"If you cannot measure it, if you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

Lord Kelvin

THE
COMMON CENTS SYSTEM

BY
DR. WILLIAM HANNEMAN

A New Approach For Defining and Objectively Measuring, By Relative Means, Rod Action and Power.

NOTICE

What follows comprises the nuts and bolts of the Common Cents System (CCS). If you take the time to read only one installment of the following series of articles, this is the article that lays the foundation upon which the entire system is built.

The system itself is quick and easy to use requiring only a couple minutes per rod. This article, however explains more than just how to use it - it explains why it is needed, why you should use it and why it works as it does.

How to accurately determine the proper casting or line weight for any blank.

How to define and rate any blank's action, power and strength.

How to determine how trimming will affect a blank - before the cut is made.

The Common Cents System

by William "Dr. Bill" Hanneman

One's first fly rod is just a start and you adapt your casting style to accommodate it. However, if your fly fishing experiences are rewarding, you undoubtedly will purchase a second rod.

By then, you are aware of your needs, wants, and how your outfit feels. Whether you want a heavier or lighter rod, a stronger or weaker rod, a longer or shorter rod, or a rod with faster or slower action, these properties are defined relative to your original rod. Consequently, your need for a means of characterizing and comparing your present rod with your next rod is obvious.

Few buyers actually care what a rod is made from, or how it was made, or even who made it, until first they are assured it will supply the right feel. Although this right feel is a subjective decision, it is derived from both the rod's power and its action.

Rod Action

The action of a fly rod is independent of its material of construction. Consequently, contrary to popular belief, the term, "fast action bamboo rod," is not an oxymoron. The action of a fly rod depends upon its method of construction - its taper - the relative strengths of the butt, middle, and tip regions of the rod blank.

Currently, action is described in terms of the flexing of these rod regions. A simple way of simulating these actions is to use a common playing card. Grasp the card successively near the bottom, in the middle, and near the top, and flex the top of the card with your thumb. This simulates progressively increasing the rod strength from the butt upwards.

When held closest to the bottom, the least force will be required to flex the card; the card snaps back slower; and the sound produced on releasing it will be of a lower tone.

Holding the card progressively towards the top, the force required to bend it increases; the speed of the snap-back is faster; and the pitch of the sound on release rises.

If significant flexing occurs all the way through the butt region, a rod's action is considered slow. If flexing occurs down to the middle region, the rod action is considered moderate. If flexing occurs primarily in the upper third, the rod action is considered moderate/fast; and if flexing occurs primarily in the upper quarter, the rod action is considered fast. These situations are often illustrated by figures similar to Figure 1. In this scheme, the operative word is primarily, as some diagrams do acknowledge the lower sections also flex to some degree, and as more and more load is applied, even a fast action rod will begin to flex more deeply into the mid and butt areas.
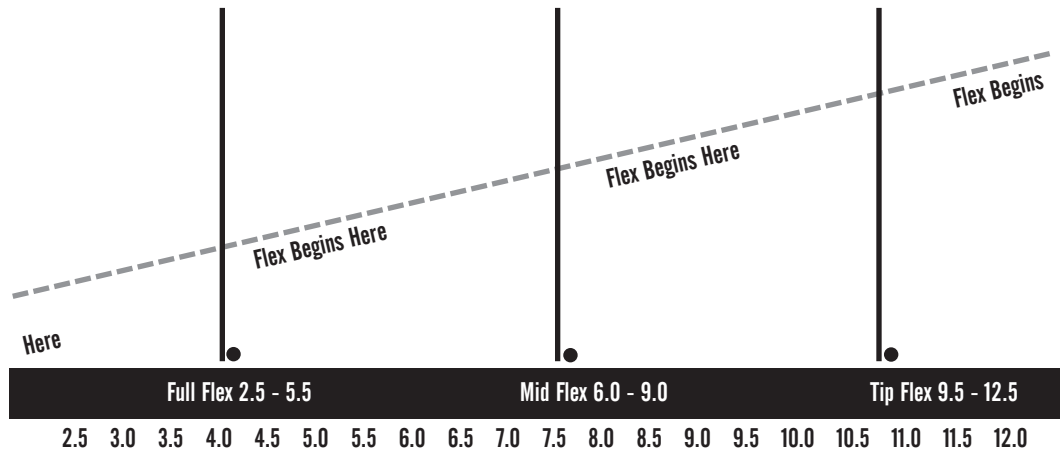
Flex Index

Recognizing an advantage to be gained by a numerical characterization of rod action, Orvis introduced their proprietary Flex Index concept. Their diagram, similar to Figure 2, consists of three tree-like figures representing Full, Mid, and Tip Flex. The numerical scale at the bottom is linear and can be related to the straight boundary line designating the points where flex begins. (From this, Orvis can calculate the Flex Index by first determining the % of length of the rod which does not flex [e.g., 29%], multiplying that value by the arbitrary slope factor [0.224] and rounding off to the nearest 0.5 value (e.g., 29 x 0.224=6.496=6.5.)

Orvis boasts of having spent two years and making thousands of measurements using electronic load cells to develop this numerical measurement. Actually, it is amazing they developed any numerical measurement at all. A single point where a straight rod begins to flex does not exist.

Figure 1

A. Fast Action
B. Moderate/Fast Action
C. Moderate Action

Figure 2

Flex Begins

Flex Begins Here

Flex Begins Here

Here

Full Flex 2.5 - 5.5	Mid Flex 6.0 - 9.0	Tip Flex 9.5 - 12.5

2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0

Since their nebulous flex point is both arbitrary and proprietary, one can not determine its position or calculate the Flex Index for one's present rod or for one of Orvis' competitors. This approach is neither simple nor amenable - at least as far as universal use is concerned. It is primarily a sales tool - a brilliant marketing tactic.

Action Angle

The Action Angle (AA) is a concept developed in the "Common Cents Approach to Characterizing Fly Rods," which will be thoroughly explained shortly. It is based on the following:

If one positions a rod in a horizontal position and, by adding weight, deflects the tip downwards, the the non-flexing tip top on the rod forms an angle which increases from zero towards 90 degrees. If one standardizes the deflection to equal one third of the rod's length, the angle formed by the tip top will have the following relationship to rod action.

Action Angle - degrees	Rod Action
below 59	Slow
59 - 63	Moderate
63 - 66	Moderate/Fast
above 66	Fast

Using this approach, one can characterize rod action on any and all fly rods in a simple manner which allows for direct comparisons of these rods.

Rod Power

The power of commercial fly rods and blanks is designated relative to AFTMA Line Numbers which increase directly with the weight of the lines. So too does the force (weight) required to fully load the rods corresponding to these lines. (By definition, a fully loaded rod has had its tip deflected a distance equal to one third of its length.) This weight is defined as the Intrinsic Power (IP) of that rod, and one can relate the IP to the weight of the line (30 ft.) which will fully load that rod. (The rationale for this will be presented later in this article.) These results are shown in Figure 3.

The IP and Fly Rod Advertising

Diagrams such as Figure 1 are frequently used by manufacturers to demonstrate the different actions of their rods and to indicate faster rods will produce longer casts.

Such diagrams imply all the rods are: 1 - of the same designated line number, 2 - subjected to the same loads, and 3 - showing markedly different deflections solely due to the different actions (taper designs).

Figure 3

DBI Fly Rod Line Coordinator
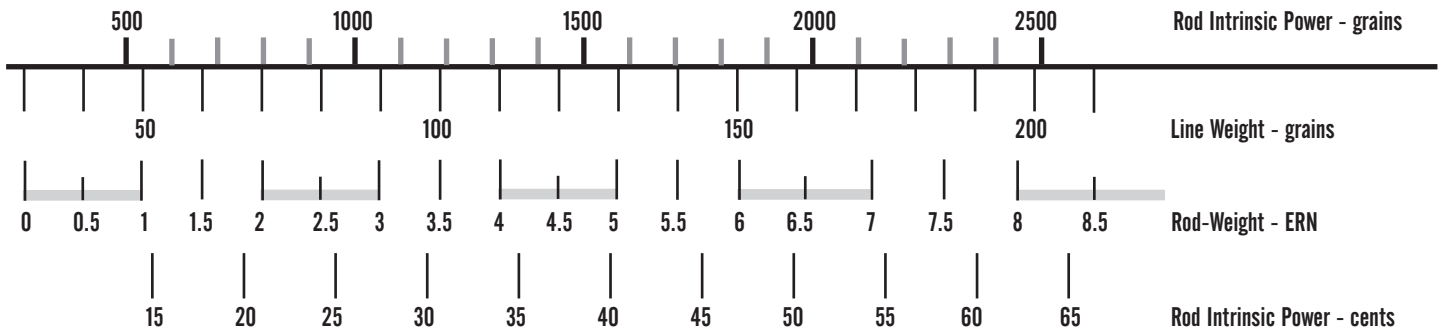
In truth, although they all may be of the same designated line number, their IP values are not all equal. Rods B and C do have the same IP but different actions. Adding additional line weight to these rods would overpower them. On the other hand, the fast action rod A is not fully loaded. This indicates a more powerful rod which could easily handle a heavier line or allow for increased casting speed without becoming overloaded.

The previous experiment with the playing card clearly indicated that if the butt section of a rod is progressively strengthened, the IP of that rod is increased and its action becomes faster. Such a rod should indeed cast a line further.

However, the unanswered question is, how much of that extra distance is due to the stronger rod and how much to the faster action? As things presently stand, Figure 1 and all similar types of rod advertising are simply comparisons of "apples and oranges."

If the Intrinsic Power (IP) and Action Index (AA) of fly rods were identified in their markings, they would be available to any concerned buyer; he could then make an educated decision based upon his subjective desires.

The Common Cents Approach – Characterizing Fly Rods

Suppose you have a client for a custom built nine foot, moderately-fast, 6-weight graphite rod. He believes he knows what he wants, but, does he really, or for that matter, do you?

Can you be certain the rod you build will meet his specifications? And, if the performance of that rod doesn't satisfy his expectations, how can you demonstrate, for your part, you did indeed meet his specifications.

Do you explain to him that since no one has ever defined exactly what a 6-weight rod is, there currently is no such animal? Do you tell him that since no one has ever defined how fast fast is, moderately-fast is merely a matter of subjective opinion? Do you tell him that the term moderately fast is not an literal measure of actual speed but rather a description of how the rod flexes - its "action" as we refer to it in rod building circles?

Do you tell him you can do no more than finish a rod blank which, in its designer opinion, appears moderately fast when used with a No. 6 fly line? Do you explain that the rod designer might have an entirely different casting style, different preferences, and his opinion might well not correspond to your client's expectations?
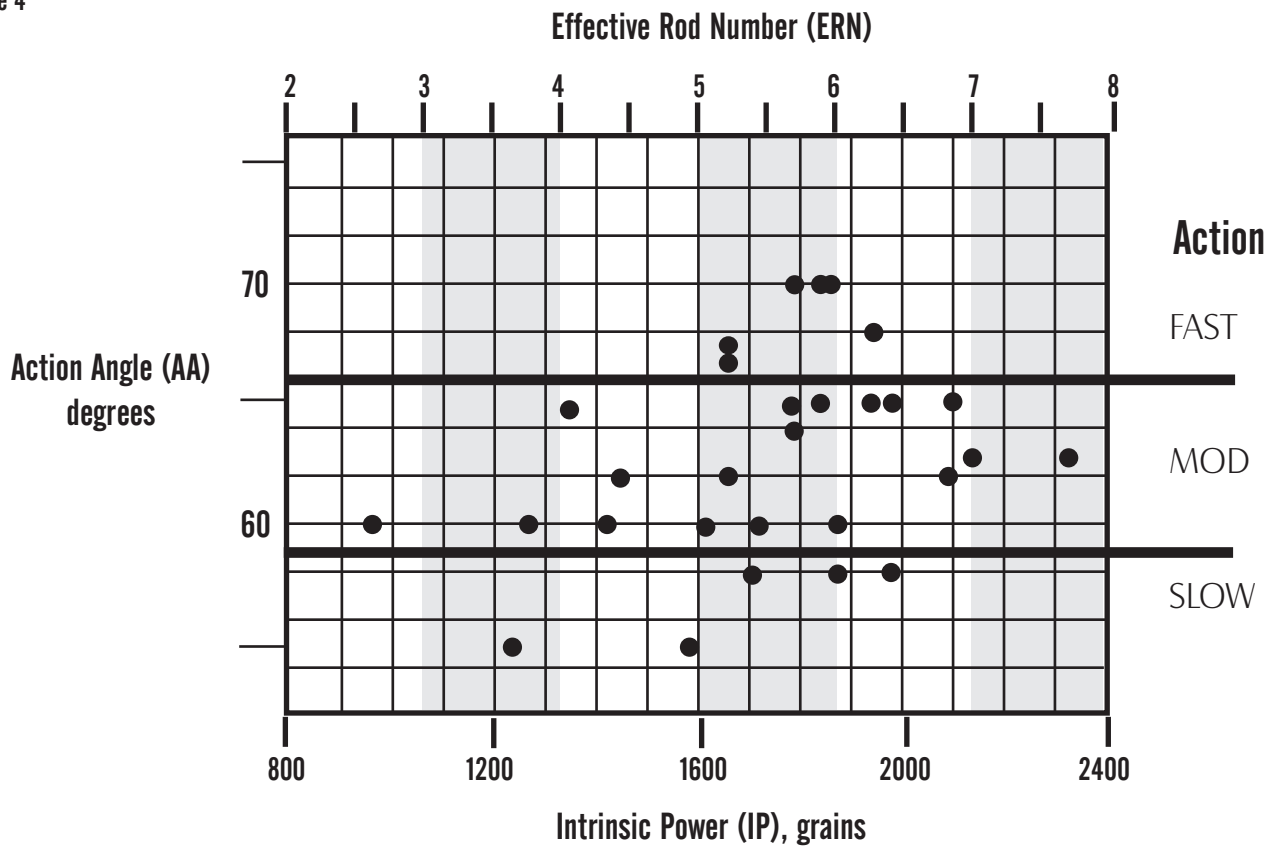
Today's rod builder can only purchase the blank he believes will meet his client's requirements and build the rod. When finished, the rod is what it is. If not what he hoped for, he has no recourse. No objective performance parameters were ever promised for that blank. This places the onus on the rod builder to choose the right blank in the first place.

This article demonstrates how to use a new technique, The Common Cents Approach to define the intrinsic power and action of any finished rod or blank. Figure 4 shows a plot relating these two properties for a number of fly rods designated for lines numbered from 2 to 6. The development of such knowledge can prove invaluable in comparing similar rods from different sources and/or checking the suitability of a rod blank for meeting specific specifications. In essence, it injects a needed bit of objective science into the art of rod building.

The Common Cents Approach

In practice, this involves attaching a lightweight bag to the tip of a horizontally fixed rod. Its power is determined from the number of one cent pieces added to the bag in

Figure 4

Effective Rod Number (ERN)

2   3   4   5   6   7   8

Action Angle (AA)
degrees

70

60

Action

FAST

MOD

SLOW

800   1200   1600   2000   2400

Intrinsic Power (IP), grains

order to deflect the tip downward a distance equal to one third of the rod's length. Rod action is defined by the angle formed by the deflected tip. (A full description of the development of this approach and detailed instructions for making the measurements will be provided in a moment.)

The basic premise is the intrinsic performance characteristics of any fly rod or blank can be usefully described using a term called the "Defined Bending Index" or DBI.

$$DBI = ERN / AA$$

where ERN represents the Effective Rod Number or power of the rod, and AA represents the rod Action Angle.

DBI Database Chart

Figure 5 illustrates the application of this approach to ten commercial fly rods designated "for No. 6 line." The power of each rod is plotted against its action. Inherent in this chart are the objective numerical definitions of what a 6-weight rod is and a measure of its action.

Every fly rod or fly rod blank will assume its unique position within such a chart, as defined by its ERN and its AA. The upper right hand corner of the chart represents the most powerful and fastest action rods. The lower left hand corner represents the weakest and slowest action rods.

1. As the intrinsic power of the rod expressed as Effective Rod Numbers (ERN) increases, the horizontal value increases.

2. As the action, measured by the rod tip Action Angle (AA) increases, the vertical value increases.

Rods are simply objectively placed in their relative positions. Unless a rod is specifically designated as, for example, a "6-weight rod," there are no "good" or "bad" positions within the chart. However, each rod will have its own unique feel. (This is primarily a function of rod action.)

When data points are identified by maker and model, it becomes obvious which rods are similar, as well as which should be considered or avoided in order to move from one feel towards a more desirable feel.

