# REPORT OF LARGE WHALE RESTRAINT WORKSHOP

**Feb 7th & 8th 2006**

**AT**
**CARRIAGE HOUSE**
**WOODS HOLE OCEANOGRAPHIC INSTITUTION**
**WOODS HOLE MA 02543**

**SPONSORED BY NATIONAL MARINE FISHERIES SERVICE**

**Order # EM133F05SE5824**

**Requisition/ Reference # NFFM5100-5-00800**

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## Executive Summary

The Problem: until large whale entanglements can be avoided, disentanglement is a necessary stop gap measure to enhance the survival of critically endangered large whales. Cases that are refractory to the standard protocols developed and used by the Provincetown Center for Coastal Studies (PCCS) are especially head and flipper wraps in right whales. There is a need both for immediately deployable solutions and development of better technology and techniques. Such advances must avoid proliferation of at sea personnel and include plans for next steps in each possible contingency. These are not currently supported within the Disentanglement Network or NOAA.

History: two prior workshops resulted in a focus on the potential for sedation to enhance tractability, the delivery of hyper-concentrated Meperidine and Midazolam via a pole delivered, gas powered syringe to an entangled right whale, the acquisition of a working right whale tail model and its use to develop tail harness systems, and the conceptualization of a suction cup tag that could deliver drugs on demand and monitor the status of the individual. Experience from sedating marine mammals in captivity, and observation of sleeping right whales suggests that adequate tractability might be achieved in free swimming animals without significant loss of equilibrium.

Three areas were focused upon at this workshop: sedation, physical restraint, and monitoring the status of the animal.

Sedation: the drug mix previously used could be deployed at higher doses than used currently. However there are questions of the bioavailability of hyper concentrated drugs. A plan to study relevant pharmacokinetics of the above and a possible alternate, Butorphanol, involving laboratory and live stranded animals, and entangled gray whales was drawn up. Enhancement of remotely deployed ballistics was also suggested. The question of whether sedation to tractability would also engender loss of equilibrium and buoyancy led to the need for concomitant physical restraint.

Restraint: a hawser to a tractor tug, applied to the tail by lasso or a clamp tool, in conjunction with a pair of lift bags, with or without a head muzzle, possibly with blindfold panels was conceived.

Monitoring: to better understand the behavior of entangled animals and their response to sedation, augmentation of the sensor package in the PCCS ball tag, or a low drag equivalent, opportunistic deployment of the D-tag, streamlined visual monitoring of sedation attempts, use of an ROV to assess and/or cut, and the development of long term AIS transponding tags were all considered.

Next steps were outlined in a series of outline budgets. Two further workshops are indicated: 1) to consolidate on the progress once made of the above steps, and 2) to examine the behavioral aspects of entanglement, disentanglement team interaction, and self-disentanglement using deployed remotely operating devices.

## Table of Contents

# Terms of Reference

## Background and Need

A number of large cetacean species are seriously injured and killed by entanglement in fishing gear used in the waters off the eastern United States and Canada. Entanglement most frequently involves rope or lines wrapped around the head, the flippers, body, in the mouth, around the tail flukes or any combination of the aforementioned body parts. Consequences of entanglement are particularly grave for North Atlantic right whales, which currently number about 300 whales and are declining due, in part, to this entanglement-related mortality. Right whales are frequently intractable and are very difficult and potentially unsafe to work with while attempting to disentangle the animal. Modifications and technological advances are needed to control, restrain and overall increase the success rate at which right whales are able to be cut free from entangling gear.

## Goal and Objectives

The objective was to review past progress and current challenges in large whale restraint and to establish a paradigm that could result in effective physical and chemical restraint being available for deployment as needed for future intractable large whale entanglement cases. The objective of the workshop was **not** to develop consensus advice from participants as a group.

## Approach

The approach envisioned was to include a workshop to:

1) Review available information on a) the nature and extent of entanglement incidents, b) current tools and techniques developed for large whale disentanglement efforts, c) the success of such efforts, and

2) Consider and develop ideas and initiatives for better delivery of sedatives and reversants, physical restraint systems, including alternative equipment, materials, or deployment methods that may increase the success and safety of large whale disentanglement efforts.

A chairperson and a separate rapporteur was engaged to run the workshop and ensure the completion of all reports and other products. The National Marine Fisheries Service in collaboration with the Woods Hole Oceanographic Institution (WHOI) developed the workshop.

**Sponsorship**

The National Marine Fisheries Service, Northeast Regional Office sponsored the workshop. The sponsor approved the contracted organization, Woods Hole Oceanographic Institution to facilitate the workshop and to provide reimbursement, through the contract, of invited participants travel expenses.

**Federal Advisory Committee Act (FACA) Compliance**

As provided by the NOAA Office of General Counsel, the following FACA guidance was followed for the gear workshop.

Ground Rules for Workshop:

This workshop is a closed meeting with whale biologists, whale disentanglers, veterinarians, National Marine Fisheries Service personnel, and other invited guests, which was not chartered under the Federal Advisory Committee Act or noticed in the Federal Register.

Under these circumstances, facilitators should:

- Keep discussions to exchanges of facts and information.
- Not seek consensus advice on future Federal Government policies or actions (i.e., not seek consensus advice or recommendations from workshop participants as a group). Any advice provided to NOAA Fisheries must reflect the views of individual workshop participants.

Regardless of what industry, agency, facilitator or attendees may have experienced at previous workshops or conferences, National Marine Fisheries Service expects this workshop to abide by the law and to err on the side of caution.

**Participants**

A range of participants with particular expertise was required. The participants had expertise in the following areas:

- Disentanglement and capture
- Biology of right whales and other large whales
- Veterinary medicine
- Anesthesiology
- Ballistics
- Large whale tagging and telemetry
- Mechanical engineering
- Professional mariner
- NMFS participants

- Chair
- Rapporteurs

The Large Whale Restraint Workshop Working Group seleted the actual participants. The Large Whale Restraint Workshop Working Group has selected Michael Moore to serve as the chair of the workshop and three WHOI staff members will serve as the workshop rapporteurs.

**Timeline**

The first workshop was scheduled for February 7 and 8, 2006, with a report from that workshop expected in September 2006. Follow-up will depend on the direction and progress made at the first workshop.

**Products**

At a minimum, the proceedings and results of each workshop will be summarized in a workshop report.

| Attendees (* denotes member of Large Whale Restraint Workshop Working Group) | | | | | |
|---|---|---|---|---|---|
| Richard | Arthur | Falmouth MA | Engineer | rarthur@cape.com | PO Box 78, Falmouth, MA 02540 |
| Alex | Bocconcelli* | WHOI | Field logistics and d-tagging | aboconcelli@whoi.edu | WHOI, MRF 50, Woods Hole MA 02543 |
| David | Brunson* | U Wisconsin | Anesthesiologist | brunsond@svm.vetmed.wisc.edu | School of Veterinary Medicine, 2015 Linden Dr. Madison, WI 53706 |
| Greg | Early | AIS, New Bedford | Whale biology | mailgearly@yahoo.com | A.I.S., Inc.<br>89 North Water Street<br>New Bedford, MA 02714 |
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| | | | | | |
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| Invitees that did not attend to retain on mailings | | | | | |
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**Agenda:**
**LARGE WHALE RESTRAINT WORKSHOP FEB 7/8 2006**

**Day 1**
0830 Assemble in Carriage House. Coffee and bagels etc

0900 Introduction and Terms of Reference – Jamison Smith

0915 Brief review of 2000 and 2001 workshops and the agenda for current workshop – definition of terms, and goals for workshop. Assumptions and questions. Michael Moore

0935 Review of videos of a 'typical' grumpy entangled right whale needing better restraint – Stormy Mayo

0950 Overview of large whale restraint strategy – Greg Early
What conditions we must reliably create for disentanglement to occur safely for the whale and the disentanglers.

1030 to 1100 Coffee Break

1030 Review of past drug delivery hardware development – Teri Hammar

1050 Review of pharmacology developed and deployed – David Brunson

1110 Review of lasso technology – Becky Woodward

1130 Review of cases that could have used sedation as part of the disentanglement toolbox, and definition of candidates for sedation and summary of safety and resource issues – Scott Landry

1200 Lunch

1300 Discussion of status quo and establishment of next steps and ultimate goals. Chaired by Michael Moore

- Delivery/application method
- Equipment needed and available,
- Equipment needing further testing/development, methods for "getting out" (of sedation).
- Maintenance of equilibrium

**Working Groups 1330 – 1700 Proposed groups. Chair in italics. (Moore, Rowles, Gouviea and Smith to float)**

Drug deployment - Attachment/ ballistics, injection, instrumentation, safety and resource deployment. Pharmacology and dosing protocol - Drugs, doses and field data requirements
*Brunson*, Gulland, Arthur, Mayo, Hammar, Walsh, Stamper, Rolland, Sharp. Rapporteur: Campbell-Malone **MRF Conf Room 204**

Monitoring sedation progress - using dtag with real time upload to assess movement, fluke strength, respiration etc. *Boconcelli*, Early, Landry. Rapporteur: Lysiak **Meeting Room MRF 232**

Physical Restraint – head harness, tail harness, plus maybe dry dock, pair trawl, seine *McLellan*, Morin, Foster, Woodward, Winn, Kraus, Foster, Wallace, Green, Pabst, Winn. Rapporteur: Bogomolni– **Carriage House**

**Day 2**

0830 Coffee and bagels

0900 – 1015 Reassemble for plenary discussion

1015 to 1045 Coffee
Working groups reconvene to write detailed work plans, team composition and budgets. Need definition of next steps with budget and responsible persons to deliver. With each working group to assemble a brief but complete plan for funding to achieve the desired goal. Objective – establish a toolbox and team composition that can actually achieve our goals.

1200 Lunch

1300 Reconvene in plenary to discuss progress and plans

1530 Depart

**Acknowledgement**

The chair wishes to thank the rapporteurs, presenters and participants for giving up multiple busy days for the workshop, and NMFS for the fiscal support.

**Working Group Study Plans**

**Chemical Restraint Study Plan**

*David Brunson*, Frances Gulland, Richard Arthur, Stormy Mayo, Teri Hammar, Michael Walsh, Andrew Stamper, Roz Rolland, Brian Sharp. Rapporteur: Regina Campbell-Malone

Promising area but one that will be deployed only in situations where other options have been determined to be non-effective.

I. Analgesia and sedation techniques

"Criteria for sedation and for not sedating"

Questions:

1. Can Butorphanol be formulated to concentrations that will reduce the volume of injection for delivery to large whales?
    a. Target volumes = < 30 mls

2. Does Butorphanol tartrate provide better sedation and dose delivery than Meperidine HCl in cetaceans?

3. Are super-concentrated Meperidine, Butorphanol and Midazolam absorbed effectively from muscle?

4. What is the effect of super-concentrated drugs on muscle and vasculature?

5. What is the limit to the volume of drug that can be injected into muscle without affecting absorption or resulting in significant tissue damage?

6. What is the effective distance of the modified Paxarms dartgun for accurate placement of 30 and 60 ml Whale Darts?

Study Plan

#1 find out the availability of bulk Butorphanol drug, test solubility for maximum stable concentration. Dosage will be based on current information from Killer Whale sedation calculate volume of administration for 0.06-0.1mg/kg.

#2 Field test Butorphanol vs Meperidine with and without Midazolam in stranded cetaceans.

#3 and 4

a. Test high concentrated drugs in laboratory animal species.
b. Test high concentrated drugs in stranded cetaceans.

c. Test on entangled Gray Whales
Measure blood levels
Clinical signs of sedation
Histopathology of muscle and vessels

#5 Test on anesthetized animal (pig) and/or stranded or entangled whale, pinnipeds?

#6 Conduct ballistic testing of modified Paxarms rifle.
- a. target
- b. muscle
- c. whale skin and blubber
- d. Dead whales
- e. Bowhead harvest
    - a. Towed dead whales
    - b.

#7 Development of remote drug injection
Injection through water?
- a. single dose
- b. multiple dose
    - a. elastameric infusion
    - b. robocyamid
        - i. version 2
        - ii. roller pump and bags of drugs
    - c. ROV delivery

#8 Myology and alternative drug injection sites
- a. Rostral aspects of whale
- b. Head, neck, mouth

Timeline:
Chemistry: 2-4 weeks
Animal testing: drug absorption, toxicity, volume: 3 months
Field Testing stranded animals: ? depends on suitable animals 6-12 months

Personnel: Team of 2 people (vet and support staff) to go to stranding
Numbers:
Training/redundancy: multi-teams
Budget

Budget:
Drugs: $5,000.00
Study animals: $500.00
Materials: $1,000.00
Travel: $6,000.00

Data collection:  $2,000.00
Personnel/consultants: $25,000.00
Training: $8,000.00
Equipment:  $5,000.00
Engineering and development: $20,000.00 Ballistic and projectile development
Robocyamid:  *$200,000.0*

**Physical Restraint Study Plan**

*Bill McLellan,* David Morin, Jeff Foster, Becky Woodward, Jeremy Winn, Scott Kraus, Bob Wallace, Mackie Green, Ann Pabst,. Rapporteur: Andrea Bogomolni

1) Do we restrain or sedate first?
A. physical restraint at first, and sedation comes second. Or,
B. sedation comes first and then we come up with what supports and controls the whale; thinking the animal is less responsive, pull pontoons or seines on side.

2) Decided that animal needs a line on it, to tag using Woodward's tag first, then decide to sedate, only with possibility of restraint (pontoons, salvage floats, float line) for safety of animal and people and if animal sinks.

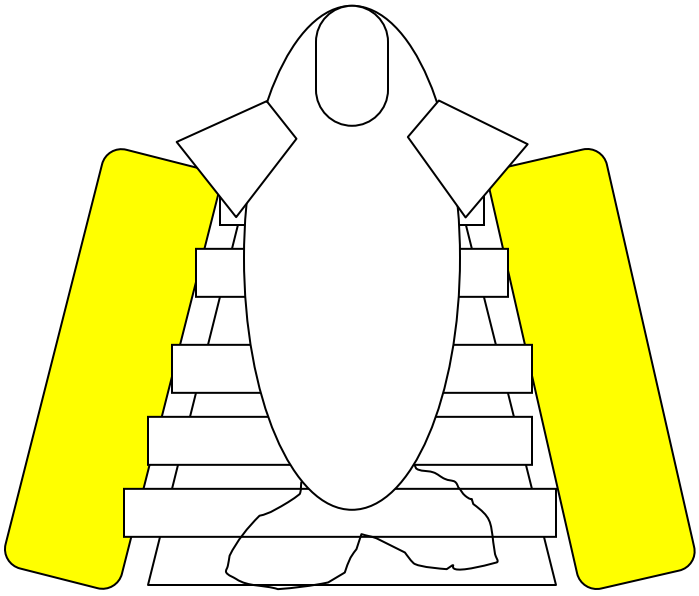
3) Head area: moving pontoons/device from head to tail possible (possibly a hoop net on head/width/lines- need to develop head model).

5) R and D on behavior- response necessary. Head first approaches, etc.

6) R and D on ROV to cut line below the surface, new tools, old tools

7) R and D on pontoon and boat

Given time of one week, we need to:
Attach line to tail
Create straps for floatation
Create salvage and lift lines with remote deployment.



Telemetry Study Plan
(A. Bocconcelli, S. Landry, G. Early, N. Lysiak)

**Monitoring** (a case that is going to involve sedation or other intervention)

I. Augmenting telemetry buoy (already outfitted with GPS)
   A. Real time sensors (attached to buoy) for measuring:
      1. depth
      2. speed
      3. towing angle
      4. tension
   B. Real time telemetry options
      1. cell phone link
      2. HF
      3. satellite
      4. AIS

***Estimated costs: $10,000-20,000, possible source of $$: WHOI/Green Award***

   C. Improve effort to monitor existing entangled population, use Dtag opportunistically to study and get baseline behavioral information
   D. Explore the legal consideration for implementing AIS telemetry on buoys (Coast Guard, IMO, etc)

***Minimal cost***
***Timeline: 1 year***
***Working Group: Bowman, Bocconcelli, Johnson, Woodward***

II. Monitoring the whale
   A. Opportunistic Dtag with EKG sensor(pre, during, and post-intervention if possible)

***Estimated costs: $5,000***

   B. Dedicated observer to monitor respiration/behavior on support boat
      1. Radio to communicate with team
      2. Camera and videocamera
      3. Emphasis on quantity and quality of respirations, body position, reactions

III. ROV monitoring
   A. Underwater camera to monitor behavior and assess entanglement
   B. Collect sounds
   C. Could assess wounds and administer chemicals
   D. Place cutting hooks/knives to cut lines

***Estimated costs: $20,000-50,000***
***Timeline: 1 year for prototypes***
***Working Group: Bocconcelli, Johnson, Shorter, Hurst, Woodward***

IV. Long term monitoring
   A. Glue-on callosity tags with AIS beacons

***Estimated costs: $200,000***
***Timeline: 2 years***
***Working Group: Bocconcelli, Wylie, Johnson, Shorter, Hurst, Moore, Woodward, Tyack***

**DRAFT Budget for Large Whale Restraint Research and Development**

| | | Step 1 | Step 2 | Step 3 |
|---|---|---|---|---|
| **Drug Pharmacokinetics** | | | | |
| | Drugs | 5,000 | | |
| | Study animals (pigs) | 500 | | |
| | Materials | 1,000 | | |
| | Travel | 6,000 | | |
| | Data Collection | 2,000 | | |
| | Personnel/consultants | 25,000 | | |
| | Training | 8,000 | | |
| | Equipment | 5,000 | | |
| | Ballistics Engineering | 20,000 | | |
| | Robocyamid | | 200,000 | |
| **Physical Restraint** | | | | |
| | Lift bags and tail grabber | 50,000 | | |
| | Rapid release rope | 10,000 | | |
| | Event logistics | 20,000 | | |
| | Design and build head/flipper model | 40,000 | | |
| | Ocean tug charter per week | 100,000 | | |
| **Telemetry** | Upgrade PCCS telemetry bouy | 20,000 | | |
| | Dtag entanglements | 5,000 | | |
| | ROV - assess and ? Cut | | 50,000 | |
| | Long term AIS tags | | | 200,000 |
| **Workshops** | 2 @$25,000 | 50,000 | | |
| **Step Totals** | | 367,500 | 250,000 | 200,000 |
| **TOTAL** | | | | 817,500 |

Steps indicate order in which tasks should be done assuming full budget is not immediately available.

## Transcript Summary

At the outset of the meeting there was a plenary discussion of the philosophy behind the intent of the workshop. It was repeatedly stated that disentanglement was no substitute for entanglement avoidance, but given the ongoing incidence of serious intractable entanglements, there had to be an improvement in right whale disentanglement efficiency, which currently stands at about 50%. Mayo stated: 'we can't handle flipper wraps, mouth entanglements, both of which are lethal…. we know with a right whale we may fail and it's because we can't handle them.' The most important animals to focus on are those that are still healthy and therefore most resistant to disentanglement. Brunson and Walsh suggested that the initial approach should allow for a non stressful application of a sedative using a remote ballistic delivery system. Early then suggested that behavioral modification rather than sedation was a more practical approach. A discussion then ensued as to how developments in disentanglement might impact entanglement avoidance. Kraus added that better ability to interact with right whales would serve other veterinary goals such as treating sub lethal trauma by ships. Thus there was a lack of a group sense that further development of chemical and physical restraint was worthless.

Moore reviewed previous two workshops (Moore *et al.* 2000; Moore *et al.* 2001), the first discounted the value of antibiotics but highlighted the role sedation might play. Gulland then deployed a mix of Medazolam and Meperidine on a stranded grey whale prior to euthanasia, and then Brunson used the same mix on Eg 1102. The second workshop focused on assessment, restraint and tool deployment. A concept drawing of a remote acting drug delivery system was generated and a right whale tail model was fabricated to enable tail capture systems to be tested. He reminded the group that the scale of physical restraint evolved by modern whalers exceed what would be practical to establish at unpredictable entanglement locales.

The discussion then turned to the level of sedation required in terms of both tractability and reliability in the context of sedation with or without restraint.

Mayo then reviewed a series of videos of disentanglement attempts, discussing safety, body orientation, strategy using kegging, indicators of a broken whale (such as a floppy tail) and the need for a remote device for injection, monitoring, cutting and tagging.

Early then summarized a historical review of restraint, suggesting that net capture was ideal but prohibitive. He favored remote telemetry and devices that operated remotely over chemical restraint.

Discussion then turned to the possibility of a blindfold. The likely utility of this was tempered by the practical issues of application.

Hammar then reviewed prior progress in drug delivery hardware: currently a gas powered syringe delivered on a cantilevered pole.

Brunson then demonstrated a modified syringe holder for cantilever or hand held pole delivery, and a modified Paxarms rifle capable of firing the Hammar dart.
He then considered 4 areas to achieve the goal of conscious sedation: Route, reversibility, duration and past agents that have been used (Medazolam and Meperidine). In terms of route the tracheal delivery was discussed, as was the need for better understanding of large whale pharmacokinetics. Brunson then discussed his ability to hyperconcentrate the above 2 drugs, and the available data on the reaction in Aug 2001 of Eg 1102 to drugs. There was little demonstrable effect, but the animal treatment was not lethal. The concern that voluntary breathing may be a concern in sedating a whale was discounted by Walsh who suggested that early captive mortalities reflected overdoses and inadequate delivery.

Woodward then summarized her development of a deck mounted net gun with a padded tail harness and a low drag telemetry buoy. The lasso would have a timed and remote release.

Landry then reviewed cases that were amenable to enhanced disentanglement using the following assessment questions: Life-threatening? Trailing line? Health assessment (healthy vs. likely to die)? Forward wrap (rostrum, flippers)? Embedded/taught line? Disentanglement attempted? Thus 3 out of 8 cases were regarded as good candidates for sedation. Especially to facilitate direct access to flipper wraps.

A discussion then ensued about which class of animal to first focus on. Healthy males was one option. Walsh then questioned if hyperconcentrated drugs were actually bioavailable: if not that could explain the lack of response by Eg 1102.

Working groups were then established for: Chemical and Physical Aspects of Drugs; Physical Restraint; and Telemetry. The members of which are listed in the agenda above.

At the beginning of Day 2 a further plenary session began with a discussion of how to integrate chemical and physical restraint, and non-intrusive approaches that relied on a deployed device or devices enhancing the opportunity for self disentanglement. There was a undercurrent that a second workshop might deal with the latter, although this was never stated explicitly.

The discussion then focused on using entangled grey whales to develop sedation protocols. It also considered immediate needs and developmental tracks. A significant question again was whether the hyper-concentrated drugs are absorbed. This could be the reason Eg 1102 did not show more response. It was noted that Xylazine was inappropriate in a grey whale, and given its high species variability in response was not a good choice for right whales. Brunson affirmed his willingness and comfort to use the same drug mix as on Eg 1102 at higher doses. The discussion then turned back to the issue that with 1102 there was no contingency if the animal lost balance or buoyancy. While not a consensus, there was a majority opinion that a live immobile right whale would float dorsal up.

