

Wildlife Inventory Plan  
Alaska Maritime National Wildlife Refuge  
Protocol #26

Version 1.3

Parameter: Sea surface temperature

## PURPOSE

To estimate sea surface temperature throughout the summer field season at AMNWR annual monitoring sites using data loggers. Sea surface temperature can be used as a correlate to the seabird monitoring data we collect, and may suggest possible reasons for changes observed in the monitoring data.

## PROCEDURES

**Data collection.**—Temperature is measured using HOBO<sup>®</sup> water temperature data loggers (Pro v2, Onset) suspended about 10m below the surface of the water. Loggers should be programmed to record temperature at hourly intervals. Deploy two data loggers at each site, so that if one is lost, hopefully there will still be data for the season.

### *Before the field season:*

Before leaving for the field, check to see if you need to build a new deployment rigging (Figure 1). If you are fortunate and both rigs from your island were retrieved the previous fall, you can reuse rigs: all you will need to do is launch loggers and attach them inside the PVC pipes of each rigging. If you need to build a new rigging to replace one that was lost, use the following description as a guide (it is much easier if you still have one rigging present that you can use as a template as you build your new one).

Each rig (Figure 1) consists of an anchor [16 lb. Danforth for sandy/gravel bottom or a 40-50 lb. halibut anchor for rocky bottom (Figure 2)] shackled to 6-10 feet of 3/8" chain which is, in turn, attached with a galvanized swivel or two shackles to a length of 3/8", sinking line that is roughly 50 feet longer than the depth of water at the highest tide level. At the point of attachment to the chain, the line should have an eye splice with a thimble inserted to allow a strong connection and prevent chaffing of the line. All shackle pins should be wired to prevent them from working loose. The line is then passed through a small, hard foam float (about four inches in diameter and seven inches long) and the free end is tied through a larger float (roughly six inches in diameter and 14 inches long) that floats at the surface. The small float will serve to keep the data logger suspended above the sea floor. The data logger is firmly suspended and centered inside a 10 inch long piece of six inch diameter PVC pipe using plastic cable ties or wire (Figure 3). The pipe is secured to the line with cable ties that are threaded through the strands of the braided line so that the data logger will be located about 10m below the surface of the water when the system is deployed. Once the pipe is securely fastened, attach the small float about two feet above it. Building logger riggings requires knowledge of line splicing and knots (Attachment A).

The logger riggings for Chowiet and Aiktak are stored in the warehouse in Homer, the logger riggings for Buldir are kept in the warehouse on Adak, and the logger riggings for St. Lazaria are stored in the warehouse in Sitka. At St. Paul and St. George islands, riggings are stored on each island (usually the ground floor of the Washhouse on St. George and the storeroom on St. Paul).

After your riggings are in order, use data logger software (HOBOWare<sup>®</sup> Pro, Onset) to launch data loggers, programming a sampling frequency of once per hour. Once launched, data loggers can be wired into tubes in the rigging. **DO NOT FORGET TO LAUNCH LOGGERS BEFORE DEPARTING, YOU WON'T BE ABLE TO DO IT IN THE FIELD!**

### *In the field:*

Deploy data loggers as soon as possible after arriving at your field camp. At Chowiet, Aiktak, and Buldir, loggers will probably be deployed by the Tiglax when camps are dropped off (be sure loggers and

anchor systems are all ready to go *before* arrival at your camp!). At St. Lazaria, St. Paul, and St. George, crews will deploy loggers themselves using skiffs at each camp (at the Pribilofs, it may be possible to coordinate with a local villager to deploy and/or retrieve loggers but this has caused some problems in the past and it is best to be independent if possible).

Try to put data loggers in the same location as in previous years (Table 1) and at an appropriate depth of water (based on the length of your rigging line, such that the logger tube will be 10m below the surface); at some camps, coordinates may be stored on an island GPS unit. When deploying, slowly lower the anchor until it touches bottom, then attach the line to the bow of the boat and back northward towards shore until the line is taut. Give a few short bursts of reverse throttle to set the anchor and then release the logger rig from the boat. Use caution when handling anchors during deployment (and later retrieval), as they have sharp edges that can puncture the skiff. **Note the time and date your loggers were deployed** so that you can crop earlier temperature measurements at the end of the season.

Throughout the season, try to keep an eye on your loggers; if one is drifting away or washes ashore, retrieve and redeploy it if possible. Camps with access to skiffs will be able to do this when boating conditions allow; camps without access to skiffs will have to wait for a Tiglax visit (so be sure to double-check data loggers just before resupply or any other time the ship is around in case the need to be redeployed).

At the end of the season, retrieve your loggers as late as possible. Again, **note the date and time loggers were retrieved** to crop subsequent temperature measurements. If you are using a skiff for retrieval, keep an eye on the weather as your end date approaches and take advantage of any day with calm seas towards the end of the season, since conditions may not always be favorable for boating.

Safety note for crews deploying/retrieving loggers using camp skiff: Prior to conducting any boat-based work, be sure to file a float plan, choose favorable weather conditions, check for proper inflation of the pontoons and keel, make sure you have enough clean gas mixed to the proper ratio (if using a two-stroke motor), test your motors on land (don't forget to hook up a hose to the water intake first), and have all safety and survival gear (including your satellite or cell phone). If you are unable to retrieve your loggers at the end of the season during good weather, don't risk boating in dangerous conditions: no data is worth risking your safety over.

**Data analysis.**—Download the data file from each of your data loggers using the same data logger software (HOBOWare<sup>®</sup> Pro, Onset) used to launch loggers in the spring (at this time, you should also stop programmed temperature recording to preserve logger battery life over the winter). The data then need to be exported from HOBOWare software to a csv file (one for each logger) and provided to the refuge data manager for import into the refuge sea surface temperature Access database. Prior to exporting data from HOBOWare to a csv file, select the export specifications as noted in Figure 4 (select File, Preferences, General, Export Settings, then settings as noted in Figure 4). Once export is completed, open the file in Excel to check over the data. Provide information regarding logger deployment and retrieval dates and times, as well as noting any unusual data observed from previewing the data, to the data manager. Once the data has been archived in the main database, temperature data are summarized automatically within the database. Crews will receive a file with summary data with weekly mean temperature values; the summary file can be opened in Excel and summary data can be copied and pasted into your annual report (see Figure 5).

