Ödsmål, Kville sn, Bohuslän

Hällristning
Fiskare från
bronsåldern

Rock carving
Bronze age
fishermen

MEDDELANDE från
HAVSFISKELABORATORIET · LYSEKIL
nr 136

Hydrografiