Copy No.________

Defence Research and Development Canada   Recherche et développement pour la défense Canada

DEFENCE R&D DÉFENSE

DRDC Atlantic Q-273 SEA TRIAL

Marine Mammal Impact Mitigation Plan

James A. Theriault

John Bottomley

Defence R&D Canada – Atlantic

Technical Memorandum

DRDC Atlantic TM 2003-044

May 2003

Canada

This page intentionally left blank.

DRDC Atlantic Q-273 SEA TRIAL

Marine Mammal Impact Mitigation Plan

James A. Theriault
John Bottomley

Defence R&D Canada – Atlantic

Technical Memorandum

DRDC Atlantic TM 2003-044

May 2003

Author

James A. Theriault

Approved by

D.M.F. Chapman

Acting Head/Technology Demonstration Section

Approved for release by

Kirk Foster

DRP Chair

Abstract

The Canadian Navy has a continuing requirement to acoustically detect both surface vessels and submarines. Defence Research and Development Canada (DRDC) through DRDC Atlantic has embarked on the first phase of development of the next generation of operational sonars for the Canadian Navy. The Towed Integrated Active Passive Sonar (TIAPS) Technology Demonstrator (TD) is being developed to demonstrate basic sonar capability and will serve as a testbed for further concept development. Q273 is the sixth in a series of sea trials that are required to develop and demonstrate this capability. Since acoustic energy will be transmitted during the trial, a Marine Mammal Impact Mitigation Plan has been developed to detail the procedures to be used. This document describes the procedures.

Résumé

La marine du Canada a un besoin continue de détecter par voie acoustique tant des navires de surface que des sous-marins. La Direction de la recherche et du développement pour la défense Canada (RDDC), par l’intermédiaire du RDDC Atlantique, aborde la première phase de développement de la prochaine génération de sonars opérationnels pour la marine canadienne: le sonar remorqué intégré actif et passif (TIAPS). Le démonstrateur de la technologie TIAPS fera la démonstration de la fonction de sonar de base et servira de banc d’essai pour le développement du concept. Le Q273 est le sixième d’une série d’essais en mer requis pour mettre au point cette fonction et en faire la démonstration. Puisque de l’énergie acoustique sera transmise durant ces essais, un plan d’atténuation des risques pour les mammifères marins a été élaboré pour préciser la marche à suivre. Le présent document décrit les problèmes et les méthodes.

This page intentionally left blank

Executive Summary

Introduction

The Canadian Navy has a continuing requirement to acoustically detect both surface vessels and submarines. The Defence Research and Development Canada (DRDC) through the DRDC Atlantic is embarking on the first phase of development of the next generation of operational sonars for the Canadian Navy: the Towed Integrated Active Passive Sonar (TIAPS). The TIAPS Technology Demonstrator (TD) will demonstrate basic sonar capability and will serve as a testbed for concept development. The TIAPS TD project (1cm) will integrate both active and passive sonars in a single system. By lowering the frequency from traditional hull mounted sonar frequencies and by giving the sonar a variable depth capability, longer range active detections can be achieved. Passive sonars have the advantage of being covert and allowing for the possibility of positively identifying a class of target by its acoustic signature. Not only will both active and passive capabilities be included in TIAPS, but also a high priority is placed on combining their capabilities. TIAPS will make use of the Sonar Information Management System to fuse sonar data with information from the ship's Command & Control system, and will in turn provide information for the Command & Control function. In developing such a system, a number of sea trials are required. Q273 is the sixth in the series of R & D trials. Though Q273 is not a full sonar trial, acoustic transmissions are to be used to meet the trial objectives.

Results

In order to minimize potential impact on marine mammals, an impact mitigation procedures will be exercised during for the trial. This technical memorandum documents the mitigation efforts to be used during the trial.

Theriault, James A., Bottomley, John; 2003; DRDC Atlantic Q-273 Sea Trial Marine Mammal Impact Mitigation Plan; DRDC Atlantic TM 2003-044, Defence Research and Development Canada – Atlantic.

Sommaire

Introduction

La Marine canadienne a un besoin constant de procéder à une détection acoustique de navires de surface et de sous-marins. Recherche et développement pour la défense Canada (RDDC) entame, par le biais de RDDC Atlantique, la première phase de développement de la prochaine génération de sonars destinée à la Marine canadienne, soit le sonar remorqué intégré actif passif (TIAPS). Le démonstrateur de technologies (DT) TIAPS prouvera la capacité de base du sonar et servira de banc d'essai à l'élaboration de concepts. Le projet de DT TIAPS (1 cm) intégrera à la fois un sonar actif et un sonar passif dans un système unique. On peut réussir des détections actives à grande distance en diminuant la fréquence émanant des fréquences du sonar de coque traditionnel et en dotant le sonar d'une susceptibilité de profondeur variable. Les sonars passifs ont l'avantage d'être discrets et d'offrir la possibilité d'identifier positivement une classe d'objectif par la signature acoustique de celle-ci. Non seulement on inclura dans le TIAPS les capacités et active et passive mais on accordera également une haute priorité au fait de combiner ces capacités. Le TIAPS utilisera le Système de gestion de l'information sonar pour fusionner les données sonar avec l'information obtenue du système de commandement et de contrôle du navire. Il fournira à son tour de l'information pour la fonction de commandement et de contrôle. L'élaboration d'un tel système requiert un certain nombre d'essais en mer. Le Q273 est le sixième d'une série d'essais de R & D. Le Q273 n'est pas un essai sonar complet, mais des transmissions acoustiques sont nécessaires à l'atteinte de ses objectifs.

Pour minimiser les incidences possibles sur les mammifères marins, on adoptera des procédures d'atténuation des incidences pendant l'essai. Ce document technique consigne les mesures d'atténuation à prendre pendant l'essai.

Theriault, James A., Bottomley, John; 2003; DRDC Atlantic Q-273 Sea Trial Marine Mammal Impact Mitigation Plan (Plan d'atténuation des incidences sur les mammifères marins); DRDC Atlantic TM 2003-044, Recherche et développement pour la défense Canada – Atlantique (RDDC Atlantique).

Acknowledgements

The plan for marine mammal impact mitigation set out in this document is based on the previous plans developed in support of sea trials. Those plans were based upon the principles used in a 1998 CAN/UK LFA sea trial and an approach put forward through The Technical Co-operation Panel (TTCP) Maritime Technical Panel - 9. Dr. E. Harland (formally of DERA/Winfrith & now with QinetiQ in the UK) contributed the major part of the methodology. Dr. Harland's contributions to the mitigation measures are consistant with the approaches proposed by the UK Joint Nature Conservation Committee. Further input came from LCdr. W. Nolan and D. Jones of DRDC Atlantic. Previous versions of this approach were used for trials Q248(2000), Q258 (2001), Q264(2001) , Q266(2002) and Q271(2002).

Table of contents

This page intentionally left blank.

1. Introduction

To meet the Canadian Navy's continuing requirement to acoustically detect both surface vessels and submarines, it is necessary to improve the performance of both passive towed array sonars and active sonars. In searching for the modern, quiet submarine, the detection range of current active sonars is inadequate; the emerging solution involves low frequency active (LFA) sonars. Low frequency (LF) sound propagates better in the ocean and is more difficult to counter using anechoic coatings. Typically, a shipborne tactical LFA sonar would employ a towed array receiver and a towed LF source.

The Canadian Navy's requirement for a tactical sonar has driven the frequency to be significantly higher than a surveillance system. A lower frequency surveillance system would have greater detection range, but would also be larger and more difficult to employ based on the Canadian Navy's vessel assets and roles. Whatever advantages an LFA sonar may provide, there remains a role for the covert, passive towed array sonar. The full requirement for acoustic detection is therefore met by an integration of an LFA sonar with a passive towed array sonar: a Towed Integrated Active/Passive Sonar (TIAPS) [1].

