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Variability in Wingspread and Headrope Measurements of Trawls in Joint US-USSR Groundfish Studies

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Introduction

Since 1967 when the first joint US-USSR survey was conducted, there have been occasional but limited measurements of the wingspread and headrope dimensions of trawls used in these surveys. The most recent tests were made last October on the USSR SRTM KVANT during the 1970 joint US-USSR research. One objective was to relate trawl characteristics to fishing power differentials, including estimates of area swept and relative volume filtered on standard surveys. Another objective was to determine the effects on trawl performance of varying operational factors such as speed and scope (ratio of trawl wire to depth). A detailed report on instrumentation methods and results of the 1970 gear tests will be available as a research document at the 1971 annual meeting (Griswold, Kurlyandsky and Twohig, 1971). My purpose here is to give a very brief evaluation of these and earlier gear tests particularly from the standpoint of developing and maintaining a standard unit of effort for a survey.

Variations in Performance of Some U.S. and U.S.S.R. Survey Trawls

The standard U. S. survey trawl, the Yankee #36, has an average wingspread of about 38 feet and a headrope height at the center of approximately 8-9 feet. The corresponding horizontal openings of Soviet trawls used for the joint surveys (27.1 m and 24.6 m trawls) are at least 1/3 greater or about 50 feet on wingspread and between 11-18 feet on headrope.

In general, our tests have shown that for a given set of conditions (i.e. vessel, rigging and sea state), performance of a trawl is relatively stable even at varying towing speeds. However, the same trawl of course can perform quite differently

with different rigging; and even when rigging is supposedly the same we sometimes have observed performance differences for a standard trawl (during different experiments) and were unable to relate the differences to other factors.

For example, most tests of the Yankee #36 show a wingspread from 35-40 feet and headrope of about 8-9 feet. However, in a test on Delaware I (a U. S. side trawler) in 1967 with standard rigging, scope and speed, the Yankee #36 showed a wingspread of only 30 feet; and on Albatross IV cruise 68-13 the Yankee trawl showed a wingspread of 33 feet and a headrope of nearly 12 feet (see attached table).

Differences have also been observed for the 27.1 m USSR trawl when fished with standard rigging and essentially identical Soviet side trawlers. In 1968 on the Blesk (Cruise 68-16) this trawl showed a wingspread of 49 feet and a headrope of 18 feet, whereas in 1970 on the KVANT (Cruise 70-2), the corresponding dimensions were 49 feet and 11.5 feet. Depending upon which set of measurements are used the estimated differential in size of trawl openings between the #36 and 27.1 would range from a factor of about 1 1/2 to 2.

The causes of these apparent discrepancies are not yet clear. Quite possibly the explanation may be that we need to take greater care in setting up the rigging on a trawl. In any case it seems to me that there is a need for monitoring trawl performance on surveys to guard against malfunctions or errors in rigging.

Another example of the potential value of monitoring equipment was provided by the recent tests on the KVANT where a series of adjustments to the rigging of a USSR 23.5 trawl were required before it performed properly. Specifically a modification was required on the rigging of the legs, and a trawl door bracket had to be adjusted on successive trials before the excessive spread was reduced (as indicated by increase in headrope from 7.5 to 10.5 feet in KVANT 70-2 hauls 1 and 2 shown in attached table). Just prior to this series the same pair of doors had been used for testing two other Soviet trawls (27.1 and 24.6 trawls) with apparently normal results. Following adjustment of the door bracket, addition of a 1 meter strap to the top 50 meter leg on the 23.5 trawl (see haul #3 for 23.5 on KVANT 70-2, attached table) appeared to increase headrope height about 30 percent.

I think these results have important implications with respect to the general problem of standardizing a unit of effort. First of course they emphasize the fact that it is not a simple task to determine the towing performance characteristics of a given trawl. Secondly it seems clear that variability in trawl performance is a potential major component in the variability encountered in catch comparisons among different trawls. Even more important however is the apparent ease with which a malfunction or a significant change in performance can occur without detection. Thus it seems to me that we risk serious bias unless some form of monitoring of gear performance is employed in our surveys as well as fishing power studies.

Ideally we should monitor each haul to guard against malfunctions and to document the variations in performance caused by factors such as currents and sea state. If this is not feasible then occasional testing of trawl performance throughout a survey would seem desirable, particularly after any repairs or adjustments

to the rigging. At the very least it seems to me that each time a "standard" trawl is rigged it should be tested before using it on a survey. We should be able to afford a half day or so for calibrating a sampling tool for use on a survey which will cost 50 or 60 times as much in terms of days at sea.