A rod's ERN is a measure of the force required to load, but not overload, that rod. An average rod designed for a No. 6 fly line should exhibit an ERN value of 6.5. The force required to load a rod defines its weight designation. If the ERN of a rod is less than 6.00 or greater than 6.99, it cannot be called a 6-weight rod.

Although all of the the rods in Figure 5 were designated for AFTMA No. 6 lines, it is apparent the GL-2 rod is underpowered for that task and the SP+ is greatly overpowered. A significant difference in action between the

Figure 5

Effective Rod Number (ERN)
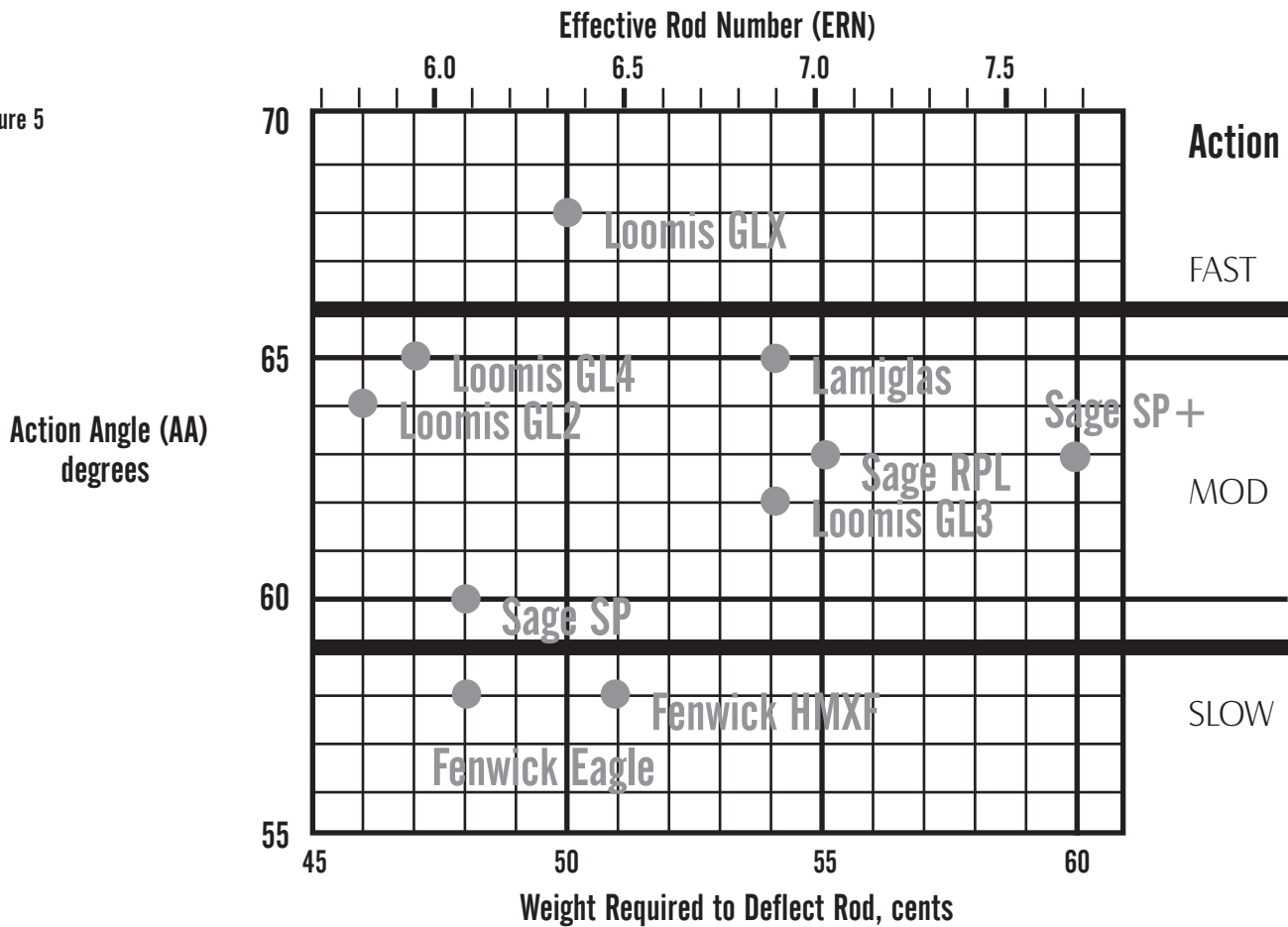
Figure 5

Fenwick HMXF and the GLX rods is also apparent, in spite of the fact they have practically the same intrinsic power.

If nothing else, Figure 5 clearly demonstrates that all rods designated for No. 6 lines are not equal. It is also evident that all these rods cannot be objectively classified as 6-weight rods. (Both the RPL+ and SP+ have been discontinued.) No wonder that meaningful comparisons cannot be made by prospective buyers!

The DBI, a purely objective description, should be inscribed on all finished fly rods. This information regarding the power and action of the rod would make it possible to intelligently compare the intrinsic performance capabilities of all rods, regardless of cosmetics or name branding. While this is a situation some large marketing departments might not welcome, it should prove a benefit for independent rod builders and manufacturers of less expensive high performance rods.

Since the DBI of a rod is primarily intended for those advanced anglers interested in the intrinsic properties of a rod, it should be of special interest to rod builders who purchase commercial blanks. At the very least, information concerning the DBI should be included along with length, blank weight, butt diameter, etc., in all rod building supply catalogs.

Applications to Rod Building

The following cases will illustrate some of the ways The Common Cents Approach can be used by a rod builder.