### **Specific Requirements**

Dates: Deploy data logger as soon as possible after arriving at the island.

Retrieve them as late as possible, just before you are picked up at the end of the summer.

Optimum Sample Size: One measurement per hour over the course of the summer field season, from at least one data logger at each annual monitoring site.

Weather: For deployment and retrieval, sea conditions must be suitable for small boat work.

Equipment Needed: Two data temperature loggers, two deployment riggings, flexible wire or zip ties for attached logger to rigging, data logger software.

For each deployment rigging: protective piece of drilled PVC pipe, Danforth (for sand, gravel, mud bottom) or halibut anchor (for rocky bottom), 10 feet of 3/8" chain, 3/8" twisted three

strand sinking line about 50 feet longer than the depth at which the anchor will lie, galvanized or stainless steel swivel, galvanized or stainless steel eye-thimble, small in-line float, large surface float, at least two shackles, an assortment of plastic cable ties.

Table 1. Locations for data logger deployment in the field and overwinter storage for AMNWR field camps.

Island	Deployment location	Overwinter storage
St. George	North coast, right off Washhouse	St. George Washhouse
St. Paul	English Bay (in a straight line between Tolstoi Point and Zapadni Point)	St. Paul storeroom
Aiktak	North coast (straight between Aiktak and Ugamak)	Homer warehouse
Buldir	North coast in front of camp	Adak warehouse
Chowiet	Chowiet Bay	Homer warehouse
St. Lazaria	North of island, off of mooring buoy	Sitka warehouse

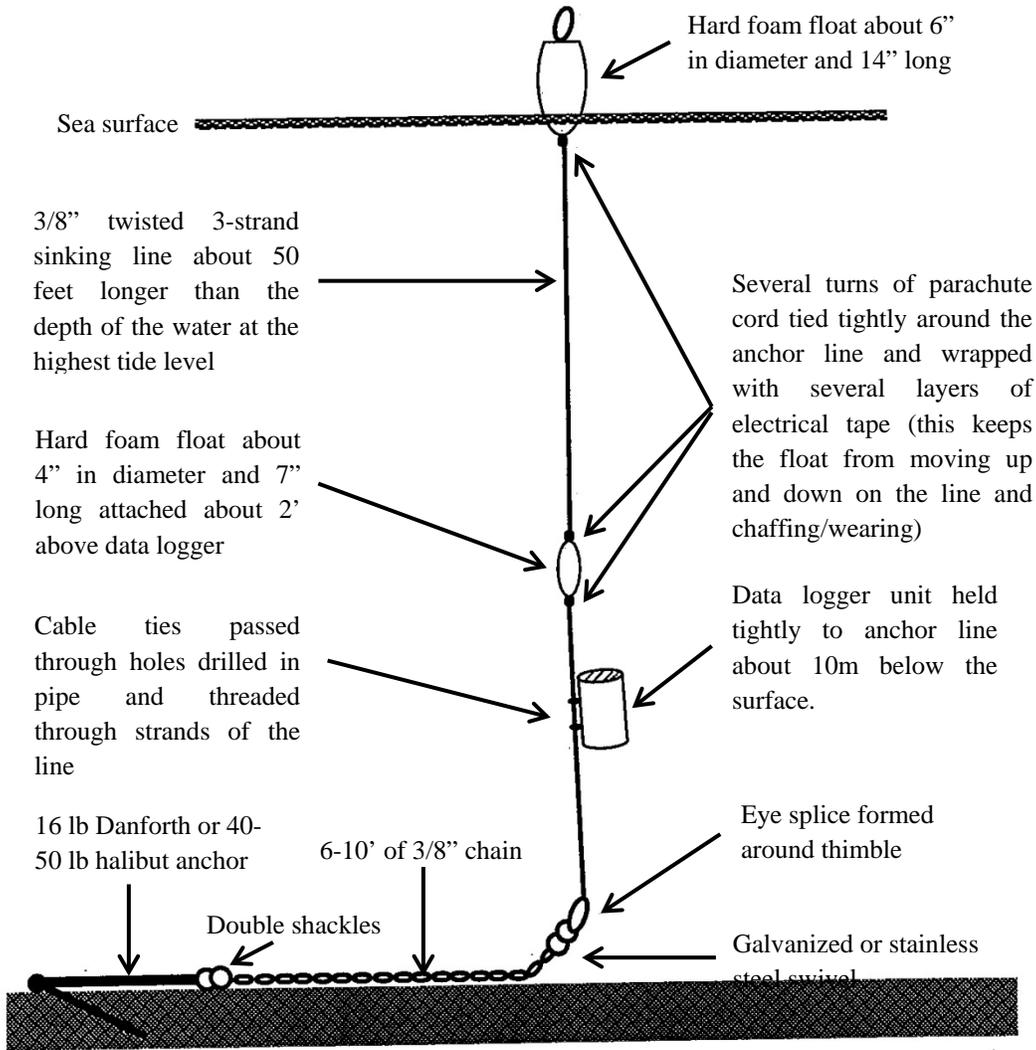


Figure 1. Sea surface temperature data logger anchor system.



