Australian Government

Department of the Environment and Water Resources

Environment Protection and Biodiversity Conservation Act 1999.

General Permit Application for:

- **Threatened species and ecological communities (section 201)**
- **Migratory species (section 216)**
- **Whales and dolphins (section 238)**
- **Listed marine species (section 258)**

TIME SAVER

If the person completing this form is representing a small business (i.e. a business having less than 20 employees), please provide an estimate of the time taken to complete this form.

Please include:

– the time taken spent reading the instructions, working on the questions and obtaining the information; and

– the time spent by all employees in collecting and providing this information.

Hours ☐ Minutes ☐

Purpose of this form

This form is for an action which will affect any species or ecological community listed under the EPBC Act in the above categories where that action is within a Commonwealth Area, and for whale/dolphins where the action is within the waters of the Australian Whale Sanctuary, or internationally.

Complete this form in addition to either Supplementary Form A, B or C described in question 1 on the next page. Please return this form, along with the relevant Supplementary Form to the Department of the Environment and Water Resources.

Do not use this form for permits in:

- The Great Barrier Reef Marine Park. These permits are available at: www.gbrmpa.gov.au/corp_site/permits/
- A Commonwealth park or reserve (e.g. Kakadu National Park). These permits are available at: www.environment.gov.au/epbc/permits/parks/
- State Waters

Additional information

Please ensure that you have read the following information sheet:
Permits required for actions affecting EPBC Act listed species in Commonwealth Areas including the Australian Whale Sanctuary

This information sheet is available at www.environment.gov.au/epbc/permits/index.html. Further information is also available by contacting the Department on phone: (02) 6274 1111 or email: epbcwild@environment.gov.au.

Incomplete information

Applications that are incomplete or contain insufficient information cannot be assessed. Delays will occur whilst further information is sought from the applicant.

If you need more space

If there is insufficient space on this form to fully address any of the questions please attach additional pages and list these attachments at question 10.

Privacy

Information provided in this application form may be exchanged with other Commonwealth and State agencies for the purposes of administering the EPBC Act and relevant State legislation.

In accordance with section 515A of the EPBC Act a list of all permits issued under the Act are published on the Department's website.

1 Which of the following best describes the purpose of this application?

Research on whales/dolphins	☒⇒	You will <u>also</u> need to complete Supplementary Form A for Whales and Dolphins (cetaceans). *Now go to 2*
To take an action that will have an incidental impact on whales/dolphins E.g. whales and dolphins are not the purpose of the action but they will be indirectly affected	☐⇒	You will <u>also</u> need to complete Supplementary Form A for Whales and Dolphins (cetaceans). *Now go to 2*
Whale and Dolphin watching in a Tier 2 area	☐⇒	You will <u>also</u> need to complete Supplementary Form B for Whale and Dolphin Watching. *Now go to 2*
To kill, injure, take, trade, keep or move a listed species (other than whales/dolphins) or ecological community <u>in Commonwealth areas</u>	☐⇒	You will also need to complete Supplementary Form C *Listed species / ecological community, listed migratory species or listed marine species*. *Now go to 2*

2 Period of permit requested
Permits are usually not issued for more than 5 years.

Start date: 1 Aug 2007	End date: 1 Aug 2012

3 The permit holder can be a group such as a business, company, or corporation?

Is the proposed permit holder a group?

No ☒⇒ *Go to next question*

Yes ☐⇒ *Give details below*

Group Name
Street address:
Postal address:
Telephone No.:
Fax No.:
Email address:

Now go to 5

4 Is the proposed permit holder individual(s)?

No ☐⇒ *You must provide a permit holder -> complete either q3 or q4.*

Yes ☒⇒ *Give details below of each individual to whom the permit would be issued.* If insufficient space, attach a separate list.

1	Name: Curt Jenner
	Residential address: Jetty 3 Capo D'Orlando Drive Fremantle WA
	Postal address: PO Box 1622 Fremantle WA 6959
	Telephone No.: 0429 922 994
	Fax No.: none
	Email address: curtjenner@telstra.com

2	Name: Micheline Jenner
	Residential address: Jetty 3 Capo D'Orlando Drive Fremantle WA
	Postal address: PO Box 1622 Fremantle WA 6959
	Telephone No.: 0429 922 994
	Fax No.: none
	Email address: curtjenner@telstra.com

3	Name:
	Residential address:
	Postal address:
	Telephone No.:
	Fax No.:
	Email address:

5 Applicant details (if different from proposed permit holder(s))

Name:
Residential address:
Postal address:
Telephone No.:
Fax No.:
Email address:

6 Give the relevant qualifications and experience of all people who will carry out the actions. If insufficient space, attach a li

1	Name: Curt Jenner
	Qualifications and experience: with 20 years field experience studying large cetaceans, 17 years in Western Australian waters.

2	Name: Micheline Jenner
	Qualifications and experience: MSc. with 20 years field experience studying large cetaceans, 17 years in Western Australian waters.

3	Name:
	Qualifications and experience:

7 Have you applied for or obtained any other approvals, permits or licences relating to this action under Commonwealth, State or Territory legislation?

No ☐ ⇒ *Go to next question*

Yes ☒ ⇒ *Attach copies*

8 Have you previously held a permit from the Australian Government to undertake this action?

No ☐ ⇒ *Go to next question*

Yes ☒ ⇒ *Give details below*

Permit number	Date permit expired
E 2002/00029	14 Jul 2007

9 Offences

A proposed permit holder is taken to have been convicted of an offence if, within 5 years before the application is made, the proposed permit holder:

- has been charged with, and found guilty of, the offence but discharged without conviction; or
- has not been found guilty of the offence, but a court has taken the offence into account in passing sentence on the proposed permit holder for another offence.