Landry then focused on the need for a small deployable, repeatable approach. Kraus felt it could start large and then become more efficient with experience.

A discussion then ensued about when divers might be used. Some felt that a completely immobile case might be suitable. A protocol would have to be developed in consultation with the NOAA dive team.

The use of an ROV to cut was then considered more possible as the speed of the animal decreased with far less risk than diving. The noise of one was not considered a problem.

Mayo then presented the outline of a protocol that included sedation etc. The outline is shown on page XX. A critical piece of which is attaching a location tag asap.

The idea of using AIS technology on attached and towed tags was then discussed. Issues included time to acquire GPS, and legality of whale deployment.

The restraint working group was then summarized by McLellan. The optimal sequence re restraint and then sedation or vice versa was a repeated issue. A concept of a pair of pontoons and a device to hold the head after a line was attached to the tail was outlined in detail.

Discussion kept returning to the conflict between needing a full capacity to physically restrain an animal under the influence of sedatives, vs. the practical limitations of deploying the necessary restraints and crew to operate.

The possibility of having a workshop between vets and behaviorists was raised. Such a workshop should include the issue of distraction.

The definition of what the actual needed degree of restraint needed was repeatedly returned to. It was perhaps more of a need for adequate support, than restraint.

Kraus likened right whales to cows grazing in a field, or bulls: they are not too interested unless you get too close. Humpbacks are more curious… like a golden retriever. More trusting. Humpbacks give up quicker when entangled. Not as much power to break free themselves.

The idea of a nasal pipe to keep the blowholes at the surface was also discussed. Concern was raised of what to do it a supported whale starts to spin. Discussion continued of physical restraint with hoops and harnesses retained a residual concern re practicality and risk.

There was a continual return to the issue for PCCS to keep field team small.
The cost of physical restraint is huge. The alternative is major human risk.
Need to consider an acoustic strain gauge on buoy line to measure degree of sedation.

**Integrated plan for development and deployment of hands on large whale chemical and physical restraint to enhance disentanglement through enhanced tractability and acceptable human risk**
(Proposed by chair in light of workshop, but not a consensus statement of workshop)

1. Sedate
2. Establish a control line and on board telemetry if not present
3. Physically restrain if necessary
4. Establish contingencies for different outcomes

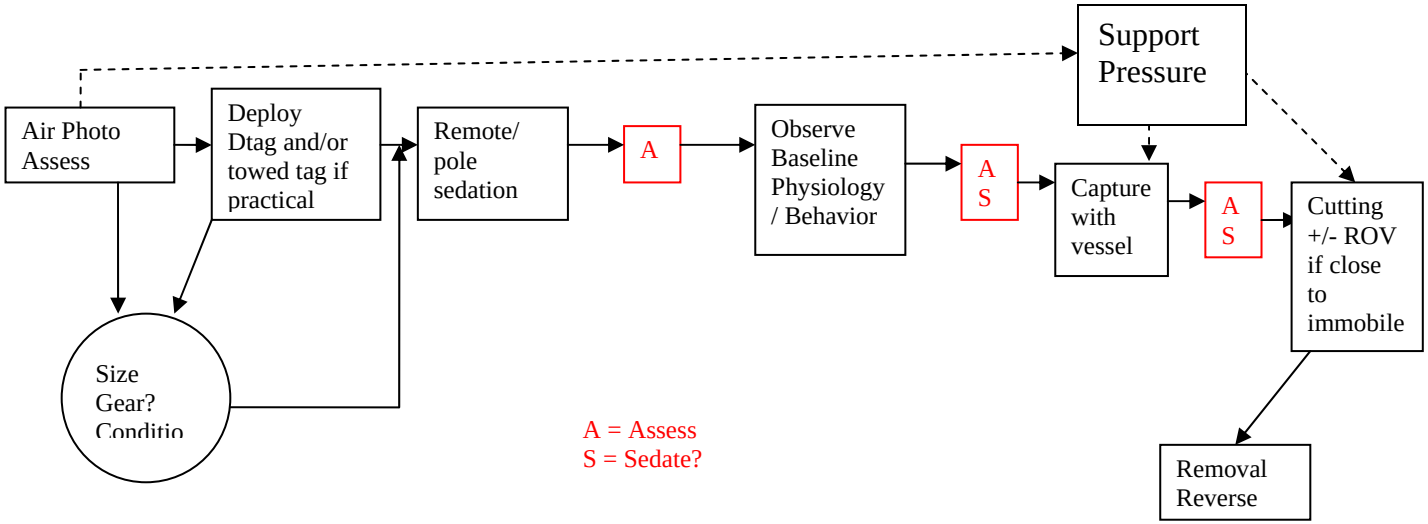
**Steps required to achieving above (see Working Group Sessions for details):**

**Sedation**
1. Test pharmacokinetics on stranded beached animals to establish if drugs are absorbed from i/m site.
2. Develop dosage regime to actually achieve sedation in large whales
3. Develop a ballistic system to repeatedly deliver drugs from mother vessel
4. Establish if a sedated free swimming whale will lose balance
5. Enhanced understanding of behavioral assessment

**Restraint**
1. Develop inflatable system to restrain flukes and head – need development to be deployable at sea.
2. Establish system on a less endangered species such as a entangled gray whale

**Possible tools**
1. ROV once essentially stopped – assessment, placement and cutting
2. Tail lasso – needs range finder and quick release development before at sea trial
3. Dtag – needs to be easily readable at sea, real time telemetered
4. Towed drag such as PCCS telemetry tag
5. Distractants – paintball, blindfold

**Summary of logistical sequence – Draft by Mayo with edits by chair**




Dashed line = Traditional approach – may be used at outset as often only chance
? Attach fluke control line and towed tag at outset using lasso

Field teams: PCCS – tag/assess/cut

Vets: one on site to sedate, others remote  Tail tag: Woodward/Winn

**Transcript of Plenary Session February 7th**

Large Whale Restraint Workshop(s)

9:00 am Jamison Smith
Acknowledgements and NOAA issue to address
Terms of Reference; Federal Advisory Committee Guidance
Keep discussion to facts, no consensus

9:15 am Moore

We don't want to generate a process that makes preventing entanglement acceptable. Restraint could be a huge mistake, need to answer this question by the end of the workshop. If not a mistake, how do we take the next steps?
If a mistake, go home and don't waste time formulating a plan.
PCCS is doing extremely dangerous work.

Moore's underlying goal for the workshop (while addressing stated questions) was to try to answer the question of whether this arena should still be considered.

*Recap of Sedation Workshop February 7th 2000:* Initiated by a desire to enhance disentanglement ability after the failure with Eg 2030 in 1999. Use of antibiotics was discounted given serious issues re the principles of such therapy. Sedation was in contrast regarded as potentially viable. Discussed doses, ballistics, restraint systems. Post workshop progress included Frances Gulland's tests of Midazolan on gray whales and Churchill sedation attempt series.

*Recap of Large whale disentanglement meeting held at WHOI on December 14th 2001*: Funded by Northeast Consortium. The focus was on Assessment, Restraint, Cutter Deployment (slides)

*Assess* - Need better aerial images. Assessment tools: photos, AUVs, onboard data collection heart rate and video – robocyamid. Progress: airship was helpful on recent humpback case.

*Restraint*- fluke harness, whale tail, net gun, remote drug delivery, robocyamid. Progress: on the water workshop with CCS and tail model.

*Deployment*- pole cutters, cutting devices, cutter on robocyamid were all discussed. Progress: NMFS funded meeting today. Airship - humpback view (Lange) helpful, but not on call. Ptown-tail model restraint workshop 2002- no significant changes in restraint ability. Woodward - tail lasso has been developed so almost ready to deploy at sea

*Robocyamid*- Sedation delivery system- drawn subsequent to workshop by R. Arthur. Cost estimate $140,000. Second, simpler, flatter version $20,000. Remotely delivered. Issues: cost, induce instability of sedated whale with inadequate physical restraint.

Operator safety, dubious philosophy of enhancing disentanglement and so reducing pressure on better entanglement avoidance

*Goal of this workshop* - review past progress and current challenges in large whale restraint. Establish a paradigm that results in effective physical and chemical restraint. Is it achievable? What needs to be done to achieve this?

Moore then reviewed comments and emails from CCS disentanglement team to try and ground the workshop in reality:

Landry email: delivery of choice is ballistics, not attached hardware (slides)
- Biobullet
- Hand poles

Boconcelli: Have handheld poles been considered?
Brunson: a couple of devices have been played with and we can deploy syringes from a hand held pole.

Landry: clarification of his own comment- Will the drugs actually work: I believe they can be deployed but will the drugs actually work?

Mayo email: 'Churchill was a sitting duck….head restraint necessary, Churchill was not a typical right whale.

Morin email: looking for close to immobile, remote projectile, not delivered by a towed vessel.

McBain email: Sedation removed animals ability to escape and control its actions, equilibrium loss is a concern

9:40 am Moore discussing Jim McBain's take on sedation and delivery

Bowman email:
- define goals
- delineate final product desires
- scrutinize common assumptions (purpose, feasibility and ethics)
- Is this a good idea?

Moore: What did 150 years of lethal pursuit technology development do for us? Lessons from technology pretty much stopped evolving by 1920. Skipper in the flying bridge, when it's time he runs down the catwalk, unleashes gun and fires. We must appreciate the enormous engineering challenge involved in physically restraining a not-so-dead whale. Images of whaling vessel bulkhead-bound spring (boat diagram). The 1910's technology hasn't changed in whale catching. Restraint is needed to hold a not dead whale.

Moore: Does it make sense to do this? Is it insurmountable? Desirable?

Mayo: Agrees with Bowman's email that we *shouldn't* have to do this because prevention of entanglement is the best answer, but we are not there. So we are obligated to consider this: "We shouldn't be disentangling, but avoiding entanglements, but with all this we are not there, if we go down the road of disentanglement, we have good luck with all species but right whales….If we don't have a new method, then we are obligated to go in the direction of original intent. Or we will fail on the most important (right whales). We can't handle flipper wraps, mouth entanglements, both of which are lethal. Other people have to ask questions about whales sinking and the like, or we will have to give up on the large percentage of right whales, but we can't give up (statistically). That is the frustration we have, we know with a right whale we are going to fail and its because we can't handle them. Give us a humpback and we are in pretty good shape."

McLellan: is the entanglement rate going down?

Stormy/Landry: No

Mayo: No, but the numbers are low. But one of the things that drives this is a ~20 year history of the most dangerous entanglements (mouth and flipper entanglements) increasing. Not known if the numbers are statistically significant.

Landry: Part of it is that we have greater coverage, looking for them and can see more from some of the platforms like planes. 50% success rate right now with Egs. ~90% rate in humpbacks.

Mayo: We can't afford the 50% loss in this species.

McLellan: Standard statement applies that this (disentanglement) is not the method we should be using.

Landry: most of the entanglements are going on without us knowing about it. We are only going to be able to deal with the animals that we actually see and notice that they are entanglemed.

Smith: Are we seeing an increase in dangerous entanglements in all species?

Mayo: No that is not my sense. It must be behavior, mouth entanglements… because of the way behave right whales are more susceptible.

Kraus: Suction or flow on the front end of the whale, increases risk to the flippers. /mouth open features (Alex Worth's paper) and the resulting flow of water around an open mouth increases risk in right whales to flipper wraps. [Agreed that more lethal entanglements are going on, his guess is that it is because of increased fishing gear in feeding areas.]

Brunson: Is this a problem of getting to the wraps or a problem of the animal allowing safe approach? Is it reaction or temperament of the whale that is the problem?

Mayo: Both in part. Ultimately getting to the wraps is the problem. Recoverable whales cannot be dealt with (often can't even approach close enough to video). He has been "involved with 3 right whales that are "broken" lying on the surface of their own volition… arguably "dead." Aquarium's catalog supports that they are essentially dead." Humpbacks show this broken response eventually, but before they are in that poor condition.

Kraus: "Most are the Cape buffalo of whales"

Brunson: A large proportion of these animals are of a mental attitude and temperament that they cannot be approached… when we are discussing sedation this is a very important concept to be pursued when it comes to drug selection, approach and delivery mechanisms. Elk vs white tailed deer.

Mayo: Mattila and I played games with 2030 for a few weeks because we knew that the animal had more in it than we were seeing and it wasn't until we made one mistake and it nearly killed us. It was also an animal that was almost dead.

Gulland: Were the broken whales nearly killed/beaten by entanglement or stressed/pursued to that point?

Stormy: Both animals were beaten by the entanglement, subdued because they were severely weakened….

Gulland: This was a chronic not an acute response to chase?

Mayo: Right, these gave up right away like humpbacks. They were wiped out. These are not the animals that we want to design this protocol for [because the chance of their survival after disentanglement is so low.]

Brunson: The most aggressive can be the most fragile animals. A Stallion you think will be tough, but it's the old backyard pleasure horse that you can do anything to and they will survive. Those that don't handle intervention get stressed, those are the ones you have to use drugs more effectively on (violent, aggressive). Once you exhaust or stress them, then they fall apart. Adrenal stress, stress physiology; you know you can push them over the brink. Pharmacological approach may be an important approach – not tough in survival. They decompensate, get stressed and really get hurt by capture. There are drugs for that type of animal and response and that should be a part of the decision.

Kraus: they need to be made happy first, then calm.

Walsh: if we overexcite the animal first, some of the drugs don't work after they have been excited. You can't wait 19 hours of wrestling, behavior says sedation first, or they

will override it (killer whales, dolphins). Sedation aspect needs to take place during a more quiet approach… must take place earlier rather than later. You approach once, if it doesn't work, try something else (right away).

Mayo: discussing sedative approach… "If you do not sedate remotely, you may be chasing that animal like crazy and it might be a wild scene, which violates the principle. We need to look at the development of a new kind of ballistics method that can deliver a substantial bullet that will work, , rather than chasing it or towing it in a dangerous position , allowing you to get it right the first time without the crazy chase first. Seems to me that there a few things in parallel…. Which direction, and on the water, how will it be delivered? Someone has to know how to accurately deliver it.

2 things: 1) what's the direction to go (sedation wise)
2) how are we going to deliver it.

Moore: "Craig Bamber, NZ, may be able to help develop a remote delivery system. I think a deliverable that doesn't require the chase is the way to go." Not getting close is the way to achieve (sedation).

Mayo: If we don't have remote devices we are not going to get to the healthy animals that were entangled 4 days ago, we will get the ones that are dead.

Mike Walsh: "Is the problem that we are only thinking of boat-bound delivery? Should we be thinking about planes, etc?" Maybe robotics, from above, something not boat related….

Moore: called for dissenters re restraint/immobilization

Hammar: I realize that this is the approach that we are left with, but what is the legislative outlook of changing the fishing industry? There is precedent with lobsterman changing their gear… tuna fisherman

Moore: the pressure has been implied. Not doing much. Not our charge. Whale-safe fishing gear problem is outside of this workshop's charge. Not going to happen in less than 5 years. (Later Gouviea questioned this time line suggesting a shorter time to material improvement).

Mayo: We will never get to zero take. The result will be that we will increase efficiency of disentanglement, will never get to zero take… and for that reason we should *not* be doing this because we'll reduce the pressure to get to the required zero–take. The result of that will be that the pressure will be decreased and more whales will go unfound and unseen, because we are improving but not enough … we cannot improve our technique enough to get to zero.

Early: ("Devil's advocate reincarnate") - Where is your end stage? The ideal end? Where will this drive us? It (new techniques) negates the need to get rid of disentanglement. The notion of restraining animals, should you come up with a bio bullet… How much reliability and how much dependence will you have on that method to restrain it. The more you depend on it, the more you restrict your option in different scenarios. Narrows field of operational development, (if it's the big club in your bag, you are obliged to keep using it again and again). If it works once, you are under pressure to act and use it again and again. Given all the different scenarios (animal behavior) it's dangerous on an operational standpoint. One stand is operational, one ethical. Modify behavior, rather than sedate and stop it. They are different things; control not necessarily restraint. That is the behavior camp is not the restrain camp. Clearly defining terms is a good thing to do. Am I pro or con restraint? I wouldn't go that way myself.

Stamper: what do you mean [when you say whale-safe gear is] 5 years away?

Kraus: Take reduction team (stop gap measure until whale safe ropes can be developed; approximately 4-5 years away), and also gear modifications, closures, various management methods are being looked at

Gulland: It's a race against time. One set of people are looking to reduce risk and another set of people working on restraint problem. Is there a problem of 2 views?

Stormy: If one group is succeeding at a partial solution, the complete group will be content.

McLellan: "There is precedent that there is negative feedback from one camp to the other. You spend all your money to improve the fire department but don't go after the problem (arsonists). 16 calves born this year gave NOAA head ability to say there is no problem…."

Early: So to the restraint team (looking at Mayo and Landry). Can you play with the other team? Are there developments that will cross fertilize? In my standpoint if you can develop something that can enhance development of other gear, that favors other development. Restraint techniques specifically.

Kraus: There is cross fertilization. Gear is based on disentanglement success and failure-lots of rope and gear development gets feedback from disentanglement
Strength, stress on gear

Early: Specifically developing restraint techniques… are disentanglement and restraint going to develop separately?

Kraus: orphaned calves, animals that were hit by ships… these are non-entanglement issues - things that seem outlandish right now but the fact is that there should be total management of the species not just for entanglement. Should include vet response to

injured or orphaned calves if it was possible. Sedation piece alone is not sufficient, must include a way to stabilize the animal and keep it afloat. They are inextricably linked.

Mike Walsh: if you do this they won't want to encourage stopping the line from [being there]/ [reducing the] risk… you won't get people to go along with this until you get the general public educated… until that happens you are still going to be in the back room dealing with an issue that should be a public concern. This was the situation with orphaned manatee calves… which are now routinely rehabilitated, released and are thriving with calves of their own. People know about manatees but not right whales. Multiple orphaned calves are now contributing to the population.

Moore: In terms of public education the welfare question is what we should focus on… not the population endangerment issue. Right whale entanglements are slowly enacted long term death sentences.

Dave Gouveia: We have to stop entanglements period. Echo Mayo's comment re: solution is not us being here, but stopping entanglement from a management perspective: we are trying, but it is difficult. Biggest problem is lack of technology on gear. One thing we have agreed on is that in lieu of good solid gear changes we dealt with the issue of line being in the water - end lines and ground lines between pots and traps. What we are able to do with the team (fishermen) is get them to understand that these are the 2 things that need to be dealt with… no more "our gear doesn't do it" or the entanglement rope that you have provides inconclusive evidence "anonymous rope." Trying to make it a more comprehensive management program by including all areas since right whales are everywhere and all fisheries are involved… The fight is with the system we are working in. Unfair economic burden…. We have the burden of a lot of information but NOT a lot of specific details. I don't think whale-safe gear is 5 years away. We proposed in our rule that this will occur in 2008. On the end line issue "will this workshop create a disincentive?" Disentanglement already has - they don't need disentanglement as a disincentive, but they are going to use it anyways because they don't want to be controlled/ changed. Agreed with Kraus that entanglement is not the only use/time for handling the animal. Scott pointed out that you can use this in other situations, belugas and right whales up river, something you can use in different scenarios other than entanglement

McLellan: [seconded that] humane treatment argument is key. Handling an animal that is not treatable anymore. If there is a situation that you had to euthanize, and understand the case, that is important (recovery of a RW). 75% are lost. We don't understand what is happening to most of these animals.

Pabst: question to Mayo, "Stormy, you had talked about the animals with a chance are impossible to get at. Dave said that if you are characterizing them as Cape buffalo, insure they are happy before you start working with them, then that takes you down a road where sedation is a preliminary part. Greg says that is a narrowing option. If you say you will deal but not debate, you will rev it (the whale) up, that takes you down a single path. If talking as a group you need to talk about parallel paths… Can we argue then that the

alternative is to spend more time understanding behavior of these animals. The alternative is spending time figuring out why they are getting entangled – Scott [Kraus] said this is because we have gear in their feeding grounds. We are talking about an endangered species that presents us with behavioral problems and we are putting gear in their habitat without knowing their behavior. We have an endangered species, with behavior problems, and we put gear where they feed.

Moore: Sensed a groundswell of support for pursuing the question of physical and chemical restraint. We should conclude that better behavioral understanding is required and that parallel alternatives are required. What I'm hearing is a very strong 2nd bow in the quiver… we need more telemetry people, behaviorists, etc… That's what I've been evolving toward. Greg's approach is valid, what I'm also hearing is that restraint and sedation babies should not be thrown out with the bathwater.

Early: not convinced that we have a good model for physiological or behavioral evaluation. Stormy, what does it mean when an animal is broken? Some of that is doable. Like, myopathyies in stranded animals. There is a need there.

Gulland: (adding to Kraus' point) There is a parallel in Africa. Standard developed for the immobilization of poached animals (elephants) which has now become routine despite the fact that years ago it was unheard of. Like elephant contraception, now routine.

Landry: I'm all for trying to come up with a routine for immobilization and restraint…. By the end of it I may be convinced that this is not reasonable or feasible. We wouldn't do this for a knife, but I'm all for spending the resources to do this, but that similar resources could be used to figure out the studies that need to be done. Rhino issue has been group analyzed in terms of 'are we effectively using our resources.' Sedation is one small tool in the toolbox OR NOT because the logistics might be beyond us.

Alex: Someone spoke about animal behavior on feeding grounds with fishing gear. The problem is not restricted to the feeding grounds. We had 50 whales in 60 feet of water with gillnets around them off Jacksonville, seabass, lobster traps… it is a mine field.

Stamper: what is Stormy's definition of sedation? Complete immobilization? Or a spectrum?

Mayo: I think there is a spectrum… there are cases of healthy right whales that we can work with that don't need sedation where we believe we can handle the animal. Tail wraps we can handle effectively. All the way down to Kingfisher where I would have thought we needed the animal completely immobile for a couple of hours. Then there is Churchill whom we could have held at the surface available for 15 minutes. Flipper wraps are the tough ones.

Landry: we just need an animal constrained to a point that it is unlikely to lash out violently

Mayo: interested in this breaking idea… when they go limp, they go really limp. Have we been close to it with right whales? People who work with horses must know what that is? Is it physiological or psychological?

Mike Walsh: Manhandled dolphins can throw off 20 people. Under sedation they are at a point of being handled still functioning, still swimming

Mayo: many cases it would be entirely possible to work on an animal in that state (above). Flipper wraps are a different story.

Stamper: Then the problem is that you get lulled into a state of safety.

Early: Is it tractability or reliability (when I put my finger on it the animal is not going to spank the hell out of me).

