

# Marine mammals & tidal turbines: what are the issues of concern & how are they being resolved?



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# What are the issues?

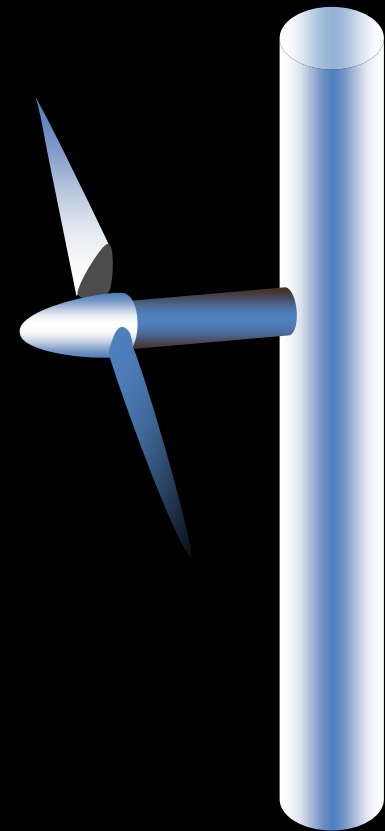
## Construction & maintenance

- Pile driving
- Cable trenching
- Maintenance boats etc

## Operation

4. Chemical pollution (anti-fouling, lubricants)
3. Operational noise
2. Spatial displacement (avoidance,  
barrier effects,  
attraction)

## 1. Collisions

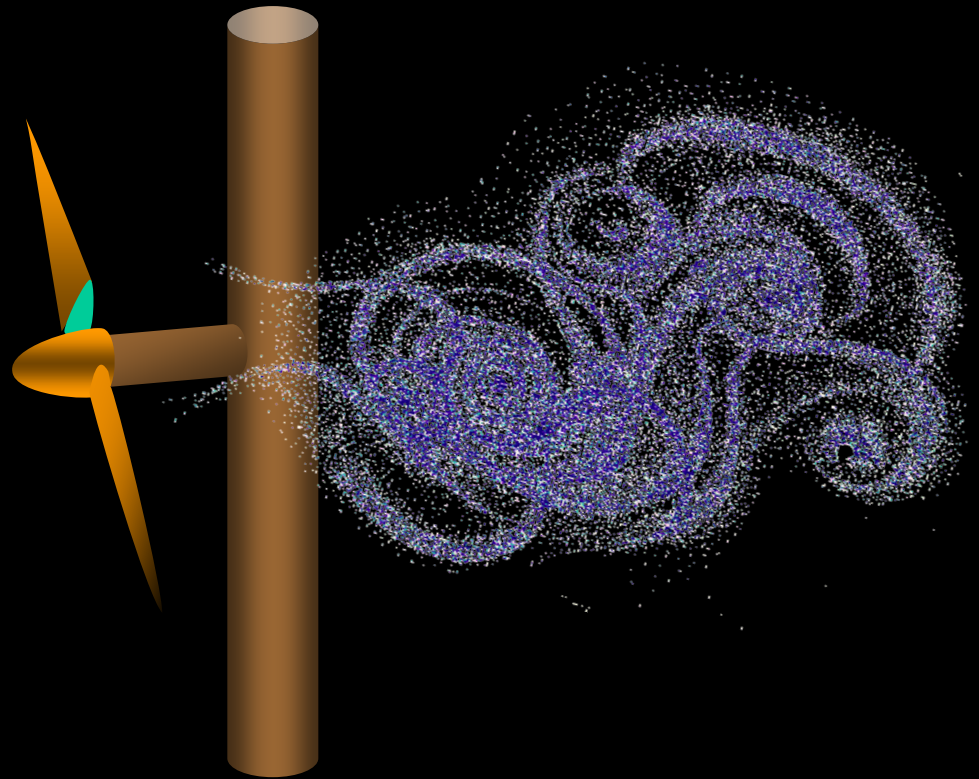
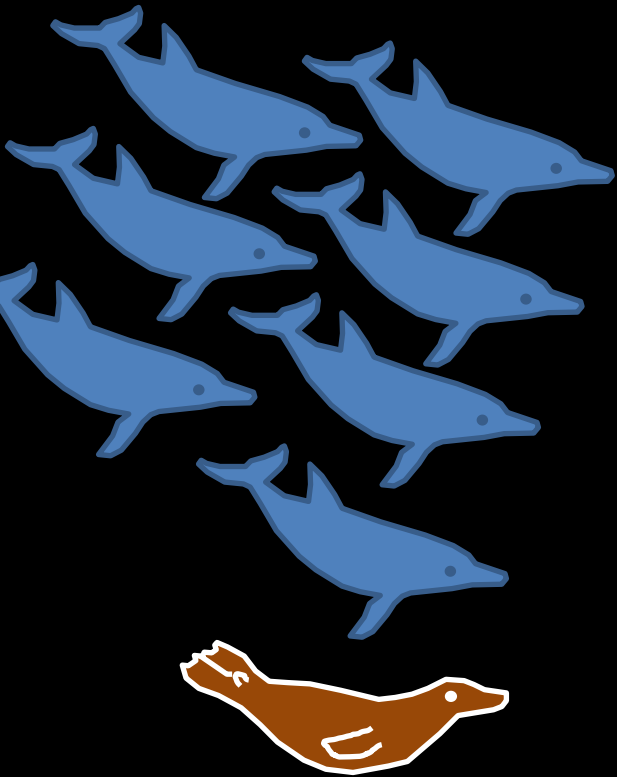