DRDC ATLANTIC Cruise Q273 is the sixth in a series of sea trials that are planned during technical development and demonstration of this LFA sonar. Underwater Acoustic transmissions will be a necessary part of the tests during this development project. While DRDC Atlantic has been conducting LFA trials in these waters since 1992 with no adverse affects reported [2], it is believed that some cetaceans could be affected by high power sonar transmissions. Although there is no conclusive evidence to support this, LFA sources can be very loud and the precautions set out in this document are aimed at minimizing any potential impact. The precise manner in which sounds (loud or soft) might lead to harm in marine mammals is not fully understood, although it stands to reason that placing a very loud sound source too close to the ear of a any animal could be injurious.

This document sets out the precautions to be observed during the Q273 sea trial in order to minimize potential hazards of low frequency energy on the marine mammal population in the trial areas. Although this mitigation plan is specific to sea trial Q273, it builds upon lessons learned from previous trials of LFA projectors and contains several generic elements that provide the basis for similar mitigation plans for future trials. Note that these procedures do not apply to the vessel's navigational sonars such as depth sounder or doppler current meter.

2 Geographic Areas

The trials will be conducted in a number of a large geographic areas. Table 1 lists the operating areas. Figure 1 shows the approximate geographical location of the planned trial areas. After leaving Halifax on March 31, 2003, CFAV Quest will transit to Area 1 (Marlant Op Area) where work will commence. This will be followed by a port visit in Bermuda before moving to Area 2 (Sargasso Sea) where a significant portion of the work will take place. Some work will be undertaken in Area 3 (Hatteras Abysil Plain) as CFAV Quest transits back to Area 1 to complete the tests.

