V. FISHERIES WATER QUALITY SAMPLING METHODS

This manual contains tactics and procedures for fisheries water quality sampling. These procedures are organized in the following categories:

- Methods for sampling the water column
- Methods for sampling the benthic environment
- Methods for sampling seawater intakes
- Other methods and procedures
- Considerations that apply to all methods

APPLICATION OF SAMPLING METHODS TO ASSESS POTENTIAL FISHERY IMPACTS

There is no prescribed set of sampling methods for any given fishery, and the methods in this manual may be combined, adjusted, or amended to suit the incident needs. The development of a water quality sampling plan and program and the subsequent selection and application of sampling methods begins with an informal risk analysis, as discussed in Section IV, which considers:

1 - what type of oil has been spilled?

2 - where and in what form is this oil likely to be encountered?

3 - how are fishery resources, gear, and processing likely to be impacted?

Figure II-1 contains a decision tree that considers the potential scenarios for each of these 3 considerations and recommends sampling methods for each.

Figure V-1 contains a flow chart that identifies potential sampling methods based on the type of oil spilled, fate and effect, and risks to fisheries. Table V-1 identifies the sensitivities of various sampling methods to the location of oil in the water column, oil characteristics, and type of fishery. In designing a sampling program, one or more methods may be combined to collect the required information.

Figure V-1. Commercial Fisheries Water Quality Sampling.

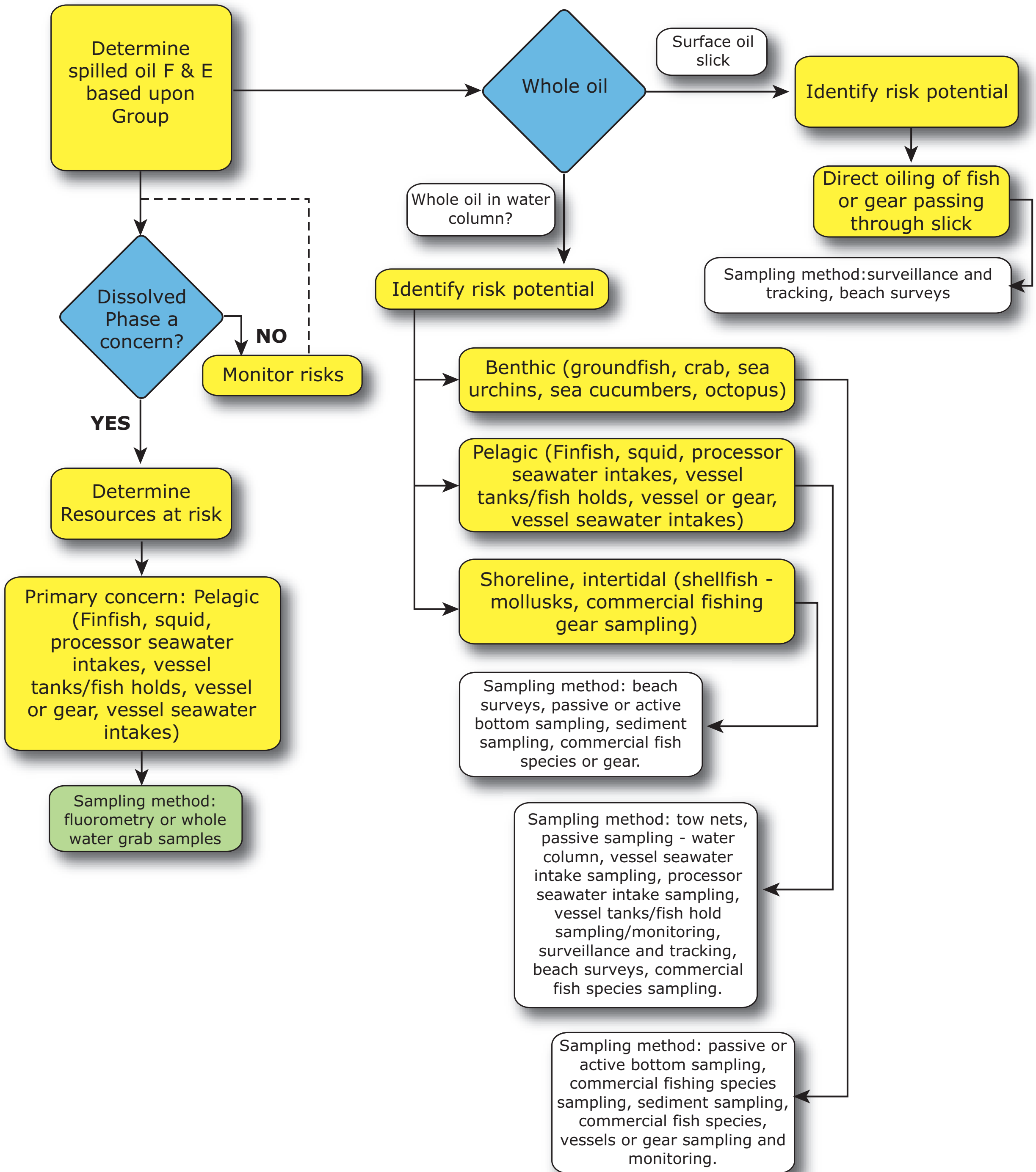

Table V-1. Potential sampling methods.

FISHERIES WATER QUALITY SAMPLING METHOD	Location in water column			Oil characteristics		Type of fishery	Specialized equipment or training or other considerations?
	surface	pelagic	benthic	whole oil	dissolved phase		
Tow Nets	X	X		X		G, P, S	Nets, vessels
Passive Sampling - Water Column	X	X		X		G, P, S	sampling devices, vessels
Whole Water Grab Samples	X	X			X	G, P, S, I	grab sampler requires training/familiarity with equipment; coordinate lab analyses
Fluorometry	X	X			X	G, P, S, I	fluorometer requires calibration, trained operator
Surveillance and Tracking	X	X		X		G, P, S, I	generally conducted by incident personnel to facilitate response. May guide sampling efforts.
Beach Surveys	X	X	X	X		G, P, S, I	Indirect measure only - presence of oil on beach suggests presence in water column, benthos, intertidal
Passive Sampling - Bottom			X	X		G, S, I	sampling devices, vessels
Active Sampling - Bottom			X	X		G, S, I	may be disruptive to benthic organisms and habitat; requires sampling devices and vessels
Sediment Sampling			X	X		G, S, I	requires grab sampler, vessels, trained operator
Vessel seawater intakes	X	X		X	X	G, P, S, I	requires coordination with vessel operators
Processor seawater intakes	X	X		X	X	G, P, S, I	requires coordination with seafood processors
Vessel tanks/ fish holds	X	X		X	X	G, P, S, I	requires coordination with vessel operators
Commercial Fish Species	X	X	X	X	X	G, P, S, I	requires trained seafood inspectors; if tissue analysis performed, helpful to know background contaminant levels
Commercial fishing vessels or gear	X	X	X	X		G, P, S, I	requires coordination with vessel operators

Key to type of fishery:
G = groundfish
P = pelagic fish
S = shellfish
I = intertidal

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METHODS FOR SAMPLING THE WATER COLUMN

INTRODUCTION

In selecting a method for sampling the water column, the first consideration is whether to sample for whole oil or dissolved phase oil or both. The determination should be based on the oil properties and characteristics, degree of weathering, and potential routes of exposure to target fish species.

Whole Oil Sampling

When spilled oil remains in whole oil form, a variety of sampling methods may be applied, depending upon the location of the oil within the water column. Whole oil sampling within the water column will typically use some sort of mesh net or oleophilic snare to filter water and entrap tar balls.

Oil that is weathered into tar balls may float on the water surface, subsurface, or at virtually any depth in the water column. The depth at which tar balls float may depend upon the oil characteristics, sediment entrapment, weathering, sea state, and environmental conditions, and may change over time. Depending upon the stratification of tar ball fields in the water column, their movement will be impacted by wind, waves, currents, and tides. A tar ball sampling program may seek to verify assumptions about tar ball movement, and as such may involve targeted sampling based on trajectory data. Or, a tar ball sampling program may seek to build a data set that can be analyzed over time. This will typically involve repeated surveys in designated locations or stations over time.

Methods to sample for tar balls in the water column are either active or passive. Active methods usually involve actively towing a net, curtain, or oleophilic snare through the water. Passive methods involve placing oleophilic materials in a given location for a set period of time and then checking them for signs of contamination.

Oil that remains on the water surface, either as slicks or floating tar patties, may be tracked through visual observation or remote sensing. This information would generally be collected as part of the overall spill response, rather than as a discrete fisheries water quality sampling program. Coordination with spill managers may yield important data regarding the movement and location of the slick. Trajectory modeling may also be useful in predicting spill movement and identifying at-risk fisheries.

A final method for indirectly assessing the presence and abundance of whole oil in the water column is through the use of beach surveys.

Beach survey data provides a gross measurement regarding the presence or absence of oil spatially and/or temporally. Beach survey data may be extrapolated to draw conclusions regarding the relative abundance and distribution of whole oil in coastal waters. Beach surveys can be used to track changes in the presence of oil in the water through time, by surveying areas known to "collect" oil and monitoring changes in the quantity of oil found on the shore over time. Surveys can also be used to monitor for the presence of oil in new locations—by surveying critical beach areas adjacent to processor intakes, for example.

DETECTION LIMITS OF WHOLE OIL SAMPLING METHODS

The sensitivity of whole oil water quality sampling methods is limited by several factors, including the relative volume of water sampled, the affinity of the tar balls or whole oil for the sampling devices used, and the location of sampling stations relative to whole oil distribution. For example, tow net sampling that occurs in a tar ball field may suggest a high concentration of oil in the water, but this may not be constant throughout areas of concern. Similarly, if tow nets are used at the wrong water depth, or are towed at too high a speed, they may not detect whole oil that is present in the water column. Passive sampling devices may be more or less sensitive depending upon the chemical composition and degree of weathering of the oil in the water column. Certain oils may adhere more readily to sorbent materials.

A major limitation to the beach survey tactic is that there is not necessarily a clear correlation between the presence of tar balls on shore and the presence of oil in the water column. The presence of tar balls on shore may fluctuate depending on weather conditions without necessarily indicating a corresponding fluctuation of the quantity of oil in the water. There is also a time lag between the time at which oil is observed on the beach and the time when that same oil was actually in the water column.

Finally, with all whole oil sampling methods, it is possible that the oil detected may not necessarily be attributed to the spill source of concern. Background tar ball levels vary in different water bodies. In areas with high vessel traffic, nearby oil and gas exploration, or adjacent to ports or marinas, background tar ball levels may be relatively high.

Dissolved Phase Oil Sampling

When spilled oil dissolves into the water column, sampling methods that measure the concentration of dissolved hydrocarbons must be used. A common methodology for assessing dissolved oil involves taking water samples from various stations and then conducting laboratory analyses on the samples to determine the concentration of dissolved hydrocarbons. This is commonly referred to as whole water sampling or grab sampling.

Another way to sample for dissolved phase oil involves the use of a specialized instrument that may be placed into a water body to provide a real-time measurement of dissolved hydrocarbons. These instruments – fluorometers – may be set in one location or towed through the water.

DETECTION LIMITS OF DISSOLVED PHASE OIL SAMPLING METHODS

Regardless of the dissolved phase oil sampling method, caution must be applied in interpreting results. Many coastal areas in Alaska have background levels of hydrocarbons that may complicate analysis of sampling data. When conducting dissolved phase oil sampling, it is recommended that control samples be taken to identify background hydrocarbon contaminant levels, if feasible.

When using fluorometry, it is important to consider that compounds other than oil may also fluoresce and send out a signal that may be interpreted as hydrocarbon contamination but in fact may be from another source.

As with whole oil sampling, the selection of sampling stations and the sampling design may also determine whether the sampling method is effective in detecting the target contaminant levels.

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TOW NET SAMPLING

OBJECTIVE & STRATEGY

The objective of Tow Net Sampling is to collect data regarding the presence and distribution of whole oil as tar balls, tar patties, mousse, or other whole oil form, in the water column. Tow nets may be deployed at different locations and depths within the water column, depending upon the oil type and information needs driving the sampling program. Data collected by tow net sampling may be extrapolated to draw conclusions regarding the relative abundance of whole oil both spatially and temporally. The sampling scheme should be designed based on the real time question posed for the incident. Different sampling schemes are required to determine the answer to the following questions:

- What is the oil distribution at the surface?
- How dense is the oil in the water column?
- Is this section of water oil-free?
- Is the amount of oil in this area increasing or decreasing?
- Is there sub-surface oil?
- Is there oil present near a seawater intake?

Care must be taken to choose a sampling design that is appropriate to the questions being asked.

TACTIC DESCRIPTION

Operating Environments

Tow Net Sampling may be deployed in any water body where tow vessels can operate. Applicable operating environments include: nearshore and offshore marine waters, harbors, bays, rivers, and lakes. Tow vessels and sampling gear must be sufficiently seaworthy to suit the worst conditions expected in the operating area.

Deployment Configurations

TOW NET CONSTRUCTION

The tow net is constructed of a conical-shaped mesh fastened around a metal hoop. The size of the tow net mouth and length of the net may vary depending upon the data needs and sampling environment. A standard-sized tow net that has been used effectively in past spills had a 3-foot diameter metal hoop with a 10-foot long net (See Figure TNS-1). The mesh size should be appropriate to the type and quantity of oil spilled and expected state of weathering. A bridle, attached to tow rings on the metal hoop, is used to tow the net. The tow net may or may not have a collection cup at the end.

Tow nets may be constructed at the time of the spill using locally available material, or may be constructed and tested ahead of time. Mesh should be sufficiently strong to withstand the towing pressure and frequent cleaning. A plastic-coated mesh should be more oleophilic. PVC pipe with an end cap may be used for the collection cup.

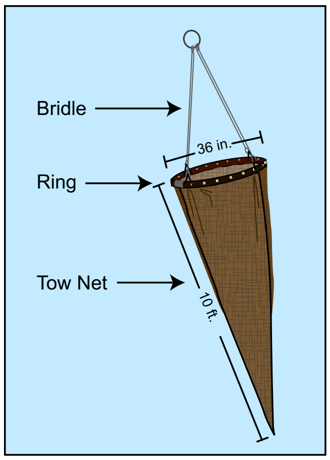

Figure TNS-1. Tow net without collection cup.

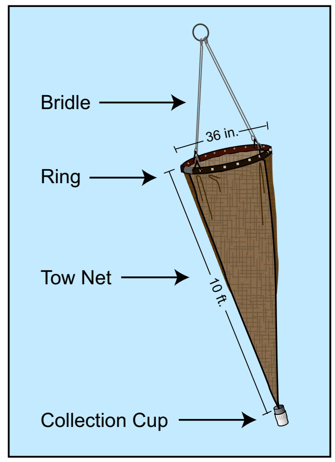

Figure TNS-2. Tow net with collection cup.

SINGLE VS. MULTIPLE TOW NETS

Tow nets may be deployed singly or in groups. The use of multiple tow nets deployed simultaneously at different depths will provide comparative data regarding the vertical distribution of whole oil in the water column.


Figure TNS-3. Single tow net.


Figure TNS-4. Multiple tow nets.

Vessel configuration

Tow nets may be deployed from the vessel in any number of configurations, based upon the vessel particulars. Fishing vessels, spill response vessels, or other vessels-of-opportunity may be utilized if available. It is recommended that the vessel platform have a boom or hydraulic arm that can be suspended over the side of the vessel to facilitate deployment of the tow net alongside the vessel. The tow net should be deployed at an appropriate distance from the vessel to avoid entanglement.

The vessel must be capable of slowing to tow speeds of 1 kt.

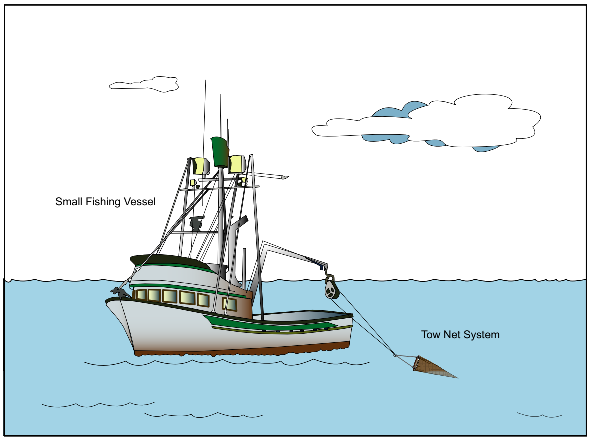

Figure TNS-5. Tow net deployment from small fishing vessel boom.

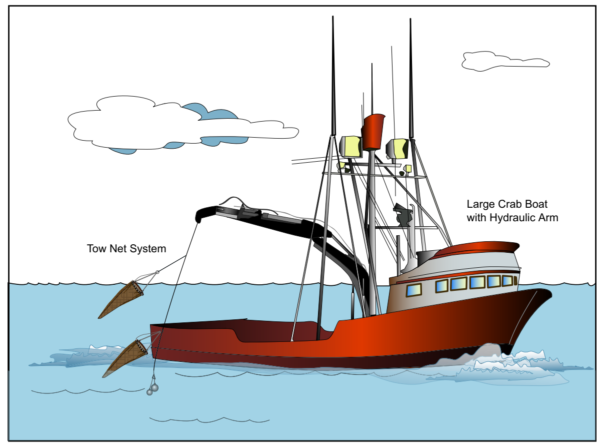

Figure TNS-6. Tow net deployment from crab boat with hydraulic arm.

Weighting the Tow Net

In order for the tow net to remain at the desired water depth for the duration of the tow, it must be appropriately weighted. The amount of weight required may vary depending upon the construction and size of the net, the desired water depth, and the environmental conditions. "Sinkers" used for fishing on the seafloor may be suspended from the tow net opening or from the line. Lengths of chain may also be used as sinking weights.

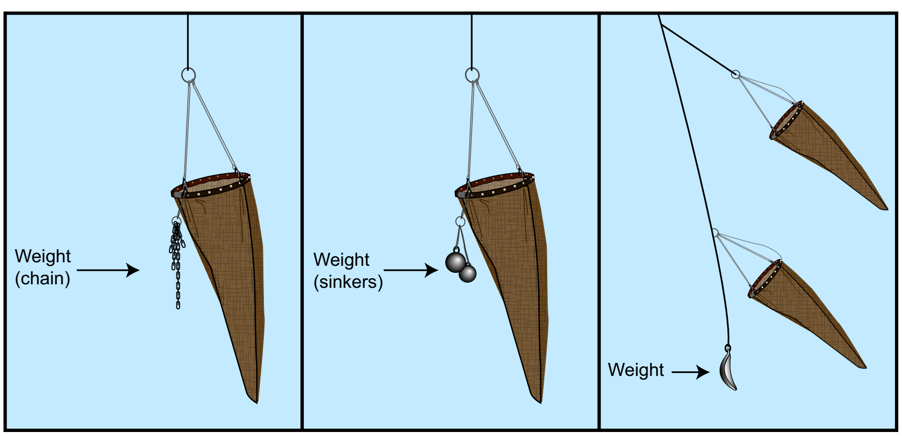

Figure TNS-7. Possible configurations for weighting a tow net.

Towing Transects

The areas in which a tow net will be deployed should be identified in the sampling plan. Towing transects may be pre-identified or they may be random. If the sampling design necessitates a data set that can be compared over time, the tow nets may be deployed along the same transect multiple times.

Use of a GPS track when conducting random tows will accurately record the actual tow pattern and distance.

Tow Speed & Direction

The tow vessel should operate at speeds of 1 to 3 kts, depending on the mesh size of the tow net. Towing a net too fast builds a head wave in front of the net, which may deflect tar balls around the net. It is important to tow at a consistent speed throughout the tow period. Tow speed must be consistent for all tows if encounter rate (e.g., catch per unit effort) is to be calculated.

Tows should be conducted in a straight line along a given heading if possible to simplify data analysis. However, topography and navigational hazards may require the vessel operator to vary course. In this case, a GPS track line should be acquired for the tow.

Current Tides, and Rips

Tides and currents must be considered when planning and conducting tows. If tow data is to be analyzed for encounter rate or catch per unit effort, tows should be standardized with respect to currents; either within the current, against the current, or cross-current.

Tide rips are collection points for floating oil. Tide rips may be targeted if the sampling plan calls for seeking out areas where the oil is likely to be. When towing for encounter rate data, known tide rips should be avoided as they may skew data in favor of higher tar ball concentrations.

PROCEDURE

Tow net sampling may utilize one or more tow nets deployed from a vessel platform.

1. ***Inspect equipment to make sure it is in working order and free from contamination.***
2. ***Start Tow.***
   a. Deploy tow net at pre-designated depth(s).
   b. Maintain constant vessel speed and heading, if possible.
3. ***Monitor and document vessel course and speed.***
   a. Document visual observations.
      i. Convergence zones, tide rips.
      ii. Impacted wildlife.

iii. Sonar/fish finder information.

iv. Vessel traffic.

4. ***Inspect tow net and collection cup at regular intervals (e.g., every half hour or hour).***

a. Consider need to check net more frequently in convergence areas.

5. ***Record tow data and findings.***

a. Latitude/longitude of tow (beginning and end points).

b. Tow duration (start and end times).

c. Vessel speed and heading.

d. Type/quantity of oil observed.

e. GPS track line if the tow is not in a straight line.

f. Location of net in water column (depth).

g. Take representative photographs.

h. Photograph of nets where oil observed.

6. ***Attempt to obtain sample of collected oil if sufficient quantity available.***

a. Use proper handling and storage procedures.

b. Maintain proper documentation and chain of custody.

7. ***Decontaminate oiled tow net and collection cup***

a. If tow net and collection cup are not contaminated, proceed directly to step #8.

b. Set oiled net and collection cup on sorbent pad on sampling table.

i. Do not allow contaminated equipment to come into contact with vessel.

c. Use proper personal protective equipment.

i. Review material safety data sheet for cleaning solution.

ii. Use eye protection.

iii. Use rubber gloves.

iv. Use splash suit/rain gear.

v. Have available first aid kit and eye flush kit.

d. Place appropriate cleaning solution in cleaning tub.

i. Soak net/collection cup in cleaning solution for 5 minutes.

ii. Scrub net or collection cup with brush if needed.

iii. Rinse with clean water.

iv. Repeat cleaning process until net and cup are clean.

v. Observe proper disposal methods for dirty cleaning solution and water.

vi. To spot clean small areas (<1 mm), use the scrub brush and cleaning solution.

8. Redeploy tow net.

a. Repeat steps #1 through #7.

9. When towing is complete, store tow net.

a. Clean net of all contamination prior to storage (see #7).

b. Store in a manner that prevents contamination from other sources, such as hydraulic oil or fuel oil from the tow vessel. Heavy polyethylene bags (e.g., oily waste bags) are a good storage option.

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by vessel speed, sampling sites, duration and depth of tows, affinity of spilled oils for tow net materials, background tar ball levels, sea state, currents, tide rips, sensitivity of laboratory analyses, and human error.
+ Daily weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
+ Vessel masters should have experience in the appropriate operating environment and local knowledge is preferred.
+ Select tow depth and configuration of tow net(s) based on information needs as identified in sampling plan.
+ Avoid deploying tow net directly off vessel's stern end because of the potential interference of propeller wash and entanglement potential.

REFERENCES TO OTHER TACTICS

Other methods associated with Tow Net Sampling include:

- Aerial Surveillance
- Handling and Storing Samples
- Waste Management
- Data Collection and Management
- Safety

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic include tow nets, towing bridle, weights, collection cups, chain or line, vessels, decontamination equipment, log books, GPS, digital cameras, and sampling technician(s). Configuration and specific resources required will be determined by site conditions, spilled oil type and volume, area of coverage, as well as resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Tow Net Sampling

Equipment	Function	Quantity	Notes
Tow nets Recommended net specifications: 36" diameter ring with 10' conical net. Net material: Phifertex vinyl-coated polyester yarn woven into an 11 x 17 strands/inch mesh, 34% open, 11 oz./yd. Collection cup: 4" PVC pipe and fittings	Collect whole oil in water column.	1 primary, with 1-2 backup/ alternate nets	If multiple tow nets are to be deployed simultaneously, should have 1 primary and at least 1 alternate tow net for each planned depth.
Bridle (6" ring or link, 4-part steel line with eyes at both ends, 6 shackles)	Connect tow net to line.	1 primary, 1 backup	If multiple tow nets are to be deployed simultaneously, should have 1 bridle for each planned depth, with at least 1 backup.
Line (typically polypropylene)	Suspend tow net.	Sufficient length to accommodate planned sampling depth, accounting for horizontal drag	
Weights or sinkers (typically lead)	Sink net to desired tow depth.	Varies	May be necessary to adjust amount and configuration of weights based on on-scene conditions and desired tow depth.
Sorbent pads	Line sorting/sampling table to examine tow nets.	2-3 pads per planned tow; recommend maintaining large stock on vessel	
Detergent (e.g. de-greaser)	Decontaminate/clean tow net and collection cup.	1 bottle	Consult bottle regarding recommended dilution. Refer to MSDS for safety. Use only products registered on the National Contingency Plan product schedule.
Wash basins	Soak tow net/collection cup for decontamination.	At least 2 basins – one to wash and one to rinse	
Oily waste storage	Store contaminated water from washing tow nets and soiled sorbent pads.		Refer to Waste Management Procedure.
GPS	Record position/location data (latitude/longitude) for each tow.	2 (1 primary, 1 backup)	Recommend using combination of handheld GPS and vessel's GPS system.
Sampling materials	Collect and store samples of encountered oil for possible laboratory analysis.	Varies	Refer to Sample Handling Procedure.
Log books and data collection supplies	Record data regarding oil observations, conditions, etc.	Varies	Refer to Data Keeping Procedure.
Measuring tape or ruler/scale	Measure size of tarball or oil observation.	One per sampling technician	Photographs of tar balls or oil encounters should include ruler or scale to demonstrate size.
Digital camera	Record images of sampling process and observations.	One per sampling technician	Ensure sufficient batteries, charger, and memory stick storage for length of sampling survey.
Vessel	**Function**	**Quantity**	**Notes**
Vessel with hydraulic arm or boom and capability to travel as slow as 1 kt	Sampling platform	1 per sampling trip	Vessel should be inspected prior to use for safety equipment, communications capabilities. Tow vessels must be sufficiently seaworthy to suit the worse conditions expected in the operating area.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technician(s)	Deploy tow nets, collect data.	2-3	Recommend at least 2 technicians per trip for safety. More than 2 may be required if towing multiple nets. Technicians must have sufficient Hazmat certification and basic vessel safety training.

