Update on abundance estimates and PBR

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ATGTRT meeting
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Overview

A. Summary of abundance and PBR
B. Recent abundance surveys
   1. Methods
   2. Results

OLD

PBR and bycatch estimate (CV)

average for 2000 - 2004

Species	Strategic ?	PBR	Total Bycatch	NE Bottom	NE Midwat	MidAtl Bottom	MidAtl Midwat	JV and TALFF
Common D.	No	1000	101 (0.12)	33 (0.19)	0	68 (0.15)	0	0
Pilot W. spp	No	249	113 (0.24)	10 (0.23)	9.4 (0.55)	12 (0.22)	0.8 (0.74)	11
White-sided D.	No	379	197 (0.09)	130 (0.09)	1.1 (0.58)	25 (0.10)	15 (0.38)	2
Harbor P.	No	747	473 (0.17)	0	0	0	0	0
Minke W.	?	31	2.8+	1+	0	0	0	0

NEW

PBR and bycatch estimate (CV) average for 2001 - 2005

Species	Strategic ?	PBR	Total Bycatch	NE Bottom	NE Midwat	MidAtl Bottom	MidAtl Midwat	JV and TALFF
Common D.	No	1000	146 (0.11)	28 (0.13)	0	118 (0.13)	0	0
Pilot W. spp	No	249	158 (0.09)	19 (0.12)	1.5 (0.35)	35 (0.15)	6.5 (0.35)	11
White-sided D.	No	509	326 (0.12)	192 (0.13)	19 (0.35)	29 (0.11)	84 (0.35)	2
Harbor P.	yes	610	739 (0.16)	5+	0	0	0	0
Minke W.	?	19	2.8+	1+	0	0	0	0

PBR = Potential Biological Removal level

$$PBR = N_{min} * 1/2\ R_{max} * F_R$$

N_{min} = minimum population estimate

$1/2\ R_{max}$ = one-half the maximum theoretical or estimated net productivity rate of the stock at a small population

F_R = a recovery factor between 0.1 and 1


Common Dolphin


Pilot Whale


White-sided Dolphin


Harbor Porpoise

				Old	2006	
Species	Year	Abun	CV(A)		Abun	CV(A)
Common D.	2004	120,743	0.23		Same	
Pilot W. spp	2004	31,139	0.27		Same	
White-sided D.	1999	51,640	0.38		63,368	0.27
Harbor P.	1999	89,700	0.22		89,054	0.47
Minke W.	1999	3,618	0.18		3,312	0.74

Abundance estimates

The findings and conclusions in this report have not been formally disseminated by NOAA and should not be construed to represent any agency determination or policy

$PBR = N_{min} * 1/2\ R_{max} * F_R$

Year	Species	N_{best}	N_{min}	R_{max}	F_r	PBR
2004	Common D.	120,743	99,975	0.04	0.5	1000
2004	Pilot W. spp	31,139	24,866	0.04	0.5	249
2006	White-sided D.	63,368	50,883	0.04	0.5	509
2006	Harbor P.	89,054	60,970	0.04	0.5	610
2006	Minke W.	3,312	1,899	0.04	0.5	19

Overview

A. Summary of abundance and PBR

B. Recent abundance surveys

   A. How collect data

   B. Number of detected species

   C. Distribution of tracklines and species

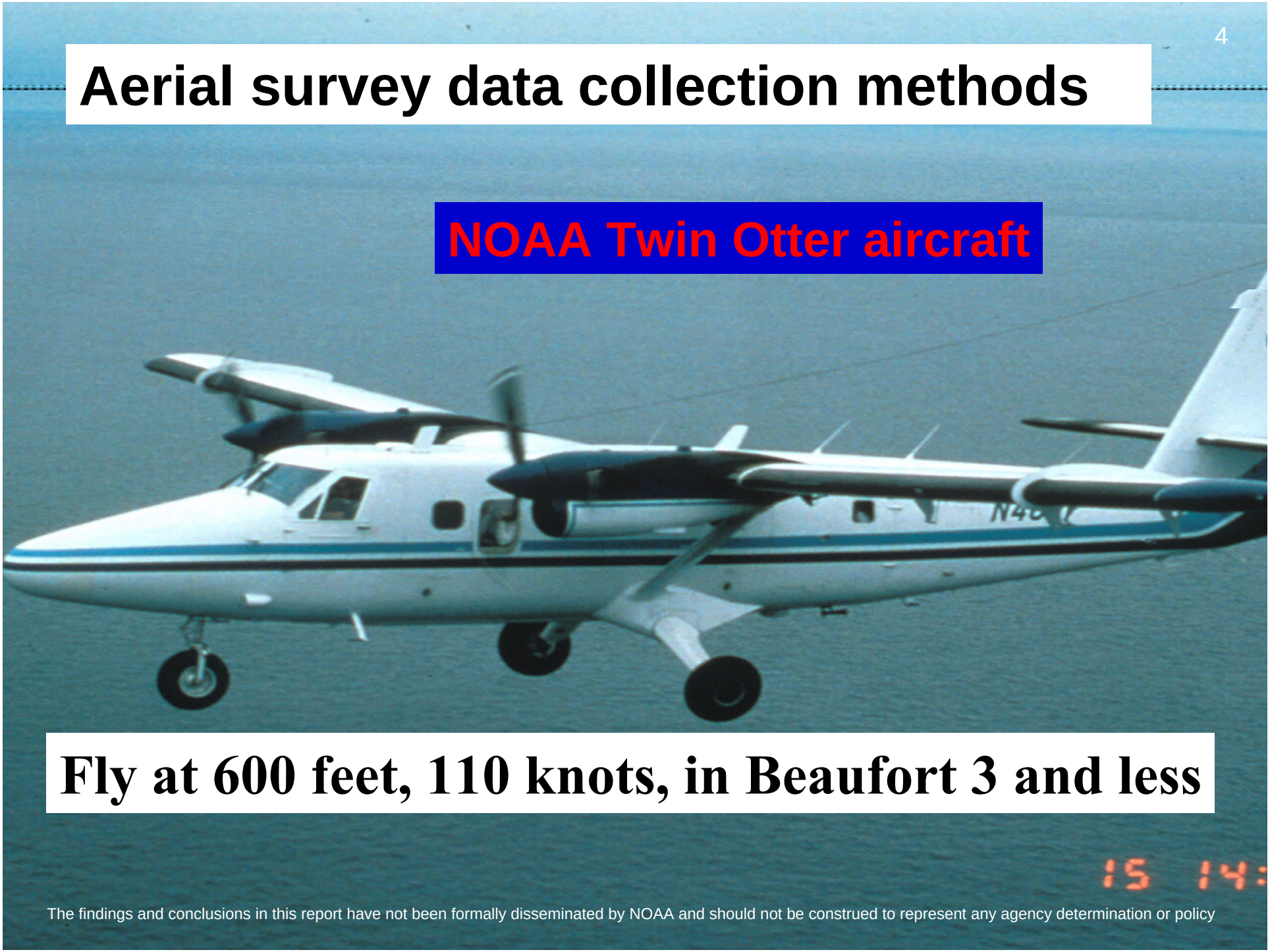
   D. Abundance estimate methods

A. Aerial abundance surveys

Year	Dates	Total Area (km^2)	Trackline length (km)	
1995	14 - 31 Aug	410,242	12,579	
1998	18 Jul - 21 Aug	319,408	11,640	
1999	10 - 29 Aug	194,471	5,833	
2002*	19 Jul - 16 Aug	215,721	7,461	
2004	12 Jun - 12 Jul	238,617	6,936	
2006*	29 Jul - 25 Aug	295,291	10,676	

* no accompanying shipboard survey

Aerial survey data collection methods



Bubble windows for good visibility

Belly window for track line visibility

RECORDER

- *observers*

- *weather*

*Beaufort Sea State
* % Cloud coverage
* Turbidity/SST
* Glare
* Overall conditions

