Knot News

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Capstan Knot Capers

by Pieter van de Griend

> [The Capstan Knot] *is an application of the Figure-of-Eight Knot. It is unreliable, except for very light work or for temporary fastening.*
>
> Graumont & Hensel, 1939.

Prologue

Towards the end of the previous century Dan Lehman launched the ELFEK-acronym, being the concatenation of the first letters abbreviating the mouthful "Empirically Less Frequent Encountered Knot Structure". Note that, strictly going by this description, the vast majority of all knotted structures in our universe are ELFEK. Obviously something else is intended. Imagine the set of all knotted structures registered in the global knotting literature. As this set actually exists, you can apply a number to how often each knot structure type occurs. For a multitude of reasons certain of these recorded knotted structures infrequently make it into the literature. Those will be our ELFEKs.

The Capstan Knot is an element in a ubiquitous, yet remarkably weird set of ELFEKs. This sizable capsizing loop knot entered the knotting literature for no apparent reason. It first showed up in print 140 years ago and managed propagation up to this date. Even more remarkable is the fact that it is not alone. There exist a number of such structures in the global knotting literature. In a string of articles I want to introduce you to a bunch of these characters and sketch the outlines of an emerging picture.

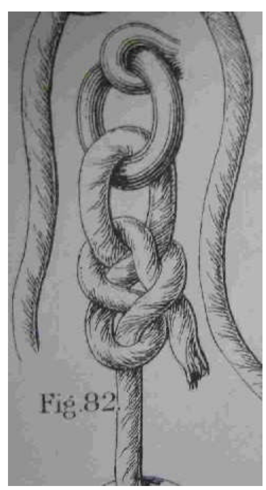
For those who do not know what a capstan is, I downloaded the following dictionary definition from the internet.

Capstan: An apparatus used for hoisting weights, consisting of a vertical spool-shaped cylinder that is rotated manually or by machine and around which a cable is wound.

Now, why should such an apparatus require sizable capsizable loop knots?

Early Sources

The Capstan Knot's name and structure, given below, seemingly owe their first recording to Tom Bowling's 1866 *Book of Knots* [5, p11, pl.1, fig.82]. In his monumental compendium Clifford Ashley acknowledges Bowling's priority [2, p308, #1831], but did not mention our ELFEK in his *Seastories Magazine* articles of 1925 [1].



It is interesting to note that other early sources, such as Joseph Burgess in 1884 [6, pp67, fig. 124] show the knot and Tyrrel Biddle around 1879 [4] do not; presumably because these gentlemen approached knots from different angles. Paul Hasluck shows it, on and off, in the various editions his books have gone through [13, p37].

As we shall see, there is no doubt that Herefordshireman Henry North Grant Bushby [7] (**HNGB**) knew the Capstan Knot structure, as he experimented with it from approximately 1902 onwards. So did the Swede Hjalmar Öhrvall in the following decennium. Öhrvall first gives the Capstan Knot structure in 1908 [16, p29]. Later he elaborates on tying methods and applications of its structure [17, p74].

Early Statements

The Capstan Knot name's origin is a veritable mystery. Clifford Ashley suggests Bowling's material was abstracted from a French manuscript [2, p11]. In French there is the *Nœud de Cabestan*, but that is not a Capstan Knot as we are discussing it here. *Nœud de Cabestan* is generally illustrated as the Clove Hitch (with or without an additional Half Hitch).

Karin Huet, who translated ABOK into French, carefully skirts the issue altogether and refrains from naming the Capstan Knot [3, p308, #1831]. Doing so she leaves the Capstan Knot a nameless structure in the French language! Considering there exist countless other lousy translations in the Land of Knot Names, the Capstan Knot Structure may be just another unsuspecting and innocent victim. As will become clear, the French connection remains fascinating. Öhrvall has a listing of international knot names [17, pp254-257]. Alas, for the Capstan Knot there is no entry. We may assume that the frequently encountered *gångspelsknut* found in most Nordic languages, originates from Öhrvall's translation of Bowling's Capstan Knot [9, p90, fig.88].