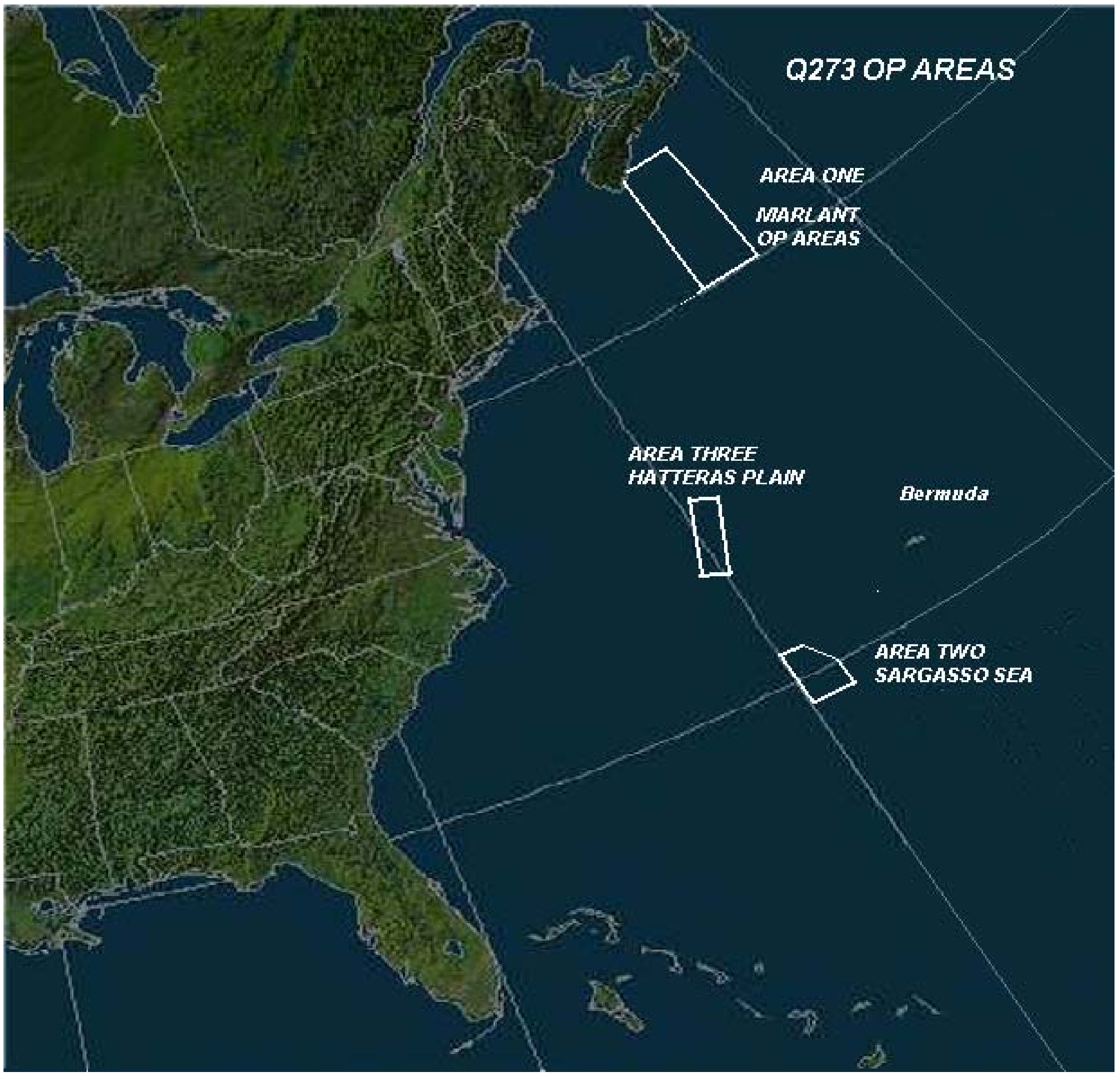

Figure 1. Q-273 Operating Areas

Operating Areas	Bounded by Geographical Coordinates
Area 1: Marlant Operating Area	44º 00'N 65º 00'W 44º 00'N 62º 00'W 40º 00'N 62º 00'W 40º 00'N 65º 00'W
Area 2: Sargasso Sea	31º 00'N 70º 00'W 31º 00'N 68º 45'W 30º 00'N 67º 45'W 29º 00'N 67º 45'W 29º 00'N 70º 00'W
Area 3: Hattaras Plain	35º 20'N 69º 55'W 35º 20'N 69º 15'W 32º 40'N 71º 00'W 32º 40'N 71º 40'W

Table 1: Q-273 Trial Areas

3 Review of Relevant Species

3.1 Mysteceti

This sub-order of the order cetacea, the whales and dolphins, includes all the baleen whales, from the blue whale down to the minke whale. This group is characterized by the baleen plates used instead of teeth to filter their food from the water. They are passive feeders which operate by taking large quantities of water into their mouths and then forcing it back out through the baleen to filter out plankton and other small organisms. Because they do not have to chase their prey they have not developed echolocation. The only sounds they make are used for inter-animal communication and perhaps for long range navigation. The sounds are in the frequency range 10 Hz to 5 kHz, with the largest species producing the very low frequencies.

In the MARLANT OP Areas (Area 1), a number of these whales may be evident but it is likely that their southward migration will have commenced. Although minke whales are concentrated in Area 4 during the summer, there has been no conclusive evidence that they leave the area for the winter. Sei whales, blue whales, fin whales, and humpback whales are believed to migrate south for the winter. Of special concern are endangered species such as the northern right whale. It is not expected that any northern right whales will be in our trials areas [3] at the time of the trial. These animals are the most likely to be affected by high power sonar transmissions since they do not transmit their own high power echolocation signals and usually do not have to cope with very loud acoustic signals.

It is unlikely to observe a significant number in Areas 2 (Sargasso Sea) and 3 (Hatteras Plain). However, migratory animals may stray from their inshore or Gulf Stream migratory routes. Of note is that though the majority of the animal observations have been made closer to the coastal areas, this may be an artifact of the shipping densities in those areas.

When these animals are detected within the trials area the precautions identified in Section 5 must be observed.

3.2 Odontocetes

This cetacean sub-order includes all the toothed whales, ranging from the sperm whale down to the harbor porpoise. Unlike the baleen whales, this group has teeth and actively chase their prey, which include fish and squid. In order to find their prey in the limited visibility encountered underwater they have evolved a system of echolocation in which a short high power acoustic pulse is emitted and echoes from the prey animals are detected to provide positional information. This echolocation system works on frequencies varying from 140 kHz for the harbor porpoise down to 2 kHz for the sperm whale. In addition to echolocation, many species within this sub-order also produce tonal signals for inter-animal communication. Depending on the species, these frequencies range between 1kHz and 25 kHz. Some animals within this group are capable of producing a third type of sound which is produced in a manner similar to echolocation pulses. These sounds are transmitted at lower power with a higher repetition rate (> 1000 repetitions per second). The sounds have variously been described as ratchets, squawks and mews.

The Odontocetes are usually tolerant of sources of loud noise. Occasionally they will come close to investigate loud noise sources even when the transmissions are at a very high level. On several occasions during sonar development trials, the commencement of transmissions has been followed by a number of animals approaching the ship to investigate the noise. This behaviour should not be interpreted as meaning they are not affected by such noise sources. Like most creatures they will investigate strange new sounds that appear in their environment but may be forced to move away from the area by the intensity of the sound.

The harbour porpoise spends most of its summer inshore but is thought to move offshore for the winter, sometimes moving south. The northern bottlenose whale is believed to be in abundance in proposed Marine Protected Area known as “The Sable Gully” to the north with at least some animals wintering over. None are expected in our Op areas. Little is known regarding the migration of the Sowerby’s beaked whale except that it probably lives some distance offshore. The Blainville’s beaked whale is rarely observed. It is conjectured that they prefer the deep waters to the east. True’s beaked whales are often associated with the Gulf Stream and are not expected in the area. Killer whales prefer deep water and do not demonstrate any regular migrations. There is a small possibility that killer whales may be in the area.

As a precautionary measures the procedure set out in section 5 shall be followed if any animals are observed within the vicinity of the ship. Although some experts theorize that Odontocetes are less affected than baleen whales by high intensity sound, circumstantial evidence (mass strandings correlated with high power sonar research trials and military exercises) has suggested that toothed whales can be adversely affected by high power acoustic transmissions.

3.3 Pinnipeds

This group of animals includes all the seals and associated species. The pinnipeds seem fairly tolerant of high sound levels. Attempts to scare them away from fish farms are usually only successful for a short period until the animals become habituated to the sounds. Although it is unlikely that the transmissions made during this trial will affect any pinnipeds the precautions set out below will be followed.

4 Monitoring for Marine Mammals

4.1 Visual Monitoring

During periods of sonar transmissions, a visual watch for marine life will be maintained and the "reporting forms" included in this document will be properly maintained. All sightings shall be reported to the Chief Scientist immediately in order to facilitate the implementation of the appropriate mitigation procedures. Where possible, the animals should be identified with the aid of an identification book. There shall be a log entry for every watch, including those where there were no marine mammal sightings. It is also important to identify the total sighting effort even when animals are not seen. A summary form for sighting effort will be provided together with guidance notes on how to complete the form. Where possible photographs or videos of the animals should be taken to confirm identification. At night, the visual watch shall be maintained using night vision binoculars.

4.2 Acoustic Monitoring

An acoustic watch will be kept by trial personnel monitoring information from sonobuoys or towed hydrophones. This will assist with the detection of baleen whales, sperm whales, bottlenose whales and vocalizing dolphins.

Beaked whales have only been recorded vocalizing when stranded. Sperm whales on the other hand are quite vocal and employ a variety of sound patterns in a predominant frequency range between 10 kHz and 16 kHz but they have been observed to use frequencies as low as 200 Hz and as high as 32 kHz. Pygmy and dwarf sperm whales are less vocal but may make use of a very directional echolocation scheme.

Bottlenose whales range in the northern waters off Nova Scotia. They have been recorded using a variety of chirps, clicks and tones usually around 4 kHz.

It is very unlikely that seals will be detected acoustically.

Reporting and recording of acoustic contacts will use the same procedure as visual sightings. Any potential biological contacts will be immediately brought to the attention of the Chief Scientist. Acoustic contacts identified as being man made shall also be logged.

5 Precautions to be Taken

The first precautionary component is to ensure that active, acoustic transmissions are not made without scientific or technical objectives and that the source levels specified shall be the minimum necessary to meet the scientific or technical objectives of the test or experiment. The specification of required source levels shall be undertaken during the planning stages through requirement definitions and awareness of the principal investigators and their technical support staff.

