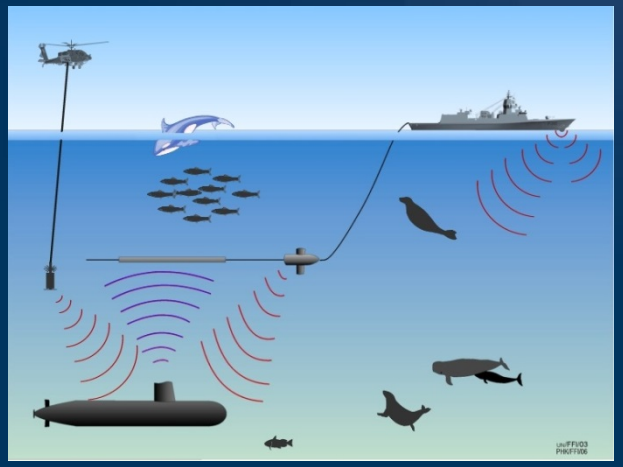
FFI Forsvarets forskningsinstitutt

Norwegian naval perspective on;

1. Active sonar risk management
2. The importance of Behavioral Response Studies
3. Data gaps

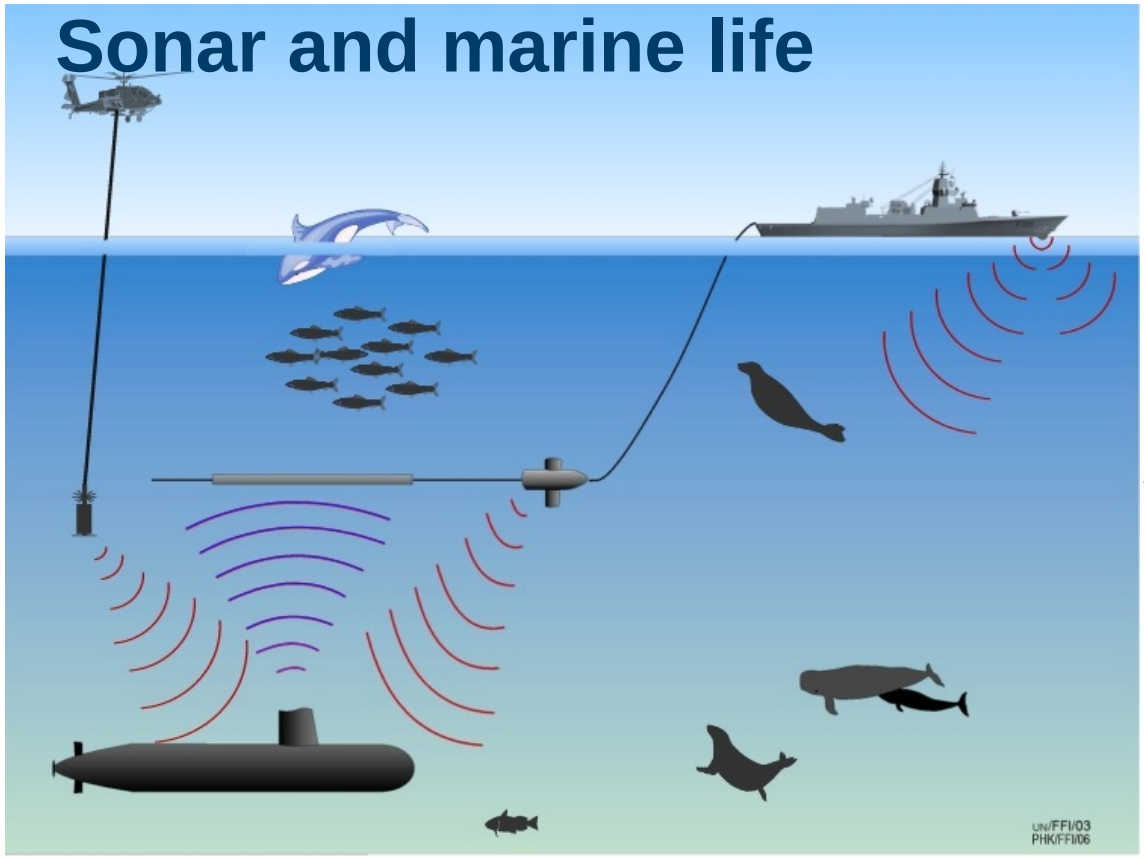


Petter H Kvadsheim

Research manager - Marine Environment

Norwegian Defence Research Establishment

Sonar and marine life



Justification:

-New Nansen-class frigates with powerful sonars operating at lower frequencies than previously operated by the RNoN.

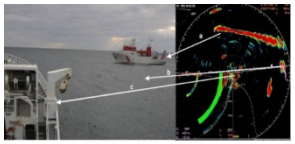
- Whale strandings in connection with sonar exercises (Greece, Bahamas, Canary Islands).

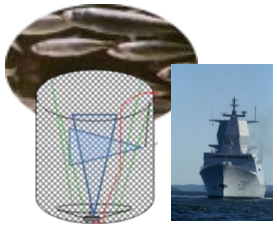
- Flotex 2000 Vestfjorden; allegations that sonar exercise caused herring and killer whales to disappear.

Project objective:
To enable RNoN to operate their sonars in an environmentally safe manner without unnecessary operational restrictions.