One of the luring aspects behind the Capstan Knot structure is that it invites capsizing. Although it is intuitively clear what this means, I find the term inadequate. Other words such as flipping, deforming, molding or changing, are useless too for our purposes. In mathematical terminology this capsizing kind of action is generally called the **isotoping** of a structure. It means "changing without modifying topological properties". In the following I occasionally use it. It is about the most generic term to be found to cover our need.

Non-trivial aspects of the Capstan Knot structure were first published by the Swede Hjalmar Öhrvall. In the second edition of his *Om Knutar* he elaborates his sharp observations on our ELFEK [17, p73, figs.69-72]. He notes that the Capstan Knot structure's operation depends on capsizing actions, but despite the suggestion that it is intended for hawsers and capstans, it works better for light materials. Ever wondered why people care to believe this capsizing heavy hawser stuff? It is evident that thin material can readily be worked into shape by isotoping it, but more substantial media are less accommodating. Of course topological principles and laws of physics, governing our universe, will cause the loaded structure to obey. However, you should try playing this trick with a screeching 5 inch diameter hawser bellowing steam and dust at you. Something tells you this capsizing business is unlikely. The forces involved are certainly not going to allow you to leisurely pull the working end (**wend**) to spill the knot. The monstrous forces are more apt to work the other way around, maiming you. Equally remarkable is the observation that none of the early sources speak of the Capstan Knot's applicability to thick hawsers [10, p19, pl.3, fig.69], [17, p73]. Somehow the capsizing business smacks of the so-called Panama Bowline Story. In merchant naval circles it goes that the boatmen of the Panama Canal use isotopy to create Bowlines by capsizing Nooses [2, #43]. If the wend is left a light year-long it might work, but otherwise I have my doubts. Unfortunately I have no reference associating this tying method with the Panama Canal, but do know of at least two sources referring to this tying method [2, p186, #1014], [10, p480, pl.261, fig.191].

So, with early sources sailing Bowling's wake and early statements not being very convincing, where did the Capstan Knot really come from? And why is it so persistent in the literature? What else is going on? In order to attempt an answer to those questions we will need some tools and definitions.

Proximities

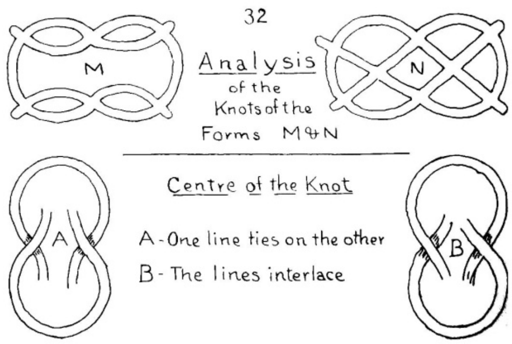
Knotters fiddling about with their piece of string are often triggered into following a train of knot structures, which are interrelated in an ad hoc manner. This exercise, also known as trambling, somewhat randomly leads one along structures, which are related in some way or other. I want to call these types of relatedness, or "reminiscence", **proximity** (nearness). Over time I have come to identify three types of proximities. Here I hope to show that proximities are facts of all knotters' everyday life.

The first type of proximity is well-known. Ashley has an interesting statement about a knot never being approximately right [2, #77-79], but certain structures may appear so identical that confusion arises. Getting one or more crossings wrong from direct observation, or perhaps from an inferior sketch, may lead to a mutant knot during replication.

Shadows, knot projections devoid of all crossing information, comprise the basis of structural proximities.

Shadow-based reproduction of any knot is tricky as very different knots may project into identical shadows.

In 1924 the various flavors of Carrick Bendish and Reef Knottish like objects have been addressed by George Shaw in his *"Analysis of Knots of Forms M & N"* [14, p32].

