

# SAKAMATA



**TNO** innovation  
for life

World-wide concern exists about the influence of man-made underwater noise on marine mammals. To assist the Royal Netherlands Navy in planning and performing operations with high power sonar systems, the risk assessment and mitigation tool SAKAMATA was developed.

#### SAKAMATA

TNO has developed the risk assessment and mitigation tool SAKAMATA. This software supports the user in planning and performing active sonar operations in an environmentally responsible way. SAKAMATA quantifies the risk for marine mammals associated with an active sonar operation, taking into account physical injury, temporary hearing impairment and behavioural disturbance. Also, the efficacy of possible mitigation measures, such as variation of the sonar parameters, ramp-up schemes or alternative operation areas are presented to the operator.

#### SENSITIVE ANIMALS

Marine mammals such as whales and dolphins spend most of their lives submerged and have a very well developed auditory system. They use sound for a variety of activities, such as feeding, navigation and social communication. As most marine mammals have good hearing sensitivity they

may be particularly vulnerable to high sound intensities. Mass strandings of whales after the use of military sonar systems have brought the concern about the effects of active sonar on marine mammals to the attention of a much wider public.

#### RESPONSIBLE USE OF ACTIVE SONAR

SAKAMATA was officially introduced on the RNLN fleet in March 2010 and is now part of the RNLN procedure for responsible use of sonar systems. Further development of SAKAMATA is performed in close collaboration with several marine mammal research projects which focus on studying the impact of sonar on marine mammals and collecting the necessary environmental and marine mammal information.

#### SAKAMATA INPUT

SAKAMATA is operated via a user-friendly user interface. A scenario can be defined by positioning a platform on a map and selecting a sonar. The risk assessment is based on



Assessment display

models for the occurrence, hearing characteristics and behaviour of marine mammals, combined with models of sonar systems, the environment and the TNO underwater sound propagation model ALMOST. A marine mammal database provides information on the population density of all marine mammals present at the chosen location at the selected time of year, as well as information on hearing sensitivity, swim speed and other relevant parameters per marine mammal species. Environmental information is taken from a database or specified manually by the user.

**RISK ASSESSMENT**

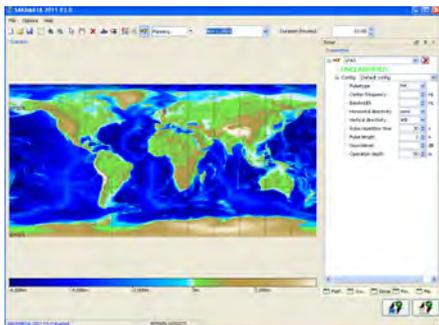
An exposure assessment is carried out based on these input parameters, the above-mentioned models and the sound propagation as computed by the ALMOST model. The total risk of the sonar operation is quantified by the number of marine mammals affected, taking into account physical injury, temporary hearing impairment and behavioural disturbance. The risk can be viewed for the total number of marine mammals affected, or specified by marine mammal sensitivity group, or even by species.

**MITIGATION MEASURES**

The output screen provides not only the risk assessment results, but presents also possible mitigation measures to the user. If the user has indicated that the operation is still in the planning phase, the risk will also be calculated for the same operation carried out at an earlier or later stage. Also changes in sonar parameters can be altered, such as source level, pulse length or pulse repetition time, a change in ship speed or operation duration. A ramp-up advice is given that can be used to slowly increase the source level of the sonar, which gives animals time to swim away. This provides insight in the variations of the risk over time (due to changes in sound propagation and marine mammal density). Finally, a plot of marine mammal density is presented to give an idea of the areas with high marine mammal density and hence possibly a higher risk. All mitigation advice is in line with Dutch and NATO guidelines.

**ADAPTATIONS**

The SAKAMATA software package is commercially available and can be adapted to your specific wishes and your nation's laws.



Input display

TNO.NL



**SAKAMATA was developed by TNO Defence, Safety and Security under contract for the MOD NL.**

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