Landry/ Mayo: Reliability

Landry: we know that we can't expect 100% reliability

Mayo: if you have sedation and add restraint does it make it better/worse, more reliable. Need to combine both – better control and reliability to get out of the way.

Early: that's usually why redundancy is done… blanket the seal after valium administered. You do try to juggle both systems at once.

10:47 break

11:00 am Mayo: video of disentanglement
Issues: 1) human safety concerns 2) disentanglement effectiveness

Present method is to drive them put floats on them, push them as far as possible until they give up on the surface, huffing and puffing and are more amenable to being freed/worked on. Most important intervention: mouth or flipper entanglements… need 1-2 hours of proximity to an immobile whale. Look at behavior not just techniques.

Clips of Eg 3346 (Kingfisher). Look at not so much the method, but what do we get from the view in terms of trying to get these animals out of the gear. Think about how the whale is behaving and in terms of what can be seen and what can be done.

Safety controls much of what we do. Safety is inseparable from the effectiveness of the effort. With that in mind, there are some entanglements where even if human safety were not a concern you probably wouldn't get anywhere unless you got the animal much more restrained. Sedation represents another layer in the context of present operations… whatever immobilizing technique that we are thinking of must be cast into the logistics of disentanglement (location, distance, weather, sea state, available support and positioning of trained personnel).

There should be a lot of early decisions. Whether there is a spectrum of dissent operations/intervention and a spectrum of desired sedation levels. There needs to be a decision making process regarding whether an animal should be sedated at all. Sedation is not an all or nothing tool.

Eg1102 pole-cam on Churchill

Mantis, tail-grabber. Not sure what he would have done had he had grabbed it.

Brunson and Hammar's syringe delivered drug successfully and repeatedly although a needle was bent and at one point drug escaped under pressure and exposed Mattila's hands and mouth. Pressurized sedative on the boat is an issue. Consider the condition of this animal- while tractable, not what you want to deal with.

Eg2427 – catchable and injectable whale. Puts its tail deep in the water, head barely under. Doing something right whales tend to do (unknown why). Swimming with its tail deep, head at surface only went underwater once every 5-10 minutes. Successfully cut free, an attempt that would have been difficult if it had not been doing this behavior. Performed this behavior for many weeks after disentanglement. Allowed boat to be pulled right over the tail, docked against the blowholes. Whale is moving along very well. Head up, baleen exposed. Same behavior seen in un-entangled whale in Chesapeake river. Immobilization not necessary.

Eg2212 – Different entanglements: 3 entanglements on it. Images from 1st entanglement. More active animal. Connected to Shearwater 39-foot Jarvis-Neuman. Typical reaction (consistent tail slap) in response to tension on tail line. Lots of lobsterpots in the vicinity. The whale reacted to having the line pulled (boat in reverse)… Eventually the animal broke the line. Floppy tail flukes on this animal. Only seen in whales that eventually disappeared. Reaction afterwards was fierce from the whale.

Moore: is the floppiness just the animal eating body protein? (no response)

Stormy: back to slideshow

Last whale: (Slay, Smith, Mayo) no ID. Could really gain a lot with a quieter whale. Different, good shape, stiff, but same general behavior. Chin up, tail up. Same in south African video from 2 attempts. Engine is out, line is slack, dangerous situation to get out of. Problem is forward (of the whale), have to work ahead of the tail, if not broken/tail down like 2427. When we picked up control line, the behavior starts again/ don't react as much from a side approach… not proved. Whale is towing, working closer. Towing it so it slows, so can be tractable and work on. With hope. Attaching another tow to create drag, didn't know if it would dive, put floatation towards the back. Slowed down. Worked with the animal, then it decided to go. Dangerous situation, let go of animal. Some flipper wraps cut, but ….

Remote device for a) injection b) monitoring c) cutting d) tagging

Recent entanglement of a good/fussy whale that would be a good candidate for disentanglement, head entanglement (in good shape, but very very fussy)

11:50 am - Early – slides available via e-mail

Document came from a request from PCCS to look at the broad picture/context of entanglement/disentanglement. 2 Questions

1) How do you move the R & D? (ethical/logistical/strategic question)
2) How do you stop a whale? (operational question)

Operations Side:

Restraint, Eg Hunting, Live Capture, Electric Whaling, Chemical Restraint, Telemetry, Behavior

Assumptions:

1) stopping a whale without killing it is more difficult
2) safety and operational efficiency are common considerations between whaling and disentanglement
3) Evolution of techniques should result in activities that were proven relatively safe, useful and effective
4) Disasters reported

Complex Systems analysis.
Successful problem solving tended to pay more attention to long-range effects

Gestalt-like approach staying aware of side effects vs. ad hoc approach to single problems as they arise

Don't channel yourself into believing that the method that worked before will always work.

What would work – in theory?
Netting (if possible paired with beaching) effective and reliable
Head control more important than tail
Size of operation may be prohibitive

What would work – in practice?
Historically most effective is nets in conjunction with beaching. Head control is more important than tail restraint. Netting would be prohibitive. Dependent on people and heavy equipment.

The path not taken:

Restraint methods (diminishing options, reliability, safety)

Telemetry –
reduces direct contact with animal
creates more options
adds stuff to animal

Restraint –
increases contact with animal
reduces options

Common needs for telemetry & restraint (information on behavior & physiology)

- Set yourself back- robocyamid, telemetry
- Behavioral control, physiological understanding.

Kraus: Did you ever run into the effects of blindfolding on large animals?

Brunson: We routinely blindfold and use earplugs on animals to reduce inputs. This technique may make a drugged animal go from excitable to calm.

Early: used telezol on a 700 lb hooded seal. Had enough drug that she was still reactive, put a doily over her head and used fingers to lay her head down. Early Tursiop experiments covered their eyes to see if they could see or echolocate.

Stamper: has used it in 2 species but not in the wild
Green turtles, birds

Kraus: humpback rested

Gulland: Stellers have both reactions, calm and totally crazy after being masked.

Kraus: this is used in captive Tursiops and pacific white sided dolphins.

Pabst: highly trained environment

Moore: Asked Scott Kraus to tell the story of the humpback that they used a blindfold on and a tail tether, then winched and pulled to beach.

Kraus: Newfoundland, Peter Beamish was interested in evaluating echolocation in balaenids. Set about disentangling and using some candidates for experimenting. Took 30 ft humpback out of entanglement and towed it backwards across a bay for ~3miles. Had 600 meters of line as a tether. Was released at night and winched it in each morning. It swam out relatively quickly. Built suction cup eyepatches. When it was released with eyepatches it moved very slowly. Held it for 30 days and then let it go with a telemetry tag.

Early: whale sharks too. No real references. Size tops out with gray whales for captivity.

Kraus: Has anyone put a Cape buffalo’s head in a sack?

Frances: Yes they do. It is the first thing that is done after you drug it.
Can you make eye cups for right whales? (SK) balaenopterids have slits by the eye.

Landry: could you paint over the eye?

Moore: no

Kraus: not a trivial matter with eyes 8 feet below the water. You could have a hoop net with mesh on the top and bottom and blanket on the sides.

David Brunson: they use parasympathetic activation in iguanas putting pressure in their eyeballs. Also occurs in mammals, chickens too. Twitching. Stories & anecdotes of hyenas grabbing zebras by the nose, twitching horses, etc… Iguanas can be immobilized by increasing ocular pressure, diminishing fight and flight reflex. Human pressure on eyes can produce a calming effect.

Early: Distraction vs. physical response. Block out sensory input vs. eliciting a calming response. Is it a physical act or a physiological one? Well the closest analog I know are young harp seals and hooded seals… you can often get away with covering its head and distracting it ~75% of the time. Where and how you poke them makes a difference. Pilot whales freak out, or are o.k. Touch the melon and you get a violent reaction. Not sure if it is distraction or "minimal pain". Allowed debriding a broken tooth and bone chip in the mouth of the seal to be done.

Alex: We are designing suction cups for dolphin eyes…

Mayo: has anyone ever used sound in handling animals?

Walsh: usually a lack of sound helps more <seconded by Dave Brunson>

----------LUNCH----------

1pm - Teri Hammar- Past dart hardware development images and ballistic systems. 1) Air chamber, plunger in middle, heavy gauge needle. Sharp point with tygon tubing over side port to hold pressure
2) Dart gun was used in one iteration. Much heavier. The needle bent, the dart on the spear gun had so much weight, it would compress the pole and bend the rod syringe attached to it. Ruled out.
3) Triple pointed spear attachment for 3-location delivery
Shooting at whale blubber with different systems
Without a sharp angle the ballistics were less likely to stick (more likely to bounce off) resulted in movement toward hand-delivered, pole-mounted hand poles.

Next: deliver, safety trials, moribund sedation, and choose the appropriate whale to sedate.

Stamper: Flexibility is key. Different systems may be likely to succeed with different individuals or different situations

Moore: all this was pre Churchill

1:15 Brunson (slides)

3 close-range options for injecting

1) Hand set needles allowing different angle of attack through a set-able head
2) Needle with long coil tubing to allow additional drug or reversal delivery
3) "Fired" injection for fast delivery - gun shooting(?)

Drug selection

Route of administration
Reversibility
Duration of effect
What has been used effectively/ineffectively

Immobilization

Not possible without unconsciousness
General anesthesia (unconscious, analgesic, no spontaneous or reflex movements)

We are talking about conscious sedation

Calming, quieting effect
Patient is able to awaken with stimuli

Neuroleptanalgesia

Combination of sedative and analgesic
Sedative: Midazolam
Opiate: Meperidine

Administration

- Oral
- Transdermal
- Rectal
- Parenteral (I.V., IM, SubQ)
- Pulmonary

Possible over the blowhole? Parenteral administration is the most likely method.

Moore: Larry Dunn euthanized a fin whale (120 ml of Phenonobarbial down trachea as a sedative, before T61 i/v: a combination of cardiac depressant, neuromuscular blocker, local anesthetic took a futher 20 minutes.

Consensus was that 20 minutes was way too long for death, concern of suffocation, no immediate IV absorbtion.

Brunson: recumbent animals get shunting and mismatching of pulmonary blood flow and cardiac output. There wasn't immediate absorbtion if it took 20-30 minutes, slow and not predictable peak affect.

Gulland: it would have to be lipid soluble and able to cross the membrane so it wouldn't be good for all drugs. Shooting it in, does not accomplish it. Has to be tiny particles to get into the pulmonary system.

Brunson: tiny particles necessary for pulmonary delivery. Shouldn't be discounted

Kraus: should consider the rete in the mouth as a high blood volume going right to the brain

Moore: would bleed like a stuck pig

Mayo: it's a rare occasion to get a RW to open its mouth.

(back on topic)

Brunson: choosing a drug highly dependent on metabolism. Kinetics of the drug. How do they get rid of the drug. Hepatic metabolized, bile excretion. This is not known. Reversibility has been an important factor and should still be.

Six years ago we started talking about Midazolam (water soluble, like valium)
Able to take it up to 90mg/ml concentration
Graph of Churchill minutes between breaths when dosed with midazolam, 500 mg on 6/26/2001.
Some breath intervals as long as 4 minutes, as short as 15 seconds.

Meperidine also chosen, opioid analgesic, used in other marine mammals, formulated stably at 550 mg/ml.
Total over 4.5 hours - 40 grams Meperidine plus 4 gms Midazolam

Respiratory effects of sedation
Average breathing interval for 10 minutes went from 1.5 minutes - 1:40 sec. after 4$^{th}$ dose
Respiration really didn't change despite all the drug.
Slight increase in breath interval at dose 3.
Last worked with Churchill on August 30 2001(?)
- Significantly debilitated
- Coated with ectoparasites
- Appeared to have systemic infection
- Last seen 17 days after last attempt, assumed dead

98% of time spent on surface
Did not seem acutely or lethally affected by sedation- but short term health not jeapordized.

Summary –
- Midazolam/meperidine is safe

Approximate dosage known
Delivery system is reliable and functional, but should be worked on
Effects (onset 20-30 minutes, duration 2-3 hours)

Other experiences with sedation in Cetaceans

Meperidine – Demerol (killer and pilots whales, Joseph ’88)
Butorphanol – Killer whales, dolphs, McBain
Hydromorphone and phencyclidine (PCP/Angeldust) – grey whales
Etorphine (Egil Ole Oen, 1999) body weight estimates have to be on point

Comparison of Doses
Meperidine (1/4 potency of morphine)
Etorphine (1000-10,000 times morphine)
Our experience is well below administered dosage range keeping relative potency in mind.

McLellan – impression is that cetaceans are voluntary breathers and a sedated whale may be a dead whale?

Brunson: That’s an over simplification- they breathe because of reflect responses to CO2, O2, they can control breathing, relax sphincters, etc. But just because they are sedated, doesn’t mean they won’t breathe. They have an ability to control breathing, but they are not going to suffocate them.

Walsh: That is absolutely not true (re: conscious breathers). Those that made early attempts overdosed, used improper delivery, etc… but it was more the case of untrained people and overdosing than that they don’t breathe.
1987 dolphin dieoff, Midazolam was used a dozen times… it was given to a sick animal and it died and people were turned off
So we’ve had to dispel that rumor. We have successfully sedated dolphins, manatees, etc with these drugs without a problem.

Brunson: Opioids can cause respiratory failure

Walsh: think of a swimmer, they can override their instinct to breathe. Cetaceans probably do the same thing

1:42 Woodward (slides)
Approach: Net gun and deployment of a padded tail harness
System Components

- Net gun deployment system
- Tail harness– padded section for contact with whale skin
- Tow line
- Telemetry buoy
- Remote-controlled release

Hand-held system vs. deck mounted system (good for gunner)
90 % opening before it hits the ground
Once lasso cinches onto tail the teye of the lass and the stop ring meet and prevents the lasso from tightening beyond a pre-set size.

Padded tail harness abrasion testing to saw it back and forth to see what type of damage could occur
Put 20# of tension on the line, ran the test to simulate ~7 days of swimming
Tested Low drag telemetry buoy to provide alternative buoy
Brunson: will the whale swim out of it?
Becky: We won't know until we test it, but our assumption is that the whale will be diving away from you.

1:50 – Landry
We are not looking for total restraint, we are looking for calming down, allowing us to mangle, manage the entanglement and free it or allow self-disentanglement

Categorized known/probably living entanglements
6 things to assess… what we want for sedation candidates

- Life-threatening
- Trailing line
- Health assessment (healthy vs. likely to die)
- Forward wrap (rostrum, flippers)
- Embedded/taught line (want it that way)
- Disentanglement attempted

List of open entanglement candidates that we might be considering for sedation
Eg1102, last seen 2001
Life threatening – yes
Trailing line – yes
Health assessment – done/poor
Forward wrap – yes rostrum
Embedded - deeply
Disentanglements – yes, sedation

Whales on the table with known entanglements:

Eg 1424, last seen in 2005
Currently not/unclear; no trailing line;
health assessment yes/decent
Forward wrap – yes;
embedded line – not externally
Disentanglement attempt – no

Eg 1167 last seen in 2005 (either new entanglement or has been carrying the same for 5 years)
Life threatening – unclear
Trailing – yes
H.A. not done/decent health status visually
Embedded – not seen
d.a. – no

Eg1430 last seen in 2003
Life threatening – currently not/unclear

Trailing line – yes, lots
Health Assessment - no/decent
Forward wrap – yes
Embedded no externally
Disentanglement attempted – no

Eg1815 last seen in 2003
Life threatening – yes
Trailing line – no?
Health assessment - no/poor
Forward wrap – yes
Embedded line - yes deeply
Disentanglement attempt -. no

Eg 3210 last seen in 2005
Life threatening - yes
Trailing line – no
Health assessment – yes/poor
Embedded line – presumed, can't see line
Disentnaglement attempt - no
Not a lot known about its entanglement, can't see rope, but health has been declining

Eg3346, last seen in 2006
Life threatening – likely over long term
Trailing line – yes very short
Health assessment - no/decent
Forward wrap – yes
Embedded line – unknown
Disentanglement attempt - yes
Good candidate for sedation

Unknown, last seen in 2005
Life threatening - yes
Trailing line – yes, some, line parted
Health assessment - no/decent
Forward wrap – yes, very tight wrap on right flipper
Entangling line – yes
Disentagnlement attempt – yes
Good candidate for sedation attempt; know that it needs help.

Table 1: Landry's Evaluation of Present Entanglement Cases for Sedation

| Right Whale ID | 1102 | 1424 | 1167 | 1430 | 1815 | 3210 | 3346 | Unknown |
|---|---|---|---|---|---|---|---|---|
| Last Seen | 2001 | 2005 | 2005 | 2003 | 2003 | 2005 | 2006 | 2005 |
| Life-threatening? | Yes | No, unclear | Either new or 5 yrs old | No, unclear | Yes | Yes | Long term | yes |
| Trailing Line? | Yes | No | Yes | Yes, lots | No?* | No | Very short | Yes |
| Health Assessment Done? | Yes | Yes | No | No | No | Yes | No | No |
| Condition | Poor | Decent | Decent | Decent | Poor | Poor | Decent | Decent |
| Forward Wrap? | Rostrum | Yes* | Flipper* | Yes* | Yes | * | Yes | Tight (R) flipper |
| Embedded Line? | Deeply | Not externally | None seen | Not externally | Deeply | Presumed, Can't see line anymore | unknown | Yes |
| Disentanglement Attempted? | Yes | No | No | No | no | No | Yes | Yes |
| Good Candidate for Sedation? | Yes | *no????* Check this | * | * | * | Not a lot known | Yes | yes |

Working from the surface we are dealing with wraps well below the surface (e.g. flippers).
What we've realized is that despite removal of body wraps there was no way that the animal was going to shed the flipper wraps.
We need a way of getting at that insertion, even worse is that the wraps are even a little bit below the whale so the zodiac would have to be in the "unsafe zone".

It took 45 minutes to cut through a flipper wrap on a humpback that was cooperating by cutting the lines one-by-one.

Image of humpback with 18 fluke-deforming wraps. Were able to remove it once the animal stopped and allowed it. Could be done in right whales given the time and cooperation.

Kraus: do you want to try it on an animal that is nearly dead (being conservative by sacrificing an animal that was already headed for death) or a healthy animal where you may be able to do some good.

Stamper: the first attempt being successful is the ground breaker allowing the project not to be killed.

Kraus: are we still going to look at [effectiveness being removal of gear or saving the whale]

Landry: we are just interested in removing the gear. We can't be responsible to what happens afterwards. The goal is to get the gear off.

Kraus: but for the testing period, do we want to test on animals that the real test is saving the animal or is the real test to confirm that acute sedation is possible and that the animal could be unwrapped

Stormy: Will it be more susceptible, reactive, its circulation bad. I think you at least want to test it on an animal that is active and healthy.

Gulland: Discussion occurs in zoos… had to wait until the panda is sick enough… this is too long and the sick animal is killed by sedation. Now we are at a point where you have to test the drug on a healthy animal to find the correct dose rate, etc…..you will get different affects on debilitated animals.

Mayo: what you really want is on these animals that are really healthy

Gulland: occasionally you get idiosyncratic responses to sedation in a species when it is tried for the first time, but I think we are past that point here.

Walsh: when you mention the word testing we don't even know if these highly concentrated drugs will work. Test if the concentrated dose is going to work I would like to take highly concentrated drugs. I'd like to go to a beach with pilot whales and try these drugs and see if it works, we have to find out if its going to work or not. We have to find out if its getting out of the muscle or not. Looking at Churchill's example this drug may not even be getting into the animal out of [the injection] site. The high concentration drug may be the wrong pH, or may not be behaving the same way when super concentrated.

Brunson: concentrated drugs have been used in a walrus, high concentrations of Medazolam have been used in pigs and have worked. Still valid concerns about how much of the super concentrated drug can be injected into a site and actually work. Like injecting  into a cows leg and still get good absorption. But nobody has actually tested it.

Moore: we could do some post mortem histology and chemistry in stranded animals.

Walsh: we often used this to check response of pilot whales when triaging for rehab… can remove "stress" from the respiratory rate, etc… taking it down to levels that can be evaluated as normal or still abnormal and able to take the animal out of triage.

Brunson: you can lose either way whether you choose the sick or healthier animal… I don't think we are at the point of choosing. Kingfisher was not sick, but life threatening. It was justified because he was a young growing whale. That was a better criteria in my own view.

Kraus: if there is a chance of death, why not kill the debilitated animal? Just trying to balance the odds. Another thing to consider is the sex. With all else being equal, experiment on the males.

Stamper: is there a difference in outcome depending on where the wrap is? Do we have stats such as 100% of the tightly wrapped flippers.?

Landry: any body part is able to kill. Doesn't matter what part, head and tail can be just as leathal. 3107 killed by a tail wrap. Any body part is lethal.

Stamper: do you have a 90% accuracy of triaging who is going to die?

Landry: we have a high number as far as predicting outcome, but it isn't 90%. 60%.

McLellan: additionally we don't know the end point of many of them

Landry: we do worry about killing a right whale outright, but that's just my opinion

2:20 pm Moore – time to divide and conquer- we need to write up what this group needs, to NMFS with specifics with amounts of money, etc.

Landry: We took out the safety working group. Can each group bullet safety issues and response?

Groups as listed in the agenda above then formed - See reports below for each working group session. Chemical and Physical aspects of drugs, Physical Restraint and Telemetry.

**Transcript of Plenary Session February 8th 2006**

Day 2 February 8th 2006

8:55 Moore: Word from the Agency is that the final product of the workshop should not look like a proposal but instead should be formatted as a strategy including the steps, timing and budget necessary to accomplish the desired next steps. This includes when (and what we need) to meet again to re-evaluate progress where the 3 strands (drugs, physical restraint and telemetry) can come together to disentangle a whale in a way that now is not possible, and give a range of budget costs that pertain to that. I think that the inherent attractiveness to self disentangle by whatever hardware we can do to make that easier, seems like a sensible way to go because our available face time with these animals is very small, compared to something that can be deployed over the course of the entanglement (telemetry buoy).

We agreed to get together after we slept on our ideas from yesterday. Any issues from yesterday….?

Pabst: For team "stop the whale" that product came out of 2 hours of multiple options/brainstorming… with that kind of a time constraint we don't even know if this will work or if it is even reasonable. What we want to make sure is that this is not the only thing that came out of it… But when combined with the other ideas out there it might look very different (e.g. if sedation was accomplished prior to this then the focus of team "stop the whale" would be on support rather than restraint).
Also, this idea of remote approaches which we haven't talked about as a group, and behavior… how do we take advantage of some of the things that Greg was talking about?

Kraus: In the middle of the night I had some doubts about our shock and awe approach to restraint. Specifically we rely upon accessibility to the tail and lots of these entangled whales do not keep their tails up in a way that they would be accessible. One thing we didn't explore was the distraction idea that Greg talked about. (Note: shock and awe refers to the general concept of combined aggressive physical and chemical restraint)

McLellan: and over the ocean… if you can't get the tail, it is a non starter---

Kraus: we could test the paint ball approach, distraction approach, easy to test, and we haven't.

