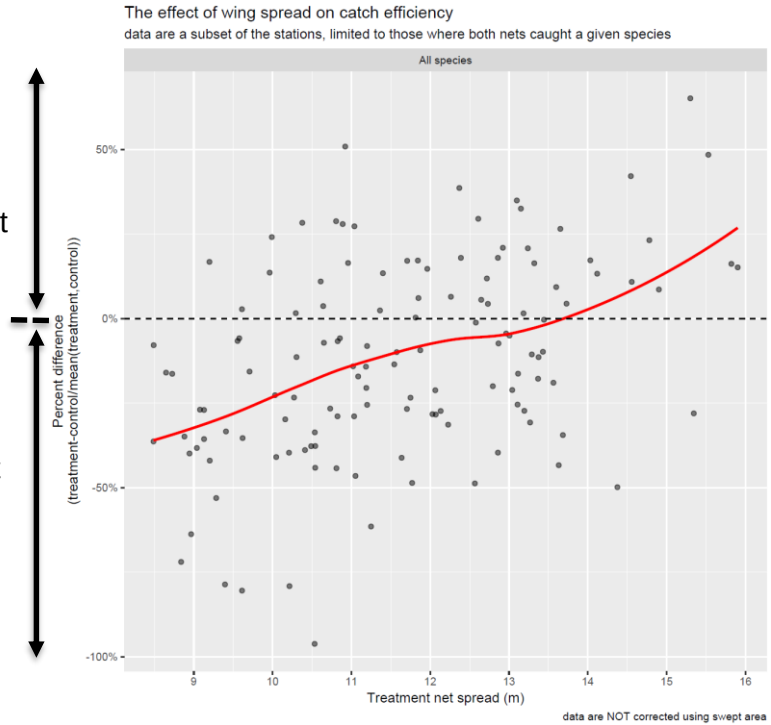

Not Corrected for Swept Area
Double positive tows only (presence in both)
Red lines = GAMs

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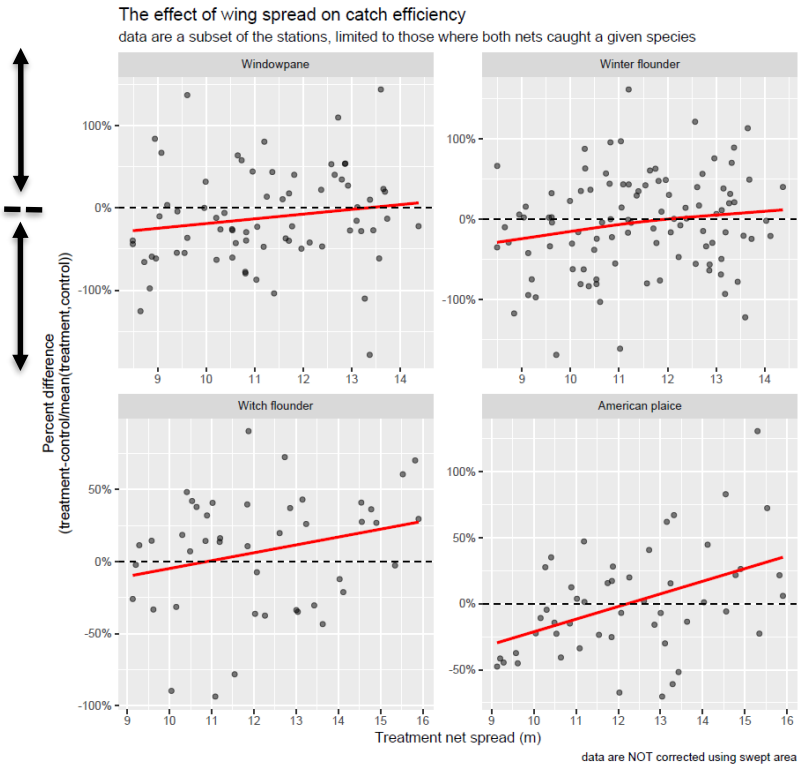