Case 1. Several years ago, desiring a light rod for small stream use, I purchased a rod kit via the internet. It was touted to construct a six foot rod for a No. 2 line. This information would lead one to expected a DBI = 2.5 / ??. However, the finished rod exhibited a DBI = 3.3 / 70. Had I determined the DBI of that blank beforehand, it would have been apparent that it would have produced a fast action rod, but not a 2-weight rod.

This raises an interesting point. The way modern fly rods are currently merchandised, this rod might well be touted as a fast action rod for a No. 2 line. That implies the rod will enable an expert caster to easily cast over 30 feet of No. 2 line - a capability rarely desired when fishing tight streams with a six foot rod. Of course, if one wishes to enjoy the small stream experience, that rod will need a No. 3 or 4 line.

Case 2. Due to carelessness, I broke eight inches off the tip of my Sage 389 LL. (389= A rod eight feet nine inches in length designated for a No. 3 line.) While Sage fully restored the rod with a completely new tip section, I was left with the broken one. Putting a new tip top on it and using the

ERN=4.5 and AA=55. While I have no burning desire for a very slow action 4-weight rod, the experiment demonstrated both how critical the design of the rod tip is to rod performance and how the DBI can objectively define these differences.

Case 3. In seeking a longer and faster rod, I explored the idea of building my own. On discovering an advertisement for "fast action" IM7 fly rod blanks, I ordered one - seven feet long for a No. 3 line.

On its arrival, I determined its DBI. It was assumed measurements obtained on the blank would be essentially the same as one would obtain from the finished rod. (The addition of guides, wrappings and finishing might be predicted to very slightly change the ERN and/or the AA of a rod. This should be confirmed and the degree of change determined by each rod builder.) Still, the results I obtained on this blank were very disappointing.

The 7′ fly rod blank produced a DBI = 3.9 / 60, indicating the finished rod would indeed be a 3-weight rod, but just barely. However, it would not have a fast action. This was conclusive evidence that the use of IM7 does not guarantee a fast action rod and that action is a function of design, not material of construction.

Along that line, consider my old fiberglass Shakespeare Wonder Rod. Designed as an ultra light spinning rod - at a time fly fishers wanted slow action rods duplicating bamboo - it has a DBI = 6.6 / 75 and proves the design of fast action rods is nothing new. I have happily fly fished with it for over 50 years.

What goes around comes around. Today, we see the introduction of new "ultra high performance, ultra expensive" rods - at a time fly fishers want very fast action rods duplicating spinning rods. It will be interesting to see if pragmatic rod builders simply put fly rod handles on spinning rod blanks to meet this demand. Better yet, use dual purpose reel seats and tout a single rod for both fly and spin fishing. The use of the DBI will provide an objective characterization of such rods.

Since the ERN of a rod is primarily a function of the strength of the butt section and the action AA is a function of the bending of the tip section, I thought it would be interesting to make another experiment - lengthen that previously described 7′ rod by adding an additional foot of stiff butt.

In this case, the result would have been an eight foot rod having a DBI = 5.4 / 65. While the increases in ERN and AA were expected, the rod action still would not be fast. I shall never build a rod from this blank.

It is evident from the above, The Common Cents Approach can be of significant help to the rod builder in explaining what to expect from any blank one might consider finishing.

As said previously, the DBI should be inscribed on every finished fly rod. The DBI should also be provided for all rod blanks. While both a finished rod and a blank have

their own intrinsic properties, when a rod is finished, its properties are fixed. The blank, on the other hand, can be intentionally altered in the process of completing the rod.

Conclusions

The Common Cents Approach, incorporating the DBI, represents a revolutionary contribution to fly fishing technology. For the first time, one can objectively determine and describe both rod power and action, as well as the suitability of any rod blank for producing the product specified.

The cases above clearly demonstrate that if one removes material from the tip of a blank, the resulting rod will be shorter, stronger, and have a slower action - the ERN will increase and the AA will decrease. Alternatively, by adding length to the butt, the resulting rod will be longer, stronger, and have a faster action - both the ERN and the AA will increase.

This means the AA of any given full blank defines the maximum speed of a rod which can be constructed from it. Anything one does to shorten it or make it into more sections will have the effect of increasing the ERN and decreasing the AA - make the rod stronger and slower.

Another feature of the DBI for rod builders is the ability to define the ERN and AA of any section of a rod blank without cutting it. One can simply make the measurements over that portion of the blank of interest. This could be extremely useful when constructing a multi-section rod having a specified DBI.

The Common Cents Approach
Measuring Intrinsic Properties

"If you cannot measure it, if you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

Lord Kelvin

Background

AFTMA's greatest contribution to fly fishing is their arbitrary objective standards for fly line weights (Table A). This opened the door to the possibility of objectively relating fly rods to fly lines. But first, it would be necessary to objectively define the intrinsic properties of fly rods.

Rods by different manufacturers, all of which specified a No. 6 line, had different feels. Although these rods undoubtedly had different intrinsic powers, these different feels were simply attributed to different actions - another intrinsic property which had never been objectively defined.

The current practice is for each manufacturer to label each rod with a recommended line weight. However, that recommendation is simply the subjective opinion of each rod's designer.

Table A — AFTMA Fly Line Standards			
Line No.	Weight/Grains	Dividing Weight	Mfg. Range
		30	
0	40		34-46
		50	
1	60		54-66
		70	
2	80		74-86
		90	
3	100		94-106
		110	
4	120		114-126
		130	
5	140		134-146
		150	
6	160		152-168
		172.5	
7	185		177-193
		197.5	
8	210		202-218

Table B
Conversion of Cents to Effective Rod Number (ERN)

Cents	ERN	Cents	ERN	Cents	ERN
10	0.61	28	3.12	46	5.79
11	0.70	29	3.27	47	5.94
12	0.79	30	3.42	48	6.08
13	0.89	31	3.57	49	6.22
14	0.98	32	3.72	50	6.35
15	1.12	33	3.86	51	6.49
16	1.28	34	4.01	52	6.62
17	1.44	35	4.16	53	6.76
18	1.60	36	4.31	54	6.89
19	1.77	37	4.46	55	7.03
20	1.92	38	4.60	56	7.15
21	2.08	39	4.75	57	7.28
22	2.23	40	4.90	58	7.40
23	2.38	41	5.05	59	7.53
24	2.53	42	5.20	60	7.65
25	2.67	43	5.35	61	7.77
26	2.82	44	5.50	62	7.90
27	2.97	45	5.65		

Table C
Casting and Spinning Rod Lure Weight Range

For the upper end of the weight range:
(1.5 x number of cents) - 20 = weight in grains

For the lower end of the weight range:
(.8 x number of cents) - 20 = weight in grains

To convert grains to ounces, multiply by .0022857.

All this leaves the angler at a loss to understand the actual intrinsic power and action of any rod. Faced with a limited number of choices at his local fly shop, he frequently purchases the rod he finds "least offensive."

If the angler persists in fly fishing, the desire for a new rod arises. Whether it be longer, shorter, faster, slower, stronger, weaker, heavier, or lighter, it must be subjectively described in terms relative to a "base rod." Finding that new rod can be a frustrating trial and error experience.

A more practical approach would be to objectively determine the intrinsic properties of one's "base rod" and the possible alternative rods and either make an educated choice or if there is no suitable choice available, contract to have a rod built to your exact specifications. This approach was illustrated a bit earlier.

Here, the fundamental concepts of this approach and the techniques for measuring the intrinsic properties of any rod or blank will be explained.

The Common Cents Approach

The shape a rod takes on bending (loading) depends on two interrelated factors, the stiffness of the body of the rod (intrinsic power) and the flexing or deformation of the tip (action). This approach develops an expression which can objectively define these intrinsic properties for any rod. It is called the DBI or Defined Bending Index and has the following form:

DBI = ERN / AA
where ERN represents the Effective Rod Number - a measure of the intrinsic power of a rod - and AA represents the Action Angle - the angle formed by the deflected rod tip.

Relating Rod Deflection to AFTMA Line Numbers

Figure 6 shows a plot illustrating the relationship between the designated line weight of a number of commercial rods and the weight required to deflect their tips a distance equal to one third of the rod's length.

As a first approximation, the dotted curve representing a plot of ten times the weight in grains of the lines listed in Table A vs their Line Numbers was constructed. The final solid curve represents the relationship upon which the Common Cents Approach is based. It is defined by the following equation. (The points appreciably above this line reflect the common current practice of "under-labeling" more powerful "fast action" rods.)

Figure 6

Relationship of Rod Intrinsic Power to AFTMA Line Number
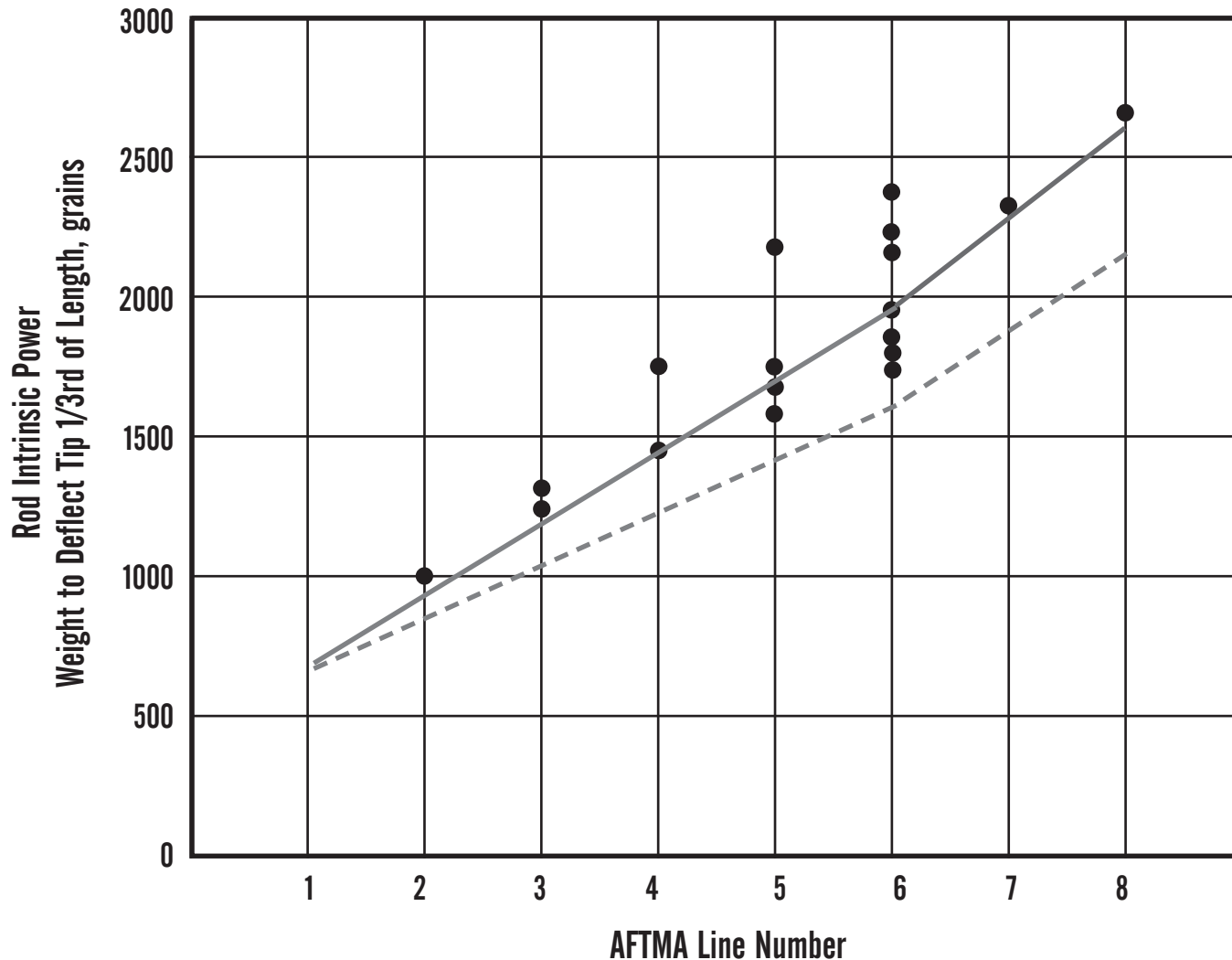
Intrinsic Power = (10)(line weight) + (60)(AFTMA Line No.)