Section 6 of the *Crimes Act 1914* deals with being an accessory after the fact. Sections 7 and 7A and subsection 86(1) of the *Crimes Act 1914* and sections 11.1, 11.4 and 11.5 of the Criminal Code deal with attempts to commit offences, inciting to or urging the commission of offences by other people and, conspiracy to commit offences.

Part VIIC of the *Crimes Act 1914* includes provisions that, in certain circumstances, relieve persons from the requirement to disclose spent convictions and require persons aware of such convictions to disregard them.

Has the proposed permit holder been convicted of, or subject to proceedings for an offence under any of the following?

a. offences under the *EBPC Act* or *Regulations*
b. a law of the Commonwealth or a State or Territory about the protection, conservation or management of native species or ecological communities;
c. section 6, 7 or 7A, or subsection 86(1), of the *Crimes Act 1914* (Commonwealth) or sections 11.1. 11.4 or 11.5 of the *Criminal Code Act 1995* (Commonwealth) in relation to an offence under a law mentioned in (a) or (b) above; or
d. a provision of a law of a State or Territory that is equivalent to a provision mentioned in (c) above.

No ☒

Yes ☐ ⇒ *Attach details*

10 *Attachments*

Indicate below which documents are attached.

Additional permit holders
See question 4 ☐

Additional qualifications details
See question 6 ☐

Copies of other approvals/permits
See question 7 ☒

Details of offences
See question 9 ☐

Other supporting documentation
List all additional documents below ☐

Titles of all attached documents *(include the document title, the specific section(s) and the page number(s) on which the information appears)*

N/A

11 Declaration

I declare that the information contained in this application Is correct to the best of my knowledge.

Signature of applicant

Name of person signing

Curt Jenner

Date

Australian Government

Department of the Environment and Water Resources

Supplementary Form A — Whales and Dolphins (cetaceans)

Application under section 238 of the Environment Protection and Biodiversity Conservation Act 1999.

TIME SAVER

If the person completing this form is representing a small business (i.e. a business having less than 20 employees), please provide an estimate of the time taken to complete this form.

Please include:

- the time taken spent reading the instructions, working on the questions and obtaining the information; and
- the time spent by all employees in collecting and providing this information.

Hours ☐ Minutes ☐

This form has two purposes:

1. To apply for a permit to undertake an action which will contribute significantly to the conservation of whales and dolphins such as research on whales and dolphins.
2. To apply for a permit to interfere with whales and dolphins, where that interference is incidental to and not the purpose of the action, for example, building an underwater structure where you may come into contact with whales or dolphins.

Please supply the following information if you will interfere with, injure, take, keep, move, possess or treat (cut up/divide) a cetacean or part of a cetacean in the Australian Whale Sanctuary or waters beyond the Australian Whale Sanctuary (overseas). If you are proposing to send specimens out of Australia you will need an export permit. Import permits will be necessary for bringing parts or products of cetaceans into Australia. For more information on imports and exports contact International Wildlife Trade Section on 02 6274 1900.

This form should be completed in conjunction with The General Permit Application form.

If you need more space

If there is insufficient space on this form to fully address any of the questions please attach additional pages and list these attachments at question 16.

When using additional documentation to answer individual questions in this application, please refer to the document title, the specific section(s) and the page number(s) on which the information appears.

Application fee

There is a $25 fee for permits where the action will contribute significantly to the conservation of cetaceans. There are some fee exemptions in certain circumstances, details of which can be obtained from the Department at the below address.

Where to send the forms and the application fee

Please send the completed General Permit Application and this form and any accompanying attachments to:

Director
Cetacean Policy and Recovery Section
Department of the Environment and Water Resources
GPO Box 787
CANBERRA ACT 2601
Fax: 02 6274 1542

1 Details of species that will be affected by the action. Use the following codes to enter details in columns 3 and 5.

Column 1 Common name of species. Common and scientific names are available at the Departmental website: http://www.environment.gov.au/erin/applications/biodiversity/sprat/	Column 2 Scientific name of species	Column 3 Conservation status of threatened species under EPBC Act (e.g. the blue whale is endangered EN) Codes for Column 3 EW Extinct in the wild EX Extinct CE Critically endangered EN Endangered VU Vulnerable CD Conservation dependent	Column 4 Estimated number that will be affected.	Column 5 Type of effect Codes for Column 5 IC Interfering with a cetacean IN Injuring TA Taking KE Keeping MO Moving TC Treating PO Possessing
Humpback Whale	Megaptera novaeangliae	VU	200	IN
Blue Whale	Balaenoptera musculus	EN	200	IN
Sperm Whale	Physeter macrocephalus		100	IN
Beaked whales	Mesoplodon sp.		50	IN

2 Provide the latitude and longitude of where the action will be conducted. Latitude and longitude references should be used instead of AMG and/or digital coordinates.

Where the project area is less than 1 square km, provide a single pair of latitude and longitude references.

Where the project area is greater than 1 square km or any dimension is greater than 1 km, attach a list of coordinates to enable accurate identification of the location of the project area.