Unfortunately the so-called "3rd wire" system used in the above tests is not only somewhat cumbersome but under certain conditions the monitoring equipment itself may affect the performance of the gear. In particular it may be difficult to obtain unbiased headrope measurements in deep water because drag on the 3rd wire tends to lift the headrope and possible even the entire trawl. An acoustic link system or conductor core cable system would dispense with the 3rd wire but these also have limitations. Any one of these systems would be expensive, and they would require special technicians for operation and maintenance at sea. In my opinion the expense would be justified in the long run.

Tests of Possible New Standard Trawls

A number of other trawls have been tested as possible candidates for a new standard survey trawl. The Soviet 23.5 trawl which was tested in 1970, was presumed to have a smaller wingspread but similar headrope height compared with the 27.1 trawl. Actual measurements indicated that the configuration was rather similar to the other Soviet trawls (see attached table). A catch comparison experiment showed little difference between the 23.5 and 27.1 (Griswold, et al, 1971).

Other trawls tested have been the Canadian Atlantic Western (models IIA and IV), a U. S. "Base" trawl (modified version of Atlantic Western), and U. S. "Universal" trawl (developed on west coast). All of these trawls were expected to have significantly higher headropes compared with the Yankee #36, without too great an increase in wingspread. In general this was the case in actual tests, except for the Atlantic Westerns where headrope heights undoubtedly were biased downward because of excessive door size (see table). Catch comparisons with the Yankee #36 or the Soviet trawls have not yet been conducted for any of these trawls.

Literature Cited

Griswold, B., Y. Kurlandsky and P. Twohig., 1971. Performance of trawls used in joint US-USSR groundfish studies. ICNAF Research Document 71/ .

Measurements of wingspread and headrope height on some U. S., Canadian and USSR otter trawls.

VESSEL	CRUISE	TRAWL	SCOPE	VESSEL SPEED (Knots)	TRAWL DIMENSIONS (Feet) MEAN WS	MEAN HR	RANGE WS	RANGE HR
Albatross IV	68-1	Yankee #36[1]	3.5:1	3.5	39.5	8.5	36-41	8.0-9.0
			4.0:1	3.5	41.0	8.0	39-42	7.5-8.5
Albatross IV	68-13	Yankee #36	3:1	3.5	33.0	11.7	32-34	11-12
Delaware I	67-10	Yankee #36	3:1	3.0	30.0	8.0	30	8
KVANT	70-2	36-1	3-5:1	3.5-4.5	42	9	39-46	8-10
	70-2	36-2	3:1	4.2	36	10	36	10-11
Delaware I	67-10	USSR 27.1	4:1	3.2	36	15.5	32-44	12-18
Albatross IV	68-13	USSR 27.1[2]	3:1	3.5	37	18	36-38	16-20
Albatross IV	68-13	USSR 27.1[3]	4:1	2.0	52	11	52	11
BLESK	68-16	USSR 27.1	5:1	3.5	49	18	46-52	14-20
KVANT	70-2	USSR 27.1	5:1	3.5-4.0	49	11.5	46-54	10-12
KVANT	70-2	USSR 24.6	5:1	3.6-4.4	51	10	49-52	8.5-11
KVANT	70-2	USSR 23.5-1	5:1	3.5-4.5	54	7.5	52-56	7.0-8.5
		USSR 23.5-2	5:1	3.5-4.5	53	10.5	52-54	7.5-14.0
		USSR 23.5-3	5:1	3.2	"50"	13.5	50	13.5-14.0
Delaware I	67-10	US "Base"	3-4:1	3	44.5	14.5	42-47	13-17
Delaware I	68-2	US "Base"	3-4:1	3.5	42	20	40-44	16-22
KVANT	70-2	At. West (IIA)	4:1	3.5-4.0	44	12	43-45	11-13
KVANT	70-2	At. West (IV)	4:1	3.5-4.0	48	12	48	11-13
Albatross IV	68-13	Universal[3]	3:1	2-3.5	48	20	36-59	17-22
BLESK	68-16	Universal	5:1	3.5	48	16	40-54	14-22
BLESK	68-16	Universal	6:1	4.6	60	14	58-61	13-14

1/ All measurements on #36 taken without ground cables.
2/ Oval doors, 2.56 m^2, 460 Kg.
3/ V-doors, approximately 5m^2