McLellan: biopsy behavior is zero; right… its when you miss that they react.

Moore: It is also dependent on sea state… in dead calm they can do a huge dorsal-ventral flexion and it'll give you a great head shot, but in higher seas you can tickle them just fine.

McLellan: do the animals stop?

Moore: well yes.

Early: One of your other frames of reference is to 'not' get a reaction. If you develop things that annoy the heck out of them, you may find something different. There are a lot of components. Develop a lot of tools; have more options, then there's a greater chance something will work, but also get the direction you want to go and the right order of using the tools. …a road map helps. Shock and awe could be last resort. Do you want to commit to doing this and this and this… or at least get your steps down. The extreme is that if you can stop them with a boat, why develop all this telemetry? You need to sneak up on it and as much as you can and limit the field as well. You came up with a tail restraint, rather than a couple of pair trawlers and a couple hundred people. The reason we chose this… is what we think is most likely to work, but we also want to shelve it because it is technically difficult, the end result is worse… etc……. it would be useful to sort things out… too many or too few choices….

Landry: In this workshop so far we have started to come up with new ideas, revisit old concepts and involve sedation. We have 2 avenues, and we should keep our options open, and maybe see if a product will be (one) useful. We might have a difficult time putting a package together. Maybe we need one thing, not a package that will work. Shock and awe is good, but keep the options open, have workshops every other week, or year, but it would be good to come out with some kind of product we can make work, …or we will go home and have nothing for the next whale in the Great South Channel.

McLellan: how many animals have been lost because we weren't able to contend with current techniques?

Kraus: 16-20. Summarized in (Kraus *et al.* 2005).

McLellan: So on order of 20, in this population that is huge. 10% of the RW population . In a year or a couple, you could deal with all those that are out there… If a method gets proven, you can clean up the mess that is still out there. You can get a lot of animals dealt with. I want to put it in the context that this is a big conservation tool-– not a one time shot.

Kraus: We will learn from our mistakes. If we use shock and awe, and assume drugs improve. But it may not ever exist, but it doesn't mean you shouldn't try options. There needs to be R and D and ideas: one doesn't preclude the other. The holy grail would be to come up with some behavioral modification that would stop a whale… this may never happen, but exploring it should still occur. We need the R&D and behavioral research to find out if it exists

Pabst: would it be possible to think of …. ONE PLAN.. maybe see one plan through that integrates the sedation component with shock and awe. Shock and awe may not be needed. We may need RV muzzle and pontoons (see physical restraint working group below). and have bail outs? We need to maintain open flexibility in the plan.

Walsh: If you look at sedation in the parks, we do that exact same thing. We have to pull a net with orcas with an "out". We have 30 people to drag it into the pool so the animal doesn't drown. And we have to factor behavior into it as well, because we don't see challenges to the net unless we use it. (naïve vs trained animals). Young ones get more tangled than adults, … if this goes wrong we do this..…. The reality is a lot of animals may not go for it. The shock & awe bit needs to be dropped. I would try it in steps with a head net for example that can be yanked off if it was going wrong. You need a well thought out plan with contingencies So unless you can show that they are tractable try a headnet first, so that people don't get caught in control nets. You need a well thought out plan with contingencies.

Mayo: I think we have come up with an integrated plan but we haven't done a good job integrating it yet. The capture people say we need sedation, the sedation people say we need capture. I don't think we have countenanced a plan that doesn't incorporate all of these factors. But what we need to do is realize that it is NOT going to go as planned.

Gulland: we say we can use stranded animal a,b c,… In all scenarios these are animals on land. We need to try it on a free swimming whale, what they do when they go under, that will define how the restraint part goes. Maybe they freak and dive, maybe they get sleepy.

Landry: Or we might find out that support is not necessary. I don't want the response of a sedated whale to be a big question mark when safety (whale and human) is on the line at sea. I would like to see that tested and made comfortable. We tried it with Churchill, we broke ground. I would feel comfortable with that one tool (sedation) and roping in more technology and techniques

McLellan: Then this plan starts scaring me. We could spend a summer throwing paintballs. The timing of all of this is scaring me when you talk about half the people in the room having to spend their time to prove this part (sedation) and that would set us back a long way time wise… These parts alone are all this team could support, but the plan wouldn't happen till 2009!

Kraus: how precise do you need to know body weights to sedate?

Brunson: The more precise the better we know what we're doing as far as margin of safety and judging response. We are used to working in uncontrolled environments where we don't have all of that information so we have a range of doses that we can operate with.

Kraus: gray whales would be a good candidate, there is probability. There is good data on weight vs. length. Right whales have spotty data. (McLellan: Southwest Region has it). We need that before sedation. You need aerial support and measuring length from a plane, and an assessment of thin or fat.

Rowles: we have estimates of thin vs. fat.

McLellan: The mass of a 2 year old animal heading to/from the feeding grounds could be very different depending on when you are looking at them

Gulland: The size is not going to be as critical here as if you were off by a kilo in a golden tamarind. We are at the happier end of being comfortable. You're going to be off by a LOT in a right whale just given the size of the right whale and the dosage we are talking about it is not a big problem.

Kraus: more buffered…..

Stamper: That is also why we are choosing the drugs we are choosing because they are much safer and have a wide margin of safety

Early: it depends on how comfortable you are using this tools. For me the comfort rests with…..well…. if you, tomorrow, could manipulate a gray whale… I would want to know what that would take, before a right whale. I think sedation is part of that. Doing that on a gray whale will tell you how close you need to get on a right whale. I don't feel comfortable not doing that on anything else first.

Walsh: Part of the answer is just figuring out if those drugs are acting in the same way in those different animals… testing the drugs on stranded animals is really to test how it is being absorbed, not necessarily the dosage.

McLellan: if you are responsible to support the whale, then for how long 8 hours or 3 minutes…we need to know that as well

Morin: there are two different sides here. One) what can we put as a plan now to execute, and 2) What do we NEED to do, to be better at what we WANT to do (drugs, effectiveness, testing.) I thought we were on the latter for this workshop. What do we have and what are we going to do with it.

Pabst: I agree…there is a dichotomy, I don't see them as mutually exclusive. Maybe we go down both paths. There is definitely an immediacy because there are animal's dying, but we want as much precision in each step as possible. We can move down both. I'm playing devil's advocate: I agree with the gray whale (sedation testing on a gray whale), but from a logistics and legal and ethical point of view, how do we move forward on that… We just don't have the logistics, funding etc to do anything. It's still protected, etc. we assume risk involved…..

Gulland: We actually have entangled gray whales… we have never been able to disentangle them for all the same reasons with right whales but no one cares because it's just another dead gray whale. We just don't have the logistics, funding etc to do anything. It is common though.

Rowles: If you were going to do this without any benefit to the animal you would have to get a scientific research permit. If you were going to do this with benefit to the animal it will be covered by our current permit.

Kraus: What about a vaccination program?

Rowles: We are talking about emergency vaccination in monk seals so by 2007. I'll have an answer for you for animals covered by ESA and MMPA, all marine mammals.

Landry: We know that we can deliver the drugs with the current tools since we've already done that. With Churchill though, we didn't achieve sedation. I have no way of gauging whether this will work. I don't think we will kill it. But will it sink, freak out? There is species variation. We need to know if this is worthwhile. If not, we need to restrain it physically. I want to know if sedation is definitely one tool, or definitely not… We may not be able to get there, but if we could that would be a big step after 3 workshops on this.

Stamper: What we have talked about is trying to figure out if the drug is absorbed at the site. We need to assess from Churchill etc if it was delivered and absorbed

Walsh: And determine what it means to sedate or immobilize. There was a difference at first between what the vets were thinking of in terms of sedation and what may have been expected as far as complete immobilization. People thought this meant 1 hour sitting still. In killer whales what we are looking for is not complete tractability, but cooperation and just not hurting us. Maybe the best we can hope for is a change in behavior that allows you to do what you want to do. You probably won't be stopped… we aren't looking at the whale sitting still for hours. You will get something that goes from 3 knots to 1 knot and doesn't throw its head and let's you approach. We've pulled teeth in whales that would never even open their mouths for us but under sedation they let us use locals and do it.

Moore: Does the phrase "enhanced tractability through sedation" encapsulate that?

Walsh: Do we go gray or humpback? One advantage is that the resources build on the coasts you have resources on.

McLellan: you also have anchored humpbacks here (and in California, etc.) or gray whales.

Landry: we tried on some humpbacks, I don't know if we would noticed a difference it was drugged. The only disadvantages that humpbacks have are their flippers.

Frances: ….our last humpback was already broken, if the question was it sink or panic - that whale would not help answer that question

Kraus: As far as behavior goes the whaling records show that the closest analog to a right whale is a grey whale.

Moore: so I should take humpback out?

Walsh: Our whales don't stop swimming, they are relaxed. We are careful if they dip to far, but 99.9% can still breathe and come up (Tursiops, killer whales, manatees). We are there just in case. The drowning aspect is not big.

Gulland: One grey whale was injected with Xylazine in preparation to euthanize it intravenously and after ~8 minutes it freaked out. It was completely nuts. It was free-swimming in shallow water. Really scary. The intent was to sedate it, to euthanize with IV, it was completely nuts. It was in shallow water (Tomales Bay) free swimming. We thought that if we could sedate and use xylizine, it would be dopy to push onto the beach,…but it thrashed.. We left it, and it died overnight. It was the drug not behavior of the whale. I don't know if it was panic, or the effect of the drug.

Brunson: When things go bad with anesthesia people have a tendency to blame the drug but there are a lot of other factors to consider (site to which it was administered, health conditions).

Gulland: My concern was not the specific drug but comparing a free swimming gray to a right whale… my point is that the grey whale freaked out with the experience of being sedated how is a right whale going to act when it starts getting dopey? Will it freak out or will it get sleepy?

Pabst: Kogia , Globicephalas,.. works well with xylazine,

Gulland: but how will a right whale feel, dopey or panic?

McLellan: There are even striking differences between offshore and coastal Tursiops

Moore: with that live right whale calf, would it have been possible to ask that question?

Walsh: No, it had other problems

Pabst: It is important to get these stories and data about different species' reactions on these drugs. It would be nice to have those compared experiences. Eg 1102: was it effective. Do we need that experience, before trying it on the first priority kid. Do you want to go ahead and try it?

Walsh: we have seen 6 species on a mix with no problem… whether you can extrapolate to a right whale, I don't know, but I feel comfortable, but because my background with Xylazine is that it does have a history of different behavior with different species, I wouldn't consider it for this. Gulland it is not effective on free swimming animal.

Gulland: But Mike all your animals have been beached.

Walsh: No they are free-swimming in the pool

Brunson: I am prepared to continue with the drugs we used, lots of questions come up to get answered. But If I had to go out tomorrow and use it on a right whale, I would be comfortable and up the doses. My concern is if we have anything to support a RW once its sedated?

Mayo: But these things go hand in hand. We have to untangle this knot… what we keep leaving out is the business of support which we could not have done anything about if something had gone wrong… that is something we need to be critical of that we were not prepared at all to handle that… what if that animal was a sinker? I don't want to stand there and watch it go down… also, what if the whale goes berserk?

Landry: People on the water have no experience with sedation, we are dependent on your experiences

Mayo: pretend Churchill slowed to a ¼ of a knot we were in a position to do a lot more, but concerned about going to the head and whether we could do a lot more. You have to entangle it (the ideas) as you do it more all together. We left out the idea of support (with Churchill) we were not in a position if something went wrong to do anything about that. And that we should criticize ourselves for. It could have happened and we could all have watched it sink. That is something we are behind on.

Landry: do we need to know if we need pontoons or a big ship.

McLellan: that was my concern in North Carolina. We were somehow going to lash on with 2 zodiacs, that was the scariest part.

Mayo: we are in a fairly good position if we ramp up the sedation. There are a couple of unforeseen things that scare me. Are they likely to go berserk to an antagonistic response to the drug,? With these drugs, there is not some wacky reaction?

Walsh/Brunson: That's why we've chosen these drugs because nothing like that has been seen
Hammar: What about the calf off NJ that died? Similar to an adult whale? Would it sink?

Moore: At the outset of the entanglement they are all going to float but during chronic entanglement they will get to a point where they are sinkers. We have had very little necropsy experience with entanglements that were over six months long

McLellan: boat strikes come in as floaters, we see more because it (death) occurs over a short time

Moore: 6 months is the time of entanglement to necropsy before they become sinkers and therefore are not brought to the beach

Mayo: Churchill was about a sinker.

Stamper: What is the experience (float/not) of floppy tailed whales?

Kraus: There have only been 3 observations of floppy flukes…and they are all now dead.

Mayo: there was a broken floppy one, that one went from healthy to floppy in a month. There is a lot of range. The tail tells you condition, not necessarily floatability.

Rolland: I think our health assessment (aerial) should give us a good idea of sinking vs. floating.

Walsh: We know that from the animals we've sedated they don't have a problem keeping themselves floating… Once we had a skinny dolphin that was having the toughest time keeping herself afloat enough to breathe so we put lifejackets on her for like 6 months and she was fine… not that I'm suggesting doing this in a right whale.

Moore: We could use DTag to analyze the behavior and body condition. Thin ones may dive differently.

McLellan: That's another thing that you have to retrieve and download… again, we are talking about adding a lot of time to this as far as "studying"

Early: No, this could be done with the towed array as an indirect measure of where the animal is spending its time and how much it is diving. We want to ramp up the telemetry to get a proxy of diving behavior.

Mayo: floatation seems critical….  What about "back" fat?

Moore: visual health assessment is good for skinny animals. Within the fatter animals there is a poor correlation between blubber thickness and visual assessment. If you want to get into a more quantitative assessment you need to measure back fat.

Kraus: I think this is a moot point because by the time something shows up as emaciated in the health assessment it has never recovered. We know that emaciated animals don't recover so do what you want with them… the others will float.

Moore:  A live right whale unconscious? What orientation will it float?...Dead ones go side up or belly up… assumed to be gassing, but what's the likelihood: will it float like a boat or keel up?

Mayo: they sleep dorsal side up, logging. They must be upright when immobile.

McLellan: flippers are good keels.

Moore: not fundamentally keels, they are vanes.

Smith: Even in Churchill, he was upright and barely conscious.

Moore: what you have are a pair of lungs, which is different to a gassing up intestine in a dead floater.

Pabst: The point is that if we do that, we want to make sure we have support system/floatation, adjustable. If the animal lists, if tail or head drops etc. we should not expect one, but be prepared for all.

Moore: to get rid of shock and awe, what about a hands on approach? Not remote?

McLellan: do we know this all moves forward ONLY if, until, a line is on? So the animal doesn't sink and disappear.

Moore: do you want Becky to harass with lasso before this? Or do anesthesiologist get first crack?

Brunson: you need staging, following, doesn't have to be first on the whale. Putting a line is important.

Walsh: but you don't harass something you want cooperation from.

McLellan: you can't move forward till you have that step.

Morin: No one has worked on floatation yet? We need assessment first, I don't think the goal of the first approach is going to be to sedate

Landry: I'm trying to simplify as much of this as possible. What I do worry about is that if we need such a huge team and are successful on one whale do we have the resources to do this on 15 whales? Can we pare this down to a small team? Can we accept some risk – this is an animal… if the animal is sedated would it allow us to put a small boat in front of an Eg like we do for humpbacks… it seems like we are working on a plan that will require lots of complex variables (the whale has to be in Mass Bay, weather, time of year because of field seasons, etc…). I'm leery of involving tons of people, equipment and logistics. Can we accept some risk and keep this simple… and this is where I ask the whole team: Do you feel comfortable putting a team at the head of a right whale? Can we modify its behavior? If we have to continue paring down our conditions… day, season, time, weather, it will be harder and harder. Can we pare it down to hold it to a tool in a box you can carry out and make it work?

Kraus: This is extremely experimental… you can anticipate a larger operation for the first time and you want to have as many hands on deck as possible… and it may cost a

quarter-million dollars… but over time you'll figure out who is unnecessary, the second time it will cost less… eventually you'll get it down to a toolbox and 1 boat – you can do it in an afternoon.

Rowles: When we move it to operational and not experimental, it should be smooth and ready to go. I think that's what I heard from Scott (Landry). I think we need to think operational. We can't spend time doing something not sustainable in an operation.

Kraus: but you don't know in the beginning, You may not be able to predict if it will work

Kraus: I hear what you are saying (Landry) that we need to have a reasonable sized operation. We want to get the process off the ground and have a 90% success rate.

Landry: I would be comfortable sedating another right whale that is already lethally entangled and taking the risk that we could lose the animal. I don't know if the right whale community would agree. We might as well try with vets' consultation. I want to get to its head where we were afraid to before. Could this be an early step while we develop a barge? Stormy might disagree….

Moore: The barge will always be in the wrong part of the country. The inflatable is conceivable, but not the barge.

Morin: we didn't have that before (floatation).

Kraus: there is a big hardware development component that has to be done before doing this.

Morin: I agree with Scott. We have less resources now. A cut in funding, we're more busy now than from the last workshop…if a simple pontoon, will be available and will work. I like taking that idea of risk, with sedatives, and we might have an effect. I am willing to take a chance on a loopy RW. Churchills' aren't the whales we are not looking for. We are looking for the ones still fighting back, we aren't going to get a barge around them, sedation is the first step.

Pabst: Then proposing this is "the" question: Is it acceptable to move forward with a sedation step without support for the animal? Is that an acceptable risk? From a vet standpoint-

Moore: We need to consider Churchill's behaviour before he died…. The behaviour of sedated animals in tanks, suggest they will float straight up.. So, should we make a criteria for individual assessment that would make that acceptable?

Kraus: I suspect that if we don't have a support plan, and we end up doping a whale and it sinks that the agency would not let us do it again. We have to be prepared to think about a plan of supporting a sedated animal.

McLellan: I still haven't seen a solution to a flipper wrap. Somehow the restraint will have to be there, even if you are on its head with a knife.

Moore: When does having a diver become acceptable: if you are in Australia or California? (The latter referring to a recent successful disentanglement of a humpback by divers and Gulland.)

Landry: I think we can do it by boat.

Stamper/ Early: I think with sedation you have to accept it is as dangerous. You have to treat a sedated animal the exact same way as you would if the animal wasn't sedated

Gulland: When I looked at an animal that was completely restricted in the tail and flipper, and had just a blowhole at the surface and it was a humpback, I did not take getting into the water lightly. This was the first time I had ever done it, this was the first time that I thought it was safe. And I had 2 trained rescue divers with 30 years of diving experience who told me that I was safer in the water with them than on the boat because it would be easier to get to me if something did go wrong

Landry: I second that.

McLellan: Can you do it though yet? The entanglement on the flippers?

Stamper: Every vet has had the experience where something gets dropped or they hit a nerve and the animal freaks

Brunson: It's less likely with these drugs. Would you go in with a lion or gorilla that is sedated. Yeah… but we don't think we can play a card game there? No. we have support, restraint, we take lots of precautions. You will see my slides of conscious sedation on humans (endoscopy) where we use same kinds of drugs. As a doctor, you would do what you need to do, but you (the human patient) won't remember. That is what we are striving for.

Gulland: I worked in a zoo with large animals. And they are extremely dangerous, I don't take getting into the water likely and that was the first time I considered it safe. Because of the support team that was there.

Walsh: we have rescue divers even with manatee entanglements

Kraus: There is little danger except fore and after the flippers. The fluke danger is at the surface, but underwater you get pushed… its not dangerous, like an airplane. You don't go in the danger zones. You have to go in safe place. Same as in a zoo. Watch where you are. I wouldn't do it with free swimming, but stopped: o.k.

Morin: I was worried about kingfisher and divers. I didn't know what to tell them.

They need that expertise. It's not a casual thing.

Mayo: if we had stopped kingfisher completely, we had an animal with (cleated) flippers, there was no way to get that. If we cleared both flippers from above, then …….the way to handle flippers would be to dive for 10 -15 minutes with excellent gear and stability and no waves and no moving whale. I can't imagine that being done from above. Diving has to be considered, but the responsibility has to be considered by someone.

Landry: The whole thing is risky. We are often in that situation with humpbacks but we have a contingency plan I'm not saying we are going to be able to do the same things with a right whale, but to some extent risk has to be taken but it has to be taken intelligently. We aren't asking you to take away our risk, because we know that's a part of the game.

Gulland: We are so focused not to go into the water, but the level of skill of divers with the given temp, swell, and visibility, you need that experience. They had been diving for 30 years. You need divers that are able to take the gear on. There needs to be a two way diver-whale behavior.

Rowles: If we are going to go forward with divers on the NOAA permit we are going to go forward with the NOAA dive team to develop protocols for how this will be done. That is something that will be pursued with the input of biologists, info re: danger zones. We are not saying the NOAA core is going to do it but they will consider the training of the personnel and the conditions that it will happen under. What those criteria are should come from here into this report.

Kraus: Divers are another tool that shouldn't be excluded, if sedation works, it would be a great option.

Mayo: If the word comes out that diving is on the table we need to have a statement re: how this is going to be done because we will be potentially signaling to the public that it is ok for everyone to do this to save whales. We have taken a position that "there is not to be diving" we sort of violated that with kingfisher but not formally. When we add that to our toolbox we need to be in a position to tell the diving community what we mean exactly.

Kraus: It is a select, permitted team of people.

Arthur: The offshore oil industry moved to ROV's because the diving was too dangerous

Early: one thing that diving concerns. It's very different from a cage with a line. You are more limited to other alternatives. It's one point that can easily go good or bad. Unless it's anchored (in oil rigs) you don't go towards it, or you'll be tethered.

Moore: (back to ROV)… and we moved away from the ROV because it was too slow but now we've slowed down the whale, perhaps it is up for consideration again. What about sound on an ROV?

Bocconcelli: Can do playback experiments this summer to answer that question, but playbacks don't bother them. As to diving, take into consideration the day after flying rule, decompression chamber move with truck… etc. ROV is an answer

Moore: As long as you don't put a European police siren [on the ROV], mimicking (Nowacek *et al.* 2004) you're fine.

Sharp: What about the noises of a dive regulator?

Hammar: Also if you are talking about divers you have to consider that the animal is still moving at 1 knot… a diver is going to take all of his energy keeping up.

Rowles: we considered trained dolphins with the navy on Kingfisher.

Smith: I've discussed using dolphins and the response from the trainers was always 'If you don't want to send a diver in why do I want to send my dolphin in?" Sea Lions might be usable, but the logistics were huge because of the team that comes with that animal

Gulland: What about sea lions? They wanted to go straight to sea lions. Someone had sea lions track live whales… it took a long time. It's an ordeal all on its own. Didn't warrant much merit, in that the logistics are already huge.

Stormy :ROV is the answer

WAM: Can ROVs cut?

Response: They cut white smoker chimney's (rock) with a chainsaw attachment.