For example: A mid-specification AFTMA No. 5 line weighs 140 grains. The intrinsic power of a rod loaded so as to deflect its tip one third of the rod's length by such a line is:

IP = (10)(140) + (60)(5) = 1400 + 300 = 1700 grains

A rod of less intrinsic power will be overloaded by such a line and a more powerful rod will not be fully loaded.

In the preceding, values were expressed in the units of grains - a measure generally meaningless to fly anglers. Consequently, a simple straight forward manner to convert that measure into an easily understood concept is needed.

ERN, ELN (Effective Line Number) and Common Cents

Figure 6 reveals the range of the intrinsic power of rods designated for AFTMA Line Numbers from 1 to 8 is over 2000 grains. With the Common Cents approach, one breaks each of the current line and/or rod designations into 10 smaller divisions. This treatment produces values called Effective Rod Numbers (ERN) and Effective Line Numbers (ELN). For a balanced rod, ERN = ELN.

The term "Effective" is used here to differentiate this system from the AFTMA approach. For example, Line No. 5 in Table A corresponds to an ELN of 5.5. and the AFTMA Mfg. Range corresponds to an ELN range of 5.2-5.8.

Common U.S. cents are minted by the billions to very tight specifications. Those dated after 1996 have an average weight of 38.61 grains and their use gives rise to the name of this approach. Using the methods described below, one can determine the DBI of any rod in terms of ERN and AA.
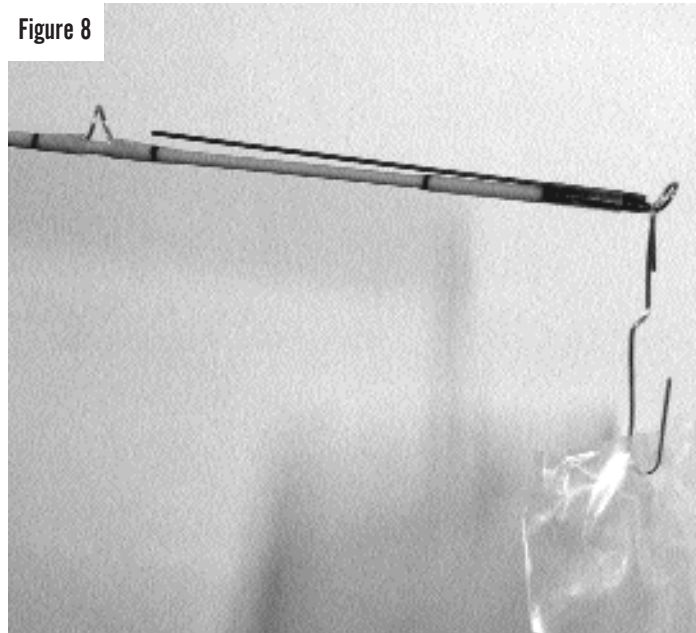
Determination of ERN

As shown in Figure 7, firmly secure the rod handle on an elevated shelf about 5 ft. above the floor. The line guides should face upwards. If necessary, use a common cent to shim the front of the handle until the first foot of the rod is horizontal. Measure the height of the horizontal rod (e.g., 64 inches).

Figure 7

Figure 8

As shown in Figure 8, using transparent mending tape attach a lightweight pointer (here, a piece of straight steel wire) to the tip top. Make certain the pointer lies parallel to the rod. Straighten out a paper clip and use it to hang a very lightweight plastic bag from the tip top.

Determine the value of one third of the length of the rod. (e.g., One third of an eight and one half foot rod is 102 inches divided by three, or 34 inches.) Again, by definition, a fully loaded rod has had its tip deflected a distance that is equal to one third of its total length.

Add shining one cent pieces minted after 1996 to the bag until the rod is properly deflected (loaded). In this case, 64 - 34 = 30, as shown in Figure 9.

Count the number of cents in the bag and convert this number to the ERN by means of Table B.

Determination of AA

(1) Deflect the rod in the exact same manner and distance as described above for determining the ERN.
(2) Make a copy of the Action Analyzer in Figure 11 and place it behind the rod tip so that the base line is horizontal and the end of the pointer attached to the tip top passes through the origin of the protractor scale.
(3) Read the scale value indicated by the free end of the pointer. In Figure 9, the value is about 70.