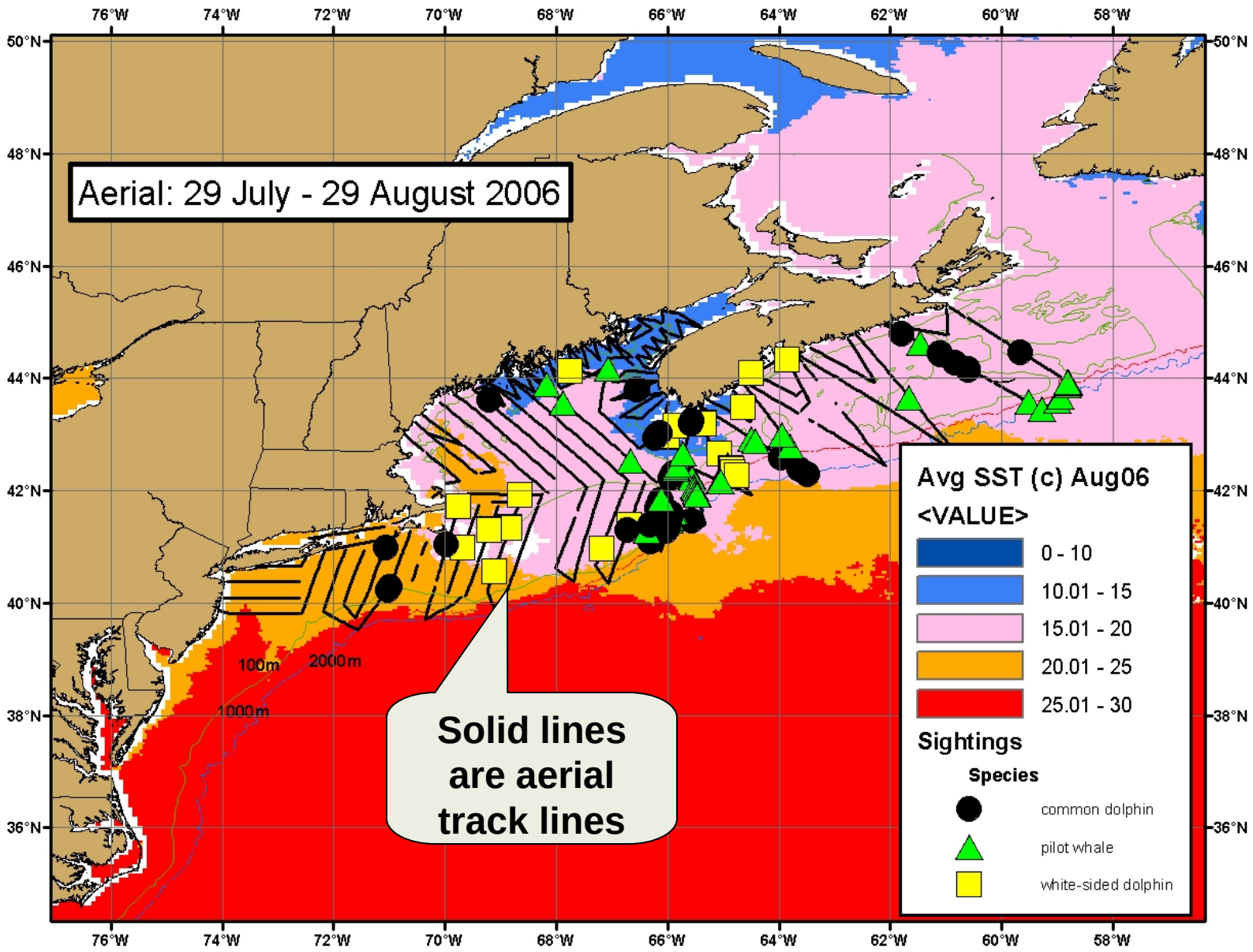
- *sightings*

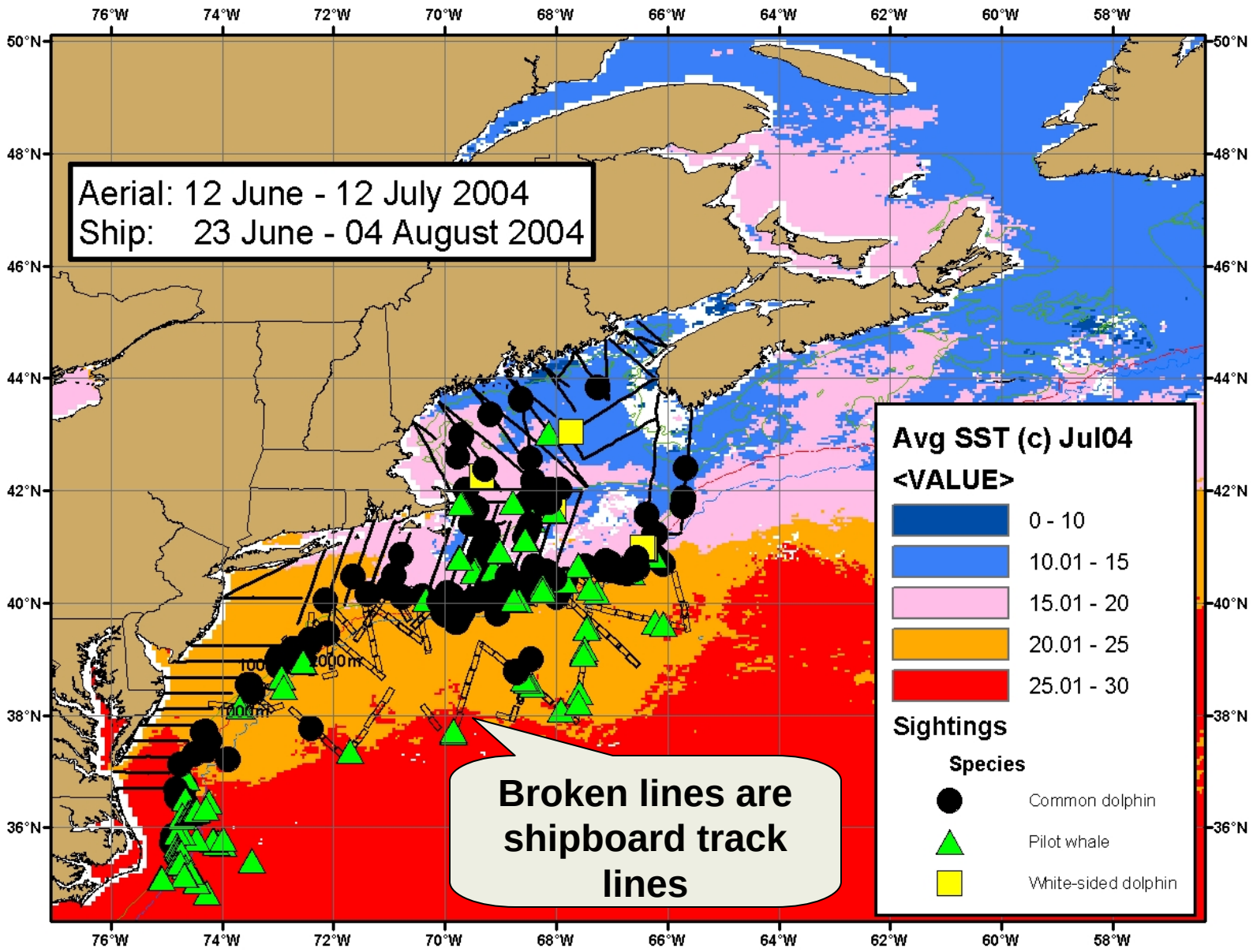
* Species
* Group size
* Swim angle
* Perpendicular distance
* Cue

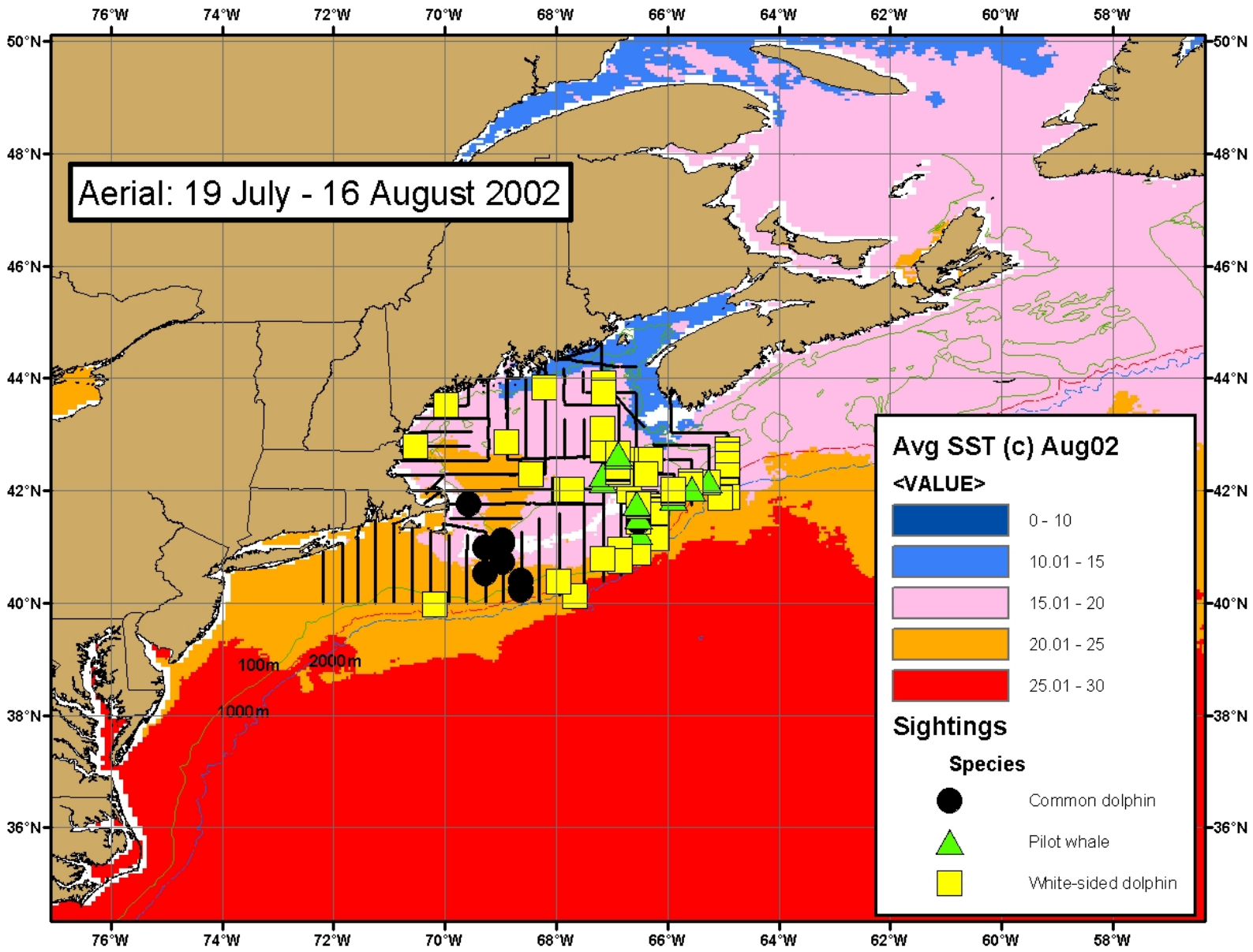
Sightings in 2006

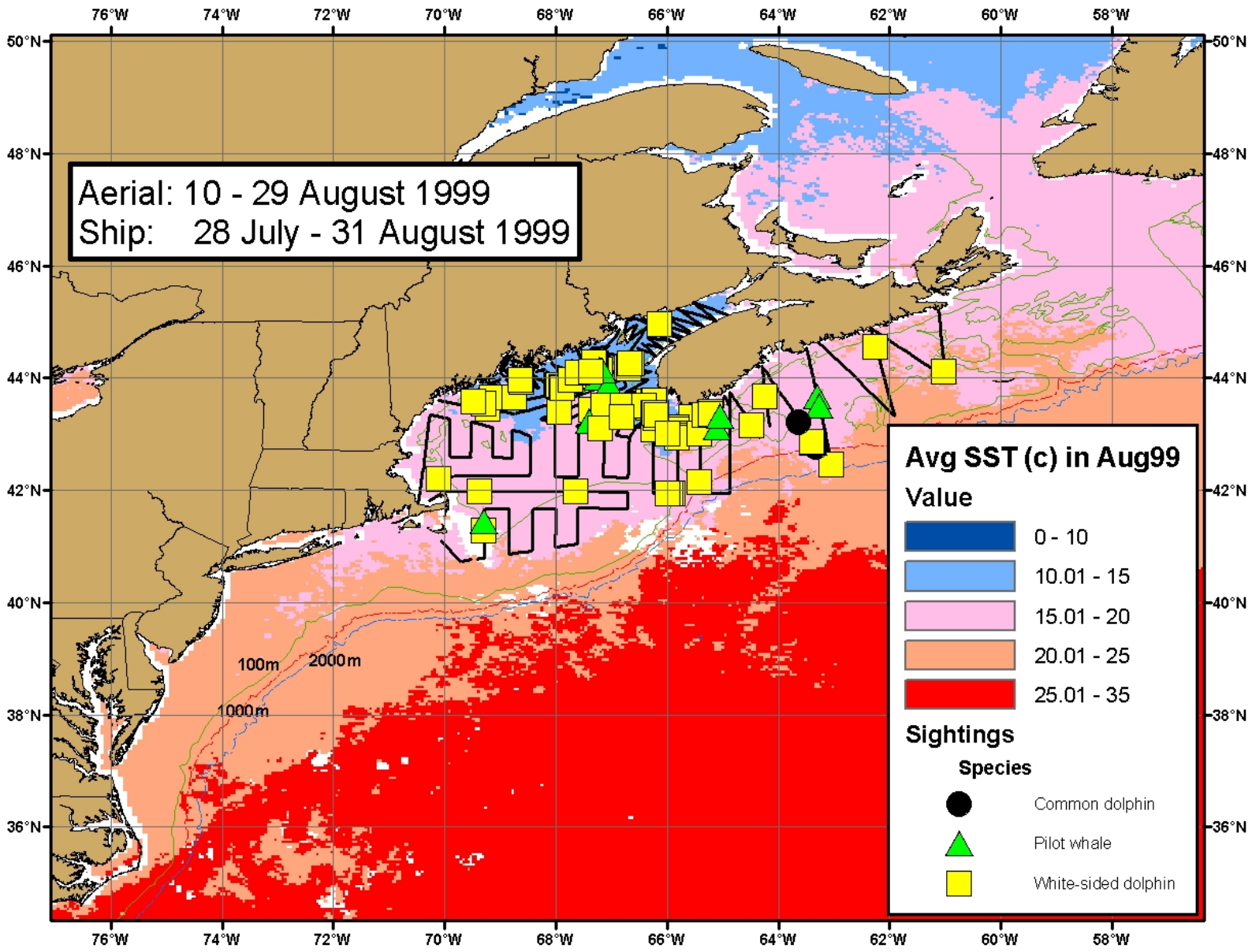
Species	Sightings from the single and leading legs					Sightings from the leading legs	Sightings from the trailing legs
	Number of groups	Number of Animals	Mean Group size	Max group size	Min Group size		
Beaked whales	2	8	4	7	1	0	0
Bottlenose dolphin	1	20	20	20	20	0	0
Common dolphin	76	1917	25.2	130	1	3	2
Fin / Sei Whale	16	19	1.2	3	1	0	0
Fin Whale	33	41	1.2	3	1	8	3
Harbor Porpoise	189	533	2.8	20	1	25	6
Humpback Whale	39	49	1.3	2	1	4	2
Minke Whale	25	26	1	2	1	6	1
Pilot Whale	48	552	11.6	100	1	3	3
Risso's dolphin	28	360	12.9	35	1	1	1
Right Whale	16	20	1.2	3	1	0	1
Sei Whale	2	2	1	1	1	0	0
Sperm whale	2	2	1	1	1	0	0
Spotted dolphin	1	2	2	2	2	1	0
White-beaked dolphin	5	46	9.2	35	1	2	3
White-sided dolphin	34	379	11.4	50	1	2	3
Unid dolphin	36	288	8	50	1	2	1
Unid whale	14	14	1	1	1	1	1
Total Cetaceans	567	4278	6.4	130	1	58	27

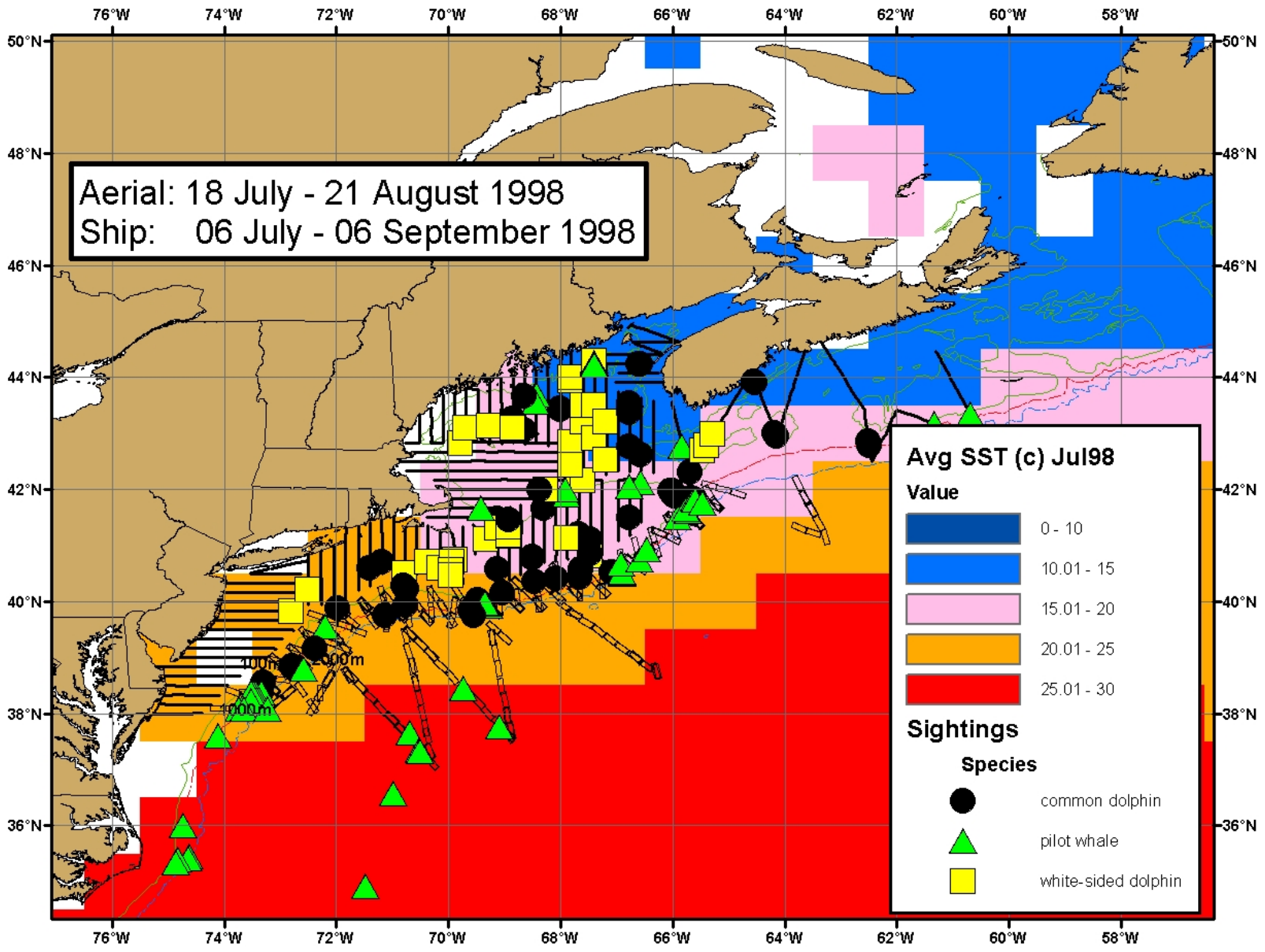
Track lines surveyed and distribution of species during summer surveys