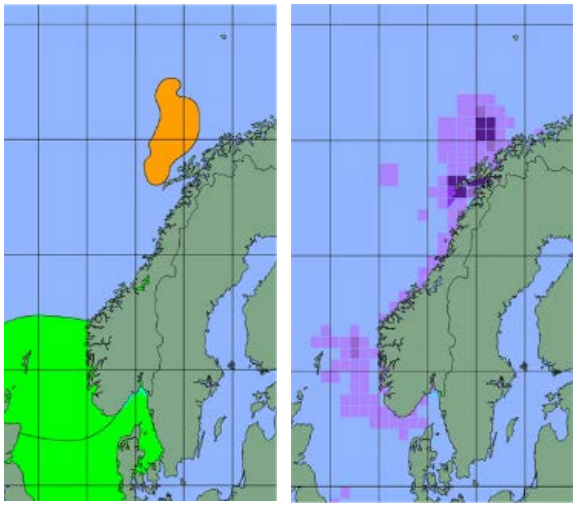
Sonar and marine life research program 2003-2015

Experimentation





SONATE



Sonar Instruction

Publication

Instruction for use of active sonar i Norwegian waters

- Changed name and legal status with increasing level of knowledge
- Sonar Code of Conduct (2005-2006)
- Sonar Guidelines (2007-2009)
- Sonar Regulations (2010-2014)
- Sonar Instruction (2015-)
- Based on science recomendations and operational consideration

- Intended to minimize negative effects of active naval sonars on the marine environment:
  - avoid significant negative effects on populations of fish
  - avoid significant negative effects on individuals and populations of marine mammals
  - avoid significant negative effects on commercial marine activity

Instruks for bruk av aktiv sonar i norske farvann

Fastsettes til bruk i Sjøforsvaret

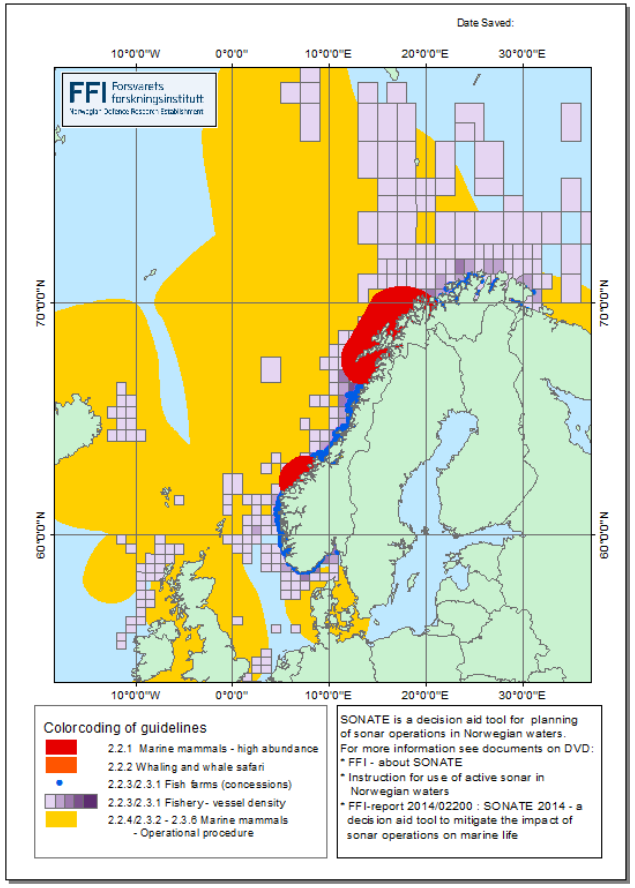
Haakonsvern, 01.april 2015

Wedervang, Thomas T
Flaggkommandør
Sjef Sjøforsvarets skoler

KORTTITTEL:	Instruks for bruk av aktiv sonar i norske farvann
SIKKERHETSGRADERING:	UGRADERT
HJEMMEL:	Bestemmelse for delegering av fagansvar i Sjøforsvaret
GJELDER FOR:	Sjøforsvaret
UTGIVER:	Sjef Sjøforsvarets skoler
FAGMYNDIGHET:	Generalinspektøren for Sjøforsvaret
FAGANSVAR:	Sjef Sjøforsvarets skoler
IKRAFTTREDELSE:	2015-04-15
FORRIGE VERSJON:	Bestemmelse for bruk av aktiv sonar i norske farvann, 31.august 2011

SONATE

Retningslinjer for bruk av aktiv sonar i norske farvann



- **Operational decision aid tool for planning and execution of sonar operations in NOR waters.**
- **All national and visiting vessels operating active sonar in NOR waters are obliged to use it.**
- **Developed by FFI, own by the Chief of the Navy**
- **SONATE WMS (web based). SONATE Off line (ARC VIEW)**
- **All risk and mitigation requirement is pre-assessed in the pre-planning phase in a 2 year cycle**
- **Integrates**
  - **Current knowledge on sensitivity of species**
  - **Distribution and abundance of species**
  - **Fishery activity and other commercial activity**

Mitigation measures

- Monitoring requirement
- Marine mammal restriction zones (density and sensitivity of marine mammal species and type of operation)
- Commercial interests (fishing, whaling, fish farming, whale watching)
- Sound budgeting regime during intensive sonar exercises
- Safety zones from marine mammals and fishing
- Ramp up 3-5 min
- Speed limitations

