

Analysis of Propeller Cuts Documented in Right Whale Necropsy

EgNEFL0602

by

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January 27, 2006

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In January, 2006, Tom Pitchford of the Florida Fish and Wildlife Conservation Commission's North Atlantic Right Whale Project asked if propeller cuts visible in photographs of a right whale carcass recovered near Jacksonville, Florida could be analyzed to determine the physical characteristics of the propeller that created the cuts. One of the photographs submitted (IMG_7680.JPG included below) was suitable for analysis. The following emails are a series of correspondence documenting the results of this analysis. Notes have been added by the author to provide clarification as necessary.

From: "Pitchford, Tom"
To: JLWood
Sent: January 27, 2006 9:41 AM
Subject: Whale Images

Hi Jim, Here are some of the images from the whale, sorry it took so long. Thanks for your willingness to take a look at them. Butch and Alex are also looking at the images and we would like to work cooperatively with you on any findings. Let me know what you think.

I will have to send the images in phases.

The scale is 15.6 cm, end to end.

---Tom

From: JLWood
To: Pitchford, Tom
Cc: Sentiel Rommel
Sent: January 27, 2006 8:20 PM
Subject: Re: Whale Images

Tom, Butch, and Alex,

Thanks for sending the photographs of the right whale calf recovered near Jacksonville. Could you please send me an identifying number for this animal? (Note: EgNEFL0602)

I have CC'd Butch on this email, but I do not have an email address for Alex. Please, forward this for me.

I used IMG_7680.JPG for my analysis. As you indicated, this was a very large propeller. My preliminary findings are as follows:

Blades	3	4	5
Dia. (in.)	80	106	133
Dia. (cm.)	202	269	337
*Max Length (cm.)	190	253	317
*Max Depth (cm.)	67	89	111

*Max Length is the maximum cut length that a propeller of the specified diameter should be capable of creating. Max Depth is the maximum cut chord depth that a propeller of the specified diameter should be capable of creating.

*Dia. (ft.)	7	9	11
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*I do not usually report propeller diameters in feet, but with propellers of this size it is often easier to visualize their size in feet rather than inches or centimeters. These values have been rounded to whole feet.

Cut Span = 69.4 cm. (27.3 in.) (Note: Measured from photograph)

The anterior cut was labeled #1 and the posterior cut was labeled #2. The cut lengths (Note: listed in table below) are calculated from the photographs and are approximate chord lengths. The chord depths (Note: listed in table below) are based on the calculated cut length and the propeller diameter specified above. These chord depths can sometimes be used to eliminate one of the calculated diameters from consideration. For instance, if cut #1 had a measured chord depth less than 7.4 cm but greater than or equal to 5.5 cm then the propeller probably was not 3-blade, 7 ft. diameter. (Note: The chord depth of the cuts are sometimes measured during the necropsy, but these measured values were not available at this time.)

Blades	3	4	5
Cut No. Length (cm)	Chord Depth	Chord Depth	Chord Depth
1 76	7.4	5.5	4.3
2 81	8.5	6.2	4.9

Rotation = CCW

***Vessel Path** = Head to Tail

*The calculations indicate that the vessel passed from head to tail. This is a new parameter that I am working with. Perhaps your direct observation of the cuts can help test the validity of this determination.

The cut lengths are too small (relative to the possible diameters of the propeller) to allow any of the blade configurations to be eliminated from consideration based on that parameter alone.

I hope this helps. I am very interested in hearing how these values compare with your determinations. Please do not hesitate to send me any questions or comments you may have.

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IMG_7680.JPG



IMG_7680_Crop.JPG

Note: During a subsequent telephone conversation, Tom Pitchford asked if the approximate vessel length could be determined from the calculated propeller diameters.

From: JLWood
To: Pitchford, Tom
Sent: February 22, 2006 2:00 PM
Subject: Fw: Whale Images

Tom,

For larger vessels, the propeller diameter is roughly 3% to 5% of the vessel length depending on the type of vessel. I have reproduced the reference to this information from Amy Knowlton's work below. I can summarize the information regarding the vessel size as:

Blades	3	4	5
Prop. Dia. (ft.)	7	9	11
Vessel Length (ft.)	140 - 233	180 - 300	220 - 367

If you have cut depth data for cuts 1 and 2, you can compare that information with the calculated chord depths listed below and possibly eliminate one or more of the calculated diameters from consideration. For instance if the measured chord depth of cut 1 was less than 7.4 cm, then the propeller was probably not a 3-blade 7 foot diameter propeller. The most likely candidate then is the 4-blade 9 foot diameter propeller. (I usually default to the smallest possible diameter unless there is some data that will specifically exclude it from consideration.) Remember, depths measured in necropsies are sometimes suspect, so do not try to put too fine an edge on this analysis. These calculated depths are chord depths. Also, you should only use the measured depths on cuts that have true bottoms. If the cut penetrates into the body cavity, its measurements are not really of much use.

Blades	3	4	5	
Cut No.	Length (cm)	Chord Depth	Chord Depth	Chord Depth
1	76	7.4	5.5	4.3
2	81	8.5	6.2	4.9

Reference: **The Hydrodynamic Effects of Large Vessels on Right Whales** - Knowlton, 1995
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"Propeller diameters range between 3 to 5% of the total length of the vessel, depending on the vessel type. Propeller sizes on large tankers and containerships range from 3 to 3.5% of the vessel length, or 6 to 8 meters in diameter. On large oceanographic ships and large fishing vessels, propeller sizes are about 5% of the length, or 3 to 4 meters in diameter. On high speed vessels such as Coast Guard cutters and mega yachts, the propellers are approximately 4.5% of the length, or 1 to 2 meters in diameter. Slower speed, small fishing vessels also have propeller of this diameter."

I hope this helps. If you have questions or comments, please let me know.

Jim

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