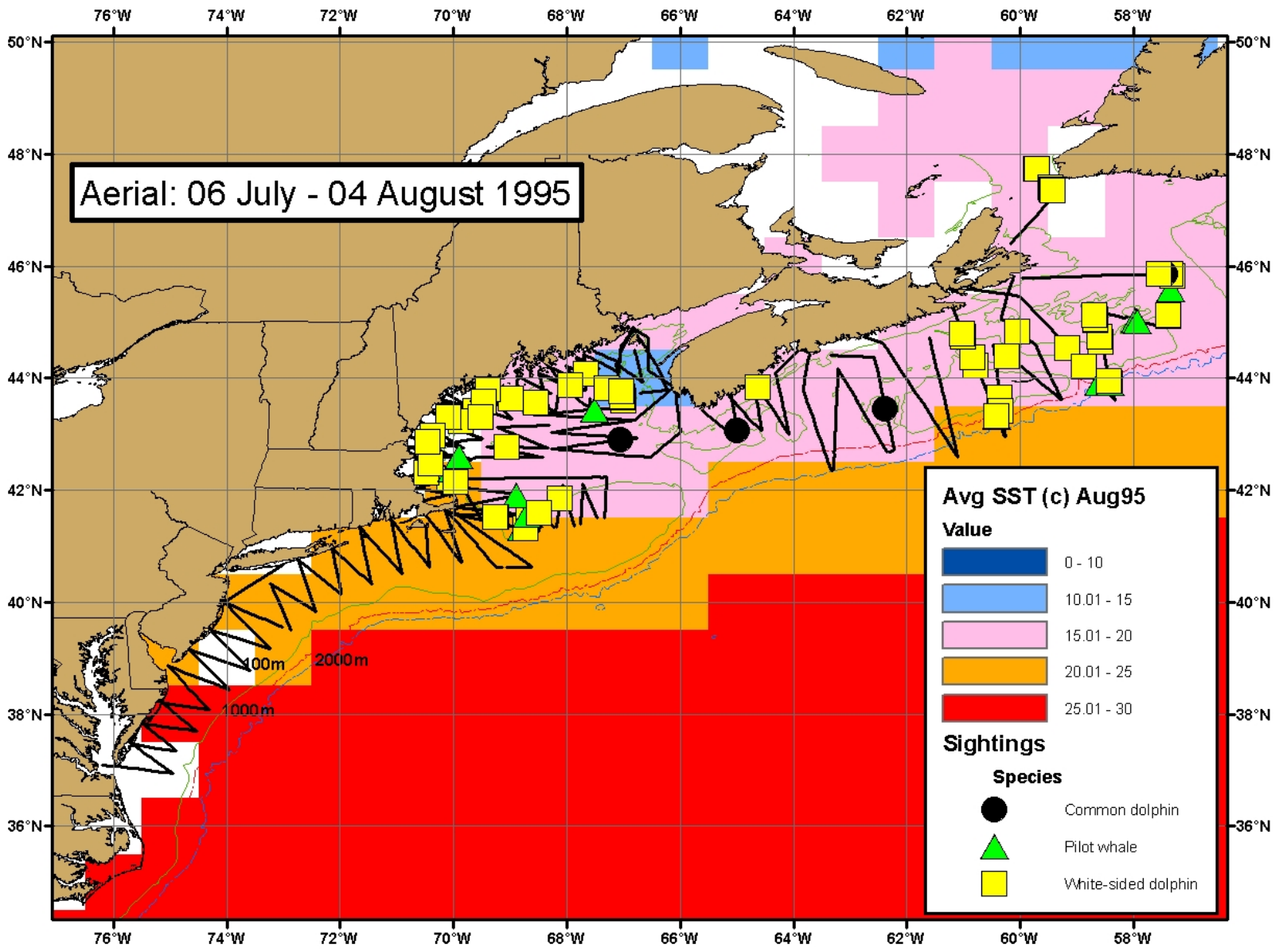












Abundance estimates

- Used data from aerial surveys conducted in the summers of 1995, 1998, 1999, 2002, 2004, and 2006
- Used circle-back data collection method starting in 1999 (Hiby 1999) to estimate abundance and g(0), where g(0) is the probability of detecting a group on the track line

Circle-back method (Hiby 1999)

5. End of dead time at 300 seconds. So now new sightings can initiate a circle-back

3. Turn back to track at 120 seconds

4. Record time plane re-joins original track line and start trailing leg

2 . Fly for 30 more seconds. Then record exact break-off time

1. See group where group size ≤ 5, sets clock at 0 and creates a leading leg

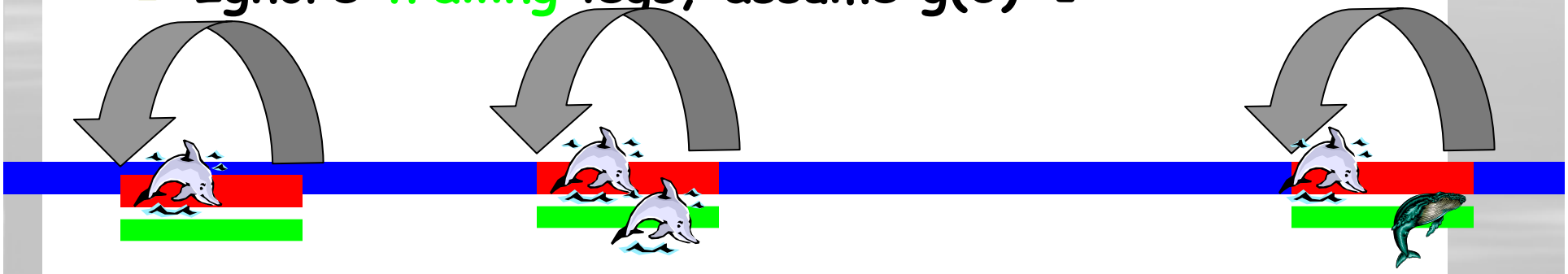
$$\text{Total abundance} = Abun_{cor.small} + Abun_{cor.large}$$

$$Abun_{corrected} = \frac{Abun_{uncorrected}}{g(0)}$$

small = groups of size ≤5 animals

where $g(0) = 1$ for large sized groups
and estimate $g(0)$ for small sized groups using circle-back data

1) **Step 1: estimate uncorrected abundance for each year by using:**
   - Standard line transect estimate from only the single plane and leading legs
   - Ignore trailing legs, assume $g(0)=1$



$$Abundance_{uncorrected} = \frac{(num\ of\ \ groups)\cdot(avg\ \ group\ size)}{2\cdot L\cdot esw} \bullet Area$$

esw = effective strip width , where covariates are incorporated
L = track line length

Potential covariates include: cloud cover, time of sighting, SST, bottom depth, bottom slope, group size, sighting cue

Pool species with similar detection functions

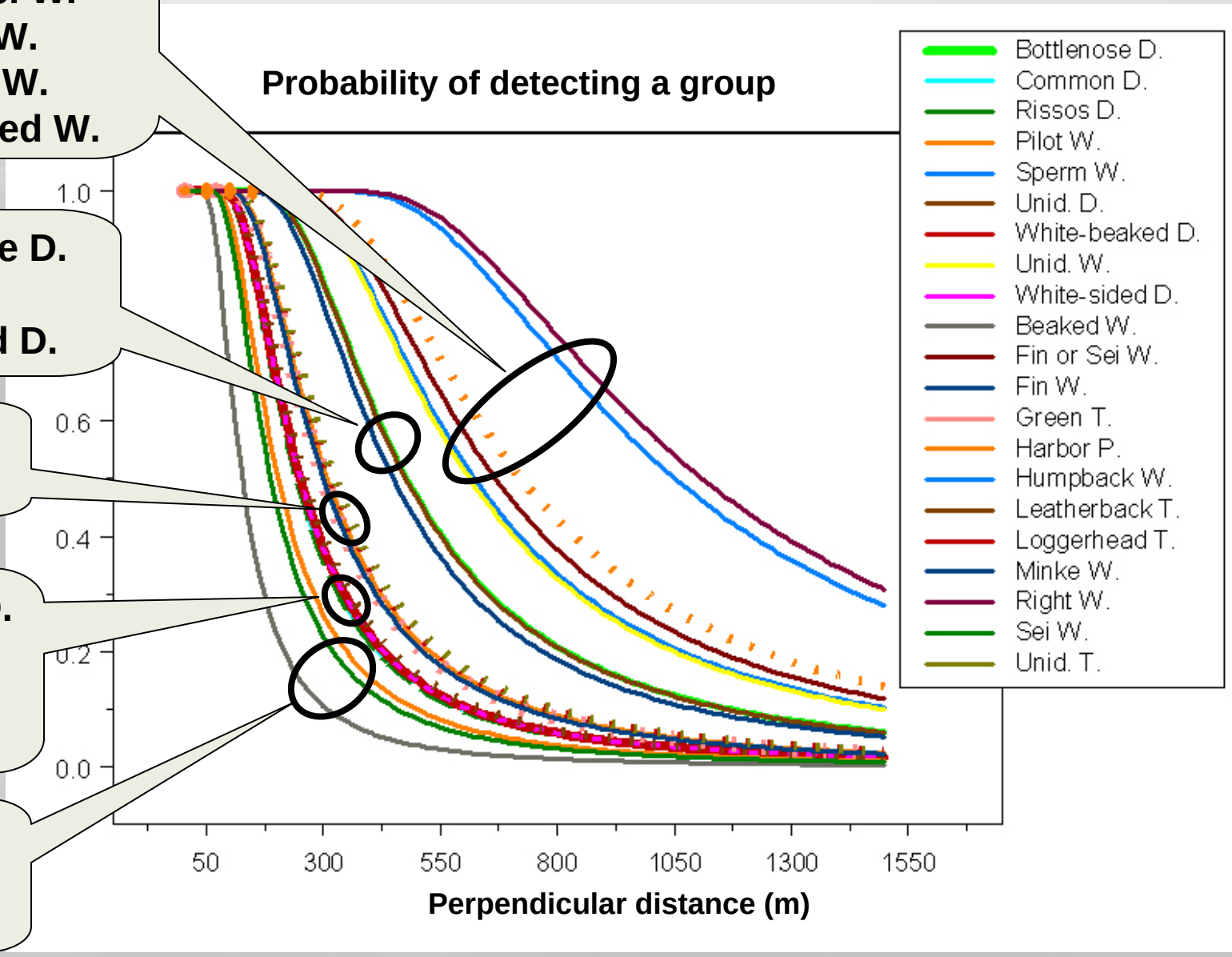
5. Humpback W.
Fin or Sei W.
Right W.
Sperm W.
Unidentified W.

