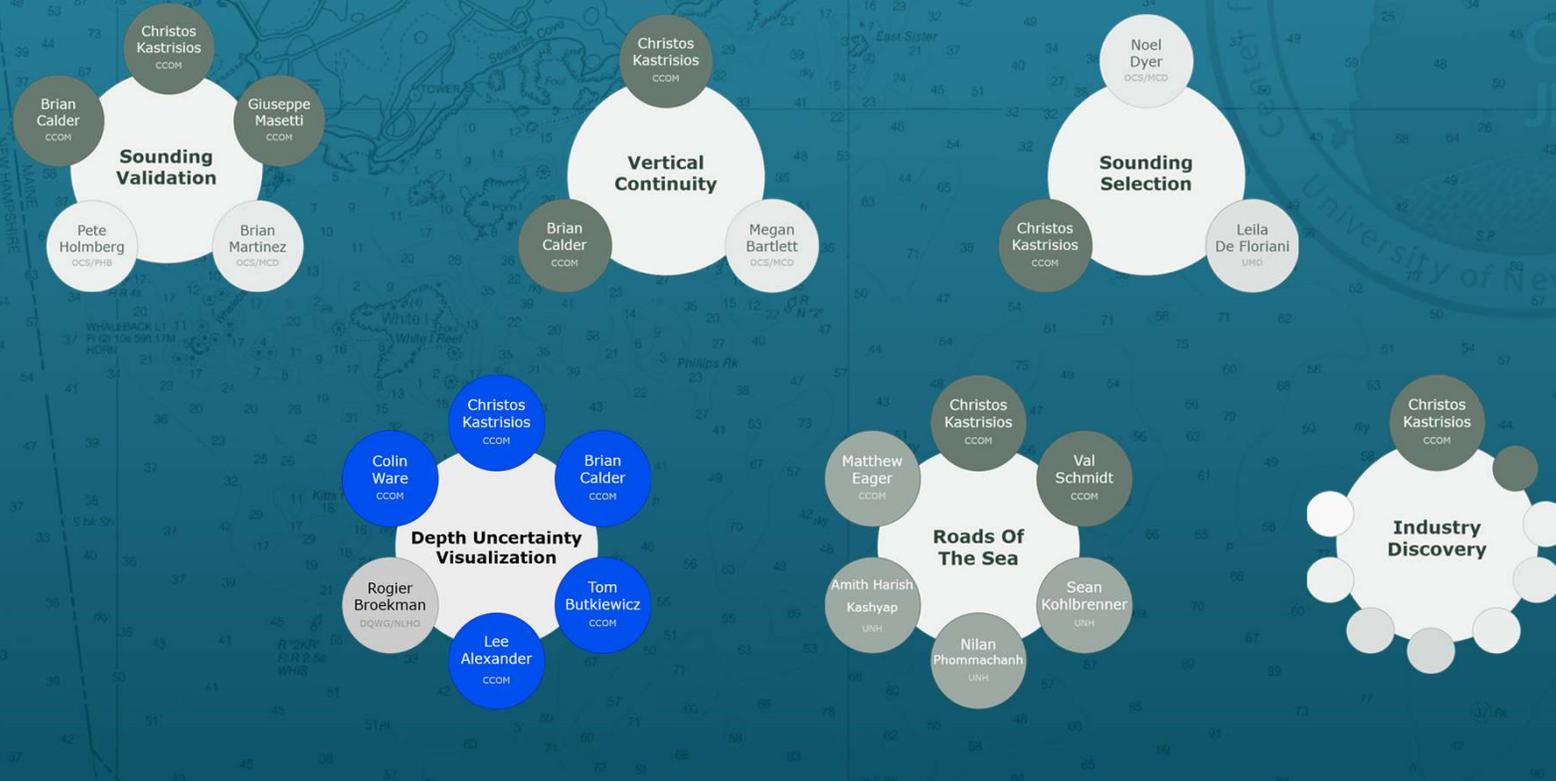




Data Quality Working Group

BATHYMETRIC DATA QUALITY AND AUTONOMOUS NAVIGATION RELATED RESEARCH PROJECTS



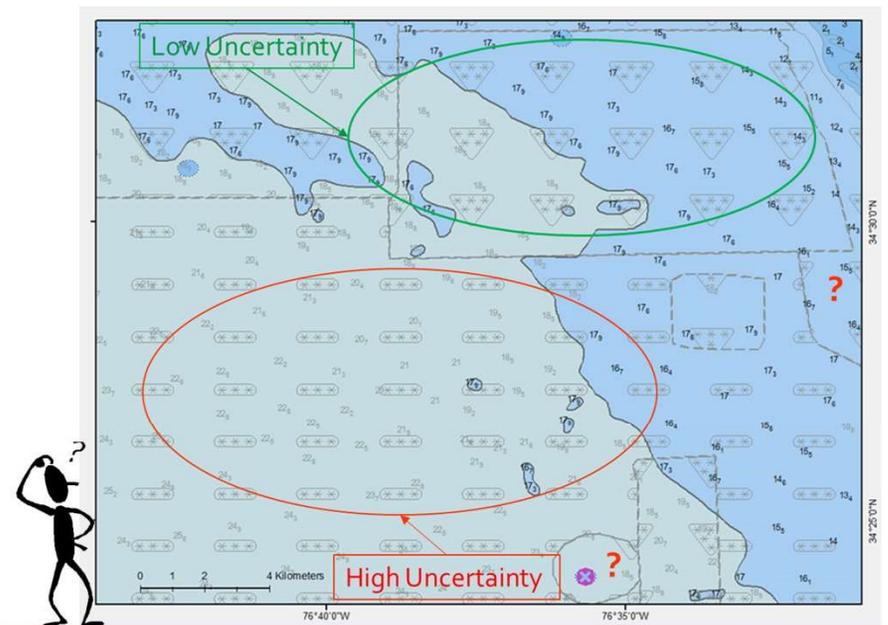
- CCOM
- UNH
- OCS/PHB
- OCS/MCD
- UMD
- IHO



DEPTH UNCERTAINTY VISUALIZATION

PROBLEMS

- CLUTTER
- Obscure high-quality more than low-quality data
- Not intuitive
- May not fit in small areas
- Continuous zoom-in/out is required
- Dominate the screen



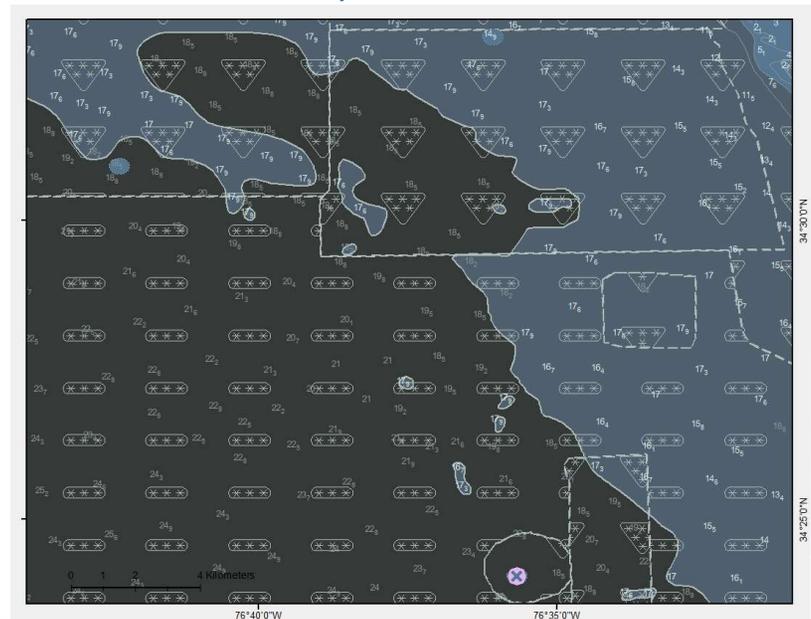


DEPTH UNCERTAINTY VISUALIZATION

PROBLEMS

- **CLUTTER**
- Obscure high-quality more than low-quality data
- Not intuitive
- May not fit in small areas
- Continuous zoom-in/out is required
- Dominate the screen

ECDIS Day Blackback Mode



DEPTH UNCERTAINTY VISUALIZATION

➤ Requirements:

- Minimize the occlusion of navigational information.
- Increase visual weight with the increase of data uncertainty.
- Unambiguously visualize the different uncertainty levels.
- Be easy to memorize
- Maintain effectiveness in all ECDIS modes

ZOC	Symbol	THU (m)	TVU (m)	Full Seabed Coverage
A1		5	0.5+ 1%	Yes
A2		20	1 + 2%	Yes
B		50	1 + 2%	No
C		500	2 + 5%	No
D		> 500	>2 + 5%	No
U		U	U	U



QoBD	Symbol	THU (m)	TVU (m)	Full Seabed Coverage
1	?	5	0.5+ 1%	Yes
2	?	20	1 + 2%	Yes
3	?	50	1 + 2%	No
4	?	500	2 + 5%	No
5	?	> 500	>2 + 5%	No
U	?	U	U	U
O	?	-	-	-



DEPTH UNCERTAINTY VISUALIZATION

Proposed Solution:

Sequence of textures,
created by combining two or more visual variables

Benefits:

- ✓ Minimally used
- ✓ Minimally interfere with chart information
- ✓ The combination can be intuitive
- ✓ Good visual hierarchy



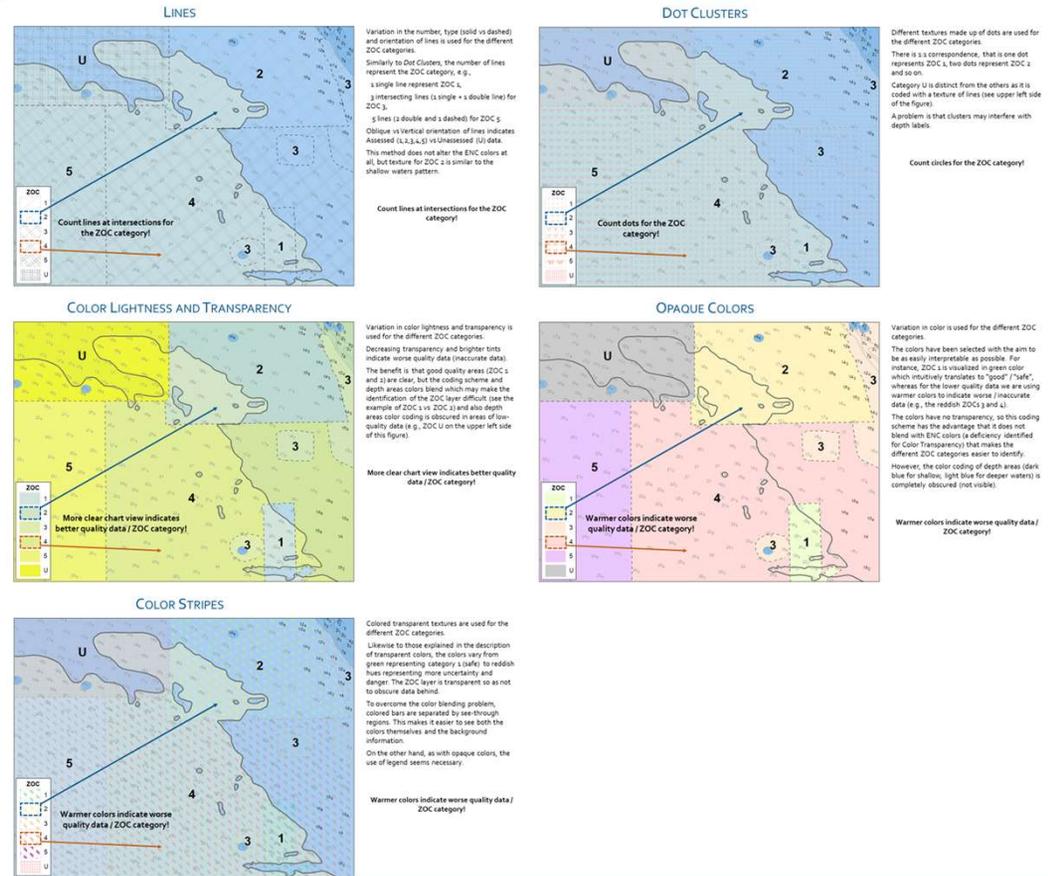


DEPTH UNCERTAINTY VISUALIZATION

5 Coding Schemes :

- Line textures
- Dot clusters
- Color lightness and transparency
- Opaque colors
- Color stripes

An online survey has been developed for their evaluation in 4 different areas



Online Survey: https://unh.az1.qualtrics.com/jfe/form/SV_gtPKpncrZusJ4RT

DEPTH UNCERTAINTY VISUALIZATION

4 Areas (3 in day bright, 1 in dusk ECDIS mode)

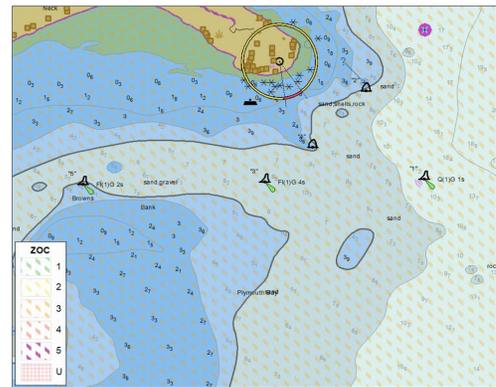


Timing
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Last Click: 0 seconds
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COLOR LIGHTNESS TRANSPARENCY

Please evaluate the following:

Are the different ZOC categories distinct / unambiguous? (0=Not At All, 6=Very Much)	0	1	2	3	4	5	6
How quickly can you identify the different ZOC categories? (0=Very Slowly, 6=Very Quickly)	<input type="radio"/>						
Is the coding easy to remember? (0=Not Easy, 6=Very Easy)	<input type="radio"/>						
How much does the coding interfere with depth, depth areas, and other chart information? (0=Very Little, 6= A Lot)	<input type="radio"/>						
Are the areas of worse quality data more emphasized? (e.g., ZOC 4, ZOC 5) (0=Not At All, 6=Very Much)	<input type="radio"/>						



Timing
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Page Submit: 0 seconds
Click Count: 1 clicks

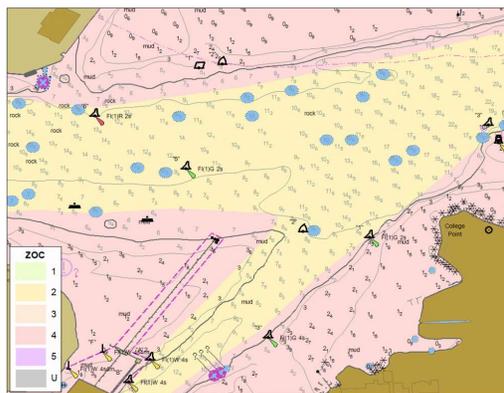
COLOR STRIPES

There is only one ZOC category in the view area. What is that?

1	2	3	4	5	U
---	---	---	---	---	---

Please evaluate the following:

How quickly did you identify the ZOC category? (0=Very Slowly, 6=Very Quickly)	<input type="radio"/>						
How confident are you that you have identified the ZOC category correctly? (0=Not At All, 6=Very Confident)	<input type="radio"/>						
Would you be able to identify the ZOC category without the use of the legend? (0=Not At All, 6=Absolutely)	<input type="radio"/>						



Timing
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First Click: 0 seconds
Last Click: 0 seconds
Page Submit: 0 seconds
Click Count: 0 clicks

OPAQUE COLORS

Please evaluate the following:

Are the different ZOC categories distinct / unambiguous? (0=Not At All, 6=Very Much)	0	1	2	3	4	5	6
How quickly can you identify the different ZOC categories? (0=Very Slowly, 6=Very Quickly)	<input type="radio"/>						
Is your ability to separate shallow from deep waters affected by the coding scheme? (0=Very Little, 6= A Lot)	<input type="radio"/>						
How much visual clutter does the coding scheme add? (0=Very Little, 6= A Lot)	<input type="radio"/>						
Are the areas of worse quality data more emphasized? (0=Not At All, 6=Very Much)	<input type="radio"/>						



Timing
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Click Count: 1 clicks

DOT CLUSTERS

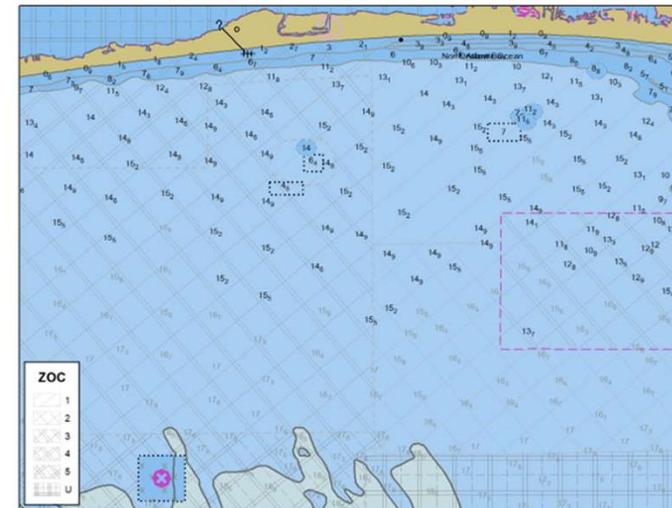
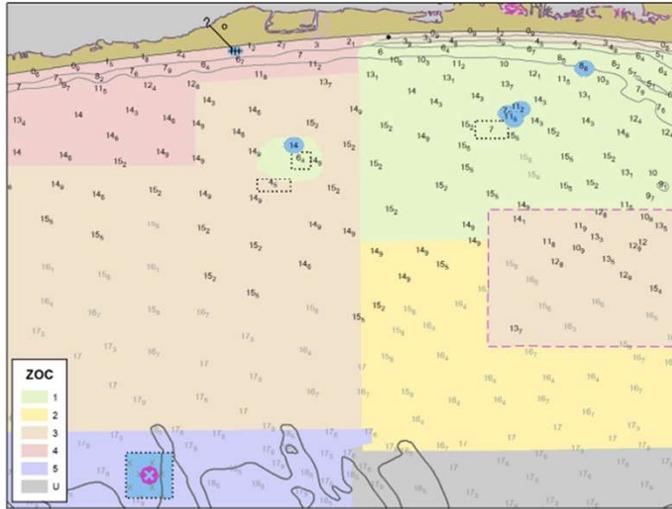
Please evaluate the following:

Are the different ZOC categories distinct / unambiguous? (0=Not At All, 6=Very Much)	0	1	2	3	4	5	6
How quickly can you identify the different ZOC categories? (0=Very Slowly, 6=Very Quickly)	<input type="radio"/>						
Is the coding easy to remember? (0=Not Easy, 6=Very Easy)	<input type="radio"/>						
How quickly can you identify shallow/deep waters when not using the coding scheme? (0=Not Easy, 6=Very Easy)	<input type="radio"/>						
How much can you read and identify shallow/deep waters? (0=Not Easy, 6=Very Easy)	<input type="radio"/>						

Please rank the 5 alternatives from 1-best to 5-worst for the Day Bright Mode.

CATZOC Visualization Scheme

		Opaque Colors	Color Transparency	Color Stripes	Dot Clusters	Lines
Your Ranking	1 Best	<input type="radio"/>				
	2	<input type="radio"/>				
	3	<input type="radio"/>				
	4	<input type="radio"/>				
	5 Worst	<input type="radio"/>				



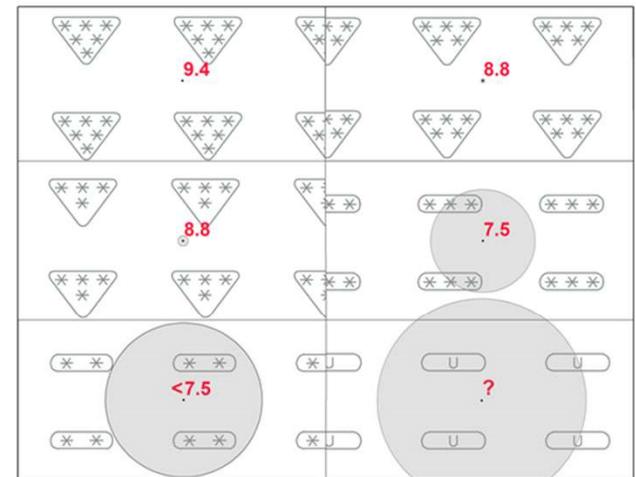
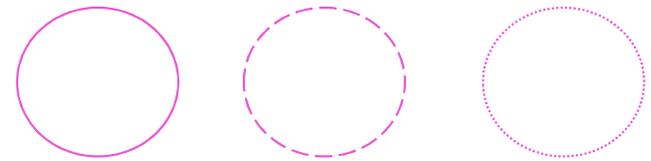
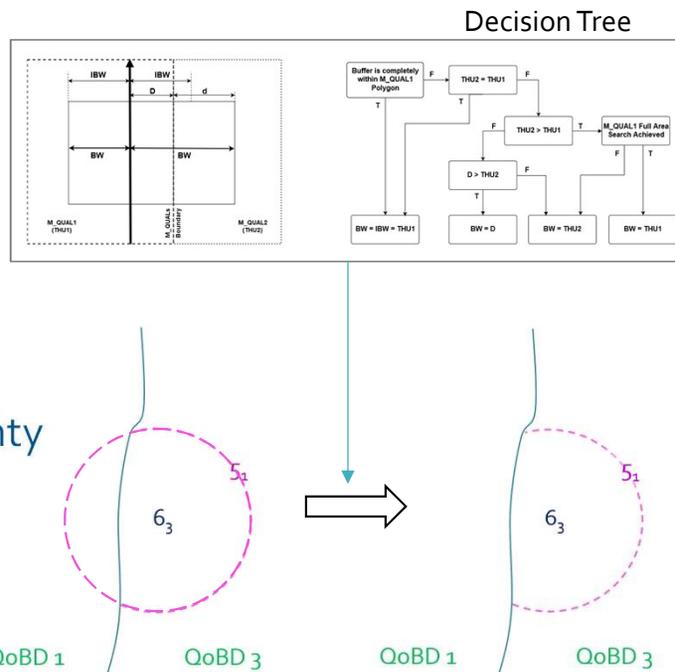
DEPTH UNCERTAINTY INTEGRATION

Individual Features:

- What?
- Where?
- When?
- How?

Factors:

- Position uncertainty
- Depth Uncertainty
- Cartographic uncertainty





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