Mayo: The ROV is not going to have to do a ton of work, but if it could assess or make the cuts that we can't or place gear

Smith: How fast can ROVs go?

Mayo: If we can't dock with it, we can't do anything. We are most concerned with the ones under the flippers, its obvious, an ROV makes sense. What about a high speed saw? a clamp to stabilize the ROV?, you are only looking to get the cleat off, from above to work on the flipper tight wraps off. Maybe Slay's cutter. It has to get the pieces we can't clear. If can go under and just assess.

Walsh: can we look at the tools you do have and have Mcgyver ideas come up?

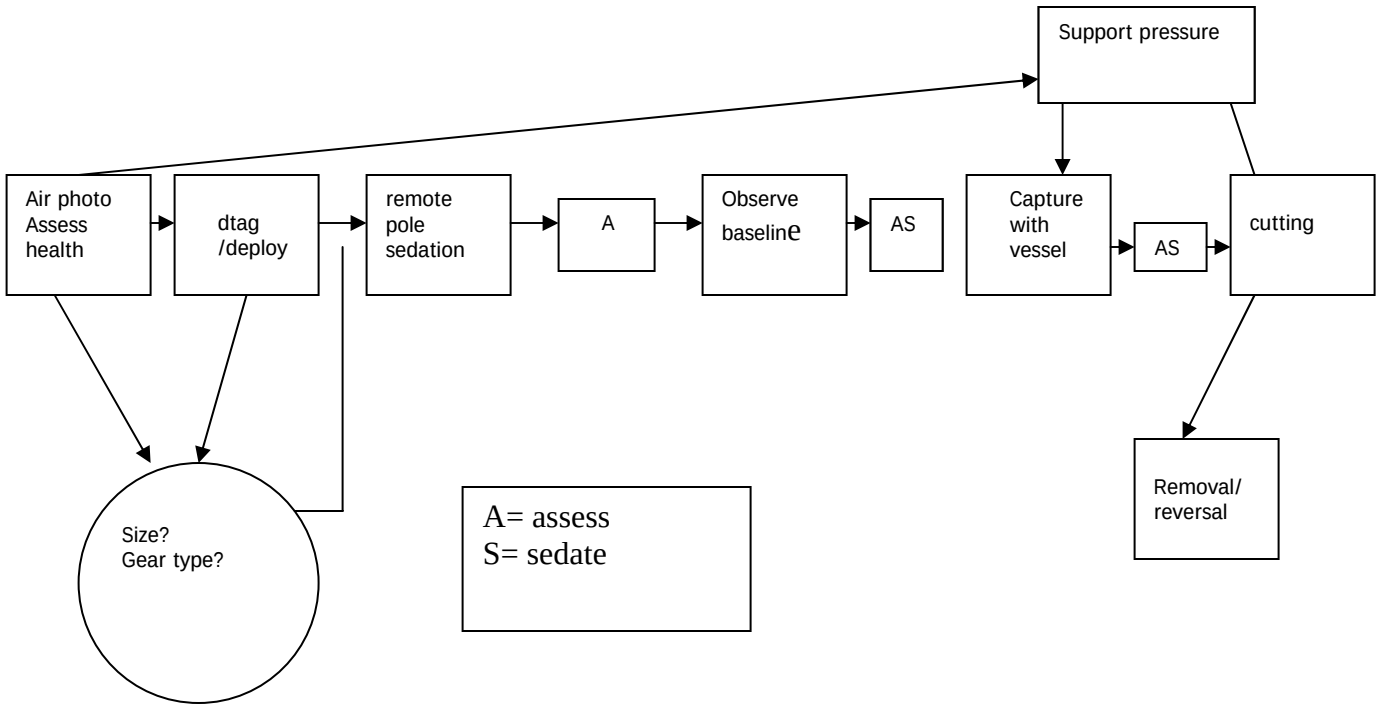
Stormy: It has to be a circular saw. If you have cleating, there is a line between there, and you want to clear that. It's not particularly tight. You can put a cutter we do have between that. An ROV might just place it. If its not tight on animals body. If you can have the whale with the boat- you can do it. We have to dock with the animal….. that is the beginning. We are not in the position to offer stability to an ROV.

Moore: Could be in the Shearwater tool box?

Landry: does the ROV come with a team?.. Do you need a trained operator? What kind of team are we talking about?

Alex: Just an operator

Stormy's Initial Diagram as how to proceed in a Disentanglement:




Mayo: we can't wait for all people to be assembled. We can't say we can't handle it without a complete disentanglement. Start attacking it ahead of time (Becky's tag) and see if we can assess and see if we CAN succeed. The AS boxes represent continual assessment and decision making in response. Initial activity is air/photo assessment where info re: size of animal, gear placement/type and condition is established. Next stage might be DTag deployment which would feed info in the future assessments. The next operation might be remote or pole sedation so that the early sedation occurs before molestation [and in one large kick-butt dose]. The next stage is observing the animal's behavior to evaluate sedation. The next stage is capture/hands-on handling, support/pressure. The next stage is the cutting component and finally removal of support/pressure and sedation reversal.

Our traditional technique goes from air/photo/assessment right to the support/pressure and then cutting.

Kraus: Can I ask about the deployed DTAG? I seem to have missed something.

Mayo: In our discussion it seemed that we needed some baseline info for the assessment of the animals for sedation. I'm concerned about this because those early shots are rare and we might not get that. I'm also concerned about getting shots in with the net gun. The group is going to have to decide what its priorities are because you don't get many approaches. We have to be very careful about how we use our first approaches.

Kraus: Funding has been cut in ½ . Your chance of finding the whale tagged again is hard, you need to tag immediately to refine/resight. We talk about launching a response, but whenever it's seen it needs to be tagged immediately.

Mayo: That is the foundation of this: that tagging needs to occur.

Scot L: It needs needs to be a buoy tag, not an implanted tag.

Mayo: If Becky's goal is to get the tag info then perhaps we might not need it with the current telemetry. If there is another goal then maybe it makes sense.

Kraus: I do worry because you have 3 approaches (DTAG, Pole Sedation and cutting)

Greg: The dtag info has to happen days before to get baseline info

Mayo: Do you want to use the first, most critical approach for a dtag or sedation?

Moore: Ideally you'll have a robocyamid with sedation

Mayo: I'm assuming that the dtag is real time. How critical if we had a real-time dtag would it be?

Stamper: It would be helpful, but it is not critical

Walsh: It is no different from a polar bear where we don't have heart rate we don't dart it to get heart rate before sedating it.

Moore: I put in "if practical" in to the flow chart

Greg : Are we assuming that the traditional telemetry buoy is in there.

Mayo: Yes.

Pabst: We should put it in there (Done – see Summary above).

Mayo: The plan is to work the animal before we consider sedation so we need to have telemetry. So this scenario has lots of pre-conditions that don't appear here.

Landry: I see your flow chart as a second tier, with a lot of assessment and a previous attempt on the animal. We've already decided that it is life-threatening, we've tried disentanglement. And next this kicks in…

Kraus & Mayo: Tagging is the critical step… none of this happens without a tagged animal.

<discussion re: tagging… implanted vs. towed>
<Discussion about chafing in manatees vs. right whales>

Kraus: Some of these whales are just seen a coupled of times in range… If you have the opportunity to disentangle it you will

Landry: Yes of course, our first druthers are to try the traditional strategy

Mayo: That is why I've said we really need to be a part of the decision making route… we have to streamline it.

Kraus: The field team has to be able to make the decisions no matter what the plan

Landry: This doesn't look very different from the plan with Churchill

Mayo: There are teams of people imaginable for all of these boxes. At some point we are willing to say we disentanglement team are not capable of doing this or we are. Usually that is a consultation with Jamison but with increasing numbers of decision makers we don't want to be bogged down.

Kraus: I agree… you guys have to be in charge of making that decision.

Kraus: The flights are cut this year, so discovery is going to become rarer and that will impact our ability to launch a response. Once one of these candidates for sedation is sighted it needs to be tagged immediately.

Landry: That tag has to be a buoyed tag, not an implantable tag.

Kraus: With animals with no length or trailing lines we might need to think about a radio tag that could be shot on.

Landry: the VHF in many regions is not helpful. You need aerial surveys day after day the search plan has to only happen. A satellite tag is most helpful.

Alex: what about AIS glue tag?

Arthur: what about iridium tags? It's been used

Moore: PCCS and Woodward's tag should both have AIS (Automatic Identification System) on them. They have VHF, but they can be picked up by any vessel. You can code the tag to be transponding the nature of the tagged object – i.e. in this case a whale to be avoided. We need to talk about AIS: Bocconcelli brought up the idea a couple months ago, AIS tags can maybe get glued on a callosity- he is talking to Dave Wiley and Moe Brown, to develop an AIS tag for whales. Because of inherent beauty of it becoming a collision aversion process it is attractive; 1) ships are already doing this among themselves… and then 2) how it relates to disentanglement, it says "please report", and the mother ship can operate without being there. You can track it and monitor behavior as well. An AIS tag, even for a short period in a shipping lane, will tell you what it (the whale) does with ships…

Kraus: What's the acquisition time of GPS and AIS?

Alex: 40 second. You can get one good fix every couple of hours…. for linear operating animal like ships, but will you get accurate fixes. It broadcasts position and transmits a message as well. There is a new system that can make a dead reckoning.

Kraus: I have a feeling you won't get any accurate fixes on a non-linear animal.

Alex: The beauty of it is you can broadcast a message too.

Moore: You can test it and see what the shortest acquisition time is… and tie it to the tow tag.

Mayo: Why should this be put on a list and not put on our tags?

Kraus/Moore: Because it is a significant IMO/Coast Guard issue. It took 20 years for the AIS system to go on line so this is not likely something that is going to happen overnight.

Bocconcelli: you can make a low drag prototype with AIS. It should be put into the floats. It could be tricky: it (the whale) will be a vessel with no one in command. But with Kingfisher, you can use its argument that it (Kingfisher) was a hazard to navigation. This will have to be an international argument.

Mayo: We need direction for our product. A description of a product, next steps to be taken and a budget.

GROUPS BREAK OUT (see Transcripts below)
Reconvene in plenary after lunch to summarize working groups.

**Restraint Group Summary – presented by McLellan**

1) First we talked about the Seine net idea - decided no control in that

2) Do we restrain or sedate first? We talked about 2 separate points:
A. physical restraint at first, and sedation comes second. Or B. sedation comes first and then we come up with what supports and controls the whale; thinking the animal is less responsive, pull pontoons or seines on side.

3) Decided that animal needs a line on it, to tag using Woodward's tag first, then decide to sedate, only with possibility of restraint (pontoons, salvage floats, float line) for safety of animal and people and if animal sinks.

4) Head area: moving pontoons/device from head to tail possible (we talked about hoop net on head/width/lines- develop head model).

5) R and D on behavior- response necessary (and do-able now). Head first approaches, etc.

6) R and D on ROV to cut line below the surface, new tools, old tools

7) R and D on pontoon and boat

<u>NEEDS FOR A PRACTICE RUN OF THIS</u>
Given time of one week: we need to:
Attach line to tail(r and d issue)
Create straps for floatation (r and d issue)
Create salvage and lift lines with remote deployment.

BUDGET:  Caveat of one use only:

Equipment costs-
20,000- Communication piece/safety-
50,000- Liftbag and straps and pontoons (Jamison) w/Strap mechanism- tail grabber
10.000- Rapid release rope
20,000 Fuel for zodiacs, food for people, travel for people- 20,000 per week for personnel
40,000 -Design a head of a right whale
---
$140,000

+++++  Plus
12 people salary for two week on the water (100,000 or 10,000 a day; Boat to charter 100,000 a week (10,000 a day) 100 ft-150 ft. ocean tug)= $240,000

Development costs-
Time required development- 2 engineers- 1 year:
One month field test time (CCS):

Re head model:
Stamper: Atlanta aq. Cast made into a slide- outreach species… might be a good group to make a model of head and flipper life size -Head of a right whale 40,000

McLellan: head can be a raft- build it off a boat….

Kraus: but you need to submerge the head-  10 ft diameter

Moore: met with Paul Brodie in Halifax NZ after workshop. Brodie has molds 9from Eg Delilah measurements) for head and flippers and could make a submersible model in fiberglass, with attachable flipper.

Landry: On average one entanglement takes 2.5 attempts for a RW to disentangle it. For humpback it's 1.0. Concern that we should have 2 plans, one with support and one without using sedation. Poles will reach 18ft underwater: it's reasonable.

Morin: The most positive idea is of a head model with flippers- good for disentanglement.

Moore: The primary product of the last meeting was a tail, now it is a head.

Pabst: I echo Scott: The point is that you want tools in your tool case, and step back more, everything that the sedation team thought of should be done, but maybe none needs to be done before your delivery system goes out next time. Just because if it works, it works.

Landry: If we are not taking a normally healthy animal, we think it is already done for before then. What would the RW community, fisheries, Canadians, think about that?

McLellan: but we are looking at approximately 10 animals right now

**Telemetry Working Group Summary**

***Summary Day 1***

**1) Baseline monitoring: quantity and quality of breath, body position, surface time, plasticity of tail**

**a. Outfit a real time video and audio so a designated monitoring person on the support boat can do this remotely**

**2) Telemetry buoy is an under-utilized resource. Outfit it with redundant tracking system including GPS/ARGOS/AIS systems, tension, velocity, and depth meter on the trailing line (swimming speed & energy output, diving behavior)**

**3) Simultaneously apply the DTAG – not in real time yet, could provide important retrospective dataset (location, depth, pitch and roll, fluke stroke rate, EKG sensor) Developing a real time DTAG would be great.**

**4) Streamline the process, have a central person on the support boat to be liaison between those on the water and the panel of vets/experts communicating remotely**

The idea of upgrading the data stream from any tag or bouy used to tag an entangled animal seemed important to better understand the behavior and physiology of entanglement. The practicality of deploying an ROV was then discussed.

Bocconcelli - Augment telemetry buoy- with some kind of satellite, phone, AIS. Possible funding would be a WHOI Green Technology award. The PCCS buoy has potential and available. Woodwards buoy should also be augmented.

Early: The idea is that the sensors can be put into any type of gear or buoy. The navy has low drag approach to a buoy which is essentially a noodle.

Landry: Short term, take it tomorrow and go with what we have

Bocconcelli: The other thing that is important, is keep an eye on entangled population, and if occasion arises this summer- if a whale is nearby, place a Dtag on it… you gain baseline behavior information that we don't have. Will be very easy, no cost…..

Landry: How would this work under the entanglement permit?

Moore: is it therapeutic under the need for assessment and baseline data under the disentanglement permit?

Rowles: Probably so.

Bocconcelli: Monitoring of the whale: Use Dtag before anything, and after if needed. We can keep suction cups on for up to 3 days, and hoping for 1 week with new cups and EKG sensor will be ready. Tested on beluga at Mystic. (Note added by Ed.: Subsequent conversation with Mark Johnson was less optimistic in terms of EKG being ready soon).

Telemetry needs:
Communication team- radio/camera/video
ROV- assess health, sounds, camera/
$20-50,000 estimate- 1 year to prototype…

Mayo: Be careful with all the lines that can get tangled up with ROV

Landry: perhaps have the ROV upstream….

Bocconcelli: …..or go and do an inspection and bring it back to the boat

Moore: A rib would be better in terms of having a platform that could delvier the necessary power for the ROV. It might be able to get over inabilities of the Shearwater.

Landry: Can the rib be towed ?

Moore: Yes

Landry: I'm worried about creating reaction- pontoon or something hard. I don't want to knock the animal out…..

Bocconcelli: the ROV is buoyant. It won't collide, just bump.

Early: I think it's a starting point. A survey for putting divers in the water.

Moore: the idea of getting an ROV in to the PCCS toolbox merits careful evaluation of the power issue.

Bocconcelli: you could almost be doing it acoustically, but processing of info won't be in real time.

Moore: in terms of assessment, NEAq has a small one(http://www.videoray.com) It would be worth seing what it could do in terms of assessment.

Pabst: We need support in this report for development of this type of monitor

Rowles: We want to know how they act at their release.

Kraus: We need to think about gluing at callosities

McLellan: it's (callosity) is the one place they won't run it off of……..

Kraus: The glue thing attachment area isn't trivial,,… it needs to dry

Bocconcelli: we have a colleague that works on mussels and barnacles….

Kraus: are their nerves in callosities

Moore: working on that. (Sokolov 1983) says there is only epithelial cells and keratin and very laminated. Whether there are growth layers I don't know…

McLellan: In barnacles, there is room for epidermis to grow into the barnacle… barnacles change the area of skin.

Moore: Anything else to address?

Bocconcelli: when you talk about stopping the whale- immobilization- do you consider water jets, bubbles…..

**Drug Working Group Summary**

Full Group Discussion:

Field study comparing Meperidine vs. Butorphenol to figure out if there is a volumetric advantage also with/without Medazolam to determine if combined drugs are possible
- develop standardized design for testing these experimentally in stranded animals
- human and animal safety are a consideration
- testing low vs. high concentration (0.1 mg/kilo)
- also talked about testing on lab animals too

Real time monitoring system so we could get some baseline and real time information on how well the drugs were working and assessing when to re-dose

Remote drug delivery from ~30 feet away
Requirements: ability to deploy from a further distance
Ability to get second doses of up to 100 cc.

More equipment that can be tested
-rifle that can be modified to deliver 30 or 60 cc darts
-needle on a hand pole for placement
-develop a way of remotely placing a needle on a whale with a cross bow with greater accuracy in combination with a system to deliver a big or long term dose

Human safety
Shield
Reversal drug delivery

Drugs
Well settled on these two opioids as choice drugs

McLellan: do you think that such a large volume is going to go in? It is still meeting the same number of cells.
Pabst: test animals would be stranded animals?
Brunson: yes
Moore: you are assuming that you know the dose that isn't going to kill them OR that the animal was going to be euthanized
Rowles: Mike talked about triaging for rehab and release so there is precedent as far as being able to use sedation as a tool for assessment before that decision is made.

Rowles: There will be 4 stranding regions where this can be compared on stranded marine mammals. People from disentanglement networks dealing with sedation should be there as well.

Drug Working Group

DAY 1

Drug Deployment and Pharmacology/Dosing Protocol

Brunson: Let's start with Pharm/Dosing Protocol
Syringe developed to this point hold 30 ccs
So we either have to increase the [conc] of the drug or increase the vol of the chamber
There comes a point where the size of the syringe, delivery mechanism becomes a concern.
If you are dealing with a whale the size of Churchill we need more volume going in

Mayo: have you decided on the chemistry used?
Brunson:
Mayo: there was one up there that looked very effective
Brunson: highly potent, margin of safety was THE big issue, it is listed as a euthanasia solution.
Rowles: it was taken off the table.
Rolland: Mattila would be dead! Butorphanol is something that could be considered
Walsh: Very dependable effects: Butorphanol isn't overidden by animals. It was only hyper-excitable within 2 minutes of the injection when used in conjunction 8mg/kg of Aminophllin. Medazolam was used instead and it was fine.
Arthur: how do you assess an animal as far as how much of a drug to use?
Walsh: We know their weights
Brunson: a ton per foot (age vs. weight)
Rolland: necropsy data, photogrammetry
Brunson: healthy calf in NJ weighed exactly what it should have
Mayo: good estimate of Staccato from Moe

Brunson: back on track; let's talk about Butorphanol – concentrations that can be obtained. Questions about absorption and reactivity are pretty important. I am confident that concentrated solutions are going to result in increased absorption or accentuate the effects.
Walsh: but that is based on going from 1 to 10x
Brunson: we went up to 550mg/ml, so we are talking 5-5.5 times the concentration
Looking at choices of drugs Butorphanol is a mixed agonist/antagonist so it is a weaker opioid than others so its effects are generally lower at equal doses. Potency is measured to similar effects.
Walsh: I'm a big fan of Meperidine because I was one of the first to use it. But I have seen animals that have overridden Medazolam.
Brunson: I wouldn't used butorphenol by itself.
Gulland: Butorphanol is often used by itself (more variability amongst individuals in combination). More predicatably sedate the animal by increasing the dose of Butorphanol instead of using both because use with Medazolam is less predictable
Brunson: sole use drugs are generally less effective

Gulland: individual predictability and variation, not effectiveness.
Brunson: that is very different from the species that I'm used to so perhaps the sole drug (butorphenol) may still be a way to go. What I've heard is that this is getting favorable use from you all.
Walsh: we don't have experience with combining it. We have 10-15 episodes with dolphins 15 in killer whales of medazolam alone
Gulland: for me it was a comfort level. Much safer drug so I felt more comfortable increasing the dose given with medazolam… but that wasn't the case early on with butorphenol. But now with increased butorphenol use I'm feeling more comfortable using it.
Mayo: comparative beach study… how do we get that moving. Is there a protocol that could be done to 10-15 animals on the beach?
Vets collectively: yes, maybe we should design it
Mayo: I propose that there should be a protocol developed for testing sedation protocols on beached animals.
Rowles: we need to have one distinct protocol and study design so everyone is using the same parameters so we can develop a single protocol even if you are using different drugs and different species
Gulland: but we don't have to apply for multiple permits we could be under one permit
Arthur: how would you standardize monitoring if you are doing this w/ different drugs on different coasts with different people
Walsh: respiratory rates, heart rates, and attitude, assessed by triage, blood levels
Rowles: which would get at what Walsh is worried about which is uptake
Rowles: what did we use for sedation of the live right whale calf
Walsh: I don't think we sedated him. We gave him lots of stuff but I'll have to look it up.
Mayo: how do we identify individuals for the study
Sharp: but sometimes you have animals who are in the euthanize category but not due to the health (lone delphinids, geographic location and hence unreleaseable).
Mayo: somehow we have to decide who the candidates are. We need to do this quickly, especially if we don't need permits.
Rowles: we also have gray whale stranding season coming up
Gulland: that's what we did with a couple of gray whales, we gave them Medazolam.
Brunson: volume of drug needed to reach the amount of drug needed in these whales. We should start at 0.1 mg/kg for Butorphanol to see how that compares with the doses of Meperidine that we know. Comparing them independently.
Gulland: it may be a volume issue, by taking out the medazolam you make more room volumetrically for opioids
Rowles: what are you losing by removing Medazolam
Gulland: nothing really, the complication
Brunson: Medazolam etc… these are anti-anxiety drugs (if you are being good because you are anxious about being bad, then sometimes you'll misbehave) they also may induce some amnesia so you don't remember what happened to you. What I'm hearing (from Walsh and Gulland is that) we don't need it.
Walsh: doesn't use Meperidine solo as an injectable sedation

Brunson: if volume is not an issue do we include Medazolam at all in the pilot study (e.g. Butorphanol and another with Butorphanol plus Medazolam). This is the game we play, massaging it back and forth and optimizing one drug vs. two or a different one. Interesting to see if you get better sedation out of mypyridine than butorphenol individually. We wouldn't combine the two because they would actually block one another. Butorphanol has less respiratory depression, less dysphoria, it is less controlled, less analgesic, less depressive.