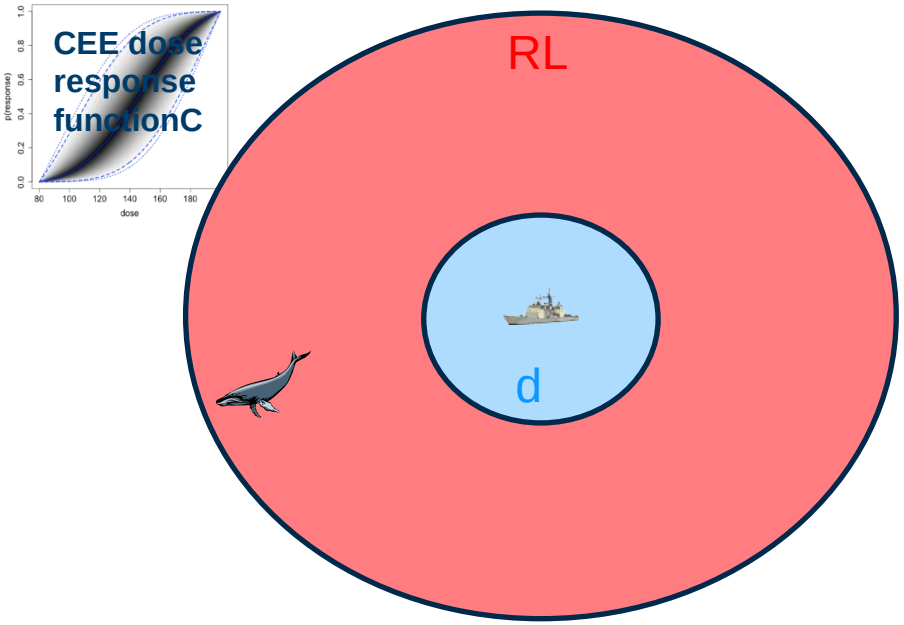
Motivation for doing BRS

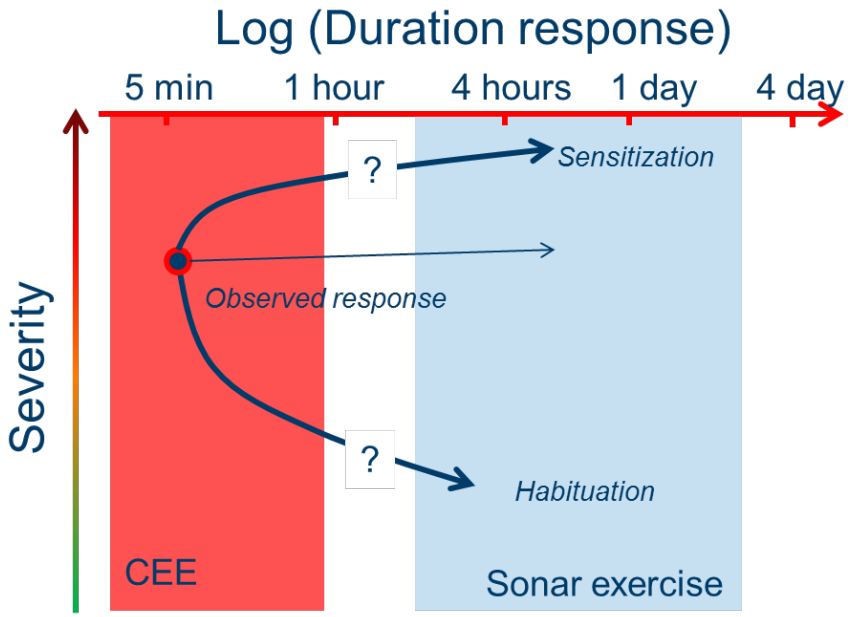
- **Strandings**
- *more information on behavioral responses to understanding the stranding risk better.*
- *behavioral mechanisms which could lead to strandings*
- *DCS study was an important part of this.*
- **Justify management regime**
- *RNON are using criteria for direct injury (TTS/PTS) to manage the sonar issue.*
- *What about beahvioral responses?*
- *In order justify their management regime they therefore initiated BRS. (avoidance/habitat exclusion).*
- **Population level effects of disturbance**
- *Potential for disturbances which could accumulate to population level effects.*
- *The dose response approach became very important in understanding the affected area*
- *What is driving responses (frequency specificity, received level versus proximity etc).*

Future prospect – data gaps

- MOD/Navy recognize some important data gaps.
- Have not been able to fund new research to fill those gaps.
- *«We don’t know everything, but we know enough»*
- As a consequence the SONAR and Marine Life program is terminated.

Data gaps - how to extrapolate from CEE to real ASW?