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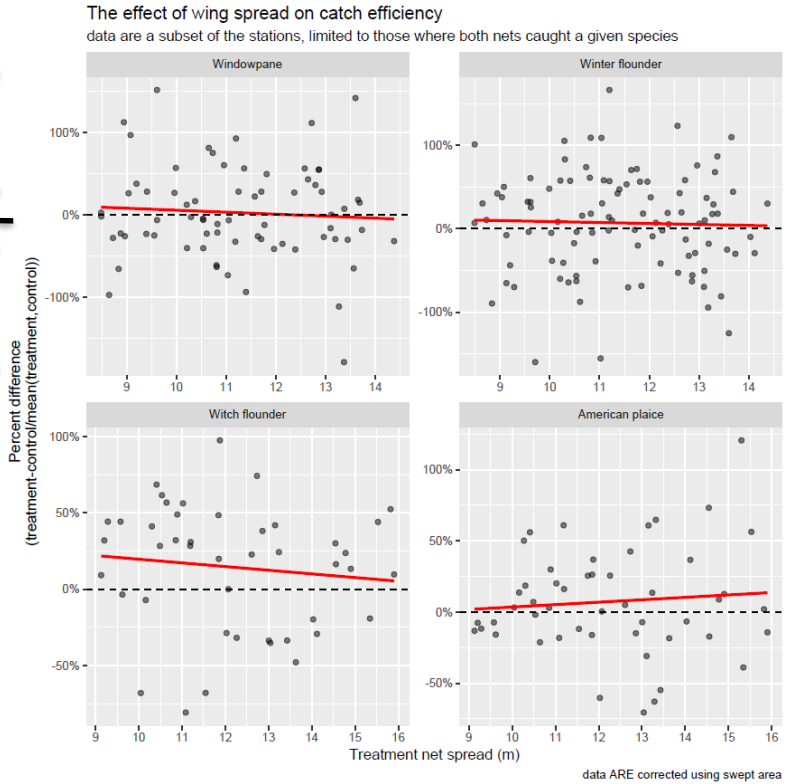

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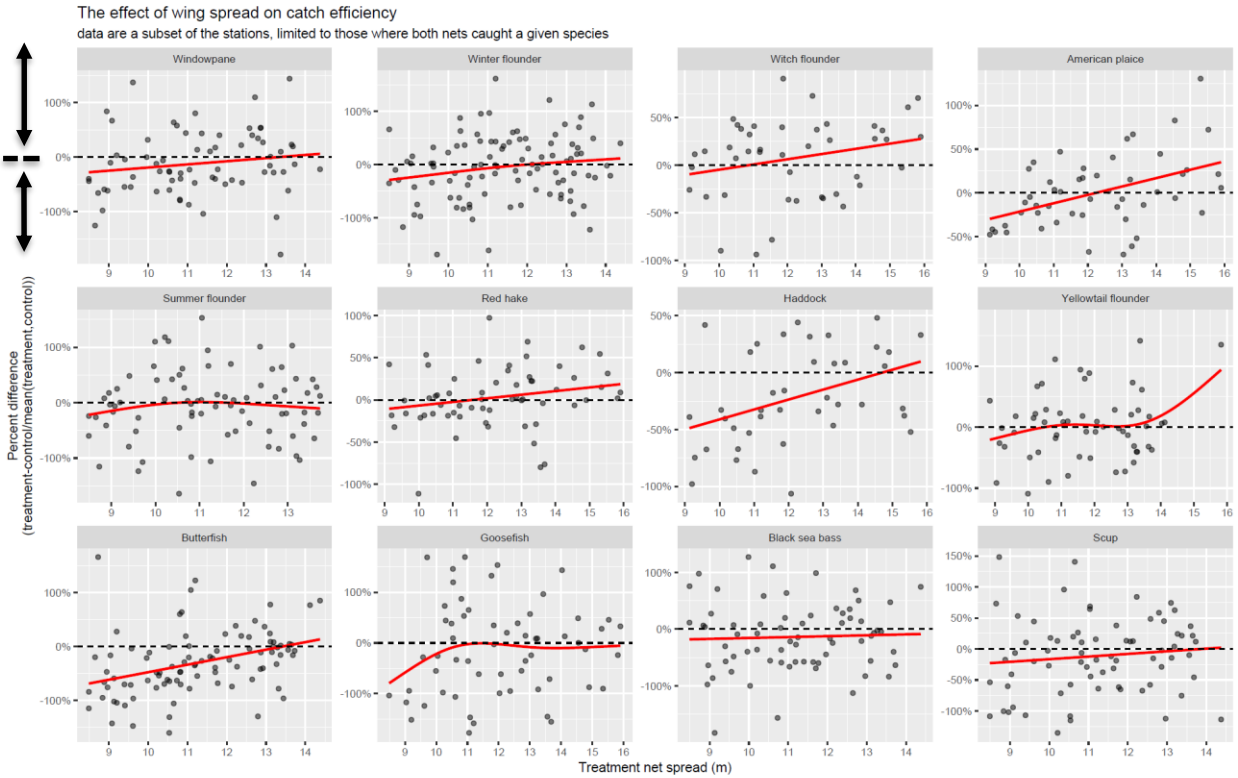
F/V Karen Elizabeth Experiment: Results