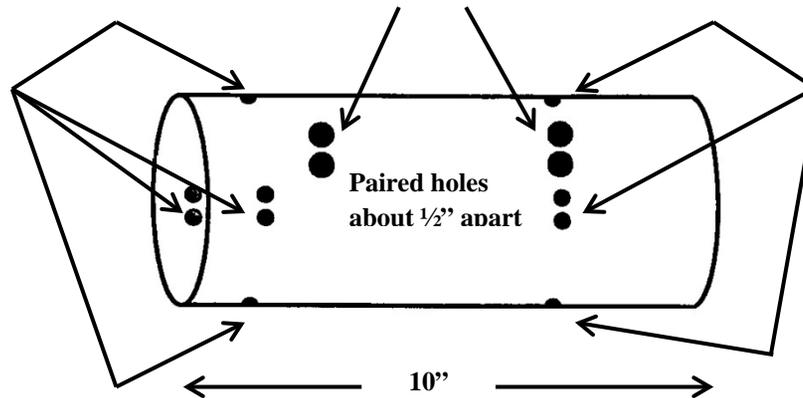
Figure 2. Examples of Danforth (left) and halibut (right) anchors.

**Side View**

Four pairs of 1/8" diameter holes equally spaced around pipe about 2" in from the end of the pipe (these holes are for the ties that will pass through the eyelet on the data logger)

Note: After drilling all holes, file edges smooth with a round file

Two pairs of 1/4" diameter holes about 3" from the end of pipe (these holes are used to attach the pipe to the anchor line)



Four pairs of 1/8" diameter holes equally spaced around pipe about 3" in from the end of the pipe (these holes are for the ties that will suspend the end of the data logger)

**End View (cross section at logger attachment holes)**

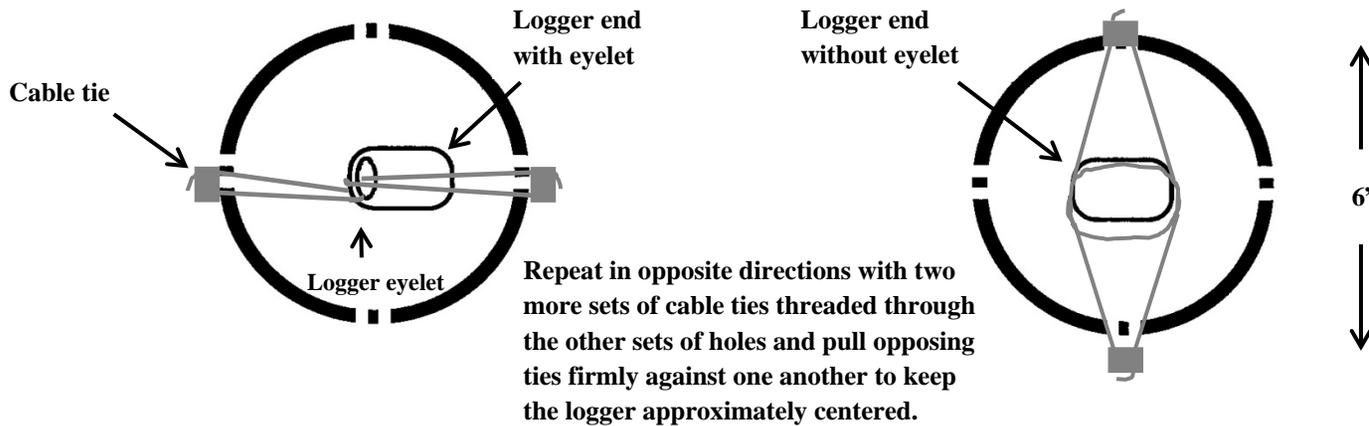


Figure 3. Protective housing for sea surface temperature data logger.