Latitude

Degrees	Minutes	Seconds
-10	42	00
-35	31	00
-36	52	00
-19	30	00

Longitude

Degrees	Minutes	Seconds
128	58	00
128	58	00
111	46	00
111	30	00

Locality

Western Australian coastal waters to EEZ

3 *Attach an A4 sized map to show the boundaries of the area in which the action will be conducted.*

4 Provide an attachment describing the action addressing the following points.

A. The equipment and methods used to comply with the EPBC Act Regulations.
B. What steps will be taken to minimise impacts on cetaceans.
C. The objectives and purposes of the action.

5 Attach a description of any research relevant to the affected species or community that will be carried out in the course of or in conjunction with the proposed action, including:

A. A copy of the research proposal.
B. The names of the researchers and institutions involved in or supporting the research.
C. Relationship of the researchers to the permit applicant, including any funding being provided by, or to, the permit applicant

6 Will the action involve invasive techniques?

No ☐ ⇒ *Go to next question*

Yes ☒ ⇒ Attach application and approval from an Animal Ethics Committee.

7 Are you applying on the basis that the action will contribute significantly to conservation of cetaceans? (Please note, a fee of $25 is required for this type of permit — see Question 21)

No ☐ ⇒ *Go to 9*

Yes ☒ ⇒ *Go to next question*

8 Why do you believe that the action will contribute significantly to the conservation of cetaceans?

Satellite Tagging will contribute to the conservation of the species we tag by providing mangers and scientists with previously unknown information regarding the spatial and temporal boundaries of critical habitats and migratory routes. In the light of increasing human activity in the Australian EEZ, this information is crucial if endangered and threatened species are to continue to recover from commercial whaling.

Biopsy sampling will contribute to the conservation of the species we sample by providing managers and scientists insight into population arameters such as sex ratio's, recovery rates, population size and poulation health. This information is a vital component in manging activities that may effect a species at a population altering level such as displacement or lethal takes.

Photographs and videos will contribute to the photo–identification of whales.

Now go to 13

9 Are you applying on the basis that the effect on cetaceans will be incidental to, and not the purpose of, the action?
You must also answer questions 10, 11 &12 to apply for this type of permit.

No ☐ ⇒ You are not able to apply for a permit using this form, please contact the Cetacean Policy and Recovery Section at epbcwild@environment.gov.au, or call (02) 6274 1111.

Yes ☒ ⇒ Why do you believe that the impact of the action will be incidental to and not the purpose of the action?

The purpose of the actions (taking photos, sateliite tagging and biopsy sampling) is to further managers and scientists knowledge of threatened and endangered species. Any disturbance to the whales caused by these processes has been shown to be minimal by our own and other researchers studies and are continually examined to see if the processes can be less invasive and more efficient.

10 Why do you believe that the proposed action will not adversely affect the conservation status of a species of cetacean or population of that species?

The annual sample size targets of both the biopsy sampling and the satellite tagging programmes for humpback whales, blue whale and sperm whales are well below the currently accepted population sizes. Furthermore, both techniques are well proven and have been shown to elicit temporary or short term responses only to the sampling event with no permanent damage to the animals.

In the case of beaked whales we propose to develop smaller satellite tags than used for baleen whales with penetration limited to appropriate levels for the blubber thickness of smaller animals (50mm typically).

Recording of photos will have no direct impact on whales.

11 Describe how the proposed action will be consistent with any *recovery plans* or *wildlife conservation plans* in force for the species of cetaceans that may be affected by the action.

Commonwealth recovery and wildlife conservation plans that are in force are available from the Department of the Environment and Water Resources web site: *www.environment.gov.au/biodiversity/threatened/recovery/index.html*

State and territory recovery plans will be available from state and territory environmental agencies.

Satellite tagging is consistent with the recovery plan for endangered, threatened or vulnerable species because it has the potential to clearly define the spatial, temporal and physical characteristics of calving, feeding and migratory areas.

Biopsy sampling is consistent with the recovery plans for these species because it provides gentic information to scientists and managers so that population structure and limits can be defined.

Photo–identification is also consistent with the recovery plans for these species.

12 *The applicant is required to take all reasonable steps to minimise interference with cetaceans.*

How will this be carried out?

The applicants have each had 20 years of experience working in the filed around vrious species of cetaceans and as such represent two of Australia's foremost authorities on cetacean behaviour. Behavioural reactions to applying satellite tags or biopsy darts can only be assessed by persons with a high level of undersatnding of "normal" cetacean behaviour patterns. If abnormal behaviours occur as a result of the biopsy or tagging procedures, the processes will be halted and documented.

13 Attach details of any proceedings against the proposed permit holder under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

14 Fees

The following fees apply:

- If you answered yes at question 7, for an action which will contribute significantly to the conservation of cetaceans - $25 (there are fee exemptions in some circumstances).
- An incidental action relating to cetaceans - nil

15 Are you paying by credit card?

No ☐ ⇒Attach a cheque, *go to next question*

Yes ☐ ⇒Complete the following details

Card: Visa ☐ Bankcard ☐ MasterCard ☐

Card number

Expiry date (month/year)

Card holder's name as shown on card

Amount

Cardholder's signature

16 Attachments

Indicate below which documents are attached.

Attach a map. *See question 3* ☒

The equipment and methods used to comply with the EPBC Act Regulations. *See question 4* ☒

What steps will be taken to minimise impacts on cetaceans. *See question 4* ☒

The objectives and purposes of the action. *See question 4* ☒

Copy of research proposal. *See question 5* ☒

Names of researchers and institutions. *See question 5* ☒

Relationship of researcher to permit applicant. *See question 5* ☒

Ethics committee approval. *See question 6* ☒

Details of any proceedings against the permit holder under a Commonwealth, State or Territory law. *See question 13* ☐

Cheque for payment of fee. *See question 14* ☒

List all additional documents below ☐

Titles of all attached documents *(include the document title, the specific section(s) and the page number(s) on which the information appears)*

17 Declaration

I declare that the information contained in this application is correct to the best of my knowledge.

Signature of applicant

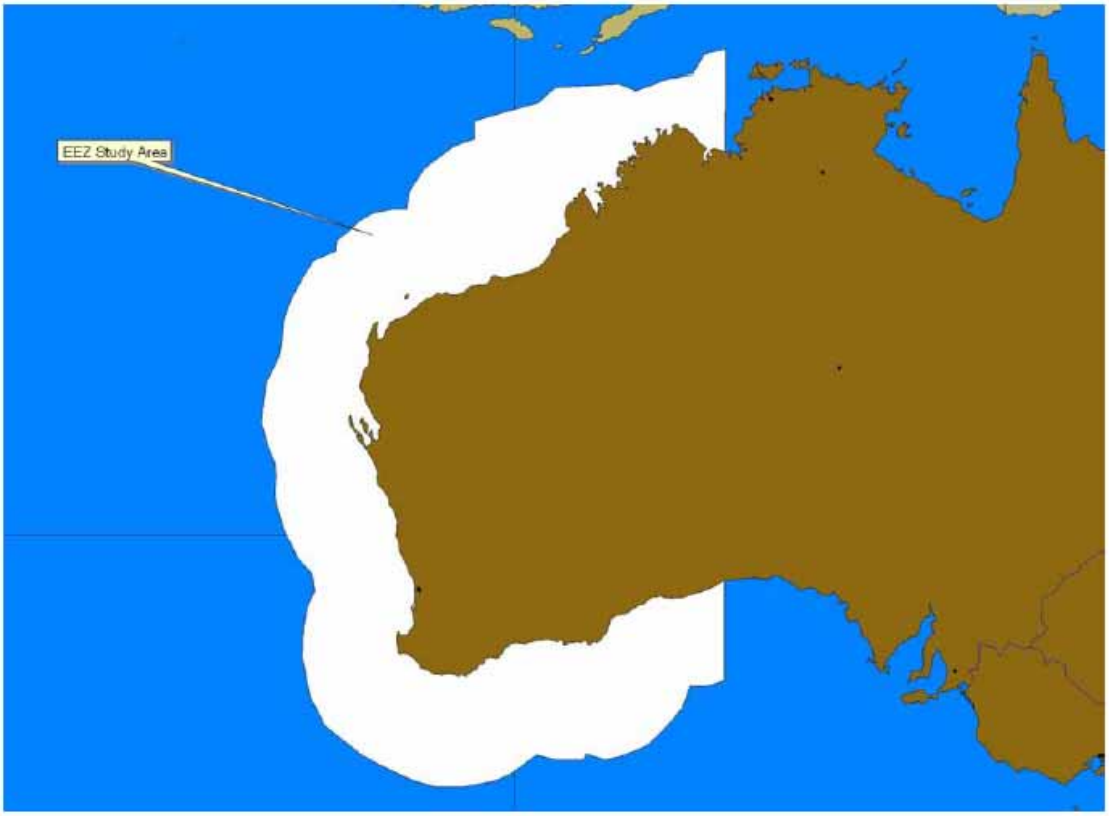
Name of person signing

Curt Jenner

Date

EPBC Act Application – Jenner

Question 3 – Map



Question 4.
A - Equipment and methods used to comply with the EPBC Act regulations: The Centre for Whale Research operates a 24m research vessel equipped with a 6m inflatable that is used for both the satellite tagging work and biopsy sampling. Satellite tags are delivered with a air powered line launching gun modified specifically for the purpose. Biopsy samples are collected using a pax-arms rifle with either “whale heads” or “dolphin heads” depending on the species targeted.

Whales are followed at a range of approximately 100m for periods of up to 30 minutes to assess behavioural state prior to approach for both the satellite tagging and biopsy sampling. If the whale is exhibiting normal behaviour patterns and appears healthy and fit, the vessel closes to a range of 6 to 10m to apply the tag or shoot the dart. Once applied or sampled, the whale is followed for a short period of time at a distance of approximately 100m to assess behavioural changes and success of the application. The same whale is only tagged or sampled once per season and notes, video and still photographs accompany each application/sample.

B – Steps taken to minimize impacts on cetaceans:
The satellite tags are gas sterilized to minimize infection and have a penetration limiting device fitted to them to prevent the tag from migrating into the whales' body over time. Whales that exhibit a negative response to the vessel approach are only approached once and all whales are not approached more than 3 times before applying the tags. The biopsy darts are made from surgical grade stainless steel and are flame sterilized using ethanol between samples to prevent infection and cross contamination of samples. The biopsy darts can be fired from a range of up to 20m so approaches are not as close as with satellite tagging.

C – Objectives and purposes of the action:

Satellite tagging whale species in Australian waters is an important technique that will be used to examine the spatial and temporal boundaries of the critical habitats for the species tagged. The technique is listed by the Australian government as a preferred technique for determining these data types.

Genetic sampling will contribute to the conservation of the species we sample by providing managers and scientists insight into population parameters such as sex ratio's, recovery rates, population size and population health. This information is a vital component in managing activities that may effect a species at a population altering level such as displacement or lethal takes.