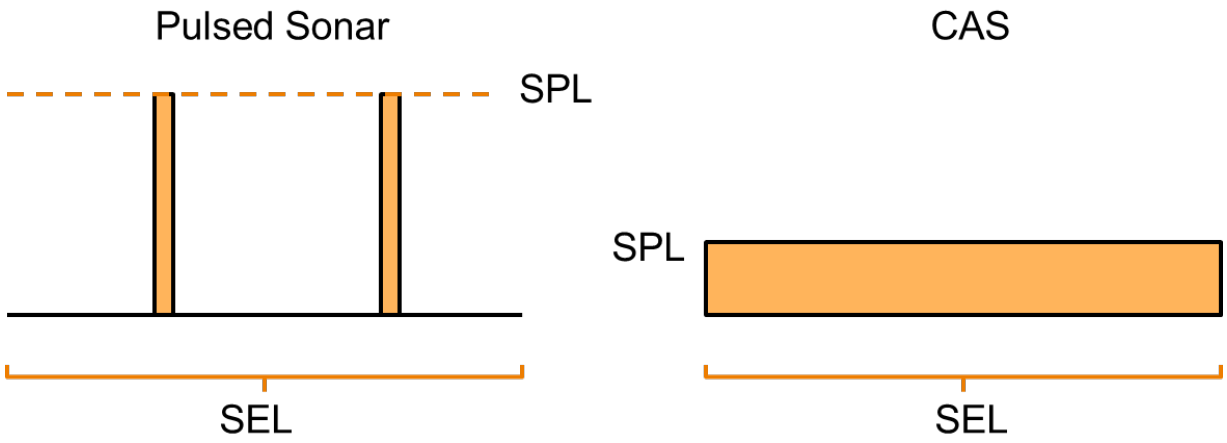




Is it received level or proximity the main response driver?

What is the effect of exposure duration?

Data gaps – new sonar systems



What is the effects of future CAS versus pulsed sonars?

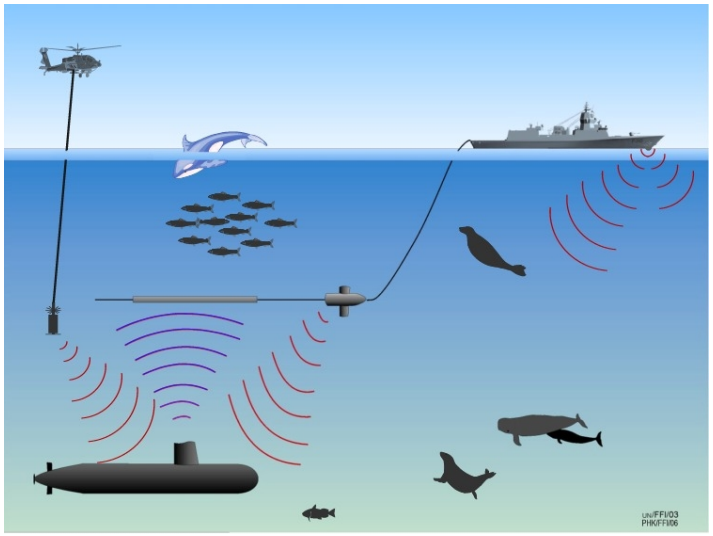
The task

A) How does your nation manage the sonar issue?

B) How is BRS useful in that process?

C) What are the data gaps?

5-10 min presentation



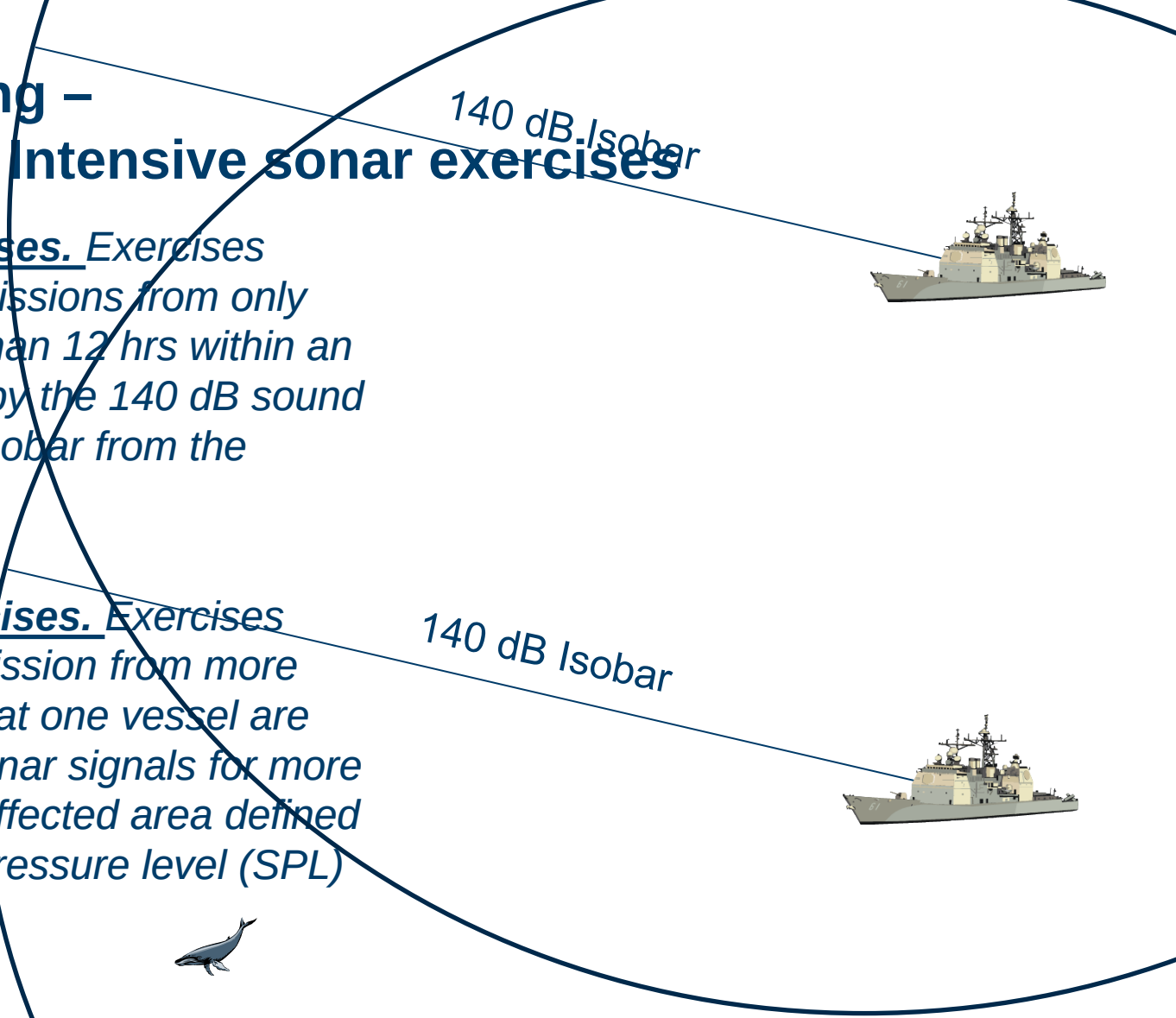
During planning

1. Avoid intensive sonar exercises in areas/periods expected to have **a high abundance of marine mammals**, and in particular feeding areas of beaked whales and sperm whales (annotation *a*, section 4)
2. Avoid intensive sonar exercises in areas/periods with **whaling and whale safari activity**. Forces are instructed to notify stakeholders, when planning to operate in areas/periods with whaling and whale safari (annotation *b*, section 4)
3. To reduce the risk of negatively affecting fishery, a **safety distance from fishing** vessels and fish farms should be maintained (see section 2.3.1).
4. To reduce the risk of inflicting **direct injury to marine mammals**, **procedures for sonar transmission** should be used in all areas/periods where marine mammals are expected to be encountered (see section 2.3.2-2.3.6).

Sound budgeting – Routine versus Intensive sonar exercises

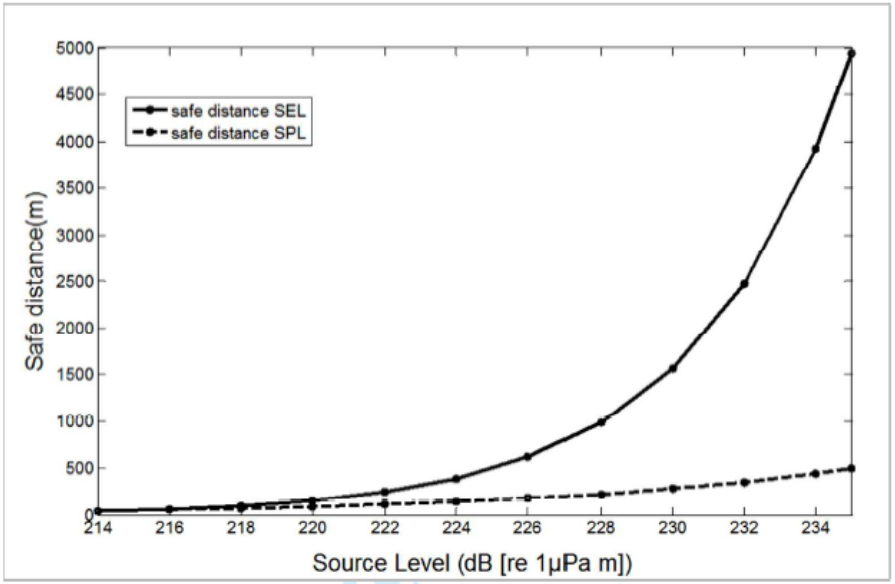
Routine sonar exercises. *Exercises involving sonar transmissions from only one platform for less than 12 hrs within an affected area defined by the 140 dB sound pressure level (SPL) isobar from the source.*

Intensive sonar exercises. *Exercises involving sonar transmission from more than one platform or that one vessel are actively transmitting sonar signals for more than 12 hrs within an affected area defined by the 140 dB sound pressure level (SPL) isobar from the source.*



Operational procedures

Safety distance from fishing vessels and fish farms



Sivle, L.D., Kvadsheim, P.H. and Ainslie, M.A. (2014). Potential for population-level disturbance by active sonar in herring. *ICES J. Mar. Sci.* doi: 10.1093/icesjms/fsu154

A safety distance of 500 m from fishing vessels actively engaged in fishing and from aquaculture installations containing fish should be maintained to avoid negative effects. If the transmitted source level exceeds 225 dB, or duty cycle exceeds 10%, or the speed of the sonar platform is less than 5 knots, the safe distance should be increased to 1000 m