At the start of a period of sonar transmissions a thirty minute "Whales Away" sequence will be transmitted. The sequence has been designed to alert animals to the presence of an increasingly loud acoustic source - in the hope that it will compel any marine life disturbed by the sound to avoid the area around the transmitting vessel. "Whales Away"' will normally commence with the on-axis source level starting at 160 dB re 1 µPa @ 1m and will build up to the maximum power to be used during the test or experiment. The "Whales Away" procedure shall be repeated if any break in transmissions lasts for more than two hours. Special care shall be taken to ensure that the ramp up transmissions do not exceed the intended source levels to be used in the experimental session.

- If any baleen whales are observed within 1 nautical mile of the transmitting ship, all active transmissions shall cease. Any subsequent "Whales Away" sequence must not start until the animals are at least 1nm away from the ship.

- If any other species of marine mammals close to within 6 cables (~ 1 km) of the transmitting ship, then active transmissions shall be suspended until the animals clear the area.

5.1 Acoustic Modelling

Transmission loss can be modeled for the experiments that require all but very low source levels. Modelling can often be undertaken in direct support of an experiment where there are specific concerns about the environmental impact. A fundamental requirement for realistic acoustic modeling is having accurate knowledge of the properties of the water column in which one is working. Accurate water temperature profiles from the sea surface to the bottom are vital for forecasting acoustic propagation. The expendable bathythermograph (XBT) is the primary tool for acquiring temperature profiles and XBTs will be taken at regular intervals (at least daily) during sea trials. If high variability is observed, a higher deployment rate will be used. Nominally, in deep water it can be shown that the transmission loss at one kilometre will be ~60dB (assuming spherical spreading).

6 Post Trial Follow-up

In addition to keeping acoustic and visual watch for marine mammals and recording all observations it is intended that transmitting will occur at source levels no higher than necessary for the planned experiment or test. Any marine mammal problems (including strandings) that occur after the first transmission and within two weeks of the last transmission in the trial area will be followed up and investigated by DRDC Atlantic Staff.

7 Summary

The DRDC Atlantic sea trials in support of the TIAPS technology demonstration project require the transmission of acoustic energy in order to meet technical and scientific objectives. With the transmission of acoustic energy comes awareness of the potential impact on the marine environment. This document specifies the procedures that will be used during the sea trials with the aim of mitigating any potential impact on marine mammals.

References

1. James A. Theriault, “Towed Integrated Active/Passive Sonar System Concept,” DREA Technical Memorandum 1999-093, July 1999.

2. James A. Theriault, “DREA Q258 Sea Trial Marine Mammal Impact Mitigation Report,” DREA Technical Memorandum 2001-044, May 2001.

3. Robert, Kenney, “Right Whale Distribution and Migratory Patterns,” in proc. of “Shipping/Right Whale Workshop,” New England Aquarium Reprot 97-3, April 1997..

4. M Carwardine. “Whales, dolphins and porpoises: The visual guide to the world’s cetaceans.” 1995. Dorling Kindersley Ltd, ISBN 0-7513-1030-1.

5. Sam H. Ridgeway and Sir Richard Harris, Handbook of Marine Mammals, Volume 4: River Dolphins and the Larger Toothed Whales, Academic Press, 1989.

Annexes

Annex A
Guide to Using the Marine Mammal Recording Forms

There are two forms to be completed. The first records basic information on where and how searches for marine mammals were conducted (“Location and Effort Data”). The second form is used for reporting relevant information on each sighting of marine mammals (“Record of Sightings”).

A.1 Location and Effort Data

One line on the “Location and Effort Data” form should be filled in for every watch period, regardless of whether marine mammals were observed. This form includes basic information such as date, observer name, ship's position and weather. It is important to note the length of time during each watch that the sonar transmitter was operating. Wind direction should be given to the nearest compass point in knots. Visibility should be recorded as poor (i.e. less than 1km), moderate (1-5km) or good (greater than 5 kms).

A.2 Record of Sighting

The sighting form must be completed when marine mammals are observed. The required details are self-explanatory. Amplifying details regarding some items are provided here for clarification.