Figure 10, with an AA reading of 55, shows results for a slow action rod having the same ERN. A comparison of Figures 9 and 10 clearly shows the greater tip flexing of the fast action rod.

Based upon experimental results, slow action rods have AA values less than 59 and fast action rods have AA values greater than 66.

The results shown in Figures 9 and 10 clearly illustrate that a rod's action is independent of its strength.

Conclusions

Here is a revolutionary approach to characterizing fly rods. It includes a technique for making simple objective measurements using a little common sense and a handful of copper plated cents. (Current U.S. cents are actually made of zinc.) It can be used by rod builders to characterize a blank before spending time and energy on one which cannot possibly produce the desired action. It can also be used to characterize any finished rod in unambiguous terms which accurately describe its intrinsic properties. ✐

Dr. W. William Hanneman is a retired research chemist, internationally acclaimed gemologist and founder of Hanneman Gemological Instruments.

Turning to his hobby, fly fishing, "Dr. Bill" has applied his unique perspectives to this field and developed some new, innovative and useful techniques for characterizing rods and lines.

As the author of "What Trout Actually See," he exposed the cherished myth of the 10 degree angle of angler invisibility. As the author of this series on his Common Cents Approach, he explains the construction and use of his simple instruments for introducing a bit of objective science into the art of making and/or characterizing fly rods.

As an angler, he has almost perfected his tailing loop and rarely casts a fly more than 30 feet - nevertheless, he is happy.

———————————

Editor's Note - I highly recommend that all serious rod builders carefully read this article several times. Keep in mind that by utilizing the conversion factor listed in Table C, the Common Cents Approach can be also used with casting and spinning rods. In a future issue we'll cover further ground regarding the use of the DBI, line weights and rod "speed."
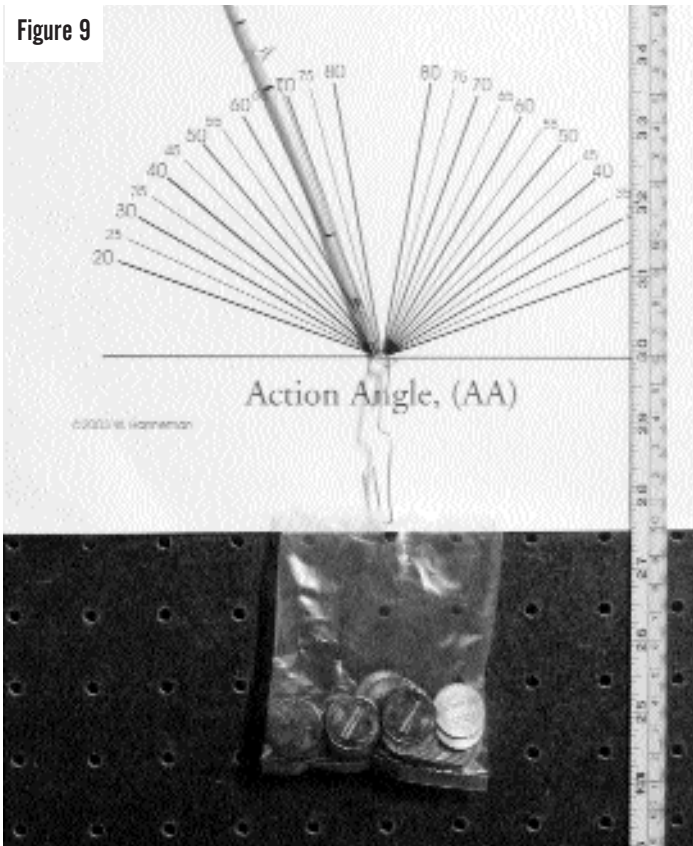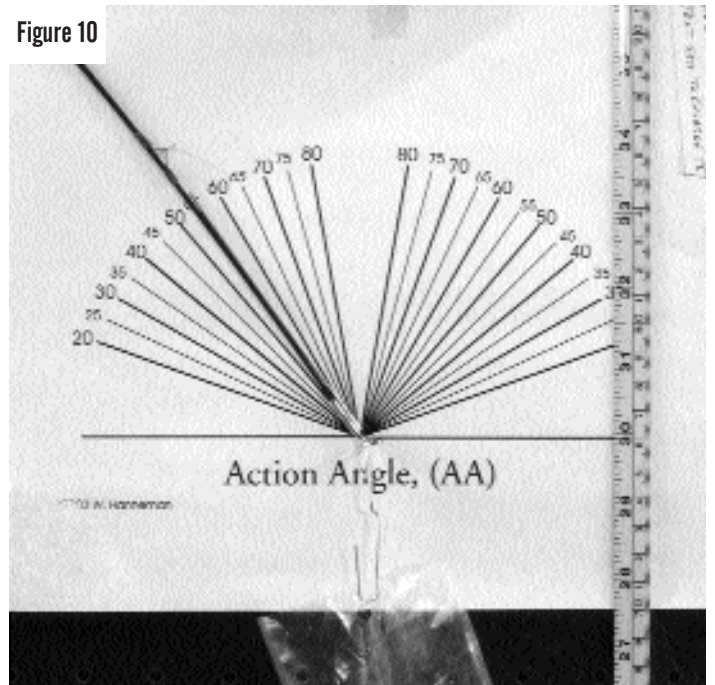
Figure 9

Action Angle, (AA)

©2003 W. Hanneman

Figure 10

Action Angle, (AA)

©2003 W. Hanneman

*Figures 9 and 10 depict two different rods of similar power deflected by the same load. Note the difference in Action Angle between them. Action is independent of rod power, stiffness, strength or material. (See text for more information.)

Figure 11

Action Angle, (AA)

©2003 W. Hanneman