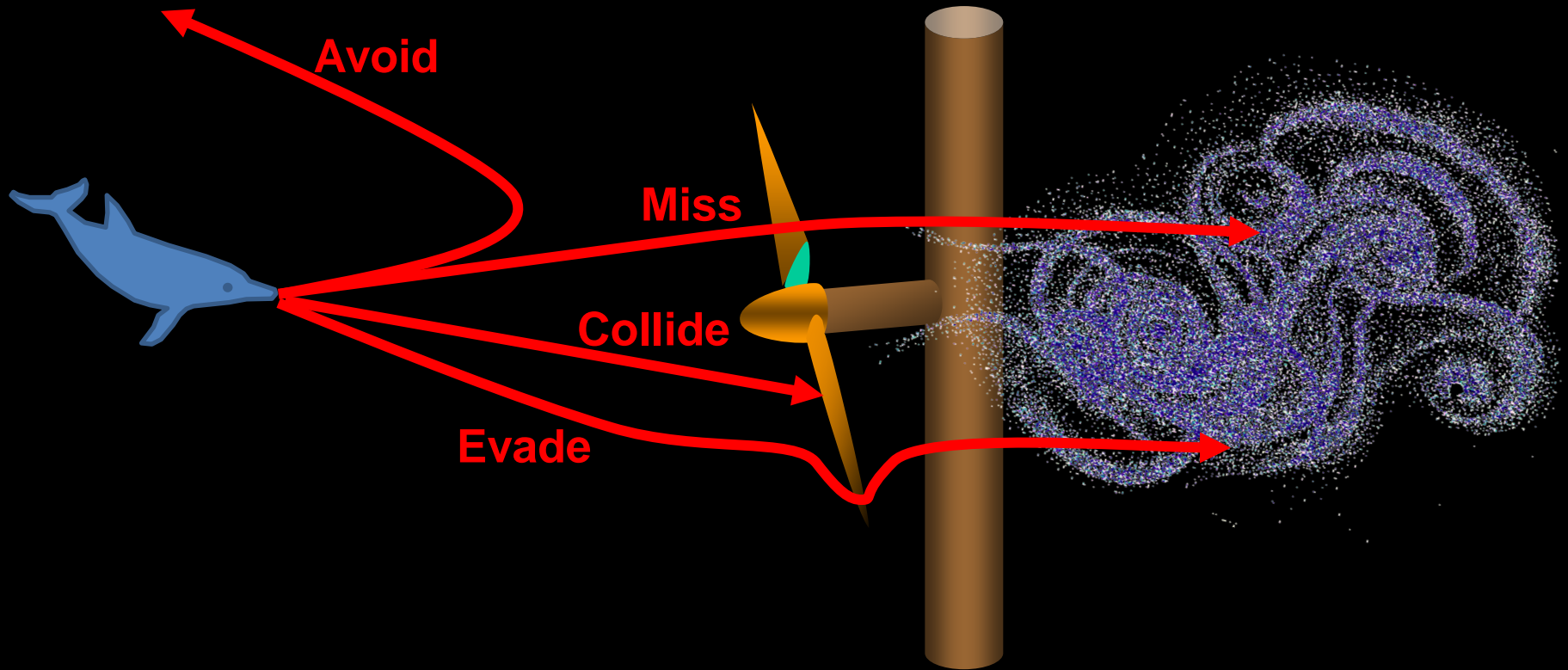
[www.seageneration.co.uk](http://www.seageneration.co.uk)

# 1. Which species are at risk (and how many)?

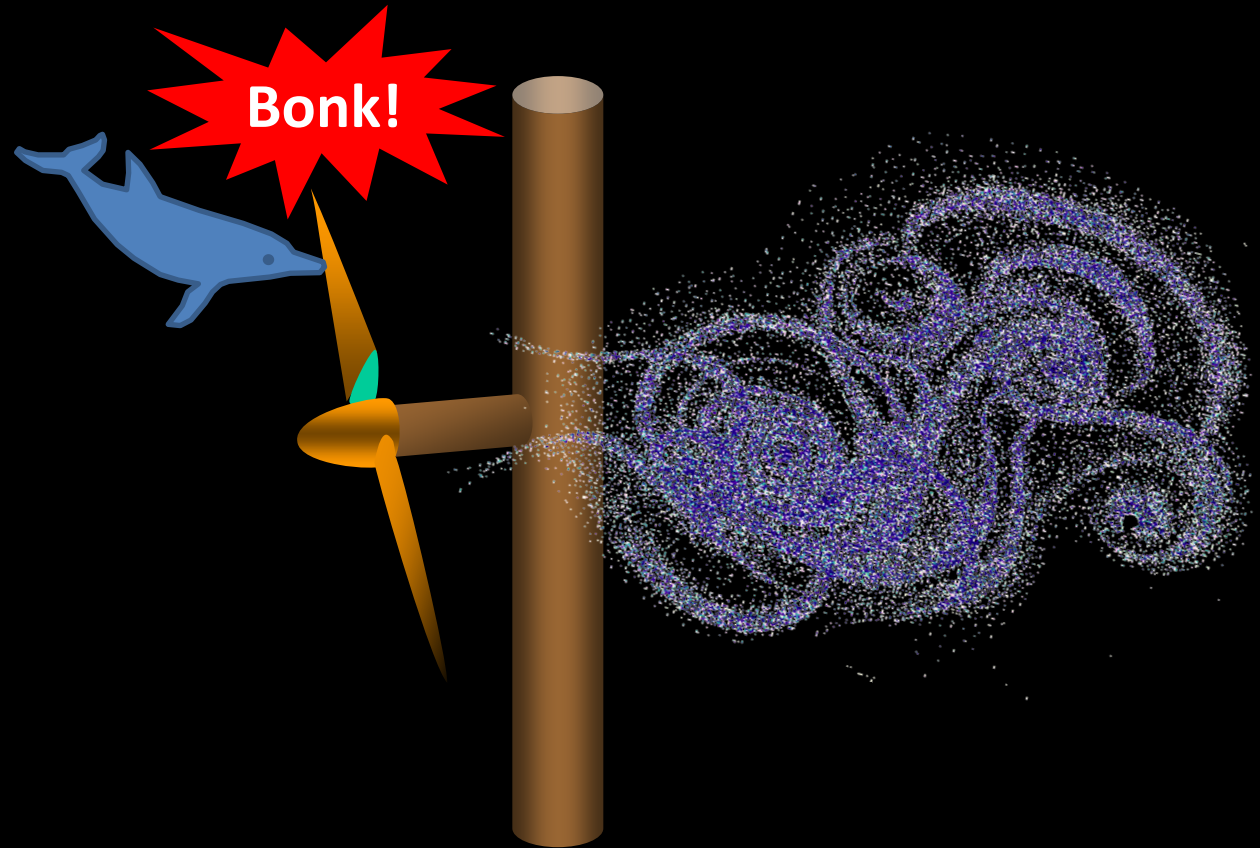




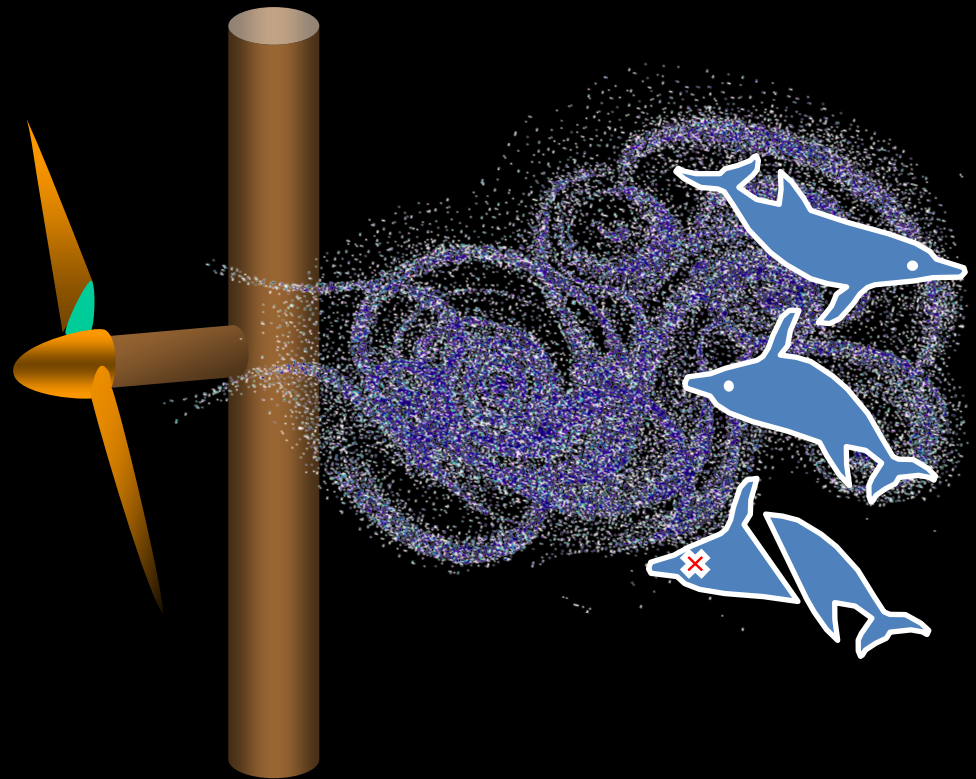
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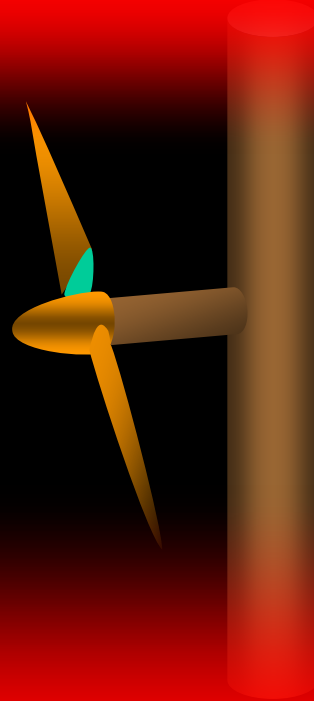
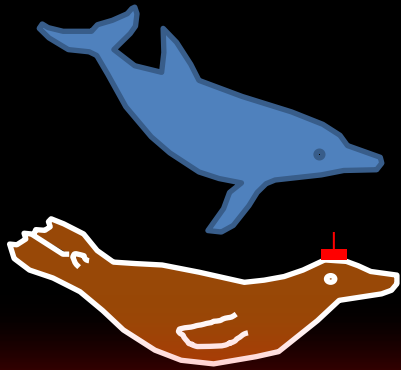




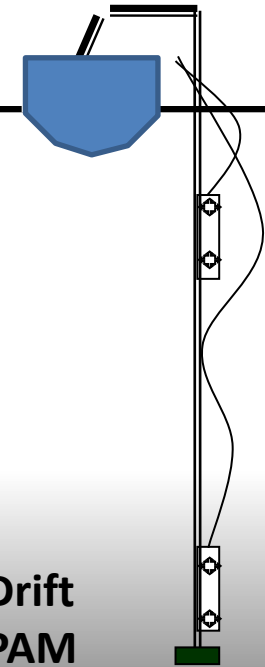
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2. What is the probability of a strike occurring?
3. Do collisions actually occur?
4. What are the consequences of a collision?
5. Are there any mitigation options?



# 1. Which species are at risk (and how many)?



Jonathan Gordon

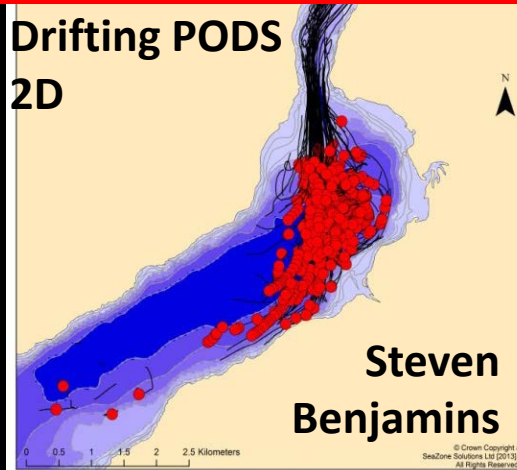


Drift  
PAM  
3D



Drifting PODS

2D

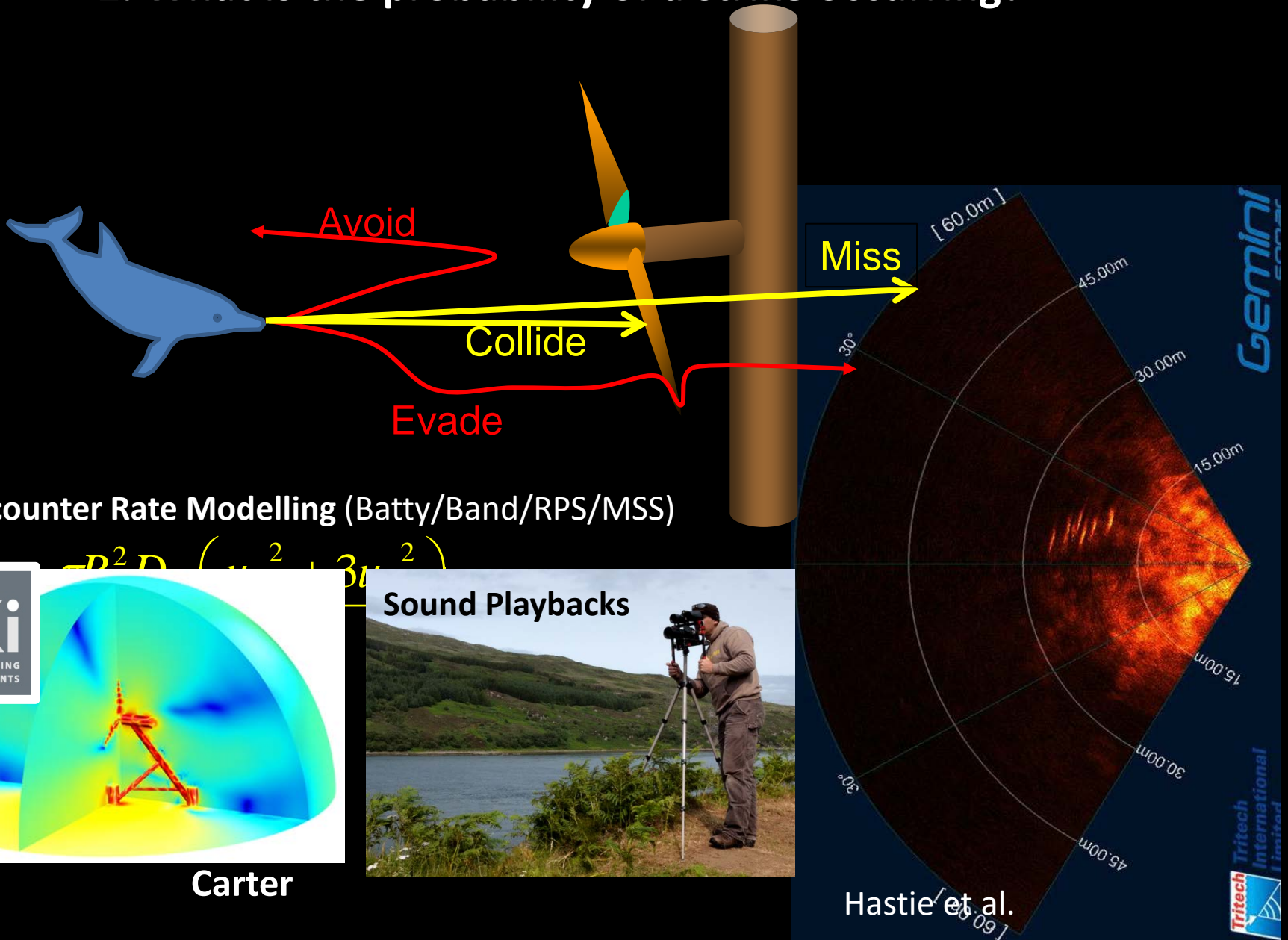


Steven  
Benjamins



UW

## 2. What is the probability of a strike occurring?

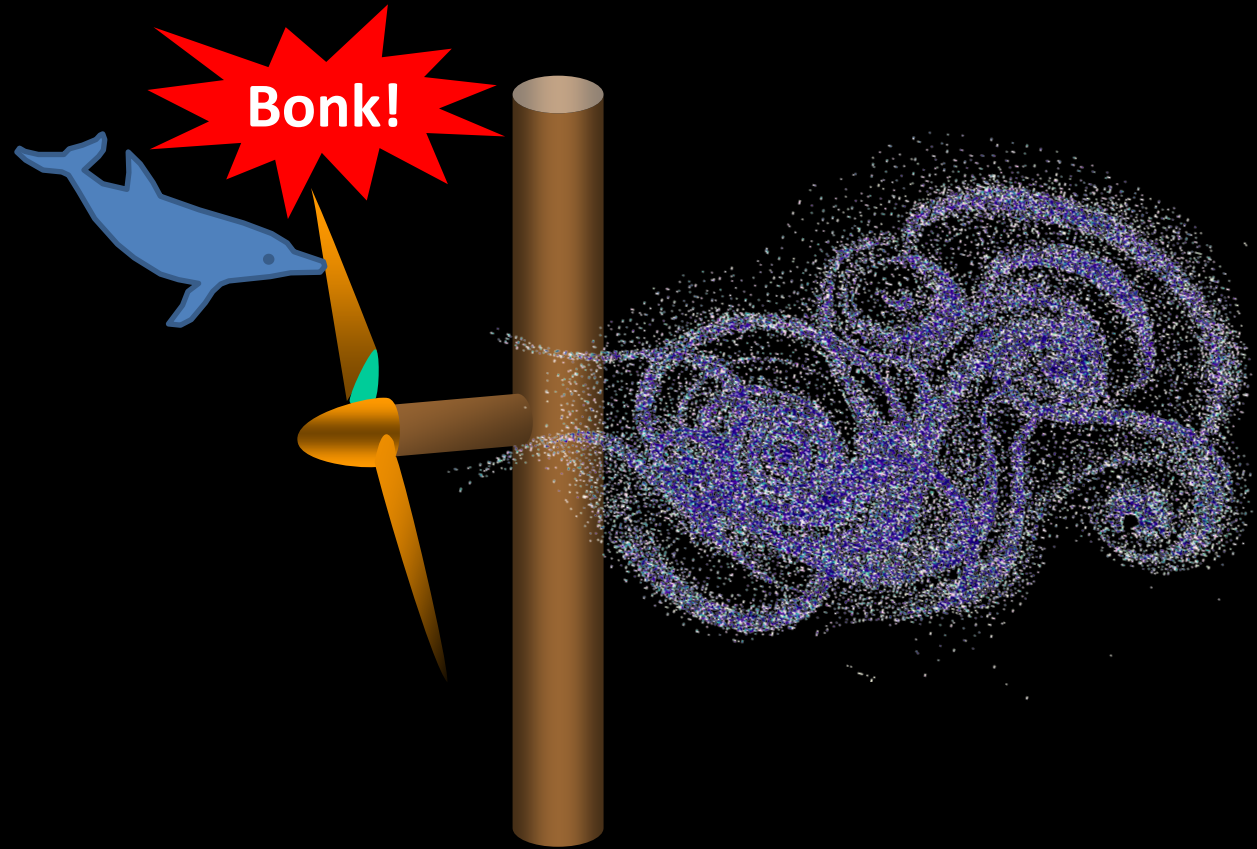




### 3. Do collisions actually occur?

HR Sonar  
Optical cameras  
Accelerometers  
Strain gauges  
Microphones

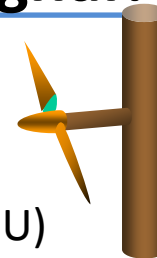
Don't yet have a  
**Collision-ometer**



How big a signal?

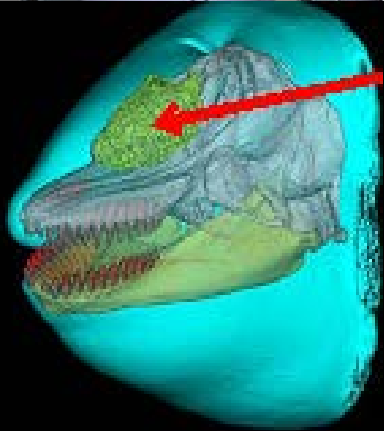
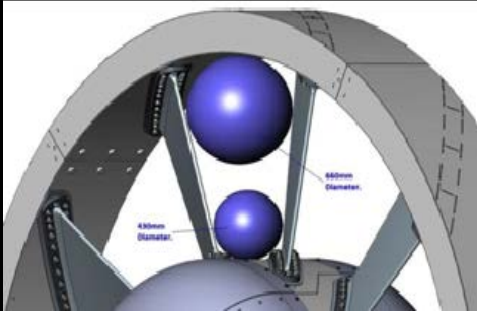


Stansby (Manchester U)



X-MED

# 4. What are the consequences of a collision?



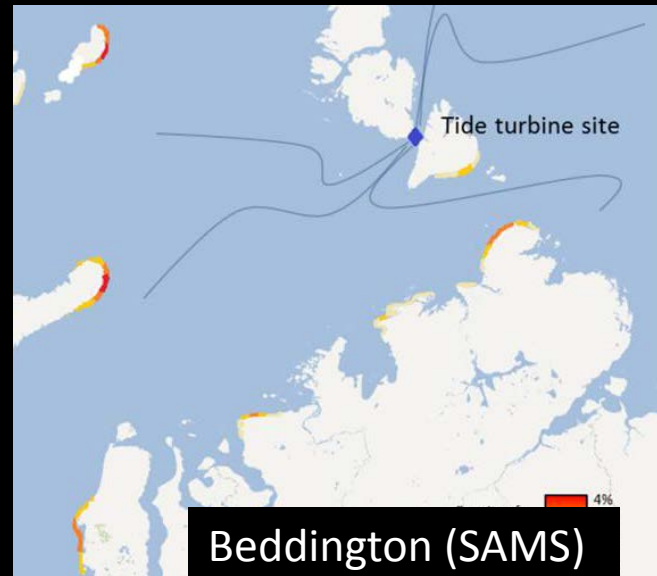
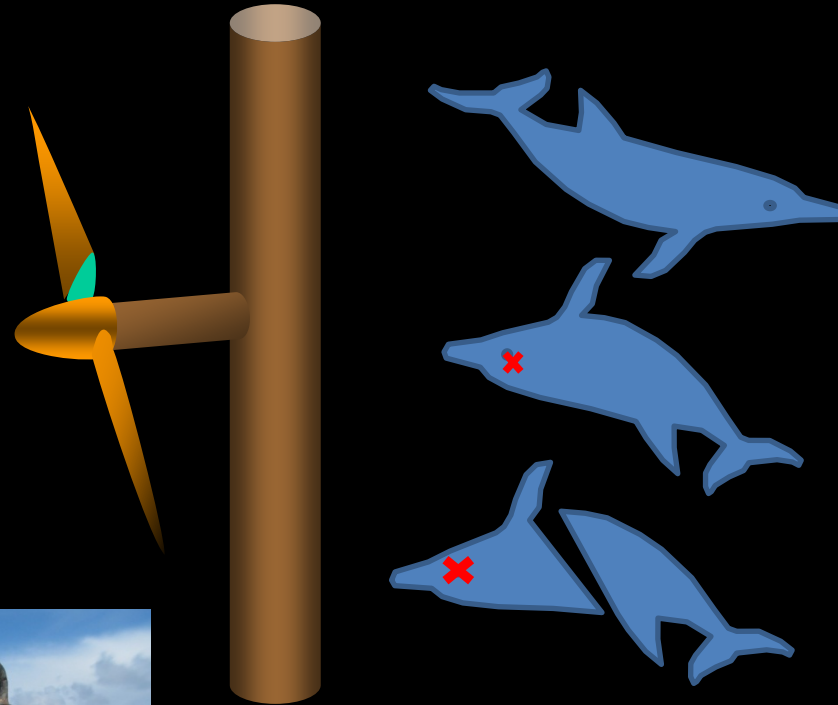
Carlson et al., 2012, PNNL report.



D Thompson (SMRU)

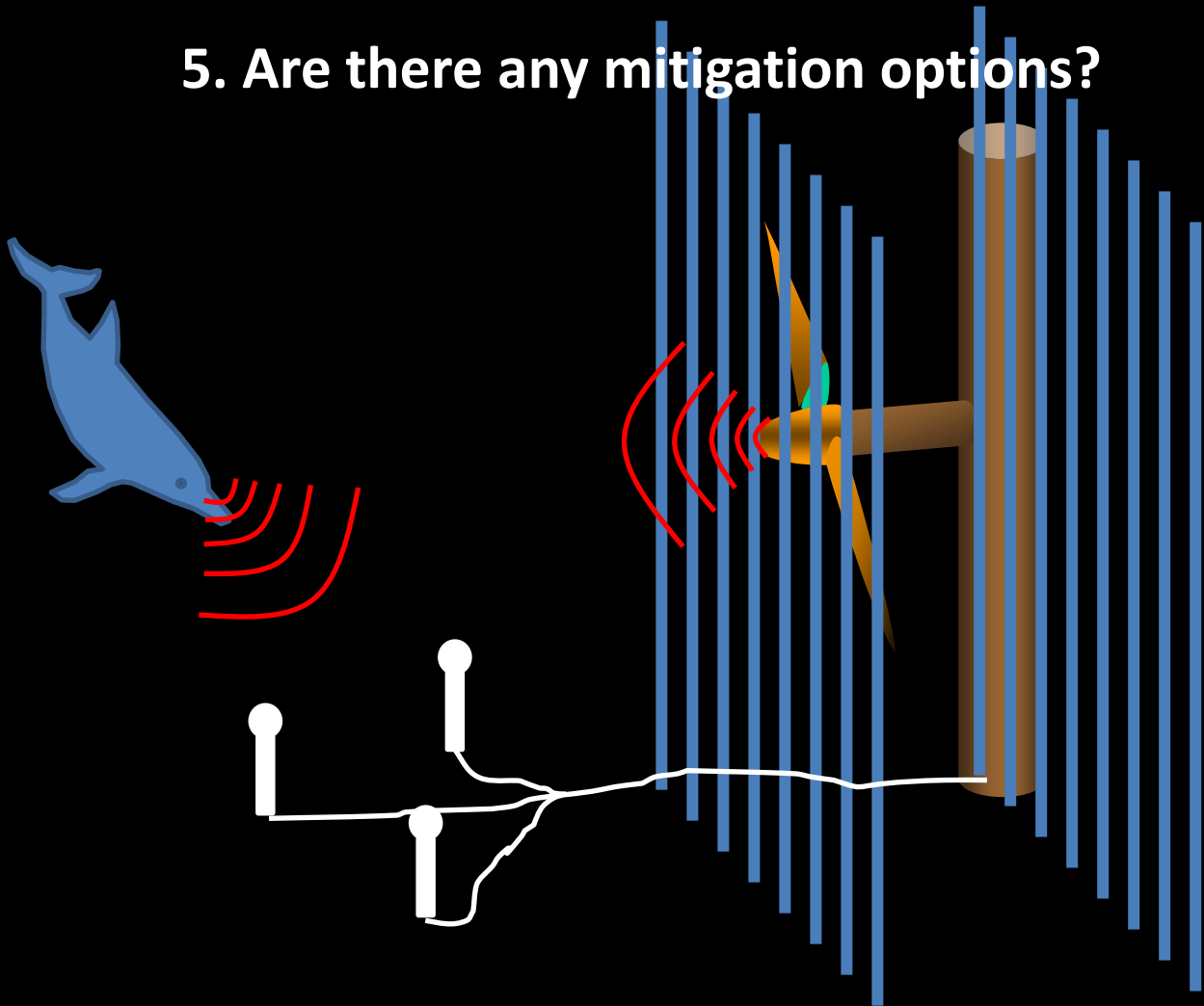


Pathologists  
Brownlow



Beddington (SAMS)

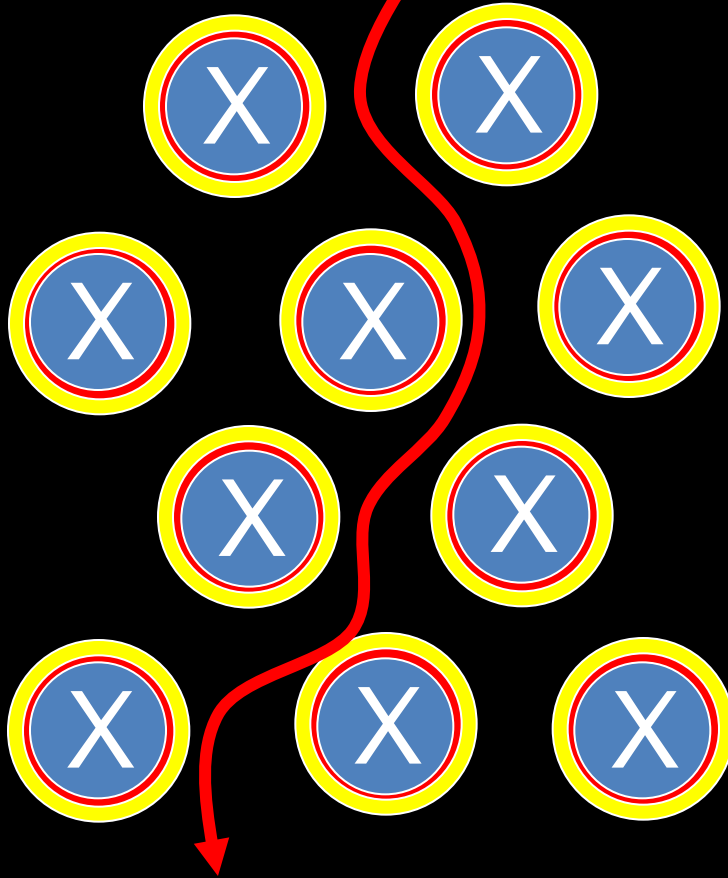
## 5. Are there any mitigation options?

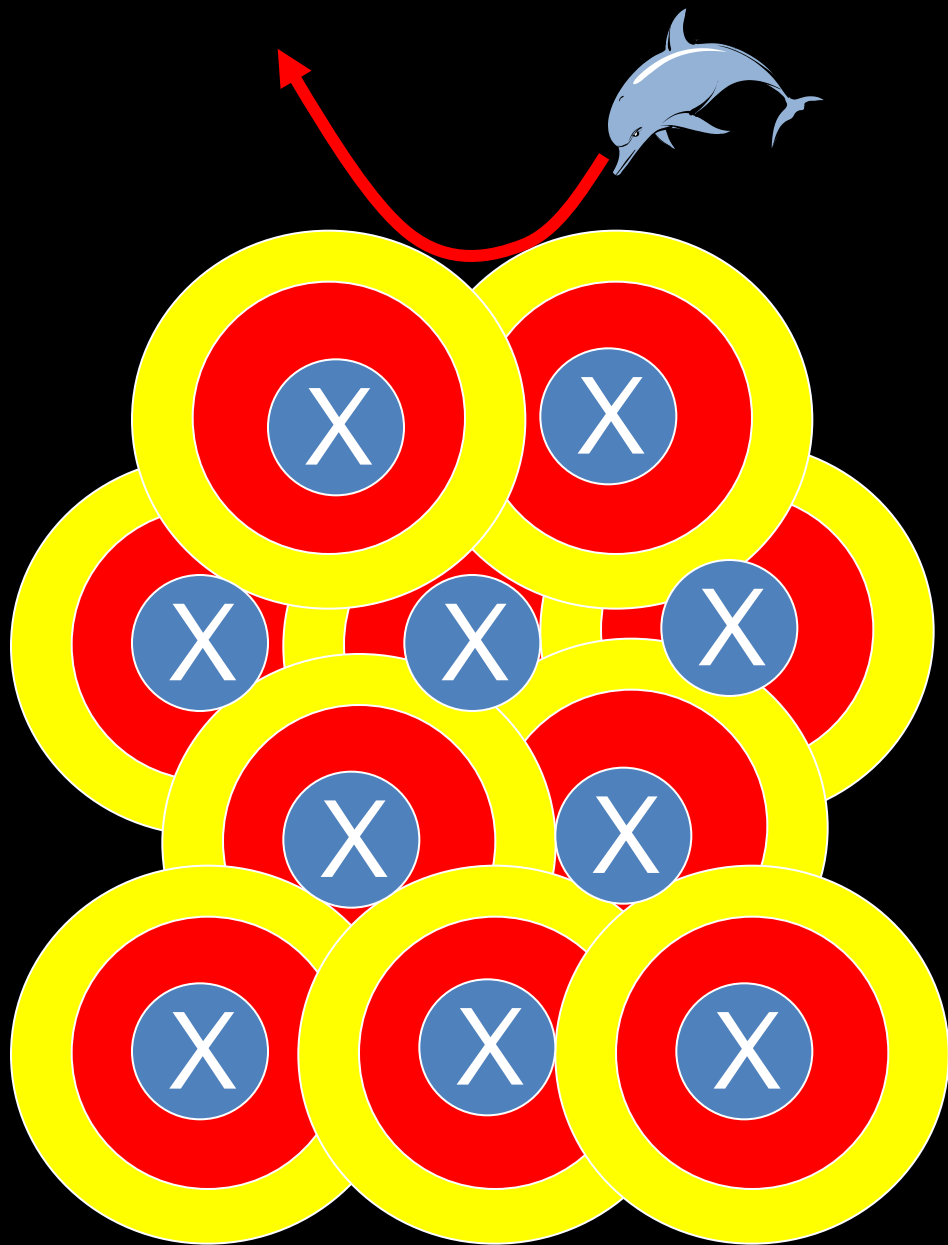


Avoid bad places !  
Physical barriers **X?**

Reduce tip-speed ?  
Detection and stop ?  
Acoustic warning







## Take homes

1. Mammal – turbine collisions a potential show-stopper
2. Many efforts on different aspects of the problem
3. Documenting actual strikes is fundamental but under-progressed
4. Mitigation if there is actually a collision problem

# Thanks to