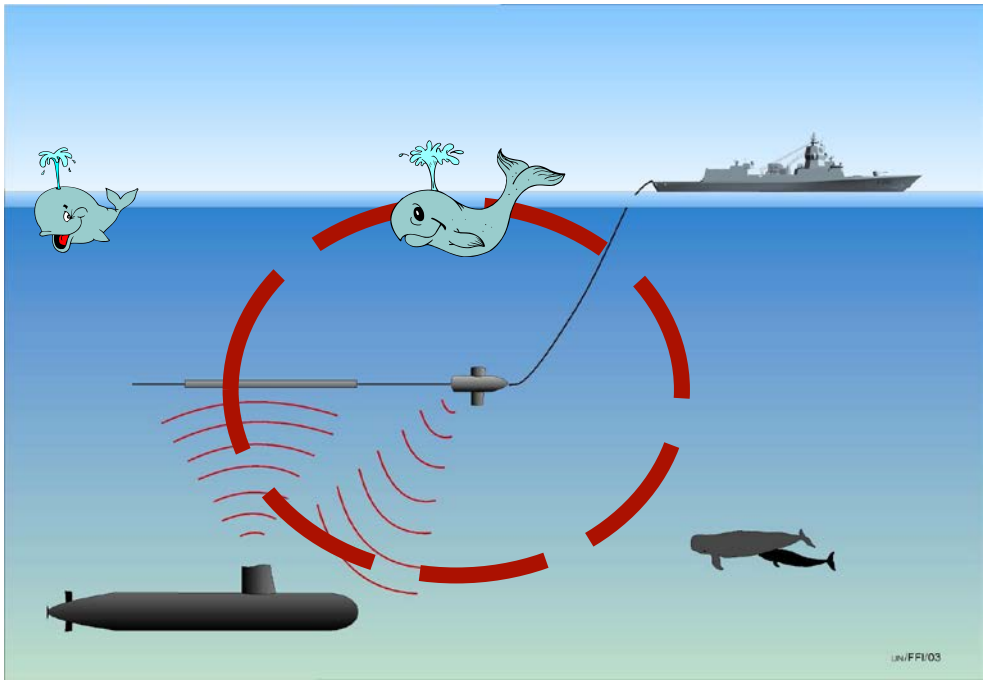
Operational procedures

Safety distance from marine mammals Risk of injury increases >180 dB SEL.

General safety distance of 500 m.
Operations using high SL / high duty cycle / low speed = 1000 m safety distance.

During active sonar transmission at source levels (SL) above 200dB, the danger zone defined by the safety distance should be monitored visually.

If marine mammals appear within the danger zone, transmissions shall be ceased, or source level reduced to 200 dB, until the animal is outside of the danger zone

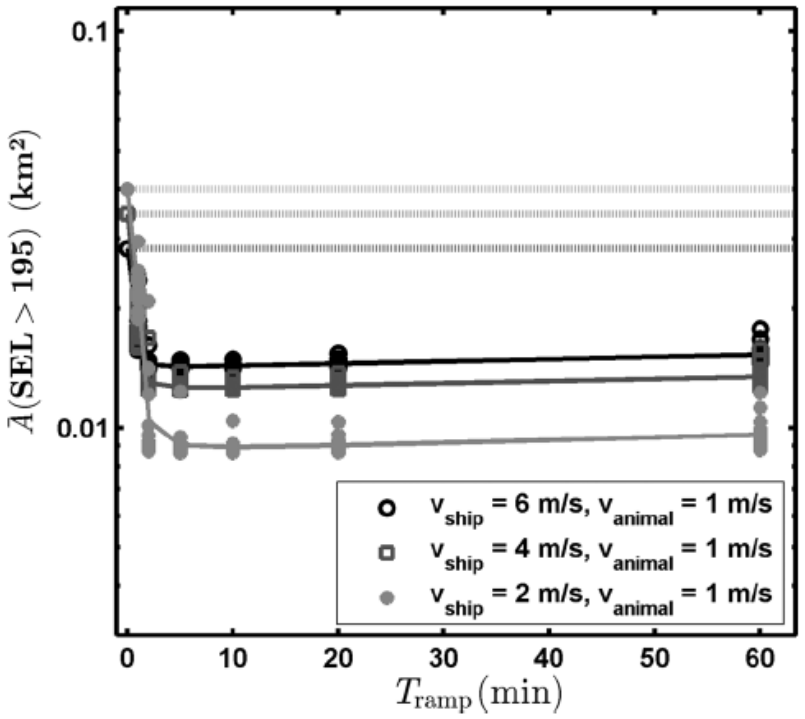


Operational procedures

Ramp Up procedure

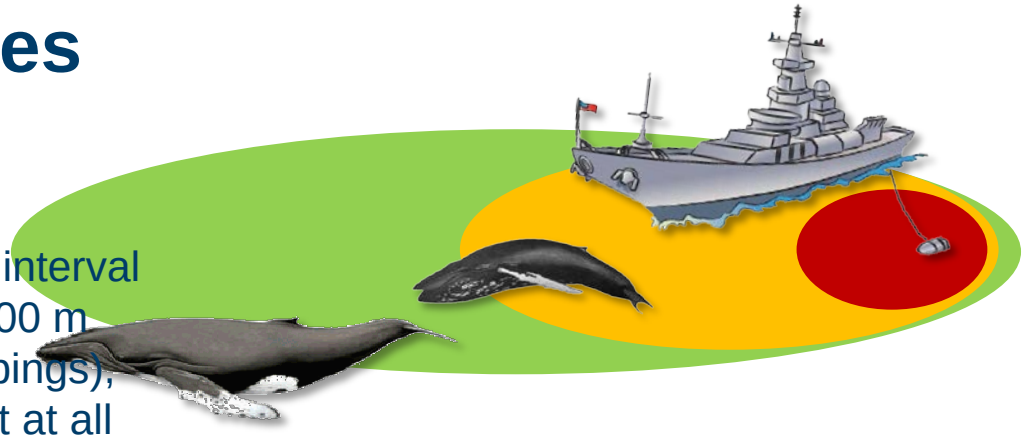
An optimal ramp up reduces risk to marine mammals by allowing animals to evacuate the danger zone around the sonar source before it reaches dangerous levels.