4. Bottlenose D.
Fin W.
Unidentified D.

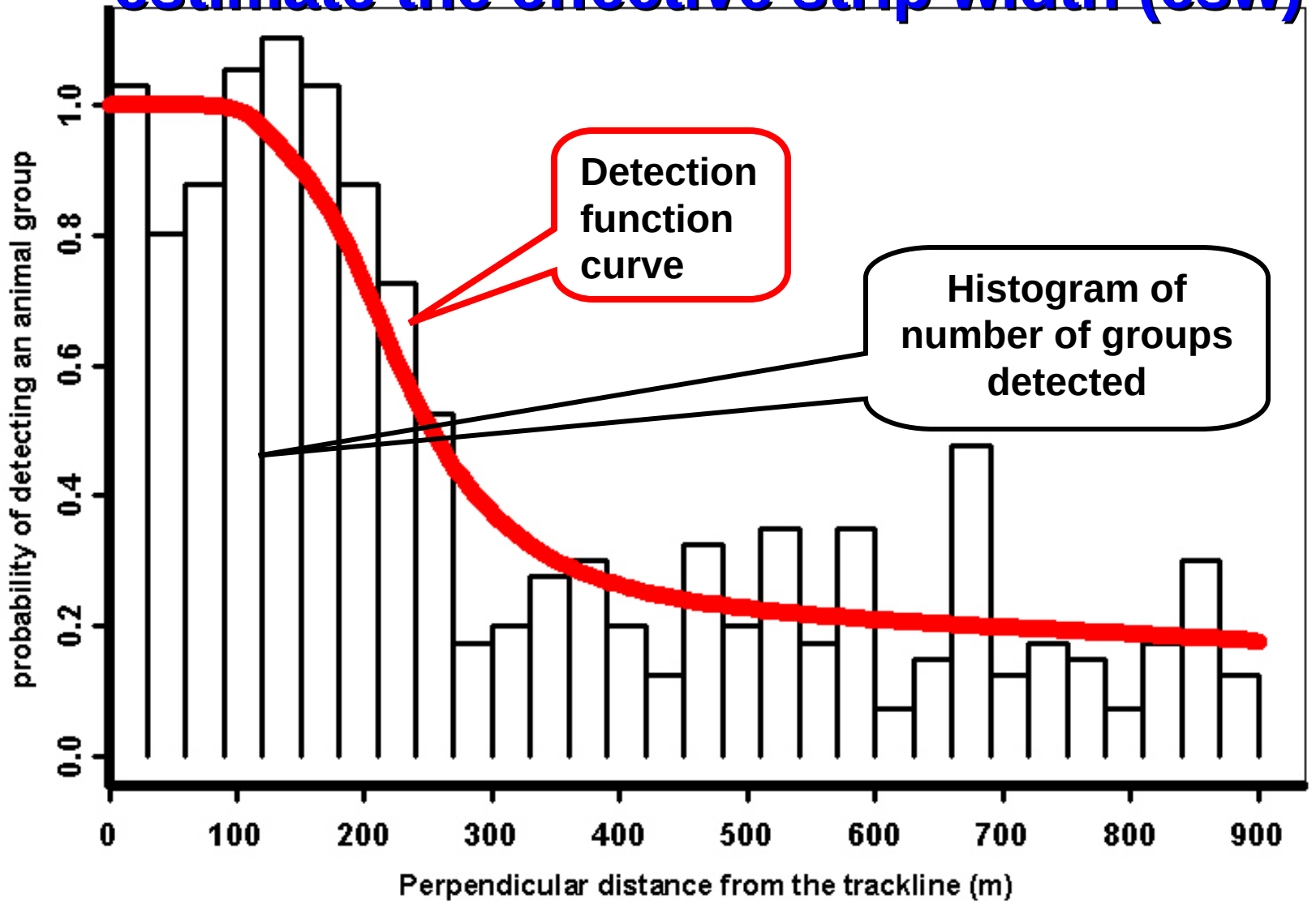
3. Minke W.
Pilot W.

2. Common D.
Risso D.
W-beaked D.
W-sided D.

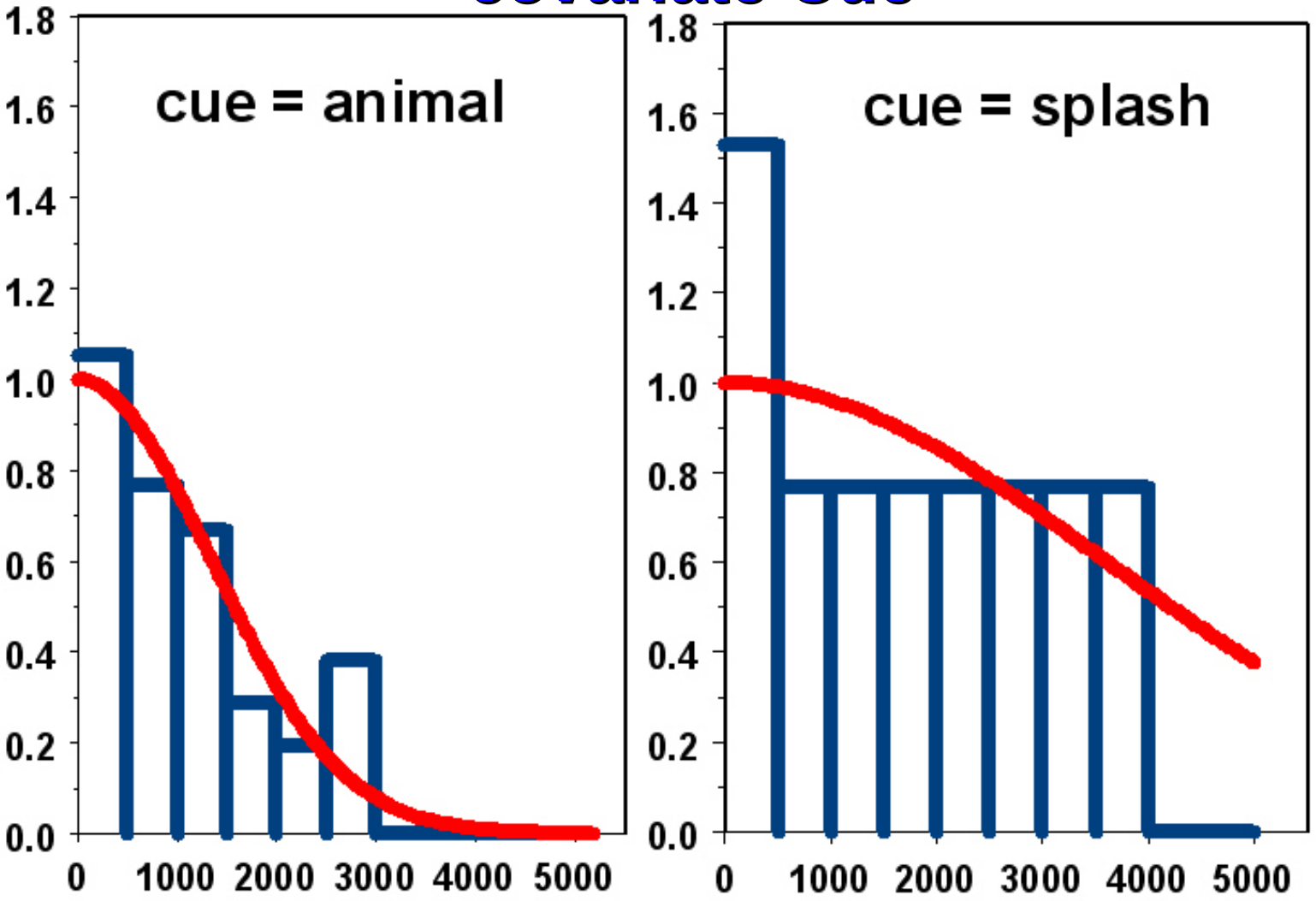
1. Harbor P.
Sei W.
Beaked W.