Position - This is the latitude & longitude at time of sighting.

Projector Depth - This should be in metres.

Species - Identify species as far as possible - if the actual species cannot be identified, then note as much information as possible. For example, if it’s obviously a whale and not a dolphin, but the type of whale is not known, write down ’whale’. Useful categories are “whale”, “large whale”, “medium whale”, “small whale”, “dolphin”, “patterned dolphin”, “seal” etc. It can also be useful to eliminate species e.g.: “medium-sized whale but not killer whale”. A guide for cetaceans will be provided to help with identification.

Total number - If it is difficult to tell exactly how many animals are present then estimate minimum and maximum number e.g. 5-8.

Number of adults/number of juveniles - If it is difficult to tell how many of each age group there are, an estimate of the minimum e.g. at least 3 adults, at least 2 juveniles, should be made.
Description - It is useful to include a description of the animal, even if specific identification has been made. Try to describe the salient features e.g. “hourglass

pattern on flanks”. If animal type is uncertain, then more detail will aid in any subsequent requirements for identification. Features and description characteristics are suggested on the form. A rough sketch on the back of the form, may be useful (e.g. shape of fin, shape of patterning).

Photograph or video taken - This will help later with identification.

Behaviour - If there is more than one sort of behaviour, then record all behaviours observed. Examples of behaviour are: normal swimming, fast swimming, porpoising, breaching (animal launches itself clear of the water), tail slapping (animal slaps tail on water surface), sky pointing (animals almost vertical in water with head pointing toward the sky), feeding, resting, avoiding ship, bow riding etc.

Ship's activity - e.g. in transit, deploying equipment, towing HPA etc.

Sonar operating - This is important information. Note whether the sonar is transmitting or not when the animal(s) are sighted.

Closest Point of Approach (CPA) - This should be filled in whether or not the sonar is operating when animals are observed. The CPA should be given in range and bearing from the ship e.g. Starboard beam 200 metres or Port quarter 500 metres. Be sure to specify range units (metres, yards, cables, miles etc).

Queries regarding the use of the forms should be addressed to

Chief Scientist,
Cruise Q-273,
DRDC Atlantic,
PO Box 1012
Dartmouth, NS B2Y 3Z7.

Completed forms shall be submitted to the Chief Scientist.

MARINE MAMMAL RECORDING FORM
LOCATION AND EFFORT DATA
(May be reproduced locally)

Ship ___________________________

Record the following information every watch, regardless of whether marine mammals are observed or not.

Date	Observer	Ship's Position (Lat & Long)	Watch Hours		Length of time sonars were operating	Wind Speed & Direction	Visibility: P-poor M-moderate G-good
			Start	Finish			

This page left intentionally blank.

MARINE MAMMAL RECORDING FORM
RECORD OF SIGHTING
(May be reproduced locally)

Options in italics should be circled or underlined as appropriate.

<table>
<tr><td colspan="2">Date</td><td colspan="2">Time (GMT)</td></tr>
<tr><td colspan="2">Ship</td><td colspan="2">Observer</td></tr>
<tr><td colspan="3">Ship's Position</td><td>Water Depth (metres)</td></tr>
<tr><td colspan="2">Species</td><td colspan="2">Certainty of Identification
Definite/Probable/Possible/not known</td></tr>
<tr><td colspan="2">Total Number of Animals</td><td colspan="2">Number of Adults

Number of Young</td></tr>
<tr><td colspan="3" rowspan="2">Description (include features such as overall size; shape of head; colour and patterning; size, shape and position of dorsal fin; height, direction and shape of blow)</td><td>Photo/Video taken?
Yes/No</td></tr>
<tr><td>Direction of travel of animals relative to the ship:</td></tr>
<tr><td colspan="3">Behaviour</td><td>Direction of travel of the animals:</td></tr>
<tr><td>Activity of Ship</td><td colspan="2">Sonar operating?
Yes/No</td><td>CPA of the Animals</td></tr>
<tr><td>Other ships within 1 km?
Yes/No</td><td colspan="2">Sea State</td><td>Visibility</td></tr>
</table>

Please continue overleaf if more information is available.