Walsh: injected Demerol was used initially to relax an animal before they are sampled and potentially euthanized with T61. Was not used in animals that you were planning on having survive.
Brunson: is there any record of these
Walsh: no (I don't have the time)
Rowles: data sheet for animals in the Mid. Atlantic recording the amount of drug given because NOAA had issue with different species responding differently so they required records of what was used and results
Walsh: I have taken advantage of the fact that you overdose them on Demerol to prevent struggling phase in public situations
Brunson: we'll sit down and develop protocol comparing Meperidine and Butorphanol You could have blinded drugs.
Rowles: worried about human safety issue. Assessor should not know so that their assessments, but the injector would need to know.
Walsh: what about accidental injection? This needs to be under tightly controlled situations
Rowles: everyone that is supposed to use it then this is what needs to be done from a human safety standard
Rolland: should we also add high vs. low concentration of Meperidine to this study
Brunson: we could do high vs. low in lab animals (e.g. pigs) so that we didn't have too much going on beachside. If someone is injecting a gram of dilute Meperidine vs. a gram of concentrated Meperidine: this is something we don't want no matter *what* the concentration.
Rolland/Walsh: lab rats will tell you certain things, but not exact muscle effects in marine mammals.
Walsh: certain drugs with antibiotics in marine mammal muscle have very different effects.
Dualpen is still sitting there when you open up the animal to see what happened
Brunson: effect of concentrated vs. not; effect of 2 differeent opioids and effect of combination with Medazolam.

Stamper: came from monitoring group… looking at DTAGS that will do a suite of monitoring. Baseline tagging data could give baselines for anaesthetic protocol.
Rolland: Can we get ekg readings?
Stamper: they are working on it
Moore: leads penetrate less than 1mm of skin
Brunson: Are there other approaches for CNS depressives that we need to look at?

Alpha2 agonists – minefield, unstable, reversible
Gulland: gas, heli with a vaporizer
Brunson: as the system gets bigger gas sedatives get highly variable
Receptor bound drugs are much more elegant
Gulland: stellars its all gas, Bruce Heaton's deal is that the marmam gas exchange system is more efficient
Brunson: but they are still within the size where it is ok
Stamper: efficient vaporizer was developed by Nat'l Aq in Baltmore, just as a delivery device, not used for inspiratory
Walsh: gas delivery of anaesthetics have to deliver in marmam relevant doses, not human doses

Deployment
Hammer: issue of volume, the bigger, the harder it is for us to get it into the whale. The bigger the dart the less likely they were to stick and stay. In this tradeoff if one drug is slightly more effective but it has a bigger volume it may not be effective after all
Two development styles – with trade offs
High tech expensive may not get in at all (needle bending, gas filled syringe would not fire)
Low tech, inexpensive, hit or miss

High tech solution (robo-cyamid) still requires chasing the whale with a boat, but then you sit back and direct the tool from a distance. If we have monitoring tags they can be incorporated in the DTAG (a little bigger) but would allow remote re-admin
Doesn't require a second boat deployment, or further danger.

Hitting the back of an Eg with a projectile is chancy unless high angle of attack is used. Not beyond doing, just requires thought.
Rolland: how close is robocyamid to being developed
Hammer: $175k
Arthur: ~4months, b/c the parts are there
Mayo: the candidate that we discussed that on (Churchill) is the only type of animal you'd consider using a robocyamid on it.
Over the back has some great strengths, but you really have to time it right.
Gulland: could we do it with a helicopter?
Mayo: It appears that they freak out from the low frequency helicopter thumping so I don't want helicopter\s involved when I'm near them. Each whale has a different slant/attitude, yet if we are going to design any of these things we want to design this for the crazy ones.
Brunson: We want to design something that will expand the candidates for medical and disentanglement intervention not reduce it. So a robocyamid's pole delivery system would limit us to working on the "nearly-dead".
(Moore (added in review): cantilevered poles routinely touch normal healthy right whales)
Mayo: is there a projectile that can be developed?
Hammer: can we get close enough to launch this dart into a feisty animal? E.g. 50 feet?

Mayo: Yes, we were easily within 50 feet of some of the feisty ones (2030
Especially with a good targeting projectile. I can think of a couple that would have worked, but I'm not convinced that you wouldn't have to have a really good shot.
We can hit the area in front of the peduncle
Vets (collectively): no, not a good area – all tendon
Mayo: what about above the eye?
Vets: no good for drug delivery
Mayo: where do you want it?
Vets: in the back.
<discussion re: putting it in the back with drug delivery system/tubing>
Brunson: one of those interventions is delivering medical care… e.g. antibiotic delivery system so that we aren't just focusing on catching as our theme. We need to look at this as both a humane issue and benefiting animals that don't need disentanglement.
Walsh: if concentrated mechanisms are not ok, then what about a balloon system where the balloon is pressurized administering the drug to the muscle where Medazalam can be delivered and re-delivered as it is absorbed. Say you have the whale that you would treat very differently if he were in your hands than away from you. E.g. you would treat with Vitamin & selenium after a long chase. Considerations may be the balloon may collapse at depth or the drug may be altered by the cold/pressure.
Stamper: you could throw the dart and have 40 feet in the animal with the ability to change things out
Walsh: the longer you make the trailing tubing the more you get into temperature effects and…
Brunson: wrapping around things
Mayo: plenty of examples of animals that we can't get near even with 20 feet of line trailing behind them.
Arthur: is that because they are fast
Sharp: they are just evasive
Mayo: with proper air support we may be able to do it, but the idea of getting on their backs is not the typical situation. Majority of the animals I think we could approach within 30 feet. I think that many of them you could get within 30 feet and the equipment will work there. No stop approach is necessary – follow them overnight. Eventually you'll get within 30 feet.
Gulland: what are the cons of this dart at 30 feet.
Hammer: nothing except the angle. As far as accuracy goes, Stamper was hitting a 1 foot square of blubber from 20 feet so it is doable.
Brunson: we have to get rid of the cantilever pole for delivery
Moore: cantilever pole is 40 feet with 10 feet on the boat, but you are 30 feet away from the animal. The idea that you need to tow the boat to get something on the whale is all wrong. You can do it without the use of the disentanglement boat.
Rolland: Safety issue – drug delivery and disentanglement together would be complicated
Mayo: we were only doing drug delivery.
Sharp: helmet cam on the end of the pole as a visual way of directing the pole. There were pros and cons…
Moore: your pole was crude

Mayo; yes and I want to get away from it. An animal like kingfisher would have knocked that pole off the boat
Rowles: but it broke when you needed it to break
Moore: that speaks to the ballistic approach
Mayo: the ballistics envelope has not been exhausted by any means. He thinks he has some money to further it. If we were to come up with the first generation, maybe later we could do it at 50 feet, at multiple sites. I would even like to see if we could cut lines with it.
Sharp & Stamper: the margin of error is small but there are many conditions
Question for Craig Bamber: can cutting be incorporated into the ballistics?
Rowles: well if you are putting the DTAG on why not have it inject also?
Moore: downside, you don't get the multiple sites for drug delivery. DTAGs do slip so that may not be a complete shut down.
Brunson: ballistics-increase delivery volume (above 30 cc)
Rowles: what is the dose volume estimate for range of whales?
Brunson: 30-100 ml
Rowles: we are at 30 ml right now, what is our outside volume in the largest animal at current concentrations?
Brunson: up to 100 ml per dose; our last dose was 30 ml, and I would probably go 60 ml now. We are talking about drugs that are rapidly absorbed, crossing membranes etc… that's why they work so quickly, they don't stay in the muscle. So I don't know if we put 60 ml in a spot if the outside of that pool is going to be picked up but the center stays put.
Stamper: so the balloon delivery system may be ok
Walsh: as long as you don't exceed the absorption time.
Hammer: what are the chances that we get one shot and then the whale dives and we don't see it again for 10 minutes
Stamper: it is a high probability that you've got one shot, and that maybe having multiple people on the boat prepped to fire is not a bad idea
Brunson: they probably will need to be barbed
Walsh: we probably don't want it to continue to enter like sting ray barbs
Mayo: I can see entry of the needle, but the tubing… you are stuck with a short tube and the need to get close to in order to deliver.
Gulland: smaller doses may give us a better advantage as you don't know if your shot got off, so missing 100 ccs is a much bigger deal than missing a 30 cc dose.
Brunson: what is our big deal? What do we want to minimize
Moore: the crapola factor is huge… if you can minimize the amount of stuff needed that is best. No pole, great. Only a pelican case… even better.
Stamper: ability to use the gun from the mother boat even better.
Moore: it would be interesting to know the average range of commercial whalers. I'd say it was 50 yards. I have a 3 photo sequence of a harpoon going to a whale. This is where Becky has got to: she scaled up to a deck mounted net gun and maybe we want to scale up to a deck mounted cannon so that you get the power that you need to throw it further.
Gulland: dart safety… mother vessel may be able to have a safety shield allowing the dart to hit. Anecdote re: dart bouncing off an animal and hitting shooter in femoral vein
Stamper: we need to have a large effective dose to begin with to take the edge off. I don't see a 3 dart system being effective at sedating it.

Arther: can one location vs. multiple locations be added into protocol

Safety
Gulland: a shield
Mayo: depends on circumstances, we may have to add a little flotation to it… that might allow us to go a little farther
Hammer: pressurization of darts comment. There was a check valve used pressurized the chamber on the way out.
Brunson: butane was used to pressurize
Walsh: old versions used to have gunpowder
Stamper: we were using a palmer dart (metal) with a blank charge behind it.
Hammer: Safety concern. Having a dart that would only be pressurized before it was shot rather than being on-board pressurized
Brunson: human safety – established protocols for human exposure, plus antagonists and safety protocols for whatever drugs are used
Rowles: With Churchill each dart was loaded as needed. Could the darts be loaded on the dock?
Brunson: we loaded them with the drug on the deck and then pressurized them in the boat. I was fine loading them with the drug. You can't pressurize them 30 minutes before you go because they may lose pressure. So we have to better train the one on the boat.
Rowles: if we are going to do the DTAG for monitoring, but it has drug deployment on it so that it could be drugged?
Stamper: DTAG was thought to be put on to get baselines a few days ahead… but it wasn't useful for real-time monitoring. Ideally we would like it being beamed to the ship.
Rowles: what info would you like
Vets (collectively):
Behavior underwater
Heart rate
Fluke strokes
Dive profile

Hammer: What happens if you sedate a whale fully? Will it stay at the surface?
Group response: Right whale to hunt, most would float
Mayo: I don't know if we could reverse a sedated whale fast enough if it started sinking
Walsh: the intention with the level of sedation that we are trying to achieve is not high enough to cause full sedation
Rowles: what if the DTAG has the reversal in it
Mayo: some sort of harness just in case
Stamper: cross bow firing mechanism to fire a long needle into the blubber
Arther: last robocyamid discussion involved finding commercially available parts and a hypothetical mechanism.
Mayo: I see two competing mechanisms that compete for time (dtag deployment and sedation delivery)
Brunson: looking for extension set for needle to give drugs and reversal. Crude, quick, with a safety line. The trident resulted in competing resistance if we couldn't get it in

parallel. (the darts themselves were pressurized, but the trident itself was manually embedded)
Stamper: the force needed to put it in is quite substantial for a single needle (tested at 20lb)
Mayo: Slay knife is spring loaded and could drive anything through anything

Use of DTAG
Walsh: not good for the go/no go scenario
Mayo: how do you make the decision to add 30 more cc?
Vets: response, heart rate, subtle, trends, subjective not strictly scientific
Mayo: when I'm sitting over the tail hearing vets say it is slowing down even though I haven't noticed striking behavior how am I supposed to know what's real?
Rowles: we need to hear your perception too Stormy as part of our evaluation of when to re-dose
Mayo: will the heart rate give you enough?
Rolland: it will give you a concrete number.
Mayo: What about EKG? Will it tell you when you are there?
Walsh: no type of monitoring is going to tell you when you are there… we don't really have an endpoint.
Rowles: It will tell you when you've gone too far.

Discussion re: figuring out breaking behavior.
Stamper: are you talking about a physiological "broken" or a psychological "broken"
Mayo: I don't know… it just stops and can stay that way even 25 minutes or more. But when they finally "wake up" they take off like a shot. One of the things that is clear is that to keep the whale that way you keep pressure on it… when you stop pressure it takes about 25 minutes and then it wakes up. I don't know how to get them to that position, but I would love to know.
Stamper: behaviorists have a psychological reaction that intense no-escape holding can impose on restrained or cornered animals where they just shut down.
Walsh: manatee response to captivity… easy when they come in for ~2 weeks you can poke, prod, etc… but then they realize they don't like it and become resistant… then they are ok again… then after another 2 weeks they stay tough to handle.

Mayo: we are looking for 60 ml as a maximum weight

Walsh: we can do anything with any sea turtle except a leatherback because long distance swimming is so engrained that it will swim into a wall for 3 weeks straight. The question is are right whales so engrained to swim that they won't stop? Doesn't matter what is touching it.

Mayo: reason that Kingfisher stayed on the surface is possibly because the pressure is up toward the head.

DAY 2
Working from Moore's overview and Brunson's Medical Intervention Study Plan

I. Analgesia and sedation techniques

Can Butorphanol be formulated to high concentrations to reduce volume to a target volume?

Brunson: has a pharmacist working on it
Gulland: has your pharmacist been doing it?
Brunson: runs pharmacy at the vet school
Gulland: wondering if Bill Lance at wildlife pharmaceuticals, has experience with drugs used for wildlife captures. Has experience with reducing volume
Brunson: this is just to evaluate whether the chemistry is such that it can be dissolved and remain stable at our conditions
(Note from Brunson after workshop: Butorphanol cannot be increased in concentration.)

1. Does Butorphanol provide better sedation and dose delivery than Meperidine in cetaceans?

Brunson: Does one work better?
Walsh: our experience is that in species where Medazolam doesn't work we have had better effectiveness from Butorphanol. That has carried over in multiple species. We also like the med because of the muscle relaxation and amnesia
Stamper: is there an additive effect
Brunson: we are finding synergistic effects, additive between the opioid in tranquilizers

2. Are super-concentrated versions of all 3 drugs absorbed effectively from muscle?

Brunson: fundamental question or doing these concentration manipulations will always be in doubt

3. What is the effect of super concentrated drugs on muscle and vasculature?

4. What is the limit to the drug volume without affecting abs or damaging tissue

Brunson: is 30 ml ok?, 60 ml too much?

5. What is the effective distance for the Paxarms dartgun for accurate placement of 30 and 60 ml darts?
Mayo: implied in #5 is further development of ballistics. We do have funds for that.
Brunson: there are some real questions re: stability of the dart, strength/power behind the 22 caliber blank, wings on the dart

**Study plan**

1) Butorphanol: test solubility for max stable concentration. Dosage will be based on current info from *Orcas* sedation calculate volume of administration for 0.06-0.1 mg/kg

2) Field test Butorphanol vs. Meperidine with and without Midazolam in stranded cetaceans.

Rowles: what feedback do we want out of it? You have to be very specific

3) Test high conc. in lab animals
4) Test high conc. drugs in stranded cetaceans
    a. blood levels
    b. Clinical signs of sedation (heart rate, body condition, posture, respiratory rate, reponse to stimulation, quality of breath…. Force and depth, swimming direction/speed, righting reflex, eyelid position)
    c. Histopath. of muscle and vessels

Stamper: is it possible to use the next stranded Eg calf that was going to be euthanized
Rowles: you guys let me know about logistics
Stamper: I think we could do it, but that depends on someone making the call that it is expendable. I'm just concerned about legality (Rowles indicated it was ok)
Walsh: if we would have had a place to take it we might have been able to do it
Is it better to do it in a baby Eg than cross species
Vets: yes

5) test on anaesthetized animal (pig) and/or stranded whale

Brunson: would need a large muscle… we could scale it down to a smaller animal, but that might not get at the same question
Gulland: we have sea lions that have cancer that we are going to be euthanized that we could do this on, but I don't know if that would be legal
Rowles: you would have to go through your IACUC but I would have to check on it because it wouldn't be routine vet care or part of the diagnostics or euthanasia
Gulland: I have the same question about it for free swimming animals that we would be testing
Rowles: it has to benefit the animal or be testing techniques that might benefit the animal/species
Gulland you could say it was for the benefit of the animal but really it is not, it is for the Egs
Rowles: I'll have to ask

Walsh: Is it worth exploring the minimum # of veterinary personnel required to do this as point #8? Mayo was talking about being the only one disentang… and we have issues of not hearing about cases
Brunson: I think we can expand the number of tools and the number of devices so that more people are enabled to do this… maybe initially having one person moved to

different cases would be beneficial. I think the expertise should be there, not necessarily a single person.
Walsh: initially we talked about NC, myself (I've got 2-3 other people that are very good at anaesth) people are on vacation, in the field… we've got one shot at this potentially

6) ballistics development
7) development of remote drug injection

Brunson: there are some development issues that require time but much of this can be done right away. Concentration of drugs, lab studies etc… so that we have confidence that these are actually viable. The longer term stuff is engineering development which could happen quickly but may be time/$ dependant

Rowles (to Moore): you are going to Barrow (AK) have you thought about taking these ballistics
Moore: I don't think that would happen before May
Rolland: we could, and we could inject saline instead of anaesthesia
Moore: Craig George's general attitude about using the Eg plight to ok the bowhead hunt seems to be positive. This is a fall hunt project not a spring hunt project. My sense is for not to try to push it for this May but to wait until the fall hunt
Rowles: they have a long tow and you could actually do it while the whale was being dragged.
Rolland: we had trouble having a boat out there with people in there.
Moore: what are you going to gain doing it in bowheads and not other stranded animals? to me the cultural obstacles are larger than the benefits.

Gulland: so what is the plan if we get the call
Brunson: there is one projector and a few darts, we need to order more darts. There needs to be some rapid re-tooling but it is doable. We could get additional dart guns, get the barrels modified so we could have multiple people equipped.
Gulland: I don't want to sit and watch a whale decompose waiting for someone to fly in
Hammar: the advantage of dealing with a whole whale is you get the sense of the angle of attack. If the logistics of the flying bridge or whatever platform prevent you form getting the angle that you need then you will just be putting it into the blubber
Gulland: maybe we ought to think outside of the back muscle box… maybe there are some other sites
Rolland: hesitate for anything in front of the blowholes
Walsh: I would hesitate for anything in front of the shoulders
Gulland: in a gray whale I could imagine that the top of the nuchal would be a great spot
Walsh: we've had misses, or bounces off the fascial plane… you also have injury to contend with if you miss your mark
Gulland: we may need to think about a protocol to identify a spot that is possible
Walsh: can the ballistics that we are talking about be modified so that it could go through 2 feet of water
Hammer: as soon as anything hits the water it will hit the bakess. Especially going through the air-water interface

Walsh: what about spear fishing
Hammer: they don't go a distance under water… there's also an aiming problem
Mayo: almost got shot by a spear underwater

Brunson: laser scope on a dart gun for underwater darting
Gulland: ROV with a speargun
Walsh: setting the needle with the balloon anaesthetic deployed by the ROV

Moving on to Timeline

Chemistry: (2-4 weeks)
Lab Animal testing: drug absorption, toxicity, volume (3 months)
Walsh (to Brunson) do you get an idea between species what the comparison is between volume delivered to volume that is ok to limit damage
Brunson: studies have been done on Ketamine because of its irritation and the amount given to a mouse despite small amt still causes massive damage and puts us off of IM in mouse… but everyone still uses the principle that the max volume is 20 cc in large animals. We could do a study on a large piece of muscle to check the tolerance
This would be for same site delivery (redosing or reversal)

Sharp: how fast would reversal happen
Brunson: Walrus darted, six minutes later a plane flew over and all the animals including that one ran for the water so we hit it with the reversal which took effect after 2 minutes as it was in the surf and it swam away…
Vets: so a good estimate is 3-6 minutes
Hammer: can you overdose on the reversal
Brunson some reversal agents are not clean but the opioid reversals are pretty free of side effects
Walsh: and some are low volume
Brunson: you usually don't have an animal that wakes up and attacks. You have a few moments before they have their bearings
Mayo: so once that reversal is put in we have to presume that you are dealing with that same active pre-sedation animal
Brunson: yes

Mayo: are there times for reversal when the animal is not in a disaster situation
Gulland: speed recovery
Brunson: anytime when we are in an environment that we need the animal to take care of itself
Mayo: the only emergency is if the whale is o.d.'s or sinks? Just wanting to imagine that. Are there any other times? Like if the whale has an adverse reaction, gets excited… you would want to reverse it.
Vets: yes, likely from the other boat.
Brunson: that's where having the ability to give remote drugs would be advisable.

Walsh between timeline/budget can we put in personnel/team development? What would be nice is to incorporate an event where vets and behavioralists are included in the discussion. A list of potential people should be developed

Sharp: we had talked about using entangled grays and humpbacks so if we are sedating animals that are carrying gear we have to think about how heavy the gear is and whether sedating them takes away their only way of countering that.
Mayo: very important. Means that the early assessment is still critical.
Brunson: criteria for/against sedating needs to be developed
Mayo: relative to that are we in agreement that the sedation course (flow diagram) will be approached conservatively with the key being the disentnglement team says they can't use traditional techniques.
Stamper: caveat is the excitement phase ahead of time… you'll have to make the call ahead of time that sedation might be an option later so you have to call off quicker
Mayo: we have already been conservative in the past with animals who were probably candidates for tagging because we knew we could free them – such that we never did it experimentally. I think it is useful to ID that our posture will remain conservative and that we will go into sedation operations "kicking and screaming."
e.g. a line where this technique holds a lot of promise but that it should be undertaken conservatively and only as a last resort.

Budget:
Brunson: Meperidine and others can be purchased as powders, cheaper than formulated. Equipment is just for dart guns, syringes, etc (not newly engineered).
Engineering and Development is what includes the robocyamid ($200k), ballistics & projectile development ($20k)
Mayo: we may be able to budget in the tens of thousands for development of delivery ballistics. If we could get a substantial prototype gun that could have various applications we may be able to invest more.
Brunson: would that include getting him here?
Mayo: that would be for consultancy for a remote ballistics delivery device… whatever seems reasonable, practical
Walsh: we think you could get into a situation where you are causing extensive damage to muscle, hemorrhaging
Rolland: is this a 1 year budget?
Rowles: this is a start-up, one-year budget
Gulland: where's the funding for the stranded animals
Stamper: needs to be done in the context of a triage situation
Gulland: may not be ready for the first stranding, may have to choose the most useful stranding. Have a study plan with a team of six people dedicated to traveling wherever.
Walsh: how much time do you have to fly a team in when a stranding happens?
Mayo: in terms of stranding response we have a large staff with interest who do not generally respond to strandings, but we're not trained. Does it have to be a marine mammal vet?
Vets: yes

Walsh: we may need to reduce the number of information needed down to a single animal or two.
Rowles: I just don’t want to put the additional burden on the mass stranding situations

Mass strandings or use of more than one or two animals may not be reasonable

Restraint Working Group Feburary 7th 2006
(Carriage House)

Pabst: Seine net or two pairs of boats and floatable underneath? There is a model after the Exxon valdez incident, the response of the govt. and people was to create system, a fleet system that would be available, designed to respond to oil spills, they are around the country, and they don't do anything, Savannah, Norfolk, New Jersey- 250 ft vessels. The oil industry pays for the ships and crews. They don't do much. If there were some way, the great dream in the sky would be a similar system, fast, and bring them to the whale, sedate the whale, drive the boat that could then just support the whale while you did whatever you could.