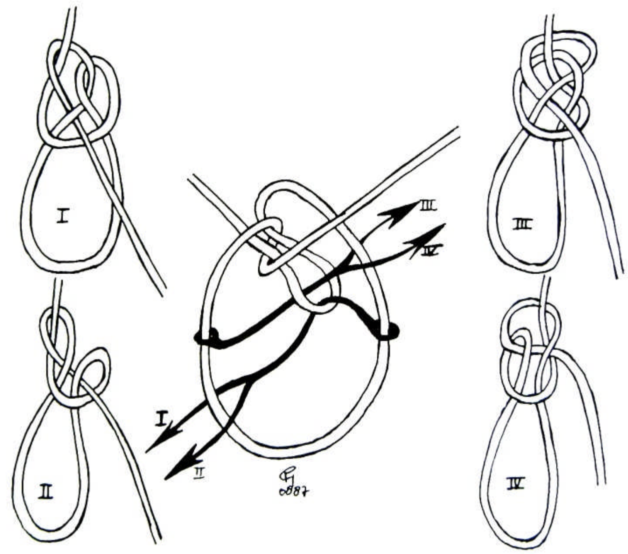


The Carrick Bend types are also sketchily documented by Clifford Ashley, preceded by a truly remarkable statement [2, p262, #1440]. I propose to call this phenomenon between structurally related knots **structural proximity**.

Less explored is the second type of proximity, probably because it is more abstract. Fact is that tying methods, also known as algorithms, can be "close", or "related". For a copying error to creep in, assume the first steps in tying methods to be identical. After a specified point divergence kicks in. Algorithmic proximity thus requires a start configuration after which the subsequent paths branch. I want to call this **algorithmic proximity**.

Clifford Ashley has some scattered examples of algorithmic proximity [2, #1055-56].

Another somewhat arbitrary example is given below. Here a well-known start configuration is shown to result in four otherwise apparently unrelated loop knots on the bight.

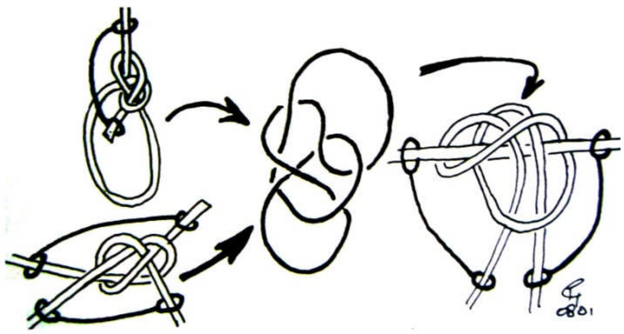


Reversing tying methods of any knot, i.e. *untying* it, is an excellent way to unveil scores of algorithmic proximities.

These examples allow us interesting observations. Foremost being that structure and ways to obtain it, are up for variation. Structure recognition by the human brain enables us to detect these links quite easily. Harder to find are the third and final types of proximity.

Another area for variation is the so-called functionality attributed to a structure. The application, to which a knotted structure is put, depends on how loading of the "operational part" of its knotted heart takes place. This knotted core is also known as a **tangle** [8]. For our purposes a tangle may have any even number of emanating strands, but will usually have 4 here. Assigning a load configuration to the emanating strands can mimic functionality. In our model we assume only **H**itch, **B**end and **L**oop Knot functionality. We shall not discern any others.

The Bowline is often presented and accepted as a loop knot. What happens when you start changing its core's functionality? It appears that bend-wise it is related to the Sheet Bend and hitch-wise it is related to the Pile Hitch. Numerous knot authors have noted this [7], [11, pp47-56], [15, pp204-206].



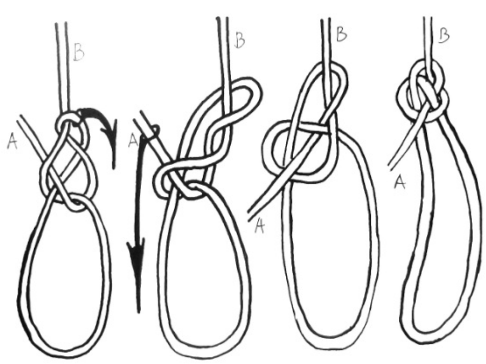
I propose to call this third type of relational nearness **applicational proximity**.