Reduce speed, preferably to less than 8 knots. Start transmissions at reduced source level (maximum 180 dB) and gradually increase the source level over a period of at least 3 min. Use short inter-ping intervals (less than 10 s) and ping durations of 0.3 sec to 1 sec. If transmissions are interrupted for more than 5 min, the Ramp-Up procedure shall be repeated. **If visual conditions do not allow for visual control of the danger zone, the Ramp-Up procedure should always be used**



von Benda-Beckmann, A.M., P.J. Wensveen, P.H. Kvadsheim, F.P.A. Lam, P.J.O. Miller, P.L. Tyack, M.A. Ainslie (2014). Modelling effectiveness of gradual increases in source level to mitigate effects of sonar on marine mammals. *Cons. Biol* 28: 119-128. (DOI: 10.1111/cobi.12162)

Operational procedures



Transmissions at high speed

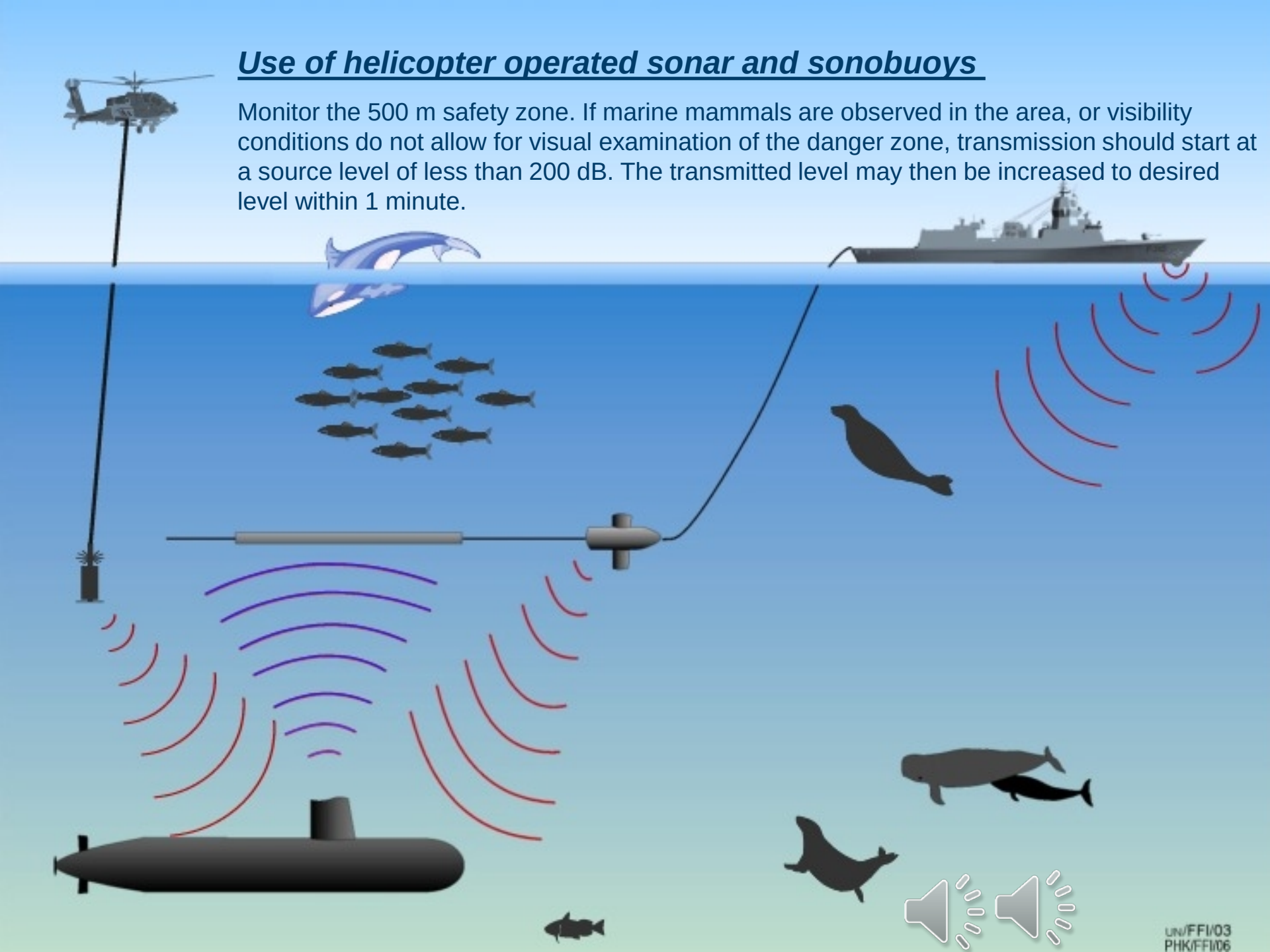
If the vessel speed and the transmission interval imply that the vessel covers more than 200 m between two successive transmissions (pings), or the speed exceeds 15 knots, one must at all times have a strong focus on presence of marine mammals in the travelling direction of the vessel. Transmissions at high speed should be avoided if visual control of the danger zone is difficult.

Transmissions in narrow or constricted waters

During transmissions in narrow or constricted waters one must have a strong focus on the presence of marine mammals in the travelling direction of the vessel to avoid chasing them with the sonar. Transmissions in such waters should be avoided if visual control of the danger zone is difficult. The combination of high speed and narrow or constricted waters must be avoided if visual control is difficult.