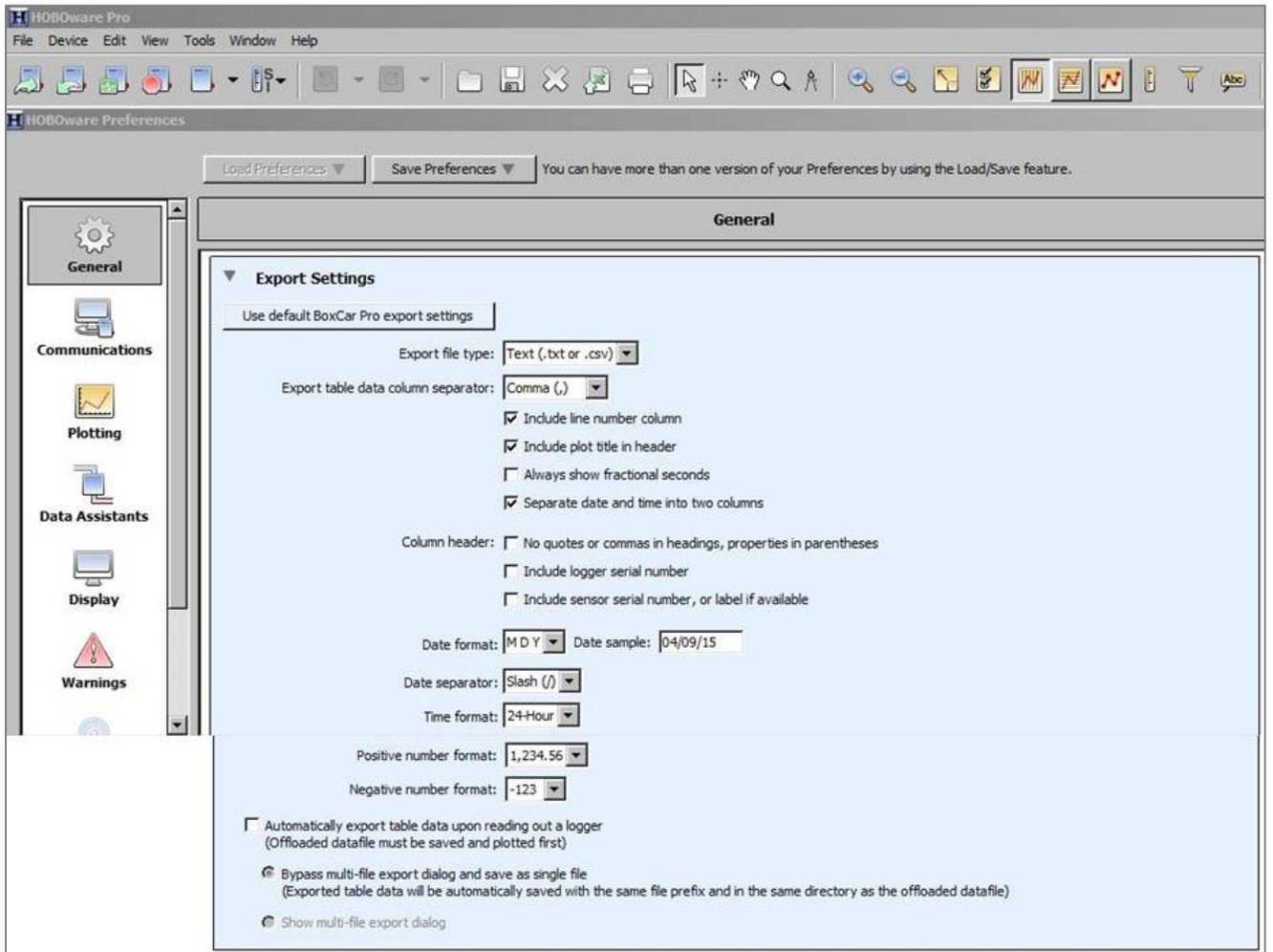


Figure 4. Export settings specifications from HOBOWare.

Table 101. Mean weekly sea surface temperatures (°C) at Buldir Island, Alaska.

Week	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
21-27 May	4.6	-	-	3.6	4.4	4.1	-	-	-	4.2	-	3.9	-	-
28 May-3 Jun	4.9	4.0	-	3.8	4.6	4.2	4.4	-	4.6	4.2	4.2	4.0	4.4	3.9
4-10 Jun	5.0	4.0	-	3.8	4.8	4.2	4.7	4.5	4.6	4.6	4.3	4.0	4.0	4.0
11-17 Jun	5.5	4.3	-	4.1	4.7	4.4	4.8	4.6	4.8	4.7	4.4	4.1	4.3	4.1
18-24 Jun	5.0	4.5	4.6	4.3	4.7	4.7	5.3	4.9	4.9	4.8	4.7	4.4	4.5	4.5
25 Jun-1 Jul	5.5	4.9	4.5	4.6	4.9	5.0	5.3	5.1	5.7	5.1	4.9	4.6	4.5	4.9
2-8 Jul	5.6	5.0	5.0	4.4	5.0	5.7	5.4	5.1	5.9	5.6	5.0	4.6	4.7	5.5
9-15 Jul	6.0	5.1	4.9	4.7	5.9	5.1	5.8	5.8	6.1	5.3	5.2	4.9	5.0	5.5
16-22 Jul	5.8	5.1	5.1	5.0	5.5	5.6	6.0	5.8	5.9	5.3	5.8	5.1	5.1	6.2
23-29 Jul	6.0	6.1	5.7	5.3	5.8	5.3	5.8	6.4	5.9	5.2	5.7	5.7	5.5	6.7
30 Jul-5 Aug	6.1	6.0	5.8	6.0	6.0	6.2	6.2	6.2	6.1	5.9	5.7	5.1	5.1	6.5
6-12 Aug	7.0	6.0	5.7	5.3	7.2	5.7	6.5	6.3	6.9	5.7	5.8	6.0	5.7	7.1
13-19 Aug	6.7	6.2	6.2	6.3	6.5	6.6	7.4	6.5	6.8	6.4	6.9	6.1	5.5	6.4
20-26 Aug	-	-	6.5	7.6	6.8	6.6	6.6	7.7	6.3	7.2	6.2	6.0	5.7	6.0
27 Aug-2 Sep	-	-	6.3	6.9	7.1	7.5	6.9	-	-	8.6	-	-	-	-
3-9 Sep	-	-	-	-	7.1	5.8	6.8	-	-	-	-	-	-	-

Figure 5. Example summary table of weekly mean sea surface temperature in AMNWR annual reports.

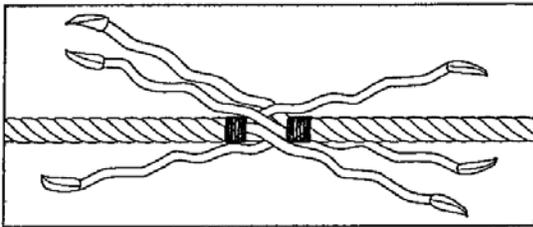
## Attachment A. Instructions for splicing line and tying knots.

**SPLICES AND SPLICING**

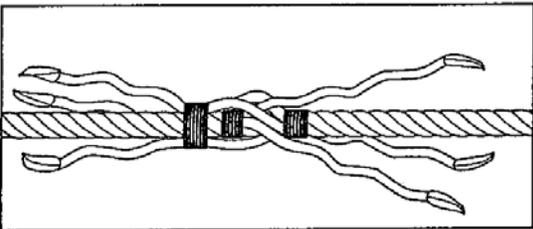
Most stock sailboats come with all basic rigging supplied; it is usually not until something new is added or something old is replaced that a splice is even thought about. Power and sailing craft may have a made-up anchor line (usually not as long as it should be), but probably will not have enough dock lines. Marine dealers often sell dock lines of various lengths already made up, or you may want to make your own. A sailmaker will often be a good source for new jib sheets, other lines or small stuff. But in spite of the fact that many boat owners do not need to do much splicing, it is a good idea to know the basics. You can be a wise customer, and you can quickly make the occasional emergency repair if you know the rudiments of splicing.

Splicing, like knotting, is a finger art. In small to moderate sizes of three-strand line you can make splices without tools, although a knife and fid are extremely helpful. If you are splicing heavier line or braided line, simple tools are necessary—a fid or marlinespike for three-strand line, and a special fid for braided line.