0-100+% = experimental net caught **more** than "optimal" net

-100-0% = experimental net caught **less** than "optimal" net



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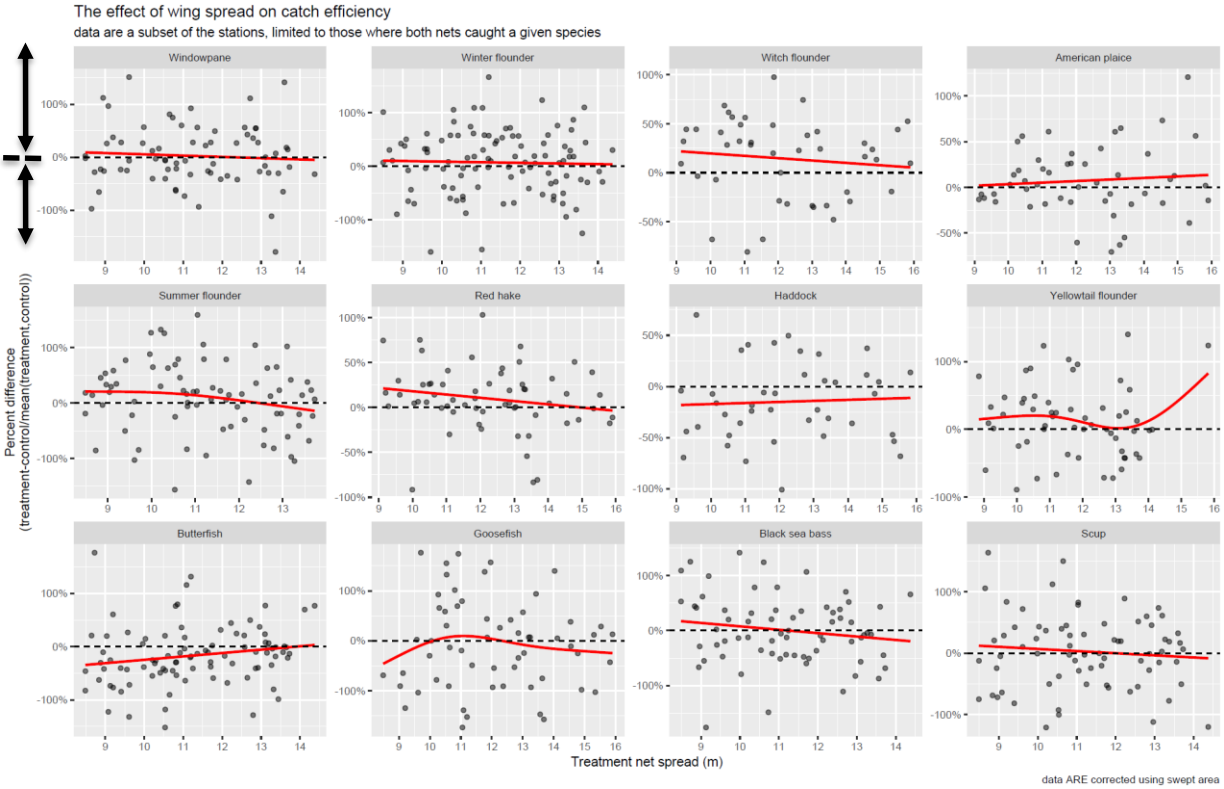

Lines = GAMS
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Planned Next Steps

- Further Analysis:
  - Length based analyses
  - Modelling
- Technical Report
- Peer Review

Preliminary Observations

- **Effect of wingspread on catch efficiency is subtle**
  - Especially in comparison to chain sweep study
- **Effect of swept area may play a larger role on catch**

Discussion Topics

- **Do we need more research on wingspread?**
  - More or different data?
  - Different experiments?
- **Different or additional analyses?**
  - Length-based analysis?
- **Alternative applications of data/research?**
  - Refine acceptable tow definition?
  - Explore using swept-area biomass in assessments?

NTAP Discussion