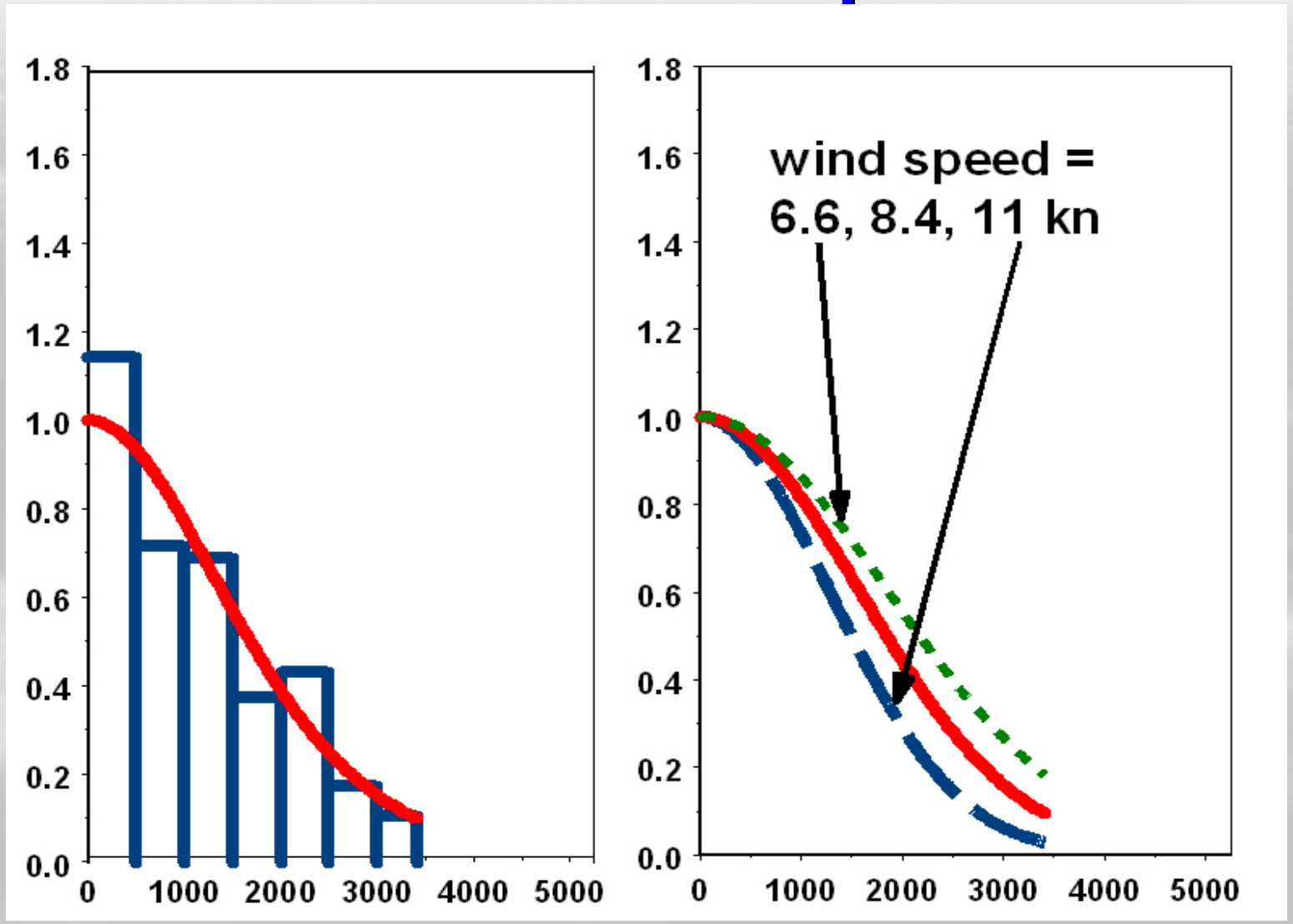
Example of a detection function used to estimate the effective strip width (esw)



Example of detection function for the covariate Cue



Example of detection function with covariate wind speed



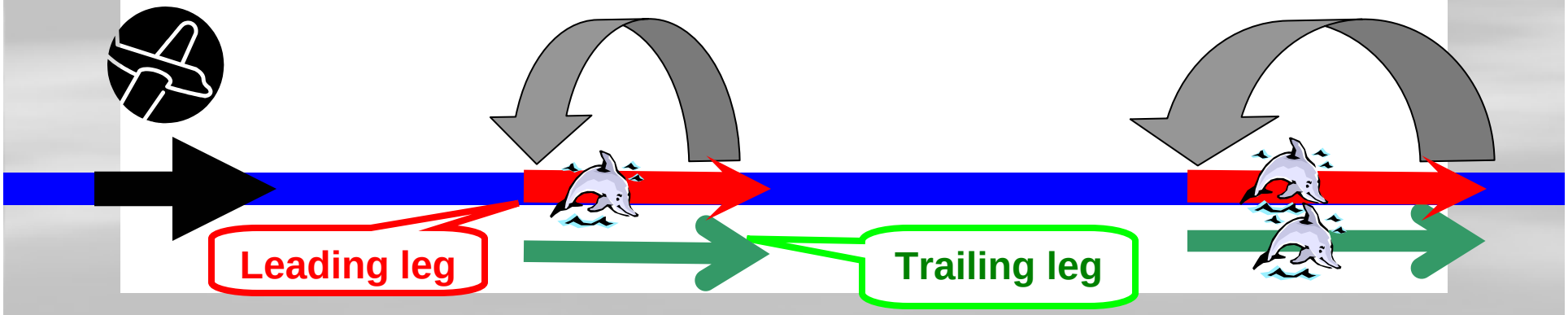
ESW (km) for species groups

Species Group	Mean ESW (%CV)	Covariates
1. Harbor P., Sei W., Beaked W.	186 (3.3%)	year, size, depth
2. Common D., Risso D., W-beaked D., W-sided D.	302 (3.7%)	year, size, SST, species
3. Minke W., Pilot W.	337 (7.1%)	cue, size, cloud
4. Bottlenose D., Fin W., unid D.	412 (5.1%)	cue, subjective, time
5. Humpback W., Fin or Sei W., Right W., Sperm W., unid W.	693 (6.5%)	seastate, size