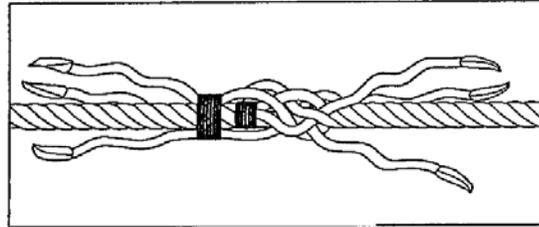
As you can easily see in the illustrations, or by looking at a splice in three-strand line that is already made, the principle is simple: Three strands are tucked over and under so that they interweave with three other strands. If you are splicing the ends of two lines together in a short splice, the result



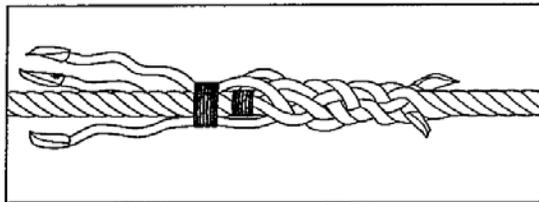
**1** To start a short splice, unlay the strands of both rope ends for a short distance, about ten turns of the lay. Tape or fuse the six strands, or whip them, to prevent unlaying. A seizing is often made around each of the ropes, or each is wrapped with a piece of tape, to prevent strands from unlaying too far. These seizings or tape will be cut as the splice is completed.



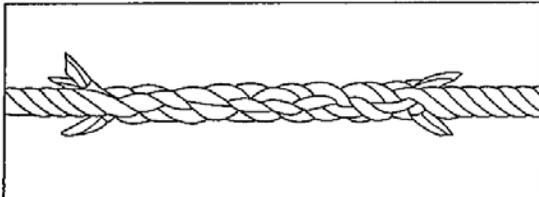
**2** Next, "marry" the ends so that the strands of each rope lie alternately between strands of the other as shown. Now tie all three strands of one rope temporarily to the other—this is desirable, but not essential.



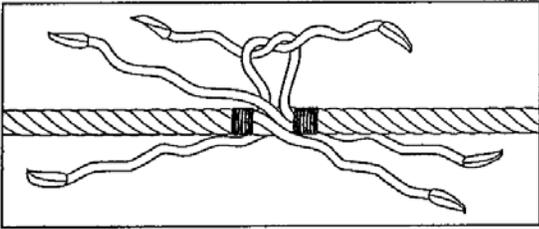
**3** Working with the three free strands, remove temporary seizing from around the other rope and splice the strands into it by tucking the loose strands over and under successive strands from right to left against the lay of the rope. When first tucks have been made, snug down all three strands. Then tuck two or three more times on that side.



**4** Next cut the temporary seizing of the other strands and the rope and repeat, splicing these three remaining strands into the opposite rope.



**5** This shows how the short splice would appear if not tapered, after trimming off the ends of strands. Never cut the ends too close; otherwise when a heavy strain is put on the rope, the last tuck tends to work out.



An alternative to the short splice technique shown in Steps 1 through 5, which some find easier, is to start as in Step 1, and tie pairs of strands from opposite ends in an overhand knot. This, in effect, makes the first tuck.

is obviously thicker. A short splice, therefore, won't go through a block of the correct size for the diameter of the line. A long splice is the solution—part of each strand is taken out and the tapered result makes a thin splice (with less strength). Most boat owners, however, will replace a broken line rather than splice it.

### Making an eye splice

Although the short splice is the easiest to learn, an eye splice is much more often needed. The same principle—interweaving—applies, but there is one point where an error is easily made. Refer to the illustration below when following the instructions given here.

Start the eye splice by unlaying the strands of the free end six to ten turns of lay. Now tape or heat-seal the end of each strand to prevent it unlaying while being handled; whipping can be applied to the strand ends, but this action is rarely done as this is only a temporary intermediate action if the ends are to be tapered. It is sometimes helpful to place tape around the unlayed strands every four to six inches to help the "turn" in the strand.

Next form a loop in the rope by laying the end back along the standing part. Hold the standing part away from you in the left hand, loop toward you. The unlayed end can be worked with the right hand.

The size of loop is determined by the point x where the opened strands are first tucked under the standing part of the rope. If the splice is being made around a thimble, the rope is laid snugly in the thimble groove and point x will be at the tapered end of the thimble. The rope may be temporarily taped or tied to the thimble until the job is finished. Now lay the three opened strands across the standing part as shown in illustration A, so that the center strand "b" lies over and direct-

ly along the standing part. Left-hand strand "a" leads off to the left, right-hand strand "c" to the right of the standing part.

Tucking of strand ends "a," "b" and "c" under the three strands of the standing part is the next step. Get this right and the rest is easy.

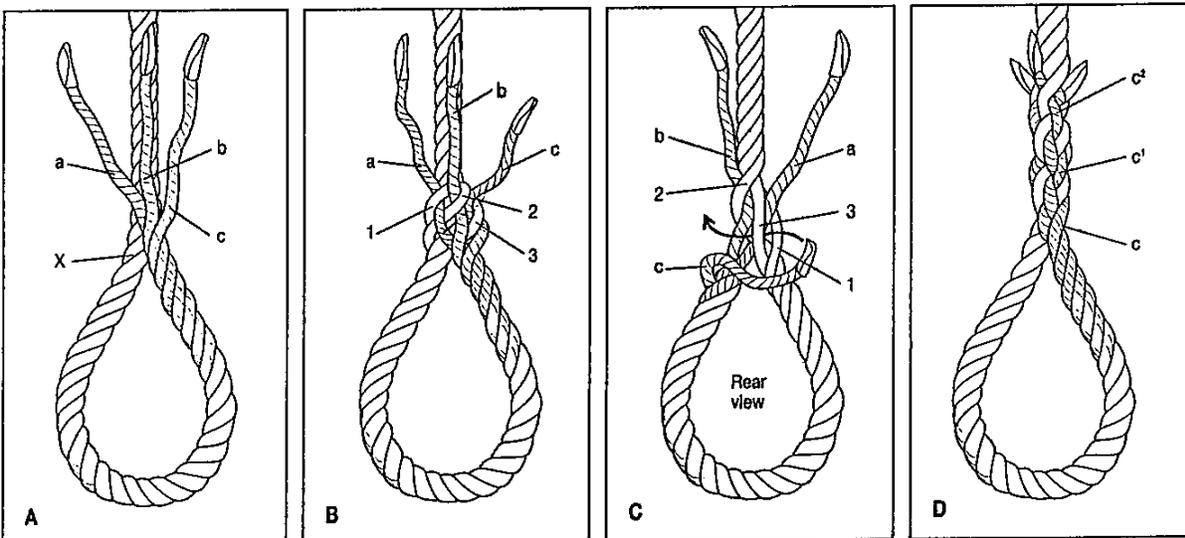
Always start with the center strand "b." Select the top-most strand (2) of the standing part near point x and tuck "b" under it. Haul it up snug but not so tight as to distort the natural lay of all strands. Note that the tuck is made from right to left, against the lay of the standing part.

Now take left-hand strand "a" and tuck under strand (1) which lies to the left of strand (2). Similarly, take strand "c" and tuck under strand (3), which lies to the right of strand (2). Be sure to tuck from right to left in every case.

The greatest risk of starting wrong is in the process of making the first tuck of strand "c." It should go under (3) from right to left and look like the drawing. The way you do it is to flop the whole thing over in your hands before making the tuck of strand "c." You'll notice that only one free strand "c" is untucked, and that only one of the original strands (3) in the standing part doesn't have a strand under it. Be certain that you make the third tuck in the right direction.

If the first tuck of each of strands "a," "b" and "c" has been correctly made, the splice at this point will look as shown in illustration B.

The splice is completed by making at least four full tucks in synthetic line with each of strands "a," "b" and "c." As each added tuck is made be sure it passes over one strand of the standing part, then under the strand next above it, and so on, the tucked strand running against the lay of the strands of the standing part. This is clearly shown in illustration D, the completed splice. Note c, c' and c<sup>2</sup>, the same strand as it appears after successive tucks.



An eye splice forms a permanent loop in a line; it may be made around a thimble to guard against chafe (such as occurs on an anchor line), or around an eyelet as part of running rigging.

### Tips for better eye splices

- The splice can be made neater by tapering. This is done by cutting out part of the yarns from the tucking strands before the finishing tucks. In any case, the first three or four tucks are made with the full strands. After that, some prefer to cut out a third of the yarns, and make the last tuck. This produces an even taper. After the splice is finished, roll it on deck under foot to smooth it up. Then put a strain on it and finally cut off the projecting ends of the strands. Do not cut off the “tails” of synthetic rope too short.

The loose fibers may be fused with a hot knife (the blade heated over a flame) or a rope-cutting tool such as a soldering gun, but be careful *not* to melt the rope. Using an open flame around synthetic line is not recommended; in addition to preventing a fire hazard, this could melt the outer fibers, ruining that part of the rope.

- The eye splice is often made on a metal or plastic thimble. When used this way it is necessary to work the splice very tightly and it is almost always desirable to add a whipping, using a needle and waxed nylon twine or tape. Refer to instructions for whipping on page 291.

- Another way to make a synthetic rope splice tight is to place it in warm water so that the rope shrinks a bit.

- In all splicing, careful re-laying of the rope—so that every strand is under the same even tension—is important.

- Remember to insert the captive fitting in your splice before finalizing it. This is often forgotten during splicing steps, even by the experts.

### Back splice

One other splice is seen occasionally on boats: the back splice at the end of a line. This makes a good, neat finish to a line, but it has a major disadvantage: If you want to unreeve the line at the end of the season, or to replace it, the back splice won't go through the blocks. Refer to the illustration above, right. A well-made whipping, shown on page 291, makes an equally neat finish. You can tie a figure-eight or Ashley stopper knot to keep the end from going through the block when you don't want it to.

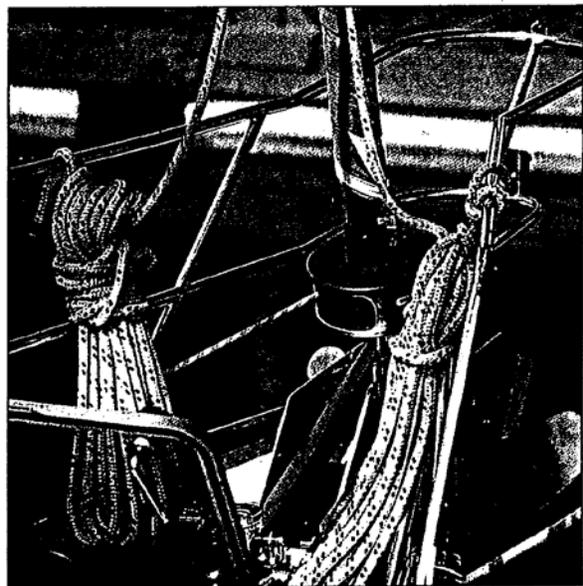
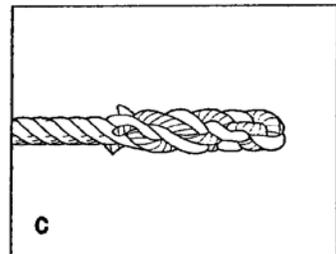
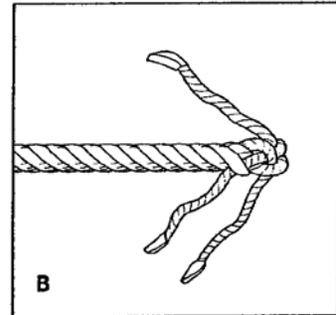
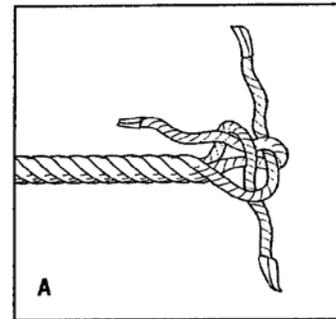
### Double-braided

An eye splice in double-braid looks difficult—but is relatively simple to learn. The technique has almost nothing to do with other kinds of splicing—it is just a logical way to use the cover and core of the braided line, since both are hollow. A thimble can be inserted during the splicing process.