This page left intentionally blank.

Distribution List

LIST PART 1: CONTROLLED BY DRDC LIBRARY

3 DRDC Atlantic LIBRARY FILE COPIES
3 DRDC Atlantic LIBRARY (SPARES)

2 AUTHOR (1 copy for each author, if more than one)
1 Director General/DRDC Atlantic
1 DDG/DRDC Atlantic
1 Chief Scientist /DRDC Atlantic
1 SO Env DRDC Atlantic
1 CFLO
1 M/TS
1 H/TD
1 H/MIS
1 H/UA
1 PM TIAPS
1 GL/TIAPS Arrays
1 GL/TIAPS Data Systems
2 Chief Scientist Q273 (2 copies)
1 File 1055-Q273

23 TOTAL LIST PART 1

LIST PART 2: DISTRIBUTED BY DRDKIM 3

1 NDHQ/DRDKIM 2-2-5
(scanned and stored as black & white image, low resolution
- laser reprints available on request)
* Full mailing address must be supplied for units other than NDHQ

1 TOTAL LIST PART 2

24 TOTAL COPIES REQUIRED

This page intentionally left blank.

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Establishment sponsoring a contractor's report, or tasking agency, are entered in section 8.) DRDC Atlantic	2. SECURITY CLASSIFICATION (overall security classification of the document including special warning terms if applicable). UNCLASSIFIED

3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S,C,R or U) in parentheses after the title).

DRDC Atlantic Q-273 SEA TRIAL Marine Mammal Impact Mitigation Plan

4. AUTHORS (Last name, first name, middle initial. If military, show rank, e.g. Doe, Maj. John E.)

James A. Theriault & John Bottomley

5. DATE OF PUBLICATION (month and year of publication of document) May 2003	6a. NO. OF PAGES (total containing information Include Annexes, Appendices, etc). 25 (approx.)	6b. NO. OF REFS (total cited in document) 5

7. DESCRIPTIVE NOTES (the category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered).

Technical Memorandum

8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include address).
Defence Research & Development Canada – Atlantic
PO Box 1012
Dartmouth, NS, Canada B2Y 3Z7

9a. PROJECT OR GRANT NO. (if appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant). 11cm TIAPS	9b. CONTRACT NO. (if appropriate, the applicable number under which the document was written).
10a ORIGINATOR'S DOCUMENT NUMBER (the official document number by which the document is identified by the originating activity. This number must be unique to this document.) DRDC Atlantic TM 2003-044	10b OTHER DOCUMENT NOs. (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11. DOCUMENT AVAILABILITY (any limitations on further dissemination of the document, other than those imposed by security classification)

(X) Unlimited distribution
( ) Defence departments and defence contractors; further distribution only as approved
( ) Defence departments and Canadian defence contractors; further distribution only as approved
( ) Government departments and agencies; further distribution only as approved
( ) Defence departments; further distribution only as approved
( ) Other (please specify):

12. DOCUMENT ANNOUNCEMENT (any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected).

13. ABSTRACT (a brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual).

The Canadian Navy has a continuing requirement to acoustically detect both surface vessels and submarines. Defence Research and Development Canada (DRDC) through DRDC Atlantic has embarked on the first phase of development of the next generation of operational sonars for the Canadian Navy. The Towed Integrated Active Passive Sonar (TIAPS) Technology Demonstrator (TD) is being developed to demonstrate basic sonar capability and will serve as a testbed for further concept development. Q273 is the sixth in a series of sea trials that are required to develop and demonstrate this capability. Since acoustic energy will be transmitted during the trial, a Marine Mammal Impact Mitigation Plan has been developed to detail the procedures to be used. This document describes the procedures.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus. e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus-identified. If it not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title).

TIAPS
Marine Mammal
Risk Mitigation
Sonar

This page intentionally left blank.

Defence R&D Canada

Canada's leader in defence
and national security R&D

R & D pour la défense Canada

Chef de file au Canada en R & D
pour la défense et la sécurité nationale

DEFENCE DÉFENSE

www.drdc-rddc.gc.ca