Step 2:
Estimate g(0) for groups of size ≤ 5

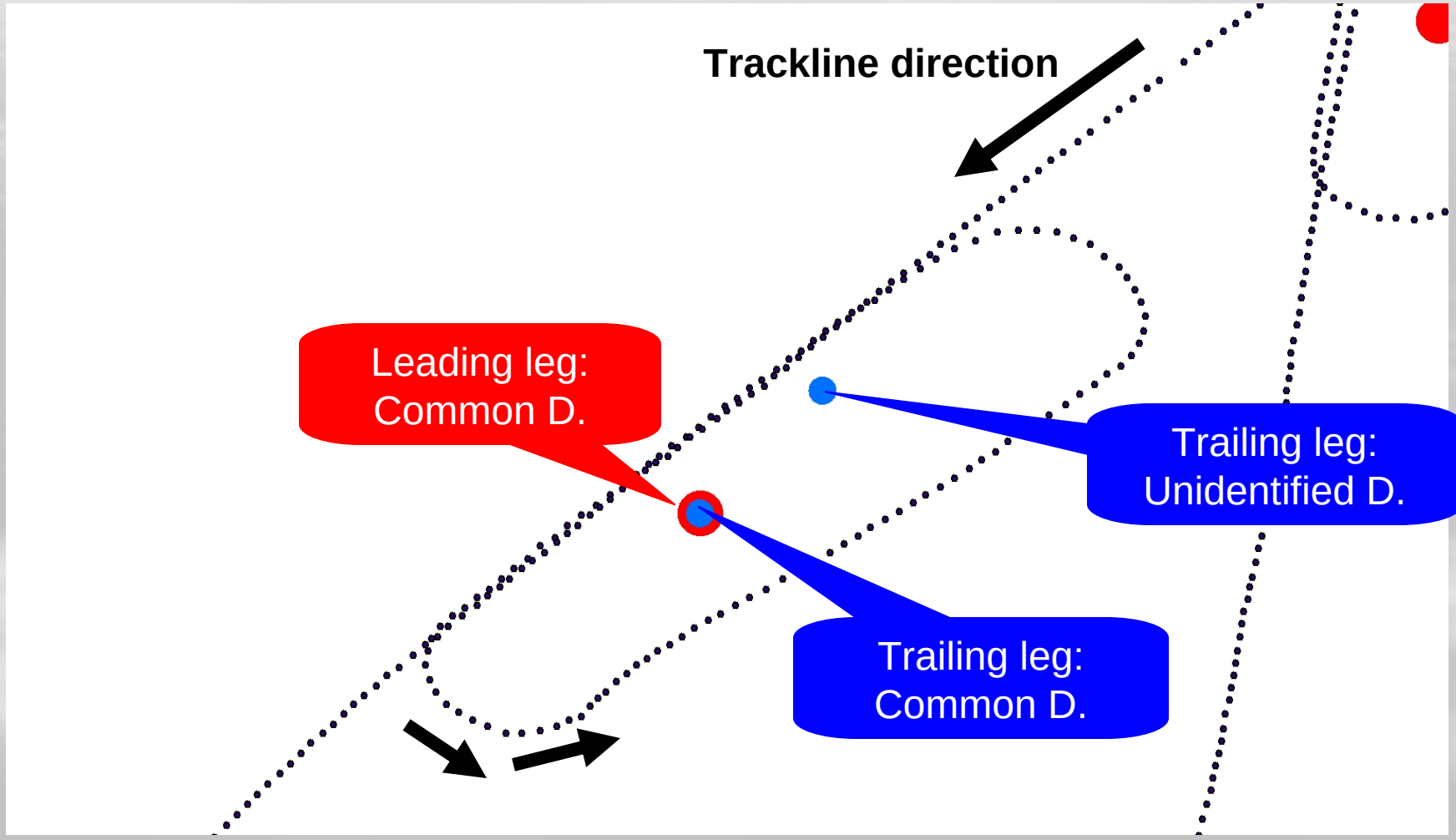
- **Standard capture-recapture techniques (Palka 1995) using leading and trailing legs for *g(0)***

$$g(0)_{leading} = \frac{n_{duplicates}}{n_{trailing}} \cdot \frac{ESW_{duplicates}}{ESW_{trailing}}$$



Used 1999, 2002, 2004, and 2006 data to estimate g(0)

Determining duplicates



Estimates of g(0)

Species group	No. of sightings		g(0)	CV(g0)
	Dup	trail		
1. Harbor P., Sei W., Beaked W.	21	36	0.288	0.495
2. Common D., Risso D., W-beaked D., W-sided D.	13	27	0.309	0.524
3. Minke W., Pilot W.	4	11	0.382	0.727
4. Bottlenose D., Fin W., unid D.	8	18	0.442	0.540
5. Humpback W., Fin or Sei W., Right W., Sperm W., unid W.	3	11	0.803	0.790

Significant covariates of duplicates = time of day
of trailing = species group, cue and time of day

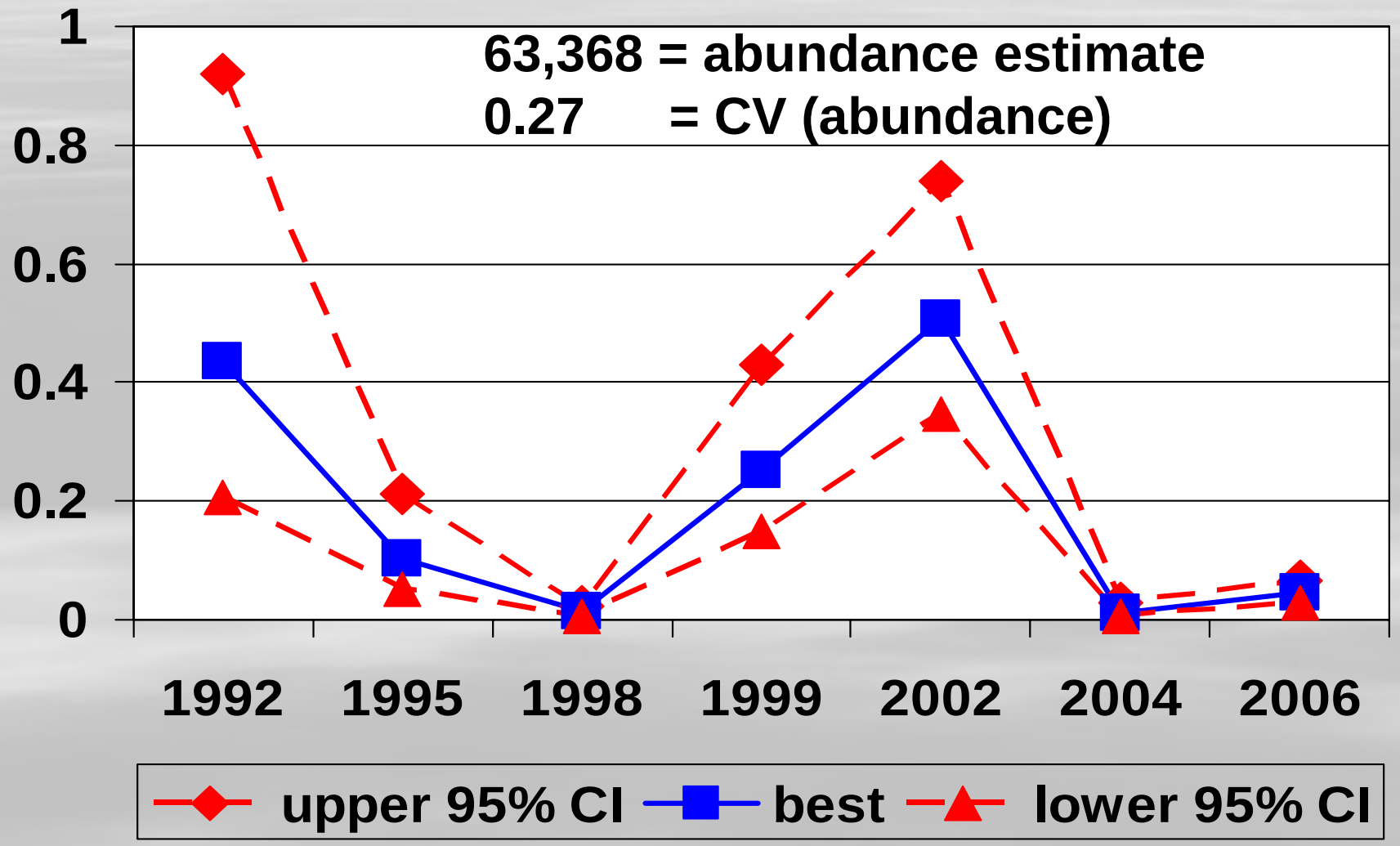
Abundance estimates

Species	Aug 1999	Aug 2002	July 2004	Aug 2006
Harbor P.	89,700 (0.22)	64,047 (0.48)	51,520 (0.65)	89,054 (0.47)
Whitesided D.	54,622 (0.43)	109,141 (0.30)	2,330 (0.80)	17,594 (0.30)
Minke W.	3,618 (0.18)	756 (0.90)	1,107 (0.83)	3,312 (0.74)

White-sided D.:
Average 2 most recent estimates from August

63,368 = abundance estimate
0.27 = CV (abundance)

Density estimate (number of animals per km^2) of white-sided dolphins



Any questions?

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