### Wire rope

Splices in wire rope, best left to professionals, and wire-to-rope, surely left to professionals, use techniques somewhat similar to three-strand splices, but differing in details. There is an equivalent to the long splice in the three-strand line but it isn't worth doing unless you are stuck and, perhaps most importantly, very adept at splicing wire rope.

The back splice is started by bringing each strand over the one to its left, and under the next one, as in A. The strands are then tucked as shown in B, for at least three strands, C. Longer strands can be used, and trimmed in thirds to provide a tapered finish.



The way lines are handled, stored or dressed are an indication of the way the boat is generally cared for.

# WHIPPING

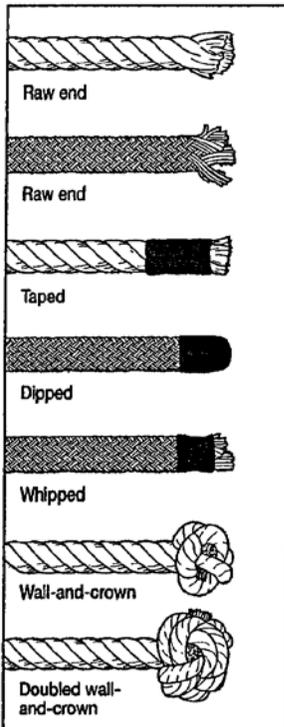
Cutting a line means that it starts to fray and unravel at the end. In order to protect the ends of your lines, you can use a hot knife to seal them. Ends can also be taped, wrapped with an adhesive tape or dipped in an air-drying liquid plastic. A sleeve of color-coded shrink tubing can even be heat formed around the end as a protective measure.

Whipping is the proper and traditional way to protect ends. This is done by tightly winding small stuff or lacing twine around the line. The width of the whipping should approximate the diameter of the rope. Two whippings, a short distance apart, would be best; one near the rope end, and the second one a few rope diameters farther up.

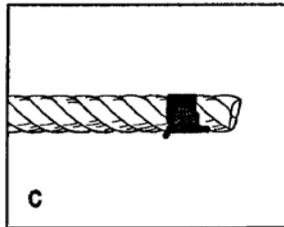
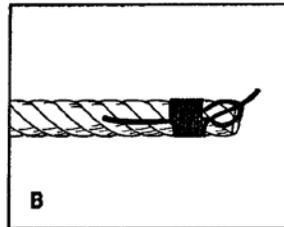
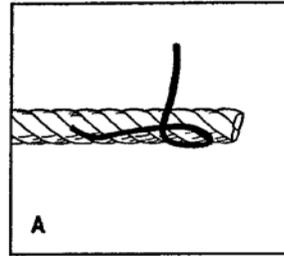
The plain whipping, shown at right, is more easily accomplished, but may undo itself over time. It can be easily done and does not require a needle. The sailmaker's whipping, illustrated below, is ultimately far better, but it requires a palm and a sailmaker's needle, in addition to the cord or lacing twine. This whipping will last longer, as well as look better, than the plain whipping.

Another way to make a good-looking end for a line—provided it doesn't have to go through a block—is the back splice. This splice, shown on page 289, can be created by using either three-strand or braided line.

Two fancier rope ends, from the many that are available, are illustrated below, without instructions. The boater can learn to make them—or many of the other ornamental and useful knots and rope work—in any of several advanced books on marlinespike seamanship.

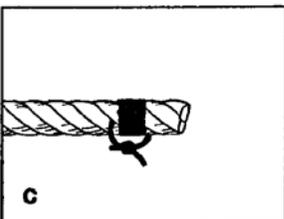
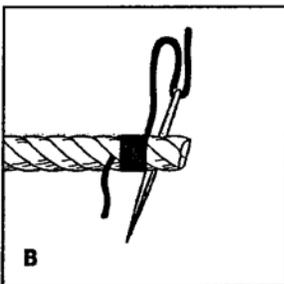
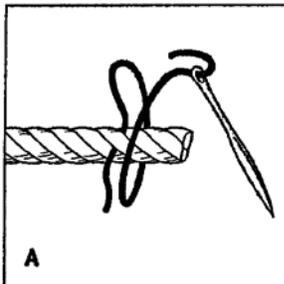


Ends of a three-strand or braided line can be taped, dipped in a sealer or whipped to prevent unlaying. Also shown is the wall-and-crown, a good-looking finish that combines two simple knots, and the manrope knot—a doubled wall-and-crown.



To make a plain whipping, begin at least an inch from the bitter end. Lay a loop of cord across the rope, leaving a tail of 5 or 6 inches on the bitter end (A). Then with the working piece of cord, wrap around the rope from the tail end toward the apex of the loop (B).

To finish off the whipping, insert the working end of the cord through the loop. Pull on the bitter end until the loop slides completely out of sight, and then clip the ends closely (C).



Sailmaker's whipping is started by stitching the cord through the line (A). Wind six or more turns around the line (B), and stitch back through it. Then bring the cord back over the turns along a groove between strands. Stitch through a strand to the next groove, and bring the cord back along this. Stitch through the next strand to the final groove (C), and finish with a square knot in the cord.

## MOST-USED KNOTS ABOARD RECREATIONAL BOATS

The recreational craft skipper does not need to have a large repertoire of knots, but the ones shown here are basic. Boaters should be familiar with them in detail, even to being able to tie them in the dark.