Kraus: you can't stop them in anyway.

The idea would be get the fast vessel to the spot, then a team and a zodiac goes out and sedates

Morin: What about sedating on the grapple. Anchored whales are easy to work on, if you have the right depth

McLellan: The boat could be in the Midatlantic, but do we set the logistics up for that in Cape Cod Bay, Canada. etc, just as a start to set up logistics? The amount of rope and scope is what you have to use.. If you strap one onto the whale, that line is broken. I don't think you'll hold the whale down with the line that is on it.

Pabst: If you had a dream- pool, baby pool, etc.. what do you see as the thing that can be the most useful? (looking at Morin)

Morin: if you can get it in a bathtub, I'm ok. Every time I address the right whale not moving - logistics are too complicated, costs too much, or whale is moving in 3 dimensions. It took 20 years to feel comfortable sedating an elephant in 2 dimensions.

Pabst - once you applied pressure, we saw the tail moving, if you are interacting, do they deep dive when you are at the surface?

Morin: both 2212 and kingfisher were complacent. For "normal" right whales – our video is too poor, but if you took the time to read all the 2000 pages on the website, it is a common thing where you can't just GET TO the animal. I have a hard time wrapping around physical restraint by itself. With sedation you could take the edge off (Foster)
I want small team, quick, reliable… I think of the bio-bullet.. maybe I'm too pessimistic…

Mclellan: at some point you have to get to head wraps and flippers wraps. Head harnesses and tail harnesses are something. Can even give you carcasses to see end results, anything.

Morin: a mouth bit is another idea. Head wraps scare me. Hood is good. I don't know how we'd do it.

Skraus: A hoopnet wrap with weak links is a possibility. The net is open at the top and open at the sides, blowholes are open. If it does lead to immobilization, it can stop the whale in its tracks .

Foster: and use enough of a blinder.

Kraus: (drawing it)……..hoopnet over whale's head

Greene: Salmon- if you get the tail stock it stops, if not, it beats you.

Foster: Killer whales do the same: they stop.

Morin: I don't think we've ever applied pressure like that.

Kraus: if you can get your tail harness on first, then something over their head, you have two pulling points.

McLellan: if you attach it to a boat? Part of it?

Green: We had a lobster trap tying, tied it to the bit, and powered the boat to take out slack, towed the whale and boat in neutral, no one down… 37 ft boat. .

McLellan: Has anyone lashed on and tried to stop a whale? (sleigh ride?)

Morin: tried on Churchill but couldn't get hooked up.

McLellan: if you can put something heavy on the whale with strong rope

McLellan: taking it to a heavier line, we have to know where the whale will be, sedate. We could have two RIBs on front, put a bib on it… you would have a team at the back of a boat as big as the RV Stelwagen then working the big boat off the front, single person in water takes 6 on deck.

Kraus: maybe you don't go in the water, have boats in the water……

Morin: if a whale is sitting there we can get almost anything off. It works on humpbacks, we get anything off. We have to suspect another Churchill.

Pabst: why? what is it about a RW that is different from a humpback?

Morin: personal experience: in Cape Cod Bay right whales, compared to humpbacks, besides physical difference, they have a different personal space. Humpbacks are used to

the buzzing of engines, fishing boats, Eg's are there at a less active time, not too keen with activity. More in my mind, the physical attributes of the different species, pushing that huge head through the water. Humpacks drag, not as powerful in the water. We started on humpnbacks in 91 and assumed it would act the same 96 on a RW. We realized they were different, but we still haven't developed a different protocol. Landry did an analysis: 90% success on humpback, vs. 50 % on Eg.

Pabst: head thing? Possible? Do you think?

Morin: Mayo is the only one who has seen a broken RW. Two were on death's door, it doesn't really count (AP). Unless we have a purpose built system I don't know if it will work.

Green: 20 years ago tail wrapped one- played out, slowed down, not 20 minute dives….

Morin: but you would not feel comfortable getting tail wrap out

Pabst: maybe a blinder slows them, doesn't break them. Maybe that is the key?

Green: Eg are the only whales I know that will retaliate - they trumpet and screech.

Kraus: Eg are like cows grazing in a field, or bulls they are not too interested unless you get too close. Humpbacks are more curious… like a golden retriever. More trusting. I think humpbacks give up quicker when entangled. Not as much power to break free themselves

McLellan: they are not going to do sedation without restraint potential.

Morin: what do you mean by restraint?

Pabst: how about we use the word support, not restraint?
Kraus: if you had your head in a bag, you could restrain it. Inflate something with CO2. with lift bags. (Smith and Kraus)
Morin: the crazy idea that I would like to try is open nasal plug- keep its nose open
Mackie: An Eskimo said that, If you put a harpoon in, it won't dive
Kraus: put pvc pipe in it! (Ed. – perhaps could try practicality on a cadaver?)
McLellan: it could make it grumpier
Morin: I don't want it grumpier!
Foster: how big a boat do you need to slow it down.
Kraus; 40 ft boat in reverse was moved forward by1971! It towed a 40 ft boat twin prop.
McLellan: need a dragger, something 100 ft range.
Pabst: physiological, its going to hurt itself
Green: how?
Pabst: its like capture myopathy, it will burn its muscle out

Kraus: there is a behavioral component to it. If you let a dog pull, everything gives, they think they are making progress- if you can stop it, and learns it cannot move, you might be able to.

Foster: what about the humpback?
Morin: free swimming humpback will take a break- habituate.
Kraus: I don't think anyone has ever stopped a right whale.

Pabst: Lets back up and see if that's possible-its tied to a boat, harness it, is that possible?
Wallace: I would think you would want something so strong. Like a horse, it won't stop. Get the strongest you have.
Macllan: even with a carcass you want to make sure of that.
Pabst: is this something doable?
Green: 19000 lbs seems like a lot of thrust in the water.
McLellan: you can calculate the force a whale can produce.. like a mouse has a force 4 x its body size.

Morin: anything with sedation you need big effort $250,-500,000
Logistics need to be talked about.

Pabst: one option then, we need to stop the whale. Number one to be done is stop the whale. Is there anyone who thinks/reasoned that something overt their heads will stop a whale?
Kraus: I don't think I've ever seen an adult whale play in CCbay. They don't like to be touched on their head. The calves push things with their heads.
Pabst: The best way then to stop it is to net it, as Early said? Will the head cover mimic the net thing?
Foster: Dolphins spin.
Kraus: and we think they may spin because of the wraps on their flippers

McLellan: same with the dolphins- there is no get out of jail card. If it starts to spin… I don't know what you would do.
Foster: we use webbing. Like with dall's porpose. Old Ken Norris footage - they caught grey whales?

Pabst: is there any age specific behaviour info:

Morin: my experience is that juveniles are a little confused, (easier) . If you watch Kingfisher video, … an adult would not have tolerated that for more than 10 -15 seconds, he was like that for well over a minute. And we talked about this before, but from a disentanglement team standpoint, I want to work on a healthy animal. I don't want to work on a dying animal, because we have high risk.
Kraus: why bother?
Morin - I don't want to put my team at that risk. 75 year potential rather than 2
Foster: I like the idea of testing on a gray whale first.

Morin: Landry dealt with grays and thinks they will act like RWs. Old whalers called them devil whales (Kraus). There is still a harvest (Morin). Gray whalers could help an endangered whale … bowheads also get 35 of them.

Kraus: you could work on bowheads in the summer?

McLellan: ice wont close- try that.

Pabst: so model one- head net, small animal, see if it stops? Paint the picture-What about starting at head- hoopnet first?

(general consensus)No… you can't control, or predict

Pabst: How many more boats- do we need?
1st) harness tail (big! Dragger),
2nd) sedate
3rd) zodiac and a winch
4td) deployer for the head

What about firing a net, closes over like a barn door? Logistics: Small whale, male or female? Though you wont have an option-

Kraus: tail attachment- Woodward has it figured already. If sedation is the next part- its not our responsibility. Now the hoopnet- we have necropsy data to figure that out (head and boyd width). We have to think of mesh size.
Morin: what about a head? Lets build a head too- Like a fishing boat with a bulbous bow. Bulbous bows might work- (general consensus-yes)

Kraus: Is Cousteau's boat is available? Irvings boat?

McLellan: dream! Instead of just a hoopnet, inflate a larger support underneath. Animal at the side of the boat, inflates up with the mesh on the side of the boat – the bathtub. You have that winch, that sedate animal, inflates on the side, and you can use that as a drydock, workstation- surrounds the whole animal, and you have all these bases to work on. It blows up under it and supports the animal. The Hoopnet- problem: callosities, doesn't come off or go on..
Foster: Zipper
McLellan: can cut callosities
Kraus: put buoys on it, that come up when the whale dives. There are models of right whales around that you can use.

Morin: tail harnesses- are cumbersome. As soon as any part hit the water- forget it.. Even the mantis… that's it… (drags). I can't see the hoopnet….

McLellan: the net has to be down 4-5 feet down below the head

Foster: it has to be like a sock/Velcro (BM) with weight that makes the hoop go down.

Pabst: is there an easier way to get something in front of a whale to stop it?

Morin: every time we approach, beyond the flippers, they dive, turn away or go after us, but never straight.
Pabst: so hoop net would be difficult
Morin: yes.
Pabst: so lets stop talking about the hoop net?

Pabst: so we are slowing it down with the tail……..

Morin: we have tried different tail harnesses. I don't want that to be the first part of restraint. Its more of a safety measure than anything. Tail harness is for control, not restraint. Imagine lots of line in RIB going out fast, and 40 feet away. You want to predict the boat and the whale, not everywhere that it can go. That's the first step. This could be a disaster deploying equipment.

Pabst: then hoop lasso is a control method.
Morin: like a leash. When sedated.

Pabst: lets go back- we have head, tail, hoop.
Morin: What is the goal of restraint:

Kraus: work on the entanglement.

Pabst: the goal is to aid in the disentanglement. (Restraint).
Morin: sedation or disentanglement is case dependent.

McLellan: Michael how long does it take to stop a whale? Not pull and pull? It hits something hard-…… and won't move-

Moore: depends on the size of the ship.

McLellan: we were thinking dragger size.. put a line and stop the animal.
Moore: there have been some calculations on the thrust of the animal. Its going to be bigger than the whale… 100 ft. not 50 ft. dragger. In the video of line parting, it parted at the boat-

Smith- it has parted on the whale too.

McLellan: it's not moving forward, and you can't depend on the entanglement to stop it.

Pabst: but are you (Morin) comfortable putting something on the tail and stopping the whale?

Morin: if it reacts favorably, go to the next step.

Green: I can find out the backing power of a tug boat is. 150,000 lbs. like new tractor tugs. This type of rope Becky is using is as good as inch rope polysteel. I know we have lifted weight with that blue rope. We lifted 2 ton mooring blocks with 3/8 rope.
Michael: we have 90 ton rating rope. That's available. 100 ft length eyes on both ends.

Pabst: so PLAN ONE _ STOP THE WHALE- heavy tail lasso over whale, attach to whale and boat- WHALE CONTROL.

McLellan: Head is not safe. I've seen broken vertebrate…..etc…

Pabst: STEP TWO- We need a version of something to hold the head and keep it floating?
Should it be a net, or two long pontoons?

Smith: Use pontoons- that can be lowered and sinking, much larger than the whale to begin with. Canisters on the side will weight it, slide under the animal. And trigger around the head. (boat shaped pontoon)
Kraus: What if you have the front end held, the chin callosities will keep it there….
Pabst: Boat pontoon could be put on a big boat.nMclellam: Yeah.. put on the mother ship. You have to know where the whale is. A radar reflector and strobe with transponder on buoy without extra drag (note added in edit: this could be an AIS transponder). Then you can always follow the whale. And you need a boat tracking all the time.

Morin: how many people do you think you need out there? Multiple days? How many staffed?

HOW MANY PEOPLE?

At least (3) disentanglers-
Mothership- tail boat
Lasso deployed- 2 people (Becky and Jeremy-) on a zodiac and a safety (3)
(2) zodiac drivers
Head pontoon structure- goes out to disentanglement team. Designed now to need 3 boats. You could inflate in the field.

1 person on big ship watching line/safety
----- could be less than 10, and sedation team (to be determined)
One diver…..
Winn: would you disentangle if the fluke was up only?
Morin: yes… and you then you don't need sedation.

Kraus: What if we bombard a RW like the hooded seal.?) Distract it. What can the lasso do in different sea conditions, winds?

Foster to Woodward: It is designed to come off the whale, has to be designed to stay.

(Back to the process)

Release the fluke as it comes out of sedation, it can swim out. You can use a controlled release of air (Jamison) for it to swim away.

Morin: MUST BE FLAT CALM- what kind of a weather window are you looking for?

Kraus: One day.
Morin: I don't want to assemble this team on a 1 day window. You need 3 days.
Kraus: You wont get it. What would be your lead time. Daylight work it first thing, and if not secured by noon- go home 6 hour shut down window. This is a bit of a process, you don't want to be doing this into the evening. Want to do post sedation and post release. Can't go past noon. Need daylight. Follow the whale.

BK: put something as most permanent on as you can. On the callosity, etc. suction cup tag… or leave Becky's breakaway tow tag on.

Smith: Do we want to develop a tag that sits in with cyamids- TDR. Etc. best tag available at the time for the whale and the species?

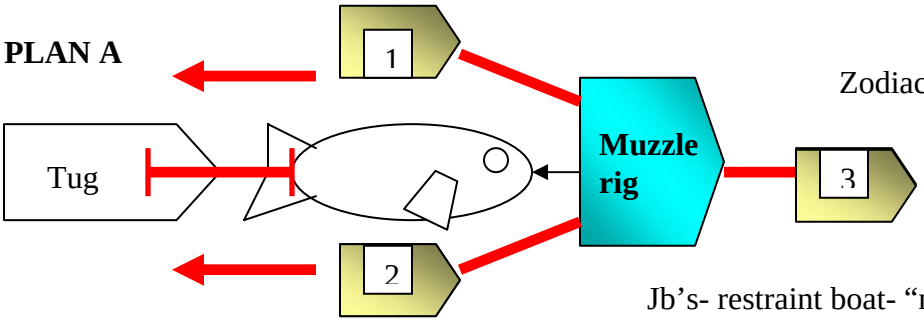
BK: how many locations?
Kraus: Bay of Fundy and Cape Cod Bay .
McLellan: Fernandina?

Morin: we have never had a whale mill down south.

Pabst: O.K. the pontoon. How does the pontoon thing connect to the head? Is it attached or slide on?
Smith: envision lifting straps to winch down on underside- slides on. Boats could pull and cinch.

Kraus: it will go down if it can't see side to side- but if you have the rope on the back end, you can work on the back forward, 2 weighted straps MOVE FORWARD, no shadows to make the whale dive down.
Morin: we can tow whales backwards and it works.
Pabst: is the difficulty trying to get something on the other side (?) (?)
McLellan: Drawing on board……

**PLAN A**



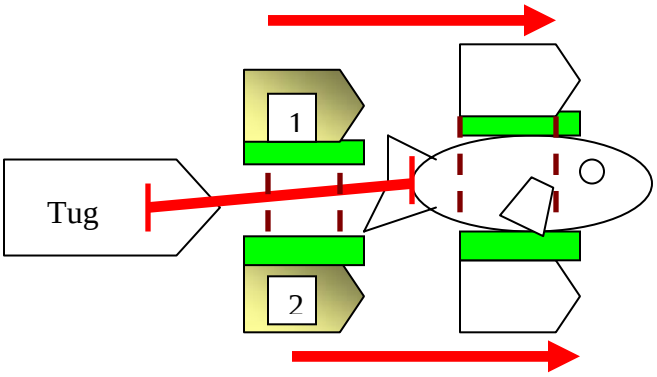

Zodiacs- yellow

Jb's- restraint boat- "muzzle boat"- inflates under whale. #3 is also the lasso boat

3 zodiacs, a muzzle rib, tug- ; minimal 12 people with disentangment and ops.
Weather: BSS= 1.Schedule 1 week time after trigger. Ops begin at sunrise end at 12-1400. Best available tag available to monitor, to 48 hrs post.
Plan A

| HAVE | NEED |
|---|---|
| Fluke lasso but……. | Fluke lasso needs to test and bigger line |
| zodiacs | RV Muzzle |
| 7 entangled whales life threatening | Rapid release every whole |
| GPS sat combo –monitor tags | Practice on live whale and dummy whale |
| staff | VHF headphones (superbowl type) |

Plan B Pontoon Rig - Lasso whale tail again, and move pontoon rig from tail to head




Zodiacs move from tail to head from the tug with lines cinching around it

| HAVE | NEED |
|---|---|
| zodiacs | Pontoon rig with sink/weighted center |
| 7 entangled whales life threatening | Salvage bags |
| GPS sat combo- monitor tags | Practice on live whale and dummy whale |
| staff | VHF headphones (superbowl type) |
| | System to go from small lasso to large hawser |

Morin: There is no way out for the whale on the big boat in plan B

Start from the back and work your way to the head to pull and cinch the muzzlw rig under and over the whale.
If the whale can't dip its head, you solve a big problem.

Kingfisher had 24 people- ribs, sedation, gear, divers, vets, NOAA

Costs:
100,000- boats
100,000- gear per shot

Restraint working group on Day 2, February 8th, 2006

11:20 working group

Morin: ..O.K…. Add in how a couple of seine nets could catch a whale (Green's drawing)?

McLellan: You are in the nebulous uncontrolled situation.

Green: Seining is safe for the crew-

Foster: in Iceland, they wait till herring is done .. Then drop the net to catch the mammals. It can happen easily.

Morin: we are assuming animal is somewhat sedated?

McLellan: If you aren't going to have a tail wrap… I can see how seiner is hard to coordinate

Green: that seiner can follow for a while wherever the whale goes.

McLellan: they do it everyday, precise, no doubt

Foster: it is an effective way to catch animals

Green: but stressful…as you are drying and purse, you bring all the line up and bring one end up to make the center smaller, and take the roller on the side to take out the slack –its likely to get balled up in there

Foster: Have you seen how a right whale will or did react?

Landry: I've seen a right whale in a weir, they go around in circles

Green: It happens that they catch a whale, but they don't want to it to make a big hole.

Pabst: if the animal goes down and doesn't come up, could the 2 boats get the line and animal up to the surface?

Green: yeah.. 20 minutes is pushing it.. 40 minutes you can set again… you have to make a circle around it and purse

McLellan: you have to be that tight to one of the ship to operate, one side of the animal you can't work with, because it will be drawn up tight

Green: you could roll it, to roll a flipper between two boats.

McLellan: its also an immense amount of weight. The industry is used to working with it.

Morin: I just don't want to limit ourselves to shock and aw with a 2 pm deadline

Foster: if you start rolling animal as well, there is risk

Morin: and to people, and risk of actually catching a whale. I want a suite of options and investigate them more.

Foster: or is it similar to catching zebras? (to Morin) with line and sinking line over the head to get the tail. When you run along side, can you get to the side of the head and pace them?

Morin: it varies, at the forward part of the flippers that's it. But I don't know if you can put something near its head….

Foster: if you are behind it? Get the chin up?

Morin: Yeah.. but …

McLellan: There is a lot of weight.

Kraus: We are trying to find a way to lift its tail. An alternative-

Foster: Like a lasso.

Morin: but its like a tail harness, we tried it on Churchill. So its possible, but… man.. we have tried lots of things on the tail area.

Green: whatever you decide it has to work in a second.
Morin: and the lasso now?

Woodward: trying to do it this summer in Canada

Morin: the only time an animal was actively diving we couldn't get closer than a 1/8 of a mile.
Smith: even the most recent… unknown entangled we couldn't get close enough.

Pabst: you have to think of 2 separate points: Physical restraint as first, and sedation comes second (?) the fluke of the tail- or risk of seining. The second process is that the sedation comes first and then we come up with what supports and controls the whale, with the thinking that the animal is less responsive. Pull pontoons or seines on side. We need to see this as two different strategies.

Morin: today it seems that we should sedate first-

Pabst: we come up as in as plan B (sedation first).

Kraus: but if you don't have a line on it and it sinks?

Green: but you could winch it up 20-30 ft up in the water…..

Kraus: you could tow it, if you had options in our dream world.

Pabst: we have to start with one plan and see it through, even with risks

First 1) sedation, no line,… it sinks.. that's the risk. But, if we are there with support boats, we deploy when it seems possible….
there's always a risk.

Pabst: Lets start with sedation first-

Winn to Morin: if you have a sedated animal can you disentangle it? Better chance
But the concern is that you can't let it sink and do nothing.

McLellan: you have been around most of those entanglements already. You have gotten on to flipper wraps….

Morin: we have come close, if the weather was better we would have gotten it…. Doug Cochran sent from Australia a Samuri type blade- it works. I, like the idea of an ROV.

Pabst: O.K. Our physical restraint role is to offer support to the animal.- tail body and head. We come up with fast deployment, and support, if the animal sinks. Possibly that then assists by making parts of the animal more accessible.

Kraus: You can't sedate without a line… the plan has to be in place- You have at least 10 minutes to tow it to the surface- then get something under it

McLellan: Its not going to recover itself anyways if it's a sinker….

Can we eliminate animals without trailing line?
Morin: but the lasso puts the animals back in play. Woodward has to be a first responder to put a line and a tag on. It has to have a trailing line for us to do this.

Morin: Skim feeders in Cape Cod Bay are slow, and can go forward on the head….
We saw one in the bay with line- and we couldn't disentangle it. 3 years ago… ..now, if you can make a whale think it needs to feed……..:

Kraus: We were talking about that last night…. Copepod chemo senses……

Pabst: o.k…. we are back to supporting a sedated animal for scenario 1) we are not lassoing.. our first shot is sedating, have a telemetry buoy attached, and would like to offer it physical support. That's the only line available.

Morin: I am not sure we can do this
McLellan: make it hard.. Let them know this is $500,000 a shot.

Pabst: how hard will it be to lasso by your shot or a snare… how hard would that be to snare or drop a line is there a way to get a line across in front of the animal?