Use of helicopter operated sonar and sonobuoys

Monitor the 500 m safety zone. If marine mammals are observed in the area, or visibility conditions do not allow for visual examination of the danger zone, transmission should start at a source level of less than 200 dB. The transmitted level may then be increased to desired level within 1 minute.



UN/FFI/03
PHK/FFI/06

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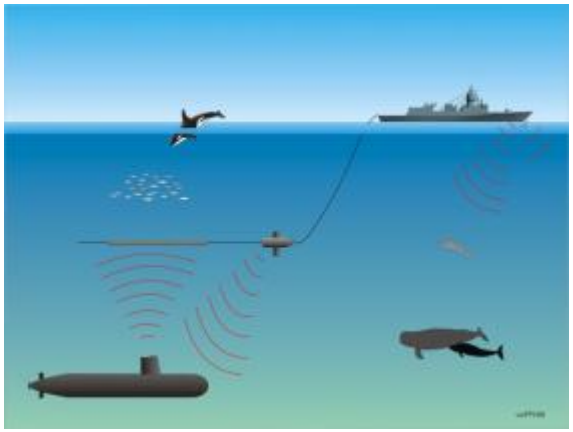
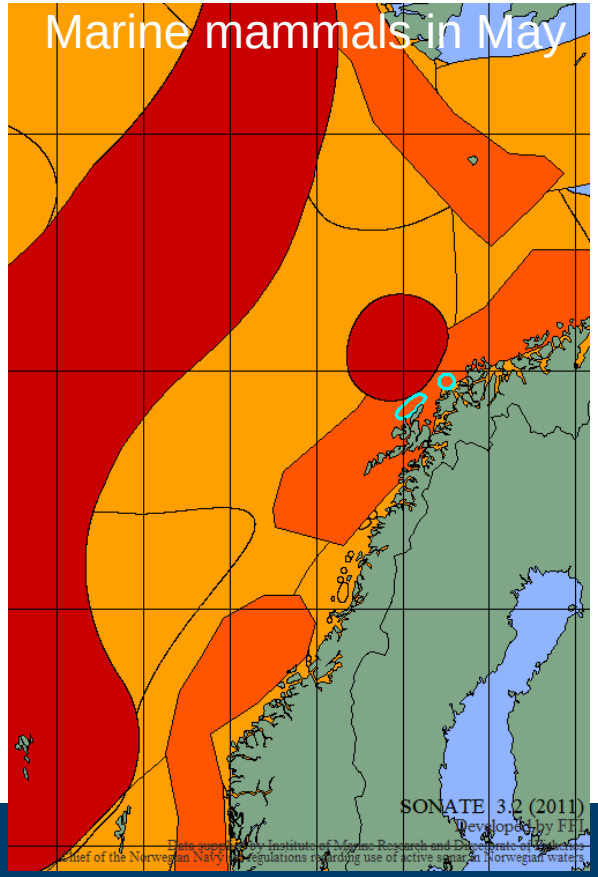
- Integrates
    - Current knowledge on sensitivity of species
    - Distribution and abundance of species
    - Fishery activity and other commercial activity

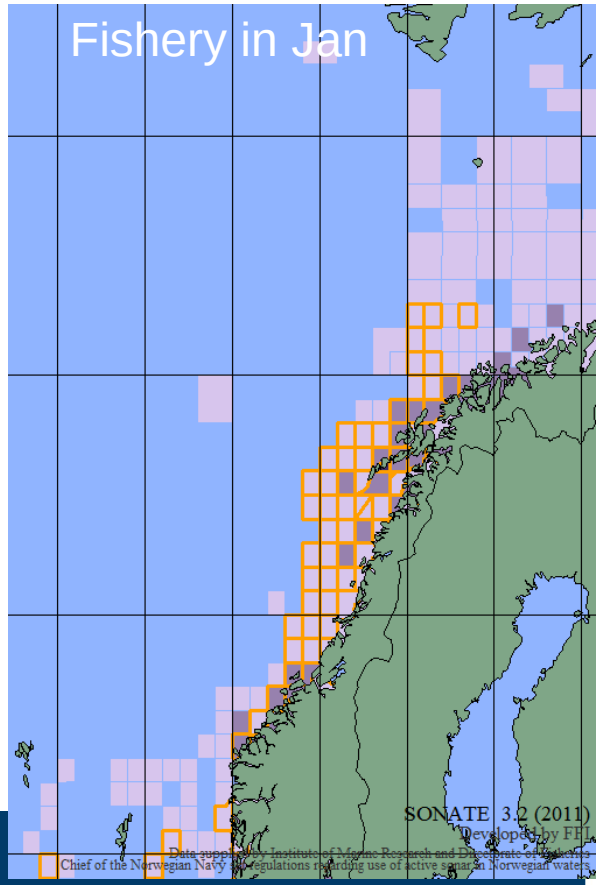
SONATE

Retningslinjer for bruk av aktiv sonar i norske farvann

Farge	Ref. til retningslinjer	Nøkkelord
	3.1	sjøpattedyr - alle øvelser
	3.2	hvalsafari - alle øvelser
	3.3	hvalfangst
	3.4	sjøpattedyr - prosedyre
	3.5	fiskeri - sikkerhetsavstand (500/200m)
	3.6	*oppdrettsanlegg - sikkerhetsavstand 200m*
	3.7	sildeyngel , restriksjoner på CW signaler
		ingen restriksjoner
		utvalg







Sonar guidelines – FISH 2005 v 2015