**FIGURE-EIGHT KNOT**  
With one more turn into the overhand knot you have a stopper knot, to keep the end of a line from running through a block or small grommet. Easy to untie.



**OVERHAND KNOT**  
Shown here chiefly because it's simple, and helps explain the figure-eight knot shown at left. Use it sparingly; it's almost impossible to untie after it is tightened. (It is useful to hold the end of a winch line on a trailer hitch.)



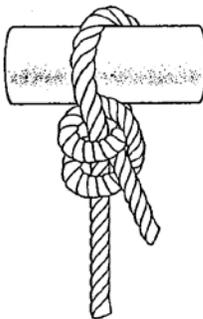
**GRANNY**  
This is a knot that too many people tie automatically when they are trying to tie a square knot. They should teach their fingers to go the other way, because the granny is a useless knot. Sometimes it slips, sometimes it jams. It has no value at all on a boat.



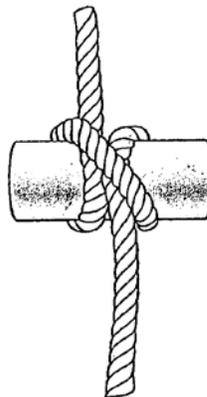
**BOWLINE**  
This is the most useful of all knots aboard a boat. Once learned (and practice is necessary) it is easy to make, never slips or jams, and can always be untied. Two bowlines, one on each line, are an excellent combination when you need to tie two lines together.



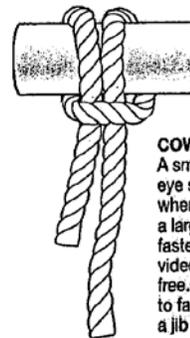
**REEF KNOT OR SQUARE KNOT**  
If you are tying a bundle, this knot works; note that the two bitter ends are on the same side of the standing parts. If the line is under constant pressure, and if both ends are the same size, it can still be untied. If it is made with a strip of canvas or webbing, as in using gaskets to furl a sail, it is a useful knot and easily untied even when wet. If it is used to tie two lines together, to make a longer line, it is a mistake. Use the reef knot sparingly.



**TWO HALF-HITCHES**  
For fastening a line to something else, such as a grommet in the corner of an awning. Quick and easy, but for many special purposes there are better knots you will prefer. A single half-hitch also has some special uses.



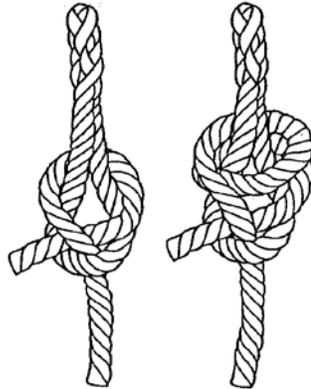
**CLOVE HITCH**  
Commonly used to tie a line to a piling. This is often a mistake. Although very adjustable, it tends to slip, especially with slippery nylon line. It is best to take an extra half-hitch (or two half-hitches) to make it secure. If you use the same line from the bow to a piling, and then to the stern, the clove hitch is ideal. Both ends are taut and you have the adjustable feature.



**COW HITCH OR LARK'S HEAD**  
A small existing loop (usually an eye splice) turned inside itself when you want to fasten a line to a large piling. It is also useful to fasten such a loop to a ring, provided the other end of the line is free. Many people use this hitch to fasten a jib sheet to the clew of a jib on a small sailboat.



**SHEET BEND**  
This is an excellent way to tie two lines together, especially if they are of different sizes or textures. As you will realize when you practice tying knots, some are just variations on a theme. You can use part of a sheet bend to fasten onto a loop.



**BECKET HITCH**  
This is really a sheet bend, in which one line has a loop such as an eye splice or bowline. If an extra round turn is taken (near left), this is called a double becket hitch. This version is especially useful when the added-on line is smaller than the one with the loop.



**SLIPPERY REEF KNOT**  
Half a square bow-knot. Good for furling a sail. This is always easier to untie than a square knot.

**CARRICK BEND**

This is one of the traditional ways to fasten two lines of the same size together. It looks beautiful in a drawing, but under strain it changes appearance. The carrick bend is probably best for fairly heavy, stiff lines of the same size.



**BUNTLINE HITCH**  
This is excellent for fastening a halyard to a shackle. It is its own stopper knot and won't jam in a block as an eye splice might. Sometimes called the "inside clove hitch," or the "studding sail tack bend," this is easy to tie and untie. Another use is on a trailer winch snap shackle—a modern use for a hitch from square-rigger days.



**ANCHOR BEND**  
Also called fisherman's bend. This is a standard way to fasten an anchor line to the ring of an anchor. It is excellent for making up a spare anchor, and it can be used in many other situations. The double loop reduces possible chafe and makes the half-hitches more secure. Of course there are other ways to make an anchor line fast, including a bowline or an eye splice over a thimble, plus a shackle. Seizing the free end of the standing end gives extra security.



**ROLLING HITCH**  
To tie a small line to the standing part of a larger one, so it won't slip, use the rolling hitch. You can use this hitch to hold a jib sheet while riding turns are removed from a winch, to haul on any line, or to make an adjustable loop for an awning tie-down. The rolling hitch is also used to attach a line to a round wooden or metal object with the least possibility of slipping sideways. It will hold best when a second rolling hitch is made with the free end. It is also very useful for making a fender line fast to a lifeline or rail.

**Protocol Revision History Log**

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Revision Date	Changes made	New version #
April 2017	Renumbered protocol from #28 to #26	1.3
April 2015	Revised data analysis section and added figure showing export setting specifications from HOBOWare	1.2
April 2014	Changed font to Arial, added revision history log, replaced revision date with version # on first page, added protocol # to first page, changed page number format to include protocol #	1.1
May 2013	Protocol developed in standardized format from historic protocols	1.0

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