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PASSIVE SAMPLING

OBJECTIVE & STRATEGY

The objective of Passive Sampling is to collect data regarding the distribution of whole oil as tar balls, tar patties, mousse, or other whole oil form, in the water column. Passive sampling devices may be deployed at different depths within the water column, on fishing gear, or in specific geographic locations, depending upon the oil type and information needs driving the sampling program. Data collected through passive sampling provides a gross measurement regarding the presence and absence of oil spatially and/or temporally.

Passive sampling data may be used to monitor areas adjacent to seawater intakes and to assess the risk of oil to fishing gear. The sampling scheme should be designed based on the real time question posed for the incident. Different sampling schemes are required to determine the answer to the following types of questions:

- Is oil present at the surface?
- Is there sub-surface oil?
- At what depths in the water column is floating oil encountered?
- Is this section of water oil-free?
- Is the amount of oil in this area increasing or decreasing?
- Is there oil present near a seawater intake?

Care must be taken to choose a sampling design that is appropriate to the questions being asked.

TACTIC DESCRIPTION

Operating Environments

Passive Sampling may be deployed in any water body where vessels can operate or where access exists from docks, shoreline, or other marine structures. Applicable operating environments include: nearshore and offshore marine waters, harbors, bays, rivers, and lakes.

Passive sampling devices may be deployed from vessels, docks or other marine structures, or by divers. Vessels and sampling gear must be sufficiently seaworthy to suit the worst conditions expected in the operating area.

Deployment Configurations

Passive sampling devices may be configured in a number of different ways, depending upon the information needs driving the sampling program. The basic components of a passive sampling device are:

- ***Sorbent material:*** A sorbent or oleophilic material will enhance the likelihood that floating oil will adhere to the sampling device upon encounter. Sorbent snares or oleophilic netting, mesh, or line may be used. Polyethylene is the most common oleophilic material used for passive sampling.
- ***Positioning device:*** A positioning device such as a length of line or a piece of fishing gear is often used to position the sorbent material(s) at the desired location and water depth.
- ***Anchor and float:*** An anchor or anchoring device and float or buoy are usually needed to secure the sampling device in place. Traditional anchors may be used, or available structures such as buoy lines, docks, or water intake pipes may be used to anchor the sampling device.

Passive sampling devices can be designed and assembled ad hoc with locally available materials. Fishing gear for species-of-concern is often a good starting point for developing a passive sampling device. For example, if a crab fishery is underway, an unbaited crab pot may be used to anchor the device, with sorbent snare attached to the float line at fixed intervals.

VERTICAL LINE PASSIVE SAMPLING DEVICES

Passive sampling devices for water column sampling may be oriented vertically by anchoring the device to the bottom and attaching a float. Sorbent snare or other sorbent materials may be affixed to a float line continuously or at fixed intervals to collect information regarding the vertical distribution of oil in the water column.

Depending upon the information needs, a vertical passive sampling device may focus on a specific zone within the water column. The line need not stretch all the way from the surface to the bottom; passive sampling devices can be configured so that they only extend down a certain distance from the surface or up a certain distance from the bottom. Figure PSWC-1 shows a variety of potential configurations.

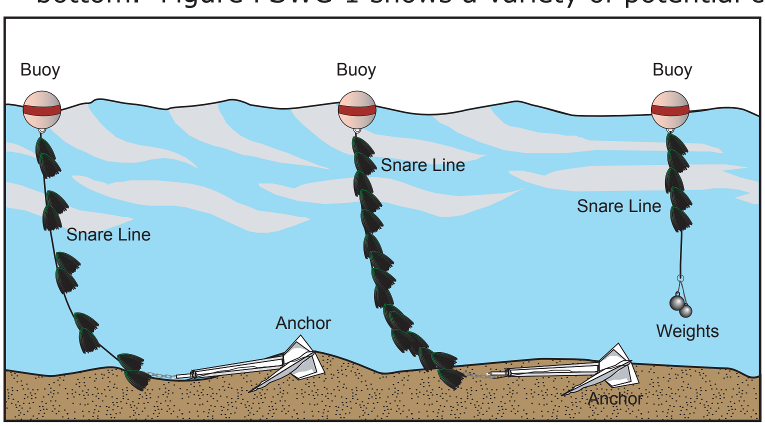

Figure PSWC-1. Vertical Line Passive Sampling Device Configurations.

MESH CURTAIN OR SCREEN PASSIVE SAMPLING DEVICES

Passive sampling devices may also be configured using a mesh screen or curtain, which may be deployed at nearly any angle. Curtain devices may consist of a single mesh curtain deployed at the desired angle in the water column, or of a series of curtains with graduated mesh sizes deployed at a specific location, such as in front of a water intake. A screen device uses a frame to affix and position the mesh. Screens are useful when deploying the passive sampler at depth, as the weight of the frame can sink and position the mesh screen.

Depending upon the deployment of the mesh curtain or screen passive sampling device, it may also be considered as a protective measure to prevent or reduce the amount of oil entering through a water intake. It is important to consider the potential for other debris and for pelagic organisms to become entrapped in the mesh or screen.

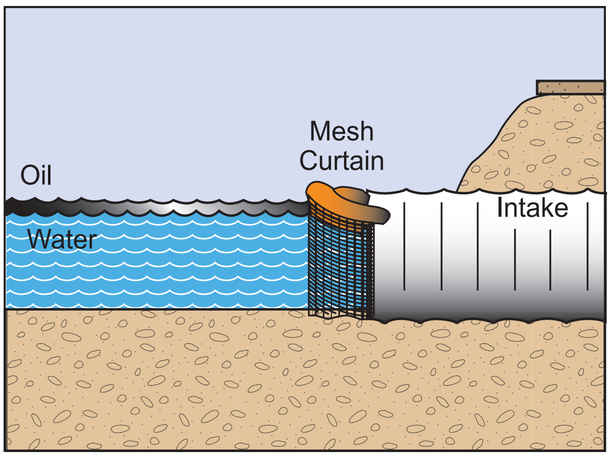

Figure PSWC-2. Mesh Curtain Passive Sampling Device positioned near seawater intake.

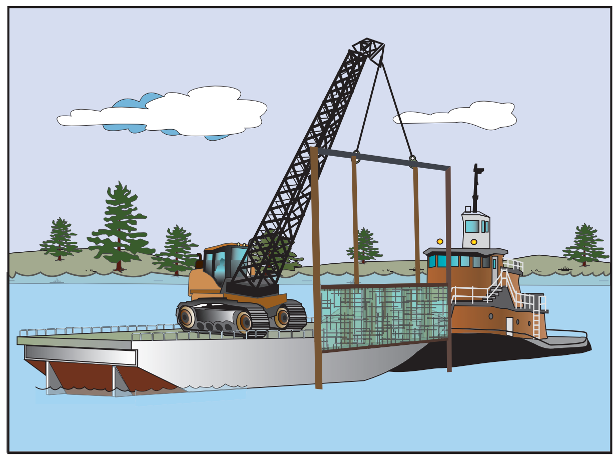

Figure PSWC-3. Mesh Screen Passive Sampling Device.

PROCEDURE

1. Prepare passive sampling device.

a. Affix sorbent snares or curtain to positioning device at desired intervals.

2. Set the passive sampling device at the desired location.

a. Mark the location using a buoy and a numbered tag.

b. Record latitude/longitude coordinates of device location along with the date and time and other relevant observations.

3. Proceed to next location and repeat process until all passive sampling devices are positioned.

4. After the desired interval of time, return to each passive sampling device and inspect.

a. Recommended minimum “soak” time is 24 hours.

b. Shorter “soak” times may be appropriate for passive samplers deployed near water intakes.

5. Remove device from its station and inspect.

a. Place each snare or mesh net on sorting table, lined with sorbent pad, for inspection.

b. Check each snare or mesh for signs of oil contamination using sight, smell, feel, and UV light if appropriate.

c. Log all results (date, time, sampling device number, presence/absence of oil). Photograph any evidence of oil.

d. Place used sorbent or mesh in appropriate waste bag (refer to Waste Management Procedure).

i. Tag and label.

ii. Oil-free snare or mesh may be re-used to reduce waste.

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by location of sampling transects, length of sampling intervals, affinity of spilled oils for passive sampling materials, background tar ball levels, sea state and currents, sensitivity of laboratory analyses, and human error.
+ Daily weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
+ Vessel masters should have experience in the appropriate operating environment and local knowledge is preferred.
+ Select passive sampling locations and water depths based on information needs as identified in sampling plan.
+ Use buoys, floats, or other obvious markers to identify passive sampling devices that may pose a navigational hazard.
+ Take into consideration the influence of tide and currents when deploying passive sampling devices.
+ Take into consideration the potential for organisms or debris to become entrapped in passive sampling devices, and take steps to minimize this potential.

REFERENCES TO OTHER TACTICS

Other methods associated with Passive Sampling include:

- Processor Seawater Intakes
- Handling and Storing Samples
- Waste Management
- Data Collection and Management
- Safety

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic may include sorbent snare or mesh, a frame for mesh screens, chain or line, anchors, vessels, divers, decontamination equipment, log books, and sampling technician(s). Configuration and specific resources required will be determined by site conditions, spilled oil type and volume, area of coverage, as well as resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Passive Sampling

Equipment	Function	Quantity	Notes
Sorbent snare	Collect whole oil in water column.	Varies	
Mesh curtain	Collect whole oil in water column.	Varies	Consider possibility of entrapping other organisms or debris when selecting mesh size.
Line	Suspend/position sorbent snare or curtain.	Varies	
Anchor or sinker weights	Hold passive sampling device in desired position/location.	Varies	
Sorbent pads	Line sorting/sampling table to examine snare or curtain.	Varies	
Oily waste storage	Store soiled sorbent materials.		Refer to Waste Management Procedure.
GPS	Locate sampling devices and Record position/location data (latitude/longitude) .	2 (1 primary, 1 backup)	Recommend using combination of handheld GPS and vessel's GPS system.
Sampling materials	Collect and store samples of encountered oil for possible laboratory analysis.	Varies	Refer to Sample Handling Procedure.
Log books and data collection supplies	Record data regarding oil observations, conditions, etc.	Varies	Refer to Data Keeping Procedure.
Measuring tape or ruler/scale	Measure size of tarball or oil observation.	One per sampling technician	Photographs of tar balls or oil encounters should include ruler or scale to demonstrate size.
Digital camera	Record images of sampling process and observations.	One per sampling technician	Ensure sufficient batteries, charger, and memory stick storage for length of sampling survey.
Vessel	**Function**	**Quantity**	**Notes**
Vessel with appropriate capability to deploy passive sampling device (e.g. with pot launcher if using crab pots)	Deployment platform	1 per sampling trip	Vessel should be inspected prior to use for safety equipment and communications capabilities.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technician(s)	Deploy equipment, collect data.	2-3	Recommend at least 2 technicians per trip for safety. Technicians must have sufficient Hazmat certification and basic vessel safety training.
Divers	Deploy equipment, monitor and check equipment.	Varies	Divers should only be used when safe to do so.

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WHOLE WATER SAMPLING for DISSOLVED OIL

OBJECTIVE & STRATEGY

The objective of Whole Water Sampling for Dissolved Oil is to measure concentrations of oil that have dissolved in the water column. Whole water sampling uses a specialized sampling bottle to "grab" samples of seawater from a specified water depth and location. Data collected from whole water sampling may be used to draw conclusions regarding the presence, absence, and relative concentration of dissolved oil in the water column, both spatially and temporally.

Whole water sampling does not yield immediate results – samples must be analyzed in a laboratory using a state-approved methodology to determine the amount of dissolved hydrocarbons. Most laboratory analyses measure total hydrocarbon concentrations; therefore, it is useful to have information on background contaminant levels before conducting whole water sampling as part of a water quality sampling program.

If whole water sampling is to be used as part of a fisheries water quality sampling program, the sampling scheme should be designed based on the real time question posed for the incident. Different sampling schemes are required to determine the answer to the following questions:

- What is the oil concentration at a given location?
- What is the oil concentration at various water depths?
- Is the concentration of dissolved oil in this area increasing or decreasing over time?
- Does dissolved oil pose a threat to a specific seawater intake?

Care must be taken to choose a sampling design that is appropriate to the questions being asked.

Whole water sampling may also be used to retrieve and analyze samples of seawater from processing facilities or vessels.

TACTIC DESCRIPTION

Operating Environments

Whole Water Sampling may be deployed in any water body where vessels can operate. Applicable operating environments include: nearshore and offshore marine waters, harbors, bays, rivers, and lakes. Vessels must be sufficiently seaworthy to suit the worst conditions expected in the operating area.

Whole Water Sampling for Dissolved Oil

ADEC regulations require that samples to determine concentrations of total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) must be collected in marine and fresh waters below the surface and away from any observable sheen (18 AAC 70.020).

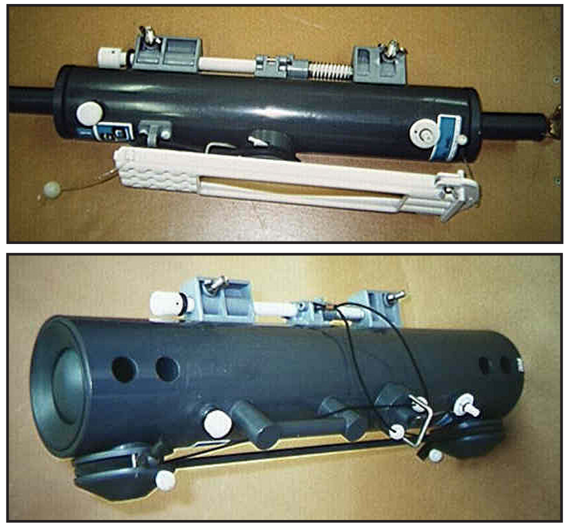

Figure WWS-1. Examples of whole water samplers.

Deployment Configurations

There are a number of different whole water sampling bottles available on the market. Sampling bottles are generally metallic, and are designed to allow water to continuously flow through them until the bottle is triggered to close. A "messenger" triggers the bottle to close at the desired depth, thus providing a "grab" sample of water from that location. Figure WWS-1 shows examples of a Go-Flo water sampler and a Niskin water sampler. Figure WWS-2 shows a messenger.

The sampler is attached to a line and deployed over the side of a vessel or sampling platform to the desired water depth. Water depth may be measured by marking the line.

Figure WWS-2. A messenger.

Once the sample has been collected, the sampler is retrieved and the water sample transferred into one or more sample bottles. It is important to thoroughly clean and decontaminate the sampler between each deployment. The sampling plan may call for replicate samples at each location.

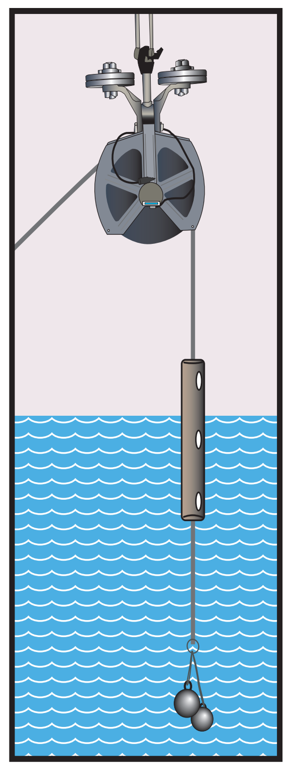

Figure WWS-3. Deploying water sampler over side of vessel, using block.

Vessel configuration

Sampler bottles may be deployed from a vessel or other suitable platform. Fishing vessels, spill response vessels, or other vessels-of-opportunity may be utilized if available. The sampler bottle is attached to a line which is deployed through a block or directly over the side of the vessel or sampling platform. The line should be weighted, with the weight located below the sampler on the line (Figure WWS-3).

Laboratory Analyses

A number of different methods exist for analysis of dissolved hydrocarbons in water. The Environmental Protection Agency (EPA) has established procedures which are commonly followed by most state-approved laboratories. According to ADEC regulations (18 AAC 70.020), concentrations of TAqH must be determined and summed using a combination of: (A) EPA Method 602 (plus Xylenes) to quantify monoaromatic hydrocarbons and to measure TAH; and (B) EPA Method 610 to quantify polynuclear aromatic hydrocarbons. Use of an alternative method requires department approval. The EPA methods referred here may be found in 40 CFR 136, Appendix A, as amended as of February 14, 1996.

PROCEDURE

Whole water sampling may utilize one or more samplers, deployed from a vessel platform.

1. ***Thoroughly clean and decontaminate sampler.***
   a. Wear clean nitrile disposable sampling gloves.
   b. Use brush and diluted cleaning solution (e.g., Citra-Solve or similar de-greaser) to clean outside of sampler, rinse with distilled water.
   c. Open sampler and pour in cleaning solution, shake sampler vigorously for a few minutes.
   d. Drain sampler and rinse 4-5 times with distilled water.
2. ***Prepare bottle and line for sampling.***
   a. Cock bottle in deployment position and shut valve.
   b. Attach weight to line.
   c. Secure sampler to line, usually above weight.
3. ***Lower sampler into water through block.***
   a. For sample near surface:
      i. Lower sampler below 10 meters to allow water pressure to open bottle;
      ii. Raise sampler to desired depth below surface of water (mark line before sampling); and,
      iii. Attach messenger to line and release to trip sampler shut.
   b. For sample near bottom:
      i. Lower sampler until weight hits bottom; and,
      ii. Keeping tension on line, attach messenger to line and release to trip sampler shut.

4. ***Retrieve sampler and remove from line.***
   a. Change sampling gloves.
   b. Open valve, push in nozzle and allow water to flow from sampler for a second or two before filling sample bottle(s).
   c. Record position, date, time, depth, sample ID and any other comments associated with sample.
5. ***Store sampling bottles as directed for transport to laboratory.***
6. ***Clean and decontaminate sampler between each use.***
   a. Repeat steps #1 through #5.

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by location and depth of sampling stations, background hydrocarbon levels, sea state and currents, sensitivity of laboratory analyses, and human error.
+ Ensure that type and size of sampling bottles are appropriate for the intended laboratory analyses. Some methods may require the use of preservatives or the refrigeration of samples. Coordinate with laboratory.
+ Daily evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
+ Vessel masters should have experience in the appropriate operating environment and local knowledge is preferred.
+ Select sampling locations and water depths based on information needs as identified in sampling plan.
+ Avoid deploying water sampler directly off vessel's stern end because of the potential interference of propeller wash and entanglement with propeller.

REFERENCES TO OTHER TACTICS

Other methods associated with Whole Water Sampling include:

- Handling and Storing Samples
- Waste Management
- Data Collection and Management
- Safety

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic include sampler, messenger, line or cable, vessels, decontamination equipment, log books, sampling bottles, and sampling technician(s). Configuration and specific resources required will be determined by site conditions, sampling design, and resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Whole Water Sampling

Equipment	Function	Quantity	Notes
Water Sampler (e.g. Go-Flo or Niskin) and messenger	Collect water samples from desired location and water depth.	1 or more as available	
Line	Suspend water sampler	Sufficient length to accommodate planned sampling depth	
Weight or sinker	Sink line to desired depth.		A 10-lb. weight will be sufficient in most cases.
Block	Deploy and retrieve line with sampler/weight.		
Sorbent pads	Line sorting/sampling table to examine water sampler.	Recommend maintaining large stock on vessel	
Detergent (e.g. degreaser)	Decontaminate/clean sampler before and between each use.	1 bottle	Consult bottle regarding recommended dilution. Refer to MSDS for safety. Use only products registered on the National Contingency Plan product schedule.
Distilled water	Use to decontaminate and clean sampler.	Several gallons	
GPS	Record position/location data (latitude/longitude) for each tow.	2 (1 primary, 1 backup)	Recommend using combination of handheld GPS and vessel's GPS system.
Digital camera	Record images of sampling process and observations.	One per sampling technician	Ensure sufficient batteries, charger, and memory stick storage for length of sampling survey.
Water sample bottles	Store water samples for transport to laboratory.		Coordinate the size and make of sample bottles with laboratory depending upon analytic techniques. Minimum sample sizes, constant temperatures, or other specifications may be required for some analyses.
Vessel	**Function**	**Quantity**	**Notes**
Vessel of opportunity	Sampling platform	1 per sampling trip	Vessel should be inspected prior to use for safety equipment, communications capabilities. Vessels must be sufficiently seaworthy to meet the worst conditions expected in the operating area.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technician(s)	Deploy sampler, collect and store water samplers, record data.	2-3	At least 2 technicians required to operate sampler bottles. More than 2 may be required depending upon conditions. Technicians must have sufficient Hazmat certification and basic vessel safety training.

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FLUOROMETRY SAMPLING

OBJECTIVE & STRATEGY

The objective of fluorometry is to detect and possibly measure concentrations of dissolved oil in the water column. Fluorometers may be used at a fixed location to measure changes in oil concentration over time, or they may be deployed from a mobile platform. Data collected from fluorometry may be used to draw conclusions regarding the presence, absence, and relative concentration of dissolved oil in the water column, both spatially and temporally. Fluorometers measure fluorescence, and other organic compounds besides oil may fluoresce. Therefore, the fluorometer must be calibrated to detect the fluorescent spectrum specific to the spilled oil. In order to correlate a positive fluorometry reading to the presence of oil, whole water samples must be taken and analyzed for dissolved hydrocarbons. It is useful to have information on background contaminant levels before using fluorometry as part of a water quality sampling program.

Unlike most of the other sampling techniques described in this manual, fluorometry requires specialized equipment that must be calibrated appropriately and deployed and monitored by trained personnel.

If fluorometry is to be used as part of a fisheries water quality sampling program, the sampling scheme should be designed based on the real time question posed for the incident. Different sampling schemes are required to determine the answer to the following questions:

- What is the oil concentration at a given location?
- What is the oil concentration at various water depths?
- Is the concentration of dissolved oil in this area increasing or decreasing?
- Does dissolved oil pose a threat to a specific seawater intake or fishery?

Care must be taken to choose a sampling design that is appropriate to the questions being asked.

Fluorometry may also be applied to seawater utilized in processing plants or onboard fishing vessels.

TACTIC DESCRIPTION

Operating Environments

Fluorometers may be deployed in any water body where tow vessels can operate. Applicable operating environments include: nearshore and offshore marine waters, harbors, bays, rivers, and lakes. Tow vessels must be sufficiently seaworthy to suit the worst conditions expected in the operating area. Fluorometers can also be deployed from docks or in a seawater intake system.

Deployment Configurations

A continuous flow fluorometer may be deployed in a fixed site or may be towed by a vessel. More than one fluorometer may be towed at multiple depths in the water column.

Towing transect locations and water depths will be determined by the sampling plan. If the sampling design necessitates a data set that can be compared over time, the fluorometer may be deployed along the same transect multiple times.

Fluorometers are generally deployed from vessels of opportunity, such as small response vessels or fishing vessels.

Fluorometry readings do not express oil concentration; they show the relative increase of hydrocarbons or other fluorescent compounds over background concentrations. Additional information on the calibration and use of fluorometers is included in the NOAA Special Monitoring of Applied Response Technologies (SMART) guidance document available at http://0-response.restoration.noaa.gov.library.unl.edu/book_shelf/648_SMART.pdf.

Figure FS-1 shows a continuous flow fluorometer.

Figure FS-1. A sample of a continuous flow fluorometer.

PROCEDURE

Fluorometers are specialized instruments that should only be operated by individuals with the requisite training. The following procedures are highly generalized. Specific operating instructions will vary depending upon the make and model of fluorometer, the operating environment, and other logistical and operational considerations.

When using a fluorometer in a fixed location:

1. ***Calibrate fluorometer and establish background readings.***
2. ***Deploy fluorometer in desired location.***
3. ***Record data at desired intervals.***

When towing a fluorometer from a vessel:

1. ***Start Tow.***
   a. Deploy fluorometer at pre-designated depth(s).
   b. Maintain constant vessel speed and heading.
2. ***Monitor and document vessel course and speed.***
   a. Document visual observations.
      i. Convergence zones.

ii. Impacted wildlife.
iii. Sonar/fish finder information.
iv. Vessel traffic.

3. ***Record data continuously or at regular intervals (e.g., every half hour or hour).***
4. ***Record findings.***
   a. Latitude/longitude of tow (beginning and end points).
   b. Tow duration (start and end times).
   c. Vessel speed and heading.
   d. Fluorometer readings.
   e. Location of fluorometer in water column (depth).
   f. Water temperature.
5. ***Obtain whole water samples of fluorometer effluent (or directly from water body) in areas where fluorometer readings suggest the presence of oil, and send samples for laboratory analysis to quantify oil concentration.***
6. ***Recalibrate fluorometer as needed.***

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by location and depth of sampling stations, background hydrocarbon levels and interference from other fluorescent compounds, sea state and currents, sensitivity of laboratory analyses, and human error.
+ Ensure that type and size of sampling bottles used to collect the fluorometer effluent are appropriate for the intended laboratory analyses. Some methods may require the use of preservatives or the refrigeration or extraction of samples. Coordinate with laboratory.
+ Daily weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
+ Vessel masters should have experience in the appropriate operating environment and local knowledge is preferred.
+ Select tow depth and/or location of fluorometer based on information needs as identified in sampling plan.
+ Avoid deploying fluorometer directly off vessel's stern end because of the potential interference of propeller wash and entanglement with the propeller.
+ Only those individuals with the requisite training should operate a fluorometer.
+ Consider that 2-cycle outboard motors introduce oil into the water, which may interfere with fluorometry readings.

Fluorometry Sampling

REFERENCES TO OTHER TACTICS

Other methods associated with Fluorometer Sampling include:

- Aerial Surveillance
- Handling and Storing Samples
- Waste Management
- Data Collection and Management
- Safety

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic include the fluorometer, chain or line, vessels, decontamination equipment, log books, and sampling technician(s). Configuration and specific resources required will be determined by site conditions, sampling design, and resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Fluorometer Sampling

Equipment	Function	Quantity	Notes
Fluorometer	Measures concentration of dissolved hydrocarbons in water column.	1 or more	Fluorometer must be calibrated prior to use. Should only be operated by trained persons.
Line	Deploy fluorometer		Sufficient length to accommodate planned sampling depth, accounting for horizontal drag.
GPS	Record position/location data (latitude/longitude) for each deployment.	2 (1 primary, 1 backup)	Recommend using combination of handheld GPS and vessel's GPS system.
Digital camera	Record images of sampling process and observations.	One per sampling technician	Ensure sufficient batteries, charger, and memory stick storage for length of sampling survey.
Sample bottles	Store fluorometer effluent samples for transport to laboratory.	Varies	Coordinate the size and make of sample bottles with laboratory depending upon analytic techniques. Minimum sample sizes, constant temperatures, or other specifications may be required for some analyses.
Vessel	**Function**	**Quantity**	**Notes**
Vessel with hydraulic arm or boom and capability to travel at <4 kts	Sampling platform	1 per sampling trip	Vessel should be inspected prior to use for safety equipment, communications capabilities. Tow vessels must be sufficiently seaworthy to suit the worse conditions expected in the operating area.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technician(s)	Deploy fluorometer, collect data.	2-3	Recommend at least 2 technicians per vessel trip for safety. More than 2 may be required if towing multiple fluorometers. Technicians must have sufficient Hazmat certification and basic vessel safety training.

AERIAL SURVEILLANCE & TRACKING

OBJECTIVE & STRATEGY

The objective of Aerial Surveillance and Tracking is to collect data regarding the distribution and movement of oil as slicks, tar balls, tar patties, mousse, or other whole oil form, on the water surface. The strategy is to use trained observers in aircraft to systematically survey the water surface where there is the potential for oil to be present.

Aerial surveillance may be used to monitor fishing grounds, assess the risk of oil to the fishing fleet and fishing gear, map areas of oiling, predict the movement of oil and direct recovery efforts. The aerial surveillance scheme should be designed based on the real time question posed for the incident. Different surveillance schemes are required to determine the answer to the following types of questions:

- Is there oil present?
- Are certain sections oil-free?
- Is the amount of oil in this area increasing or decreasing?
- Is the oil moving?
- Is there oil present on the fishing grounds?
- Will oil impact fishing gear?
- What condition is the oil in?

Care must be taken to choose a design that is appropriate to the questions being asked.

TACTIC DESCRIPTION

Operating Environments

Aerial Surveillance and Tracking may be utilized over any water body where aircraft can operate safely and weather conditions permit good visibility of the water's surface.

Aircraft must have the capability to suit the worst conditions expected in the operating area.

Deployment Configurations

AIRCRAFT

Aerial surveillance and monitoring data is gathered using aircraft as the platform from which trained observers can establish the presence of oil, its state of weathering, and amount. Either fixed wing or rotary wing aircraft may provide adequate capabilities. Consultation with local pilots on conditions that may be encountered will inform surveyors on appropriate aircraft for the task. In selecting an aircraft consideration should be given to the following factors:

- Distance to the spill site and location of the oil.
- Location of the nearest landing strip.
- Location of a refueling station.
- Duration of the flight and mileage to be covered of proposed area to be surveyed.
- Quality of visibility from the aircraft.
- Terrain to be flown, i.e., open ocean or rugged mountainous coastline.
- Number of observers and flight crew required.

In considering these factors the strengths of a fixed wing aircraft or rotary wing aircraft will determine the aircraft chosen. Generally, fixed wing aircraft can fly farther and cover more area than rotary wing aircraft. Rotary wing aircraft can usually fly slower, which may provide better visibility for surveillance personnel.

OBSERVERS

The use of at least two trained observers is necessary for all survey flights. A lead observer should be identified. This individual will direct the pilot and make the decisions regarding the course of the survey if changes need to be made. The other observers will give input and data to the lead observer as it is gathered. The lead observer should be experienced and trained in over-flight observations to be able to detect, recognize, estimate the volume and record the presence of oil on water. Observers should develop sketch maps that reflect the consensus observations of all observers regarding the location and characterization of oil slicks.

OIL DETECTION

The ability to visually detect oil from aircraft can be influenced by a variety of factors and many naturally occurring phenomena and features can present much like oil. The presence of oil at or near the surface can exist in various forms depending on the oil type, ambient temperature, amount of weathering, sea-state and many other factors. Observers should be trained in the behavior of spilled oil in open water and methods of quantifying the amounts to ensure the collection of proper data.

The altitude of the flight should be determined by the visibility. If there is no visual impairment, an altitude around 1000-1500 ft. and a speed of 80-90 knots is optimal for oil surveys.

RECORDING DATA

Data should be recorded with the use of onboard and hand held GPS, digital camera. Data should include:

- Location of and extent or size of oil.
- Color of the oil -
  - Slick are typically black, brown or orange.
  - Sheens are typically silver, iridescent or rainbow and brown.
- Character -
  - Windrow.
  - Slick.
  - Patch.
  - Streak.
- Coverage - coverage is expressed in percent of the area covered -
  - Traces of oil are 10%.
  - Scattered oil is 25%.
  - Patchy oil is 50%.
  - Broken oil 75%.
  - Continuous oil is 90% or greater.

PROCEDURE

1. Prepare flight plan.

a. Develop plans to avoid duplication and increase safety.

i. Coordinate flights with other response-related aircraft.

ii. Consider areas of restricted access due to incident and environmental factors.

iii. Position the sun behind the observation craft to increase visibility of the oil.

2. Establish scope of survey to establish area of operation.

a. Past information of oiling.

b. Use modeling data to identify areas to survey.

c. Areas used for fishing.

3. Pre-flight briefing.

a. Lead Observer should brief flight crew on identified areas and distance to be covered.

b. Flight crew should provide safety and operations briefing to all observers and passengers.

4. Execute flight and survey plan.

5. *As the flight progresses identify areas of oiling and record data.*

a. Oiled areas may need to be flown over at lower altitudes for positive identification.

b. Log all results – date, time, location, altitude, observation.

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by flight path, environmental conditions on-scene, differences in perception among observers, fate and behavior of oil, and human error.
+ The pilot is responsible for flight safety and ensuring flight conditions are conducive to safety during the entire flight.
+ Flight following procedures should be used.
+ The pilot can discontinue the flight at any time.
+ Lead observer should direct the pilot in the route used for surveying the identified area.
+ Pilots should have experience in survey flights and the operating environments expected.
+ Technicians should be thoroughly briefed on the aircraft safety features by the flight crew.
+ Select surveillance locations based on information needs as identified in sampling plan.
+ Consider having sampling vessels take samples from areas where oil is observed to verify presence and identify source.

REFERENCES TO OTHER TACTICS

Other methods associated with Aerial Surveillance & Tracking include:

- Data Collection and Management
- Safety

Refer also to the Spill Tactics for Alaska Responders (STAR) manual, Appendix C - "Estimating the amount of spilled oil" for guidelines on estimating spill volume based on slick size and characteristics.