Photographs and videos will contribute to the photo–identification of whales.

Question 5 - Description of Relevant Research

A. Copy of Research Proposal(s)

Examples of the research proposals associated with both the satellite tagging and biopsy sampling are attached separately.

A further ACAMMS proposal will be lodged to biopsy sample humpback whales in Exmouth Gulf in the August 2007 round of funding.

B. Names of Researchers Involved in or Supporting Research:

Name: Dr Nicholas Gales
Institutional
Affiliation:
Australian Government Antarctic Division
(AGAD)

Name: Sarah Robinson
Institutional
Affiliation:
Australian Government Antarctic Division
(AGAD)

Name: Dr. Michael Double
Institutional
Affiliation:
Australian Government Antarctic Division
(AGAD)

Name: Dr. Luciana Möller
Institutional Macquarie University
Affiliation:

Dr. Luciano Beheregaray
Macquarie University

Dr. Rick LeDuc
Southwest Fisheries Science Center, NOAA
Fisheries Service

Dr. Peter Gill
Australocetus Research

Margie Morrice
Australocetus Research and Deakin University

John Bannister
Western Australian Museum
Dr. Robert Harcourt
Macquarie University

C. Relationship of the researchers to the permit applicant:

Colleagues

RESEARCH PROPOSAL 1

Project title

Monitoring medium and large-scale movements of baleen whales using satellite telemetry

Proponent(s) details

(a) Chief Investigators

	1	2
Name:	Dr Nicholas Gales	Curt Jenner
Institutional Affiliation:	Australian Government Antarctic Division (AGAD)	Centre for Whale Research (Western Australia) Inc. (CWR)
Address:	203 Channel Highway, Kingston, TAS 7050	PO Box 1622 Fremantle WA 6959
Phone Number:	03 6232 3437	0418 912 669 0429 922 994
Fax Number:	03 6232 3449	0011 870 7646 38182
Email:	Nick.Gales@aad.gov.au	information@cwr.org.au

	3
Name:	Micheline Jenner
Institutional Affiliation:	Centre for Whale Research (Western Australia) Inc. (CWR)
Address:	PO Box 1622 Fremantle WA 6959
Phone Number:	0418 912 669 0429 922 994
Fax Number:	0011 870 7646 38182
Email:	information@cwr.org.au

(b) Co-investigators

	1
Name:	Sarah Robinson
Institutional Affiliation:	Australian Government Antarctic Division (AGAD)
Address:	203 Channel Highway, Kingston, TAS 7050
Phone Number:	03 6232 3122
Fax Number:	03 6232 3449
Email:	Sarah.Robinson@aad.gov.au

Project summary

The AGAD is developing a small, biologically inert, blubber-implantable satellite tag to monitor the movements of baleen whales, in particular humpback, blue and southern right whales. The AGAD and the CWR are collaborating to perform field trials of the tags.

The effective development of a capacity to determine the movements of large cetaceans will enable researchers to address major components of federal and state based conservation management plans, as well as provide data and advice to international fora. More specifically, the satellite telemetry of blue whales and southern right whales is detailed as a high priority in the respective recovery plans. The tracking of these and other whales is also noted as a priority in the Action Plan for Australian Cetaceans.

Project objectives

This activity aims to determine the seasonal, medium to large scale movements of baleen whales in Australian and Antarctic waters. Current understanding of the movement of high profile baleen whales that visit our coasts seasonally (humpback whales, southern right whales and pygmy blue whales in particular) are poorly understood. Data of this type is of key, strategic importance in the management of human interactions and threatening processes with these animals, and in particular with the economically significant whale watching and petroleum industries. As whale numbers continue to increase, interactions with shipping, in major shipping channels, will become of greater importance. The need for such information was identified in the Action Plan for Australian Cetaceans. The information is of particular relevance for the conservation of threatened species such as the southern right whale and blue whale. Information of this type is also highly relevant to international forums such as the International Whaling Commission.

Monitoring the movement patterns of baleen whales using satellite telemetry has been successful in North America[1-4] and recently in the southern hemisphere[5], however these tags are long and penetrate deep into the muscle layer. The AGAD is developing a small tag to be implanted into the blubber layer, which will reduce the invasiveness of satellite telemetry work.

Many of the activities described in this application represent collaborative research with other Australian cetacean researchers, including Peter Gill, Rosemary Gales and Rob McCauley.

More specifically, this action (and the collaborative research) will lead to information regarding:

- Temporal and spatial descriptions of the northern and southern migratory pathways of humpback whales past the east and west coasts of Australia.
- The dispersal of humpback whales from Australia into the Southern Ocean, and the degree of mixing that happens between the putative eastern and western Australian humpback whale stocks.
- Feeding grounds of humpback whales.
- Residency, movement and migratory pathways of pygmy blue whales in Australian waters and beyond. Currently, the pygmy blue whales that are seen seasonally off Western Australia and Victoria move to unknown areas for most of the year.
- Residency, movement and dispersal patterns of southern right whales in Australian waters.
- Feeding grounds of southern right whales.
- Movements and patch residency times of minke whales in certain Southern Ocean regions (this work is driven within the Strategic Plan of the AGAD).

1. Mate, B. R., Gisiner, R., and Mobley, J. 1998. Local and migratory movements of Hawaiian humpback whales tracked by satellite telemetry. *Can. J. Zool.* 76(5): 863–868
2. Mate, B. R, Krutzikowsky, G. K., and Winsor, M. H. 2000. Satellite-monitored movements of radio-tagged bowhead whales in the Beaufort and Chukchi seas during the late-summer feeding season and fall migration. *Can. J. Zool*. 78(7): 1168–1181
3. Mate, B.R., and Urban-Ramirez, J. 2003. A note on the route and speed of a gray whale on its northern migration from Mexico to central California, tracked by satellite-monitored radio tag. *J. Cet. Res. Manag*. 5(2): 155–157.
4. Baumgartner, M.F., and Mate, B.R.. 2005. Summer and fall habitat of North Atlantic right whales (*Eubalaena glacialis*) inferred from satellite telemetry. *Can. J. Fish. Aquat. Sci.,* 62: 527–543.
5. Zerbini, A. N., Andriolo, A., Heide-Jørgensen, M. A., Pizzorno, J .L., Maia, Y. G., VanBlaricom, G. R., DeMaster, D. P., Simoes-Lopes, P. C., Moreira, S., and Bethlem, C. 2006. Movements of satellite monitored humpback whales (*Megaptera novaeangliae*) in the Southwest Atlantic Ocean. *Mar. Ecol. Prog. Ser.* 313: 295-304.

Project methodology

During the 06/07 financial year two rounds of deployments will be attempted. We hope to deploy five tags on Humpback whales off the southwest coast of Western Australia in November 2006. We then hope to deploy five tags on blue whales in March/April 2007.

Tagging method

Purpose built satellite-radio tags (Platform Terminal Transmitters or PTTs) will be attached directly to the whales and their movements tracked using the Service Argos system. The tags to be used comprise the latest, most miniaturised transmitting electronics available, with minimum battery power to achieve the tracking duration. The electronics and battery are encased in epoxy and high grade stainless steel and/or titanium components. The result is the smallest package possible, constructed of materials that are almost completely inert in body tissues. The tag has been developed jointly by the AGAD and Sirtrack Ltd, New Zealand. The tag is still in development and the design continues to be improved with further testing. The proportional size of the tag in relation to the size of the whale is several orders of magnitude less than tags used routinely on other marine predators such as seals, dugongs and sea birds.

The satellite tags are deployed via a modified pneumatic line-thrower from a distance of 3-15m. The tag penetrates the whale's skin and blubber and may also penetrate the dense connective tissue layer (fascia) that encases the muscle mass.

A flexible transmitting aerial extends about 17cm from the top of the tag. The positioning of the tag is species specific, and aims for a location giving the aerial maximum time at the water's surface at each surfacing event of the animal. This is generally close to the whale's dorsal midline, somewhere between the dorsal fin and the pectoral fins.

The tag is designed to transmit for a period ranging from weeks to months. The tag will fail due to electronic malfunction, battery exhaustion or eventually tag rejection. Because of the superficial application of the tag, they will eventually be rejected, or simply fall out.

Each whale is approached in a 6m rigid-hulled inflatable boat (or other vessel that allows regular close access to the whale) to facilitate the deployment. Strict protocols are followed to ensure that the whale is not unduly harassed during the deployment. The particular method of deployment is species dependent. When using a small vessel the deployment falls into one or other of the two following categories:

- Fast Approach (blue whales and some humpback whales): Initial approaches are slow and are ceased if the whale actively avoids the boat. Once in position, a single rapid approach is made to the whale during a surfacing and the tag is deployed. If the tag is not deployed during this fast approach, further approaches are only attempted if the whale continues to be unconcerned by the movements of the boat. Avoidance behaviour by the whale is used to signal the animals' level of concern, and determines whether the attempt is terminated. Fast approaches will not be made on animals or groups with calves.
- Slow Approach (some humpback whales and southern right whales): where possible, drift approaches (from up wind) will be made on whales that are surface resting. The tag will be deployed once the whale is within the required range. Females with calves will not be excluded from this group as 'slow approaches' are relatively straightforward for this group, and the potential for impact on the calf is negligible. Furthermore, information on the movements and behaviour of cow-calf pairs is of particular management relevance, given the need to be particularly cognoscente of impacts on this group.

Recent experience using a larger (20m) vessel has shown that in some circumstances deployments can be achieved when the whale approaches the vessel. This technique has been used very successfully on northern migrating humpback whales, and may also be possible for blue whales.

All attempts and actual tag deployments are videotaped, and the tape is reviewed each day. Data on time an animal was sighted, its behaviour before, during and after approach (and deployment), and general environmental conditions are also kept. Such data, and videos are always available for review by regulatory agencies.

Data collection and analysis

Once deployed, each tag transmits a unique frequency according to a pre-programmed transmission protocol. Typically, this will range from transmissions every 30 seconds for an entire day, to transmissions for only a few hours of each day. The tag is equipped with a salt water switch, and will only transmit when at the surface.

The transmissions are received by polar orbiting satellites (System Argos), and the location of the tag (and whale) calculated via Doppler shift. The location data are available from any computer terminal by dialling into the various land stations of System Argos. It is also possible to receive data from the tags on parameters such as surface behaviour, and any environmental sensors built into the tag (water depth of dives, temperature, swim speed etc). At this stage, such sensors have not been incorporated into the tag, as the intent is to keep the tag as small and simple as possible. Whale location can then be overlaid with data such as bathymetry, water temperature, water colour, sea height etc.

The AGAD is developing a specialised animal tracking software system (AT SEA) and this will continue to be used to analyse and integrate the spatial data.

RESEARCH PROPOSAL 2

Project title

Novel genetic markers for stock identification of blue whales and genetic differentiation between the two main Australian feeding aggregations

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Project summary

We will develop nuclear microsatellite genetic markers specific for blue whales, which will provide powerful tools for identifying stocks of blue whales worldwide and, potentially, as diagnostic markers for differentiating subspecies. We will also infer population genetic structure of the two main Australian feeding aggregations using mtDNA control region sequences and a large panel of microsatellite markers to investigate potential genetic subdivision between areas. This study will fulfil one of the actions of the Blue Whale Recovery Plan by gathering information on population structure and therefore providing indicators of structure to be incorporated into models for measuring recovery and status.

Project objectives (maximum of 1 page)

1. To develop approximately 10 novel nuclear microsatellite markers for analysis of genetic variation and differentiation of blue whale populations;

2. To assess the usefulness of these novel microsatellite markers as diagnostic markers between subspecies of blue whales in the Southern Hemisphere by comparing samples from putative Australian pygmy blue whales with those from Antarctic 'true' blue whales;

3. To infer population genetic structure and migration rates between the two main Australian feeding aggregations of blue whales (Perth Canyon and Bonney Upwelling) using both mtDNA control region sequences and a panel of microsatellite markers.

In the Southern Hemisphere (SH) two subspecies of blue whales are currently recognised, the pygmy blue whale *Balaenoptera musculus brevicauda* which is found mainly in the Subantarctic Zone north of 55^0S, and the Antarctic 'true' blue whale *B. m. intermedia* which summers in the Antarctic Zone south of 60^0S (Rice 1998). Blue whales were heavily exploited by past commercial whaling, with numbers of 'true' blue whales in the SH decreasing from hundreds of thousands to possibly less than a thousand individuals (IWC 1995). The number of pygmy blue whales pre-exploitation is not well know but its believed to have been reduced to about half its original size, especially from illegal whaling by the Soviets which continued, including in Australian waters, after blue whale catches were banned by the International Whaling Commission (IWC) (Zemsky and Sazhinov 1994, Bannister et al. 1996). Blue whales are currently listed as endangered under the Australian Environment Protection and Biodiversity Conservation Act and appear on Appendix 1 of the Convention on International Trade in Endangered Species and the Convention on Migratory Species. 'True' blue whales are also considered endangered by the International Union for Conservation of Nature and Natural Resources, while pygmy blue whales are not listed due to insufficient data. Blue whales occur in southern Australian waters, but with relatively large numbers sighted in only a few areas, including summer feeding aggregations in the Perth Canyon, off Rottnest island WA, and in the Bonney Upwelling region, southeast SA to western Victorian waters. Ecological studies in these areas have concentrated mainly on determining numbers and distribution, seasonality, movements and habitat use (e.g. Gill 2002, Gill and Morrice 2003, McCauley et al. 2004), with one re-sighting made between the two aggregations (C. Jenner, M. Morrice

and P. Gill, unpublished data). Although most, if not all, of Australian sightings in summer/early autumn are likely to be of pygmy blue whales (Zemsky and Sazhinov 1994, Kato et al. 1996, Bannister and Burton 2000), 'true' blue whales also appear to use the Australian coast during the winter months, but possibly at very low numbers (Stafford et al. 2004). The Australian Recovery Plan for Blue Whales includes as one of its objectives 'the recovery of populations utilising Australian waters' and, among the actions required for population recovery, 'establish models for measuring recovery and status incorporating indicators of structure', as well as, 'gather information on population structures and limits (e.g. though the use of genetic analysis)' (DEH 2005). Moreover, one of the current objectives of the IWC is to be able to discriminate individuals of the two nominal subspecies in the SH by genetic, morphologic, acoustics or other means, as at-sea identifications are difficult. To this end the IWC Scientific Committee has recommended that further effort to obtain biopsy samples of SH blue whale should be a priority (IWC, 2003).

A recent genetic study using mitochondrial DNA control region sequences and nuclear microsatellite markers on SH blue whales (including samples from Perth Canyon but only few from whales stranded in South Australian and Victorian waters), has failed to find diagnostic markers between the two subspecies (LeDuc et al. 2003). Nonetheless, the study reported highly significant differentiation in haplotype and microsatellite allele frequencies between populations of 'true' blue whales and pygmy blue whales, with only few individuals missassigned between the two subspecies using a genotypic Bayesian approach. These results are very promising as they suggest that increasing the number of microsatellite markers, as well as the number of samples, will increase the power to characterise allele frequencies within populations (LeDuc et al. 2003), and therefore to differentiate populations and subspecies. In addition, with the development of novel microsatellites, diagnostic markers can potentially be found.

The main objectives of this project are twofold. First, we will develop novel nuclear microsatellite genetic markers specific for blue whales, which will provide powerful tools for studying population structure and identifying stocks of blue whales worldwide and, potentially, as diagnostic genetic markers for differentiating nominal subspecies. Second, we will use both mtDNA control region sequences and a large panel of microsatellite markers to infer population genetic structure of the two main Australian feeding aggregations of blue whales to investigate potential genetic subdivision between the areas. These results will be later incorporated into a study of genetic variation and differentiation of Southern Hemisphere's blue whales, led by Dr LeDuc at NOAA Southwest Fisheries Science Center, La Jolla. These objectives fulfil one of the actions of the Australian Blue Whale Recovery Plan by gathering information on population structure and therefore providing indicators of structure to be incorporated into models for measuring recovery and status.