Kraus: there is a tool to wrap studs in renovation,……. Build one on a big scale….

Morin: if a whale is swimming at 1 knot, you don't need more floatation.

Kraus: you don't worry about floatation till it sinks and then its too late

Smith: You need a contingency plan in place. Whether it's a float bag or something.

Morin: and you go back to snaring the head to keep the blow hole up. The size of that…

Kraus: the answer is in the salvage bags….. Tail wrap, strong line, drop heavy weight line, pass through salvage bags,.. keep it up….

Pabst: what about something similar just to get the line around the tail…. Sinking line pulled by 2 vessels under the tail you want to loop around the tail and snare the peduncle after the whale slows down. Instead of shooting at it, drag it forward underneath-

Foster: you want to go head to back. What's the tail stock diameter? Head? of flukes? You can use some handling gear- and when retrieving it, we use these gadgets, it carries a line at the end of a pole with a snap and open mouth, when it gets to what you want to attach to it, it feeds the line around the hook and now you have both ends of the line , and you toss the pole away……. If you had a hook that was large enough to accept that area of the tail stock you could recover the line.

Morin: we tried building it, but you need a substantial size vessel for it… as soon as it touches the water, the whole thing moves. We don't have it. We tried it, like a big staple with sea drogue that opens and takes up line…..

Foster: all you need is a line around tail fluke. I don't think a whale could take down 2 zodiacs. If you can harness it mid body.

Pabst: lets integrate the muzzles.. the inflatable things that add support. If we could get a line under or the RV muzzle…

McLellan; We know they will get excitable, we don't have a time frame yet for this… ½ hour? 45 minutes?
Pabst: Assume its sedated at 1 knot… they (the sedation team) did their job. We need to tell NOAA we don't give up if the animal crashes. O.k. the forward line, we need to know how wide that is. (girth)

Kraus: What about white noise generators? We need behavioral info on these animals.

Pabst: I know that but how does that help you this year?

Morin: I would love to hit a whale this year on the nose and see what happens.

McLellan: smack it on the blow hole? Nose? And see what it does? That was brought up two years ago in Boston. That's something you work on through ballistics- hand held 20 ft away.. and see what they do…. You can hit something on the head this summer. This year's behavior R and D.

Group: Response to behavior and distraction is needed.

Morin: in order to attach a buoy in 5 seconds would be good. A paint ball gun has fast … no reloading.. fire 200 in 20 seconds… (not saying you would but……)

Kraus: We need R and D on behavior. Like deer, light is effective, physical harassment like paintballs, acoustics…. Twitch thing- related to paint balls.
McLellan: documented with bowhead folks - (blowhole/rostrum?)

But how do you support the whale?

Morin: strap-

Pabst: You have more experience….If you are worried about floatation, the strap is a good idea, lift bags to inflate, good idea if you have winches. And you want to deflate quickly- (pull chord) and not expensive- and have knives with you-

Pabst: How about on the fore and aft section of the animal.?

McLellan: is this deployable at 1 knot… (chest line)? It depends on zodiac drivers… And the head muzzle drawing thing. Where do you usually tow from zodiac, do you back up, or use the motor end…

Kraus: you have to use the motor end - you need cleats, or a  tow post.

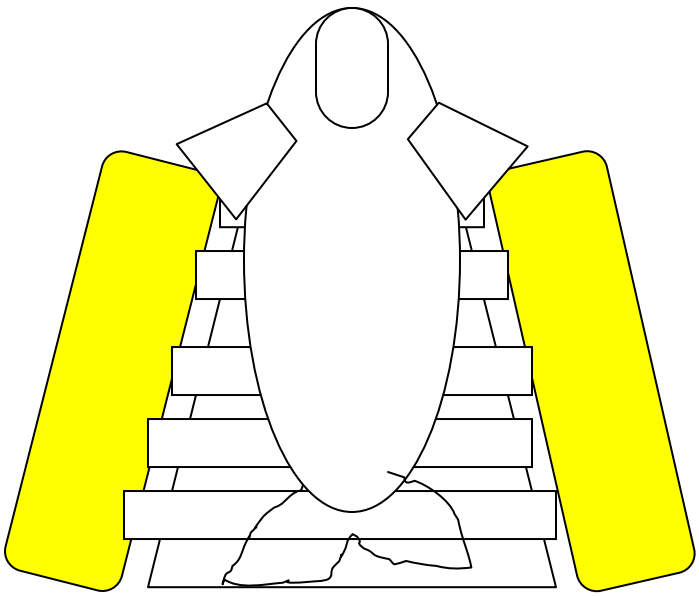
Morin: seems simplest even though difficult…. Most comfortable.

Smith: I have contacts for someone who works for the aquarium (subsalve.com). Will make specified lift bags.

McLellan: you need all your deployment in 4-5 ft. you don't have a lot of distance from the bottom of the whale and the surface……Do you want the girth of strap to be less than girth of whale so its tight?

Pabst: do we need to see if we can deploy this at 1 knot, from zodiacs (2) ….?
(ribs or soft bottom boats available…. Safer for crew and whale… whatever boat works the best we will have)

Green: What if the strap inflates?  Jamison's rib thing with straps and pontoons that inflate



The ROV is easiest to get down and cut it. The front end of the flipper is still open.  It will raise the whale up to see the flipper wraps……

Jamison: What about glass bottom boat for assessment…

Kraus: Or a cage

Smith: looking, leaning over the side, was scary. I can see what happened to Doug (that went over).

Morin: there are ways to support a person like that….. Scott could totally do it. But it's not easy.

Is there a way to capitalize being on the surface? while not on the animal- you have all the depth under you. It all comes down to the speed of the whale. You can handle being on top of the whale.. but 3 knots, no.. You need control line on the tail pulling backwards. If you go sedation first, that's fine, see what it does.. If it slows down… mission accomplished for the moment… If you start cutting and knick the whale, what will happen? If the whale is moving you need tail restraint to slow it down. We want as little drag as possible as in a normal disentanglement….. that's what we do.. add drag.. same as traditional disentanglement… they've gotten multiple flipper wraps in Nova Scotia at 1 knot. In 5 ft seas. If they can get a flipper off that……

McLellan: I want sedation and rope. You need to handle and predict.

Smith:1167- we suspect it has flipper wraps with no back wraps.

McLellan: how do they get both flippers tangled?

We have video of manatees entangling to see how it happens…. (Smith)

Pabst: we have a two wiggly end problem: where are we at now:

We need control. Preference being lasso
But we are not sure.. we need to get a hold of a tail of a non fluking, sedated whale

Kraus to Morin: What about big frame harness- It didn't work on free swimming, but what about sedated?

Morin: it was so tall, we couldn't manage it. The little drogue would hit the water, and pull it and fell apart. (talking about the harness/hoopnet you could throw over the whale).

Smith: We need to shoot something down in the water that you could pull heavier line through.

Morin: Egg floats with window weights the weights would pull anything underneath and the tack line go up and you can pull heavy lines behind. We couldn't get it to work often because it was hard to set up and trigger.

Green: what about a line throwing gun?

McLellan: or hand held? If you can approach the fluke, you won't want to be by the head.

Smith: If you have the big gun for sedation, what about something with a float that pops up on the other side? You can modify the tag gun to shoot the 2 weights with the line that the line sinks

Woodward: We need to have a gun that sinks a lasso on the peduncle that cinches on the fluke. Hand held, like what we have, but sinks. We need to start fresh

Morin: We have the fluke to test on…. .

Pabst: don't feel constrained to be on one boat… we have more to see what's needed.

Smith: And needs to be a simple something you can release from the inflatable would be huge…….

Foster: I have a DVD of hoop netting animals.

We have a great need for a practice run of this (general feeling)

(Pabst starts asking for pieces of what we would need and estimated cost)

Pabst: Rand D- Given time of one week:

Attach line to tail(r and d issue)
straps for floatation (r and d issue)
salvage and lift remote deployment.

BUDGET: Caveat of one use only:

Equipment costs-
20,000- Communication piece/safety-
50,000- Liftbag and straps and pontoons (Jamison) w/Strap mechanism- tail grabber
10.000- Rapid release rope
20,000 Fuel for zodiacs, food for people, travel for people- 20,000 per week for personnel
40,000 -Design a head of a right whale –

Stamper - Atlanta Aquarium right whale cast made into a slide- outreach species… might be a good group to make a model of a head and flipper life size -Head of a right whale 40,000
McLellan: head can be a raft- build it off a boat
Kraus: but you need to submerge the head- 10 ft diameter-
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$140,000

Plus 12 people salary for two week on the water
Volunteer time

(100,000 or 10,000 a day; Boat to charter 100,000 a week (10,000 a day) 100 ft-150 ft. ocean tug)
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$240,000

Development costs-
Time required development- 2 engineers- 1 year:
One month field test time (CCS):
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Landry: On average one entanglement takes 2.5 attempts for a RW… or disentangle it., for humpback its one.
TIMELINE:

1 year

McLellan: Each necropsy is 25,000  to run.

**Telemetry Working Group:**
*Boconcelli*, Early, Stamper, Landry, Lysiak

Stamper: Anesthetic monitoring parameters:
1) Baselines are important. Spend ½ hour+ getting baseline parameters. Breath is the best proxy. Quantity and quality of breath (length, depth of breath, interbreath interval) allows for monitoring. Monitor unusual sounds.

Landry: no trumpeting or extra noise in right whales

Stamper: when odontecetes loose control, they begin to blow raspberries

Boconcelli: these baseline measurements are done by an observer, we should limit the # of close approaches, how close do you have to be to monitor

Landry: not close at all, does not interfere with animal. People in support boat will do monitoring, not in the working zodiac

Stamper: should be a secondary person who focuses just on respiration, who is skilled enough to notice trends in respirations, especially if animal is starting to chuff or slow down significantly.

Landry: for sedation, we will assign someone who is focusing on respiration

2) body posture (at surface, any listing)
3) buoys – VHF telemetry, any way to relay depth in real time from buoy?
4) Depth of dive. There will, be natural variation

Boconcelli: DTAG can monitor all of that, also may have an EKG sensor in future that we can put on it. We can put them on without startling the animal.

Stamper: in a perfect situation, the DTAG would be on through the whole process

Boconcelli: the DTAG transmits position, but does not transmit other data in real time. You could easily put a depth sensor on the buoy that would send you the data in real time. Also a tension gauge on the line. You can tell how much energy the whale] is putting forward. These sensors are already packaged and used on trawl nets, work acoustically. Used in mid-water trawls

Early: can use load sensors for pitch & roll data, etc

Stamper: we use those in manatees and that sort of data is very useful. If you see the animal going down and rolling over, you know there is too much drug and you are in the danger zone.

Stamper: real time is the best, but down loading retrospective data is also very useful.

Boconcelli: we have several, so you can put one on with a short release, then slap another on with several days before release time. To get a variety of measurements.

Landry: we need to create a best case scenario so that we can easily communicate with vets

1) Breath
2) Body position
3) Surface time
4) Plasticity of tail

Early: how do you communicate between boats? Is the video in real time?

Landry: no, it is all recorded. The communication back and forth becomes logistically heavy.

Early: what sort of things can you do, from a stranding triage perspective, that don't require you to touch the animal? Looking at the quality of breathing from helmet cams for example, using a parabolic mic, outfitting the zodiac with a system that allows the info to be transmitted to the support boat. You want the people in charge of the assessment out of the loop (ie not the people handling the lines). Use the platform, use microphones and cameras that are dedicated to assessment.

Stamper: quality of breath is key

Early: pattern and character were much more important than quantity. Rates are secondary. (Ed.: Churchill #1102 major observed change was a tendency towards premature exhalation before the blowhole broke the surface.

Stamper: it takes experience to understand that.

Early: pattern is easy to capture, it can change abruptly.

Stamper: an animal that is hyper-excited on the beach vs an animal that is stressed and then sedated. You are looking for that pattern to develop.

Landry: Our big problem with Churchill: we were so encumbered with people and equipment. We had multiple boats, chemicals we had never worked with. We should identify someone who can capture breathing data. The people assigned to it with Churchill became fatigued in a few hours. Is it possible to not have constant monitoring?
Stamper: Yes, establish a baseline and then do spot checks. If things seem to be going downhill, then you need constant monitoring. The rule of thumb with anesthesia is that you need someone to focus solely on that. Otherwise it is easy to get distracted and suddenly things go down hill.

Early: what is the timing on monitoring?

Stamper: 5 min on, 5 min off. If stable you push it up to 15 min. if it is erratic, go back to constant monitoring.

Landry: I want the monitoring to be solid. Anything new we tend to be fearful of.

Stamper: Body posture is key.

Boconcelli: EKGs are new, but it seems to be doing well in our trials at Mystic. The tag is your black box

Landry: I don't want to add a specialized team, is it something that I can put on.

Boconcelli: if you can use the pole, you can do it.

Stamper: how do they react to that?

Landry: probably just a flinch

Boconcelli: the reaction is between 0 and 1.

Stamper: as long as it didn't get the animals revved up, it is worthwhile.

Boconcelli: if you are going up to the animal anyway, do it.

Landry: if we are committed for sedation, it sounds good. Our first approach is our best one, so if we are going to mess up that chance then it is not useful.

Boconcelli: can be useful for long term monitoring (5+ days)

Stamper: will also give info about baseline/normal behavior (including pitch/roll data)

Early: buoy is intermediary data collection (diving and swimming rate) can't get 3D picture of animal's behavior. Idea is to develop application to accomplish both goals (DTAG or super-telemetry buoy), implement in case by case basis. The minimum info you need is swimming speed/rate

Landry: we can currently get that with telemetry. I see telemetry as the first step.

Stamper: When you do telemetry an animal, can you get a DTAG on at the same time?

Landry: Yes?

Early: the only way that would hurt is as you said, you only get one good approach on the animal.

Stamper: so we would collect baseline info a few days before the sedation attempt, BEFORE you are ready to pounce on the animal. If you want to DTAG an animal, don't do it right before you sedate it. You will get a good baseline and not interfere with your sedation attempt. Will give you a chance for a medical consultation.

Landry: Put a DTAG on the animal, get the assessment, and then plan the sedation attempt.

Cost: $4,000 each

Description of DTAG, could make cheaper tags (different specs since Johnson tags are tested to 2,500 m) Can do tagging from small zodiac with electric motor & 4 stroke. Use a 6 m carbon fiber hand pole. Detaches by burn wire and suction breaks, off comes tag.

Cost: pole $600

Landry: fluke stroking rate

Boconcelli: with 2 accelerometers

Early: can you get it in real time? The DTAG is a great platform for all this…what is the minimum package and how can you add to the tag. I would like to see some sort of movement modeling. The minimum is swimming speed and some indication of surface time (is it at the surface? That is the minimum).

Boconcelli: that is easy in real time, with a wet dry circuit. At the surface= continuous beep, not at the surface= silence.

Early: if the buoy is already on, it would be great to have a minimum package.

Boconcelli: a tension and velocity meter would provide a running behavior line
Landry: If there is no trailing line, then we can only attach a DTAG. I like attaching stuff onto the telemetry.

Early: it would be a cost benefit: if you are already using the buoy, put the sensors on the buoy.

Gouviea: what about the end? If you put everything on a buoy that you are ultimately going to remove, don't you loose that info after the fact? What are you comparing the baseline and during info to then?

Landry: I would be happy monitoring just the baseline and during. But you are right, it would be egregious to have the opportunity to collect the long term data with the DTAG and not take advantage of it.

Landry: with the new generation of tag, we will get GPS.

Early: the difference between the DTAG and an incremental transmitting tag is you just get a series of points rather than a detail of behavior between the points. The behavior data will give you perspective about why does an animal hold its head that way, does it do something every time a boat comes by?

Boconcelli: also the tags can rub off in a SAG, with bad placement, if it is rubbing on gear, rub the tag off in the mud.

Photos of right whales tagged with DTAG & poster of DTAG and process
Landry: Datasheet in existence since Churchill. Monitoring is the first thing that gets thrown out the window, since we need bodies to do other work.

Early: can we have someone there with a mike? If you could pick up the sound with a digital recorder, you could analyze it later and have a hard copy of the sound.

Landry: the person doing that will be photodocumenting, videodocumenting, and getting gear ready for people on the water. Giving them more equipment and work to do. So we set up monitoring/assessment times. They have a given time schedule to monitor and assess the respiration. Support boat entails a captain and a data collector. 3 people (for right whales) in the zodiac.

Gouviea: maybe you need another person on the support boat to help monitor or assess.

Landry: then we have more logistics (getting people to the airport on time, etc)

Gouviea: what about having more boats standing by (coast guard)

Boconcelli: a third person on the Shearwater could really help you. Or mount a video camera and microphone before you start.

Early: what if you put a microphone on the buoy?

Boconcelli: we have audio on the DTAG, breaching is incredible.

Boconcelli: have you looked into hydraulic knives or acids to dissolve plastic?

Landry: yes. Hydraulics were too complicated and acids to burn through plastic but not fat/skin does not yet exist. The cutting is not the problem. It is the catching and stopping the whale that is the kicker. That's why our success rate is as low as it is, because we can't catch them. That is why tagging is so hit or miss. If you don't get it the first time, you are done. You will play cat and mouse all day.

Early: our short list is: respiration quality and index, body posture, floppy-ness of tail

Landry: our protocol is a health assessment, and skin (either from biopsy or sloughed) and poop.

Early: can maybe get muscle from the needle/drug delivery device

Drafting a "procedure"
Early: identifying the operational road blocks, time constraints, weather windows, why you have to be hyper-efficient

Gouviea: which is why you have a strict operation plan, tagging/buoy then you contact NMFS, plan the logistics, weather windows, getting people there

Landry: we try to get perspectives from everyone

Early: is there something that you need to manage the circus on the water?

Landry: the suite of biopsies from Churchill, I wanted to know what was going on physiologically over time.

Early: need to do studies on animals that died acutely from entanglement, or need to monitor a physiological baseline.

Boconcelli: talk to Johnson about making sensors for beaked whales

Micro-sensors, lab analysis, stress test, lipid content and stable isotopes: is the animal starving, is it stressed?

Landry: I don't want to ignore important information, it would be nice to use the library of tissue and samples that we have, we just don't know how to use it

Landry: With Churchill we had lots of vets, and we would often stop our work and all convene. Which worked very nicely. They were very conservative, and I expect that they won't be next time. They won't be afraid of killing outright.

Early: number of people involved…do you reduce it to a single central person that has access to a panel of vets via satellite phone?

Gouviea: can you have a vet on call? That goes with you and can relay between team and vets consulting remotely?

Early: try to make the process more efficient.
Landry: it is SO hard to get everyone assembled. Maybe we should just have the team involved, plus one vet/central person?

Gouviea: it is good to have the vets all there to consult, but you only want one person on scene.

Landry: we could have streamlined the Churchill process. We do need A vet, I don't want to be in charge of administering the drug. I will administer them, but I want to be advised on it. After the de-briefing on Churchill, we decided that we needed ONE point person. The people on the water communicate with that point person, who is advised by the vets.

Boconcelli: how does your decision process work? Do you identify it?

Landry: no, we start from scratch when we get a new report. We make a matrix (trailing lines, health, embedded), and if it looks sick, does that mean we should exclude it or not? It depends on who you ask.

Boconcelli: but your level of monitoring should be the same?

Gouviea: but you will only put a DTAG on an animal that is a candidate for sedation?

Landry: we should attempt to put a DTAG on every animal that we can (every right whale, every right whale trailing gear….)

Boconcelli: we have never tagged a burdened animal, so it is valuable information. It shouldn't interfere with the goal saving the animal and would provide a dataset

Early: we should do it because it will give us information/monitoring that we need, it's a bigger piece than the restraint piece. You want to put in the effort for monitoring before you start the restraint.

Landry: permits…. We can just get one tag, in a toolbox since right whale disentanglements are so rare it shouldn't be a problem. It will be hard to get the team to agree since they don't like more bells and whistles. It is logical to put it in the protocol, and we can at least try.

Early: augmenting the standard buoy is good bang for your buck. It is no small thing to identify the DTAG as an information gathering device that can help you

Landry: where should we put it?

All: on the animal

Boconcelli: you need to augment the ball/buoy, since you are risking your life to put it on anyway.

Landry: say I can't put it on the body, should I put it on the buoy?

Boconcelli: the buoy should be #1 priority. A depth guage, speed, tension. Augment your primary device. Then comes the DTAG. AIS beacon on the buoy. Discussed callosity tag for right whales.

Landry: but is AIS really assessment, health assessment?

Early: you should be packing that ball

Boconcelli: AIS is expanding as a part of Homeland Security plan.
Early: you want to put redundant tracking systems (GPS, ARGOS) and other sensors. As long as you can get it off when you need to, it shouldn't be an issue.

Landry: it is manual release. We know where the whale is, and we can take off the buoy.

Boconcelli: we can make the buoy smaller with everything you need

Landry: worried about changing buoy, may loose the whale because of new buoy design.

Boconcelli: I thought you were using the buoy for slowing down the whale

Landry: the drag of the buoy has actually meant that ¼ of our right whales have been disentangled. The weight of the buoy has actually pulled some gear off. So I am very reluctant to change it.

Boconcelli: we can build you something that is almost off the rack, inexpensive gear.

Early: this is an under-utilized resource. We should put some effort behind this.

Boconcelli: this could be very useful to you, you will know if this whale is going to be crazy or not…saving you money and time later. If you know it will not work b/c the animal is freaked out.

Early: the easiest fast track is to modify a buoy you already have, the DTAG is already there. Integrate a detaching/weak link

Landry: the amount of drag on the buoy is a problem for some, or duration the tag stays on. If you are adding gear to the whale, then the weak link should be there ethically.
**TO DO: How to make AIS operational**

**2/8/06**
1133: Meeting #2
Boconcelli, Landry, Early, Lysiak

Boconcelli: make a simple experiment with air bubble curtain, hookah net? Sound signal to make whale react

Early: you can exploit any sense, are all R & D ramp-ups. For tracking, I think you have to tweak the existing buoy, and get it operational. Hard restraint also makes the need for monitoring.

Bocconcelli: having a DTAG on will give the physiologists a picture of what is going on, since they have no idea.

Landry: I am not so thrilled by the DTAG, since we did sedation with Churchill with nothing. It will be the first thing to go if we have budgetary constraints.

Early: becoming comfortable with sedating whales, like gray whales, is going to be so expensive. Hedge on the side of understanding what is going on in the animal. I see the value in not narrowing your toolbox too much.

Boconcelli: it is a free-bee, getting lots of information for very little work. If you are on the whale, you should just slap the tag on. Also, if 10-20% of the animals are getting entangled, we should put a DTAG on entangled animals opportunistically. Then you can learn about their behavior and movement. It has been taboo to tag an entangled whale because they have their own problems, but we need to change our thinking because the DTAG is not invasive.

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