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic may include aircraft, log books, GPS, digital camera, flight crew and sampling technician(s). Configuration and specific resources required will be determined by site conditions, spilled oil type and volume, area of coverage, as well as resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Surveillance & Tracking

Equipment	Function	Quantity	Notes
GPS	Note and record location and time of observation.	1 GPS and 1 backup	Recommend using combination of handheld GPS and the aircraft's GPS system if this does not interfere with flight operations.
Digital camera (still and/or video)	Photograph oil encountered during flight.	1 and 1 backup	Ensure adequate memory for multiple photographs. Consider use of video photography to document observations.
Log books and data collection supplies	Record data regarding oil observations, conditions, etc.	2 (1 primary, 1 backup)	
Aircraft	**Function**	**Quantity**	**Notes**
Aircraft with appropriate capability to safely operate in survey area	Observation platform	1	Aircraft should meet operation requirements and provide adequate margin of safety.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technician(s)/ observers	Provide observations and collect data.	2-3	Recommend at least 2 observers per trip. Technicians must have sufficient training in the identification of oil and basic safety training.
Flight Crew	Operate Aircraft	1 to 2- depending on requirements of the aircraft	Flight crew should be experienced in aerial surveillance activities.

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BEACH SURVEYS

OBJECTIVE & STRATEGY

The objective of Beach Surveys is to collect data regarding the distribution of whole oil as tar balls, tar patties, or other whole oil form, on the shoreline. Beach survey data provides a gross measurement regarding the presence or absence of oil spatially and/or temporally. Beach survey data may be extrapolated to draw conclusions regarding the relative abundance and distribution of whole oil in coastal waters.

Beach surveys can be used to track changes in the presence of oil in the water through time, by surveying areas known to "collect" oil and monitoring changes in the quantity of oil found on the shore over time. Surveys can also be used to monitor for the presence of oil in new locations—by surveying critical beach areas adjacent to processor intakes, for example.

Compared to on-water sampling methods, beach surveys are generally safer, less expensive, and less dependent on sea conditions. However, a major limitation to the beach survey tactic is that there is not necessarily a clear correlation between the presence of tar balls on shore and the presence of oil in the water column. The presence of tar balls on shore may fluctuate depending on weather conditions without necessarily indicating a corresponding fluctuation of the quantity of oil in the water. There is also a time lag between the point at which oil is observed on the beach and the time when that same oil was actually in the water column. Also, tar balls encountered on shore may not come from the spill source.

Beach surveys can be designed to answer the following types of questions:

- Is oil present on the shoreline?
- Is the amount of oil in this area increasing or decreasing?
- Is there oil present near a seawater intake, or on fishing vessels/gear?

Care must be taken to choose a sampling design that is appropriate to the questions being asked.

TACTIC DESCRIPTION

Operating Environments

Beach surveys can be conducted on any stretch of shoreline that is safely accessible on foot, by vehicle, by vessel, or by aircraft. To retain the benefit of beach surveys not depending on sea conditions, stretches of beach accessible by vehicle may be preferable. Surveys should be completed at low tide.

Though less dependent on sea state for implementation, beach surveys do require adequate visibility for the sampling team to identify and record oil observations, follow a consistent and pre-determined route, and communicate with one another. Sampling personnel should wear attire appropriate for the weather and should carry appropriate safety and communications gear.

Deployment Configurations

Beach surveys can be configured based on the information needs driving the sampling program. Procedures should be agreed upon by the whole survey team to start, and remain consistent throughout implementation.

The sampling plan should define which beach segments shall be surveyed, and at what intervals. Selection of beach survey locations may be based on oil observations in nearby waters, or beach segments may be surveyed because of their proximity to seawater intakes, fishing gear or boats, or nearshore fishing grounds. Survey personnel should be instructed that oil tends to accumulate in the drift line of the previous high tide.

Figure BS-1. Handheld GPS unit marks waypoint for tar ball observation during beach survey.

Beach surveys involve sampling personnel walking along the shoreline at low tide and surveying the entire tidal zone for evidence of whole oil. Oil observations are waypointed using a handheld GPS unit (Figure BS-1), and are also marked with flags or markers. The oil must then be removed from the beach, to restore the beach as much as possible before the next scheduled survey. When a segment of beach has been surveyed and all oil observations marked, the sampling personnel may photograph the field of markers to get an overview of oil distribution and abundance along the beach segment (Figure BS-2).

All recovered oil that is not retained as samples must be properly disposed according to the incident waste management plan.


Figure BS-2. Beach segment with oil observations marked by flags.

Source: Nuka Research, 2005

PROCEDURE

1. Observe proper safety procedures.

a. Work in teams of two or more.

b. All surveyors should wear personal flotation devices and appropriate outerwear, and carry VHF radios or cellular telephones, as well as handheld GPS units.

c. Inform Unit Leader of your survey plan and expected return time.

2. Conduct the initial beach assessment.

a. Walk the shoreline segment slowly, with one person at either end of the tidal range, and survey throughout the tidal area.

b. Mark all tar balls using a survey flag. Do not remove.

3. Document all observations.

a. Once beach survey is complete, take a photograph of the entire beach segment, so that all surveyor flags are visible.

b. Record observations using the SCAT Tar Ball Shoreline Assessment Form, or other documentation being used in spill response and clean-up operations, and sketch tar ball observations on beach map.

4. Slowly walk the same beach segment in the opposite direction.

a. At each tar ball or tar ball field, take a photograph of the site with surveyor flags and a handheld GPS next to them, with coordinates visible. This allows for clear record-keeping of both the location of the finding (GPS coordinates) and the size (relative to the GPS device).

5. Remove all oil from beach if possible.

a. Remove flags.

b. Wear protective gloves.

c. Scrape residue from rocks using a trowel.

d. Collect tar balls to the extent feasible. Remove tar balls from beach in approved containers, such as Ziploc bags. Dispose of collected oil according to oily waste disposal requirements.

6. Once beach segment has been surveyed and tar balls removed, move on to next beach segment.

CONSIDERATIONS AND LIMITATIONS

+ Detection limits may be affected by location of beach segments, length of time between sampling trips, water circulation patters, storms or changes in weather patterns, background tar ball levels, sensitivity of laboratory analyses, and human error.

+ Laboratory analysis may be required to determine source of tar balls.
+ There may not be a direct correlation between the quantity or type of oil found on shore and the quantity or type of oil in the adjacent water column.
+ Daily weather evaluations are recommended and should consider visibility and potential for high water/surf.
+ Surveyors should have experience identifying tar balls and other forms of whole oil, and local knowledge is preferred.
+ Select beach survey locations based on information needs as identified in sampling plan.
+ Take into consideration the tide schedule and other access issues when planning beach surveys.

REFERENCES TO OTHER TACTICS

Other methods associated with Beach Surveys include:

- Handling and Storing Samples
- Data Collection and Management
- Waste Management
- Safety

EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic may include surveyor flags, handheld GPS unit, camera, VHF radio or cellular phones, logbook, trowels, oily waste disposal materials, personal protective equipment, and sampling personnel (at least two). Configuration and specific resources required will be determined by site conditions, sampling design, and resource availability. Resource sets may need to be refined as site-specific requirements dictate.

Beach Surveys

Equipment	Function	Quantity	Notes
Surveyor flags	Mark oil observations.	Recommend at least 25-50 – more, depending upon quantity of oil encountered	May substitute large zip ties, stakes, or other markers as available.
VHF or UHF handheld radios or cellular phones	Communication between sampling personnel.	One for each surveyor	If cellular phones are used, ensure that the area has adequate coverage for reliable use.
Personal protective equipment	Personnel safety	Foul weather gear, nitrile gloves, personal flotation devices, and appropriate footwear for each person based on conditions	
Oily waste storage bags	Store tar balls collected from beach for approved disposal.	Varies depending on anticipated conditions	Refer to Waste Management Procedure.
Handheld GPS	Record waypoint (latitude/longitude) of oil observations.	One for each surveyor	Spare batteries.
Logbook, data collection supplies	Record data regarding oil observations, location.	SCAT forms or other documents, surveyor flags (quantity depends on anticipated findings)	Refer to Data Keeping Procedure.
Measuring tape or ruler/scale	Measure size of tarball or oil observation.	One per sampling technician	Photographs of tar balls or oil encounters should include ruler or scale to demonstrate size.
Digital camera	Photograph oil encountered during flight.	1 and 1 backup	Ensure adequate memory for multiple photographs. Consider use of video photography to document observations. Spare batteries.
Personnel	**Function**	**Quantity**	**Notes**
Sampling technicians	Inspect beaches, identify oil signs, collect data.	Minimum of 2	Technicians must be adequately trained to identify oil signs and complete all data collection and record-keeping requirements.