What can we use all this machinery for? Proximities are useful in explaining how ELFEKS come into being by considering well-established knots' structures and algorithms. Proximities are a modestly systematic mechanism for generating knot structures.

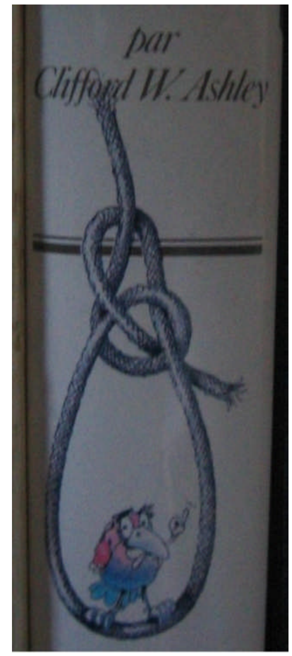
Capstan Knot structural proximities

The Capstan Knot has a number of stable configurations. The lockable one generally presented in the literature and another publicity-shunning version.

In terms of structural proximity, the Capstan Knot is closely related to the Bowline. As shown below, the Capstan Knot can be deformed into a form whose shadow and that of the Bowline are identical.



On a sideline, this Bowline shadow equivalent structure tantalizingly features on the French translation of ABOK's dustcover [3]. Surely there must be deeper grounds to this mystery appearance. Is our analogue of the DaVinci Code rearing its head here?

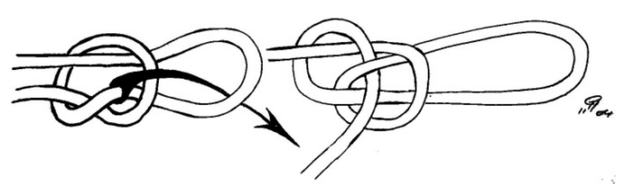


The Capstan Knot is thus structurally proximate to the Bowline due to its shadow. Shadow equivalence is the worst case structural proximity flavor allowing for rigorous topological modification of the structure. In general, so does algorithmic proximity. Applicational proximity, on the other hand, usually ensures a large degree of topological invariance of the structure.

Capstan Knot algorithmic proximities

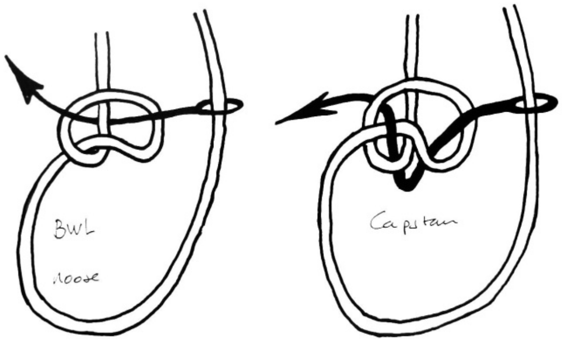
Hjalmar Öhrvall was among the first to publish results on algorithmic proximial experiments [17, pp71-72]. Henry Bushby bequeathed us numerous examples in his works [7], but he never published them [12].

Öhrvall exemplifies 5 different loop knots on the bight derivable from a Slipped Overhand Knot on the Bight. Interesting for our discussion is only his fifth path. It is illustrated below.

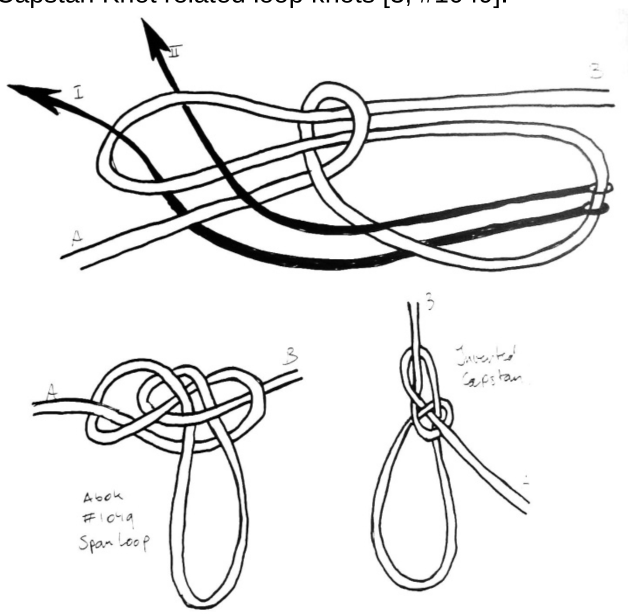


By this action, Hjalmar Öhrvall suddenly conjures the Capstan Knot as a loop knot on the bight!

We have just shown structural proximity between the Bowline and the Capstan Knot. The Bowline can be obtained from the spilling of a Noose [2, 43] threaded with it's wend. It would be interesting to see which structure must be spilled to obtain the Capstan Knot. The algorithmic proximity in that direction is given below. As Öhrvall showed, the Capstan is a loop knot on the bight type of knot. The Bowline is not. Try and determine where the algorithms below must (!) differ.



As can be expected most loop knots on the bight will have many ways of tying. The bell ringer configuration yields another unexpected set of Capstan Knot related loop knots [3, #1049].

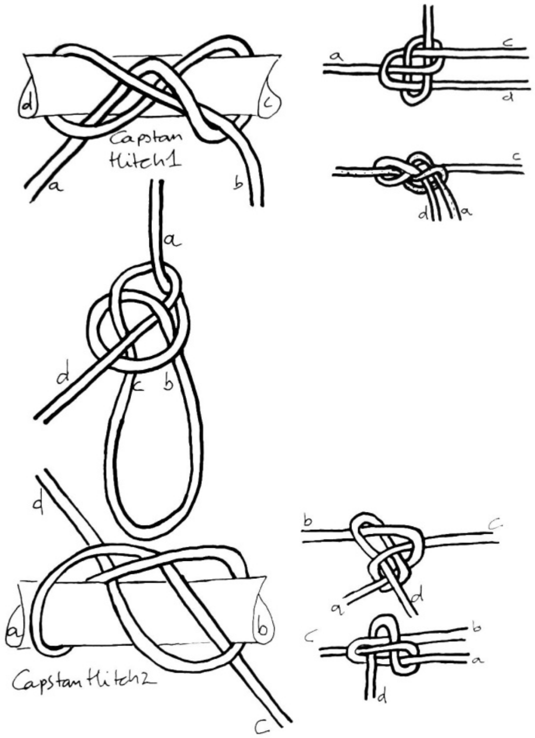


These results, from algorithmic proximity, show that the Capstan Knot structure turns out to have some well-known relatives, depending on the chosen starting configuration, of course.

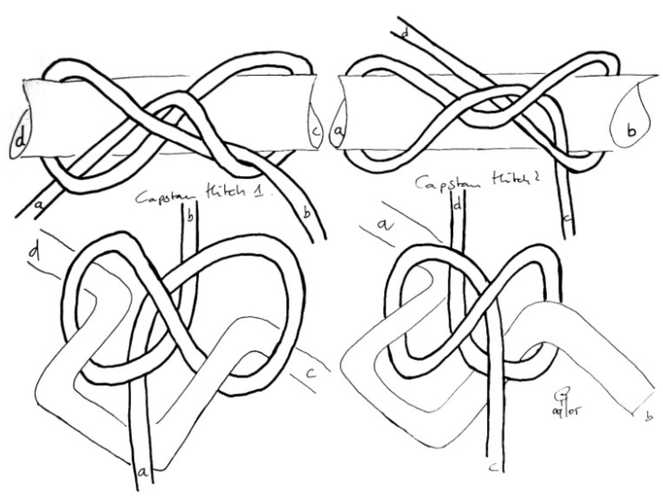
Capstan Knot applicational proximities

Not only does good old Hjalmar illustrate the usefulness of structural and algorithmic proximial thinking. He extends it by switching functionality. Of course he was the first in print again to note that the Capstan Loop knot must lead to an interesting bend [17, p74]. However, he did not care to illustrate this find. Moreover, his observation is incomplete.

So, what does the complete picture look like? There are four bends and two interchangeable hitches. It can easily be proved that only they can resort from operating on the Capstan Loop Knot. Below we present an overview, illustrating all options.



Henry Bushby, like Hjalmar Öhrvall, must have played around extensively with the Capstan Knot. He also found these functional proximities, but only circumstantial evidence of his results is known to this author. He certainly did know of both Capstan Hitches, derivable from the Capstan Loop Knot. They are shown below.



Some study of the Capstan Hitches shows they are deformed Constrictors. In the bottom row of the image above you can see how both Capstan Hitches can be obtained by tying a Constrictor around a so-called "buckled spar". Problems with applicational proximity arise in the Capstan Bends. Depending on how they are loaded, capsizing may or may not take place. In general all Capstan Bends need considerable dressing to result in any form of reliable connection.

Epilogue

In this article we have seen the Capstan Knot fall out of the blue sky and piggyback a ride into contemporary knotting literature. We investigated some of the many intersections at which its relatives reside by exploiting three types of proximity. We showed that the Capstan Knot Structure can be linked to other famous structures by means of them. In the next installment of these articles on early sources and statements we will meet another uncommon structure.

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Stiphout June 2005.

From the Treasurer

The annual dues drive has been a disappointment with half of the membership who were solicited not responding. Maybe it's a sign of the economic times? This is something I can understand and have no control over. Are you unhappy with the value received with the Branch membership? This is something I can deal with if I can learn what people would like to see changed, added or done differently.

Here is how the Membership Roll looks for 2006:

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John Williams

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Ronald Hacker

Nevada

Dean Cole

South Carolina

E.J. "Skip" Dickens

Washington

Richard Gehring
Robert Leggate
Brad Peterson
Bob Schwartz

US Navy

Gene Smith

I am sending this newsletter out to these members in a last attempt to lure them back into the fold. The bad news is that the Guild in England has increased their dues to £23 a year starting January 1st, 2006. With the exchange rate this works out to US$40. Branch Membership dues remain the same for now at $15, so the total combined cost for the Guild and the PAB is now $55. Yes, this is a lot of money but I am hoping that you will consider carrying on with us for another year or (at least) give a reason why.
A full Membership List is always available to all members upon request.

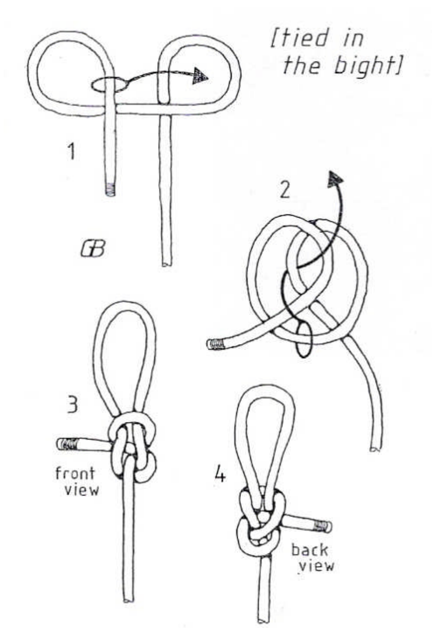
The Angler's Loop

by Geoffrey Budworth

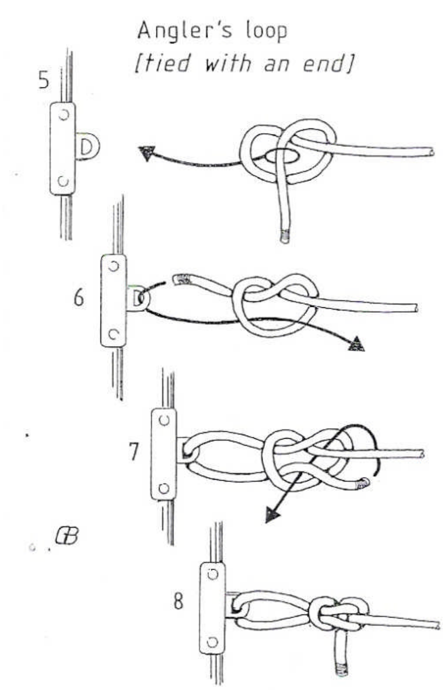
Prelude

This robust knot is more reliable and versatile than a bowline. In 1985 some of us circumnavigated the Isle of Wight off the English south coast in kayaks and, prior to launching, we had to rig criss-cross deck elastics to hold charts, compasses, snacks, drinks and other necessities within easy reach. Our leader advised us that it was impossible to tie such stretchy stuff and issued a roll of self-amalgamating tape for the task.
Concerned for my "Fidspike" reputation, I tried a bowline, a water bowline and a round turn bowline (ABOK #'s 1010, 1012 and 1013), all of which, as predicted, spilled and came undone… but my fourth selection, the angler's loop, held perfectly. I even contrived port and starboard versions, so that all the ends were streamlined to point aft. During three days afloat, repeatedly sloshed by waves, then dried by wind and sun, the knots did not yield a fraction of an inch; but they untied readily enough back on shore.

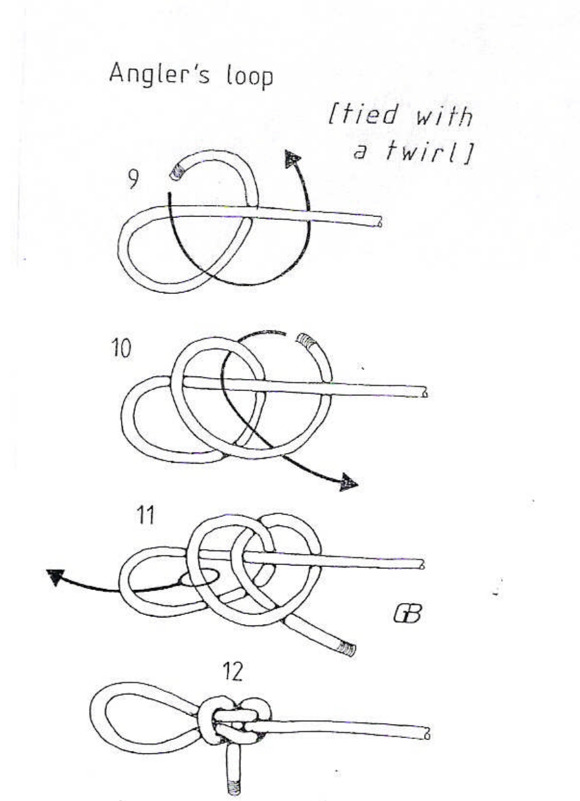
Method 1 – tied in the bight.
The angler's loop can be tied in the bight (fig. 1, 2, 3, 4), which is no doubt why Graumont & Hensel labeled it '*a single bowline in the bight'*.



Method 2 – tied with an end.
To attach the loop directly to a ring or other item of hardware, as I did on my kayak, tie it with an end as shown (fig 5, 6, 7, 8).



Method 3 – tied with a twirl.
Alternatively twirl the working end around the standing part a couple of times, before pulling through the loop. I once saw this slick bit of manipulation done synchronized to music by a chorus of Englishman at a Christmas social gathering of the IGKT Surrey Branch.



Summary

The angler's loop may date from the days of horsehair and gut fishing lines, but the earliest appearance of this knot in print that I have seen is 1933 (*Knots Useful and Ornamental* by George Russell Shaw, a reprint of the original 1924 edition published in New York). Back in Europe, Sam Svensson in 1940 (*Handbok I Sjömansarbete*) mentions it as '*… an attractive hitch… never heard a name for it… for medium size rope.'* Ashley (1944) asserts however *'… it jams and is not suitable for rope.'* Maybe so in his day. Now it has been abandoned by anglers but adopted by rope workers who find it ideal for modern synthetic cordage.