Project methodology (maximum of 2 pages)

Samples

A total of 93 blue whale samples are currently available from the two main feeding aggregations of blue whales in Australia; the majority from Perth Canyon (n = 90) obtained by the Centre for Whale Research Western Australia, and a few from the Bonney Upwelling region (n = 3) through the Australocetus Research.

Additional samples of blue whales from the Bonney Upwelling will be obtained through biopsy sampling during January - May 2007.
Samples from blue whales stranded in South Australia and Victoria will also be requested to the South Australian and Melbourne Museums if available.

Thirty samples from Antarctic 'true' blue whales will be provided by the NOAA Southwest Fisheries Science Center, La Jolla, USA. In addition, samples of blue whales from the Australian Antarctic Territory will be obtained opportunistically by Dr Nick Gales while on survey in the area (Australian Antarctic Division).

Genetic methods

DNA will be extracted using a salting-out protocol (Sunnucks and Hales 1996). Genetic sexing and amplification of approximately 460 bp of the mtDNA control region will be carried out according to Möller and Beheregaray (2001). Seven cetacean (LeDuc et al. 2003) and approximately ten novel blue whale microsatellite loci (see below) will be amplified by the Polymerase Chain Reaction (PCR). Genotypes of 30 samples from the Perth Canyon are already available for 7 microsatellite loci (LeDuc et al. 2003).

Microsatellite library development
Microsatellite loci will be isolated from blue whale samples using an enrichment technique (Fischer and Bachmann 1998) modified as in Saltonstall (2003). Genomic DNA will be digested with RsaI and HaeIII and fragments ligated to two oligo adaptors. Six biotinylated oligo probes will be hybridized to the digested DNA and selectively retained using streptavidin magnetic particles (Promega). PCRs will be performed on the microsatellite-enriched eluate using one of the oligo adaptors as a primer. The enriched library will be purified using a gene clean kit (Qbiogene), ligated into pcR 2.1-TOPO vector (Invitrogen) and transformed into TOP10 cells. The plasmid DNA will be then purified and 50 putative positive clones will be sequenced on an ABI 377 automated DNA sequencer (PE Applied Biosystems) using dye terminator chemistry. Primers will be designed using primer 3 (Rozen and Skaletsky 1997). We will attempt to obtain 10 novel polymorphic microsatellite loci for blue whales. Microsatellite loci that are successfully amplified will be initially screened for variation by PCR in a sample of 10 'true' blue whales from Antarctica and 10 pygmy blue whales from the two main Australian feeding aggregations; Perth Canyon and Bonney Upwelling. Primer sets will also be tested for cross-amplification in other cetacean species (e.g. sperm whales, humpback whales, common dolphins and bottlenose dolphins) to evaluate the potential usefulness of these markers for characterizing genetic variation in other cetacean species. These markers will provide powerful tools for studying population structure and identifying stocks of blue whales worldwide and, potentially, as diagnostic genetic markers for differentiating subspecies of blue whales.

Data collection and analysis (maximum of 1 page)

Microsatellite DNA analysis
Departures from Hardy-Weinberg equilibrium for each locus and each putative population (Perth Canyon, Bonney Upwelling, Antarctica) and linkage disequilibrium for each locus-pair will be assessed by an exact test in genepop 3.4 (Raymond and Rousset 1995). Genetic variation within populations will be estimated by calculating mean number of alleles per locus, allelic richness (number of alleles corrected for sample size), private alleles, and expected and observed heterozygosities. To test for population genetic structure, a Bayesian model-based clustering method implemented in structure 2.1 (Pritchard et al. 2000) will be used. Analyses will be performed without and with prior information on the sampling population, with the population admixture and no admixture model, and with the correlated and with the uncorrelated frequency model. The number of clusters (K) (i.e. most likely number of populations in the dataset) will be inferred from the posterior probability distribution Pr (K/X) calculated from the posterior probability of the data Log Pr (X/K). Genetic differentiation between putative Australian populations (Perth Canyon and Bonney Upwelling) will be investigated by computing FST using arlequin 2.0 (Schneider and Excoffier 2000) and RST using RST Calc (Goodman 1997). For samples obtained through Museums, assignment tests implemented in geneclass 2.0 (Piry et al. 2004), which are based on a Bayesian approach (Rannala and Mountain 1997), will be carried out to assign individuals to their population of origin. An asymmetric estimate of the migration rate between areas will be calculated using Migrate 1.7.3 (Beerli 2002) and a Bayesian approach implemented in BAYESASS 1.3 (Wilson and Rannala 2003).

Mitochondrial DNA analysis
Mitochondrial control region sequences will be edited and aligned using sequencher 4.1.2 (Gene Codes Corporation, MI). Genetic variation will be estimated in Arlequin 2.0 (Schneider and Excoffier 2000) by calculating haplotypic diversity and nucleotide diversity. To examine genealogical relationships among mtDNA lineages a haplotype network will be constructed using the maximum-parsimony method of Templeton et al. (1992) implemented in tcs 1.06 (Clement et al. 2000). Genetic divergence between pairs of putative Australian populations (Perth Canyon and Bonney Upwelling) will be investigated by computing FST and ΦST using arlequin 2.0 (Schneider and Excoffier 2000). An asymmetric estimate of the migration rate between areas will be calculated using Migrate 1.7.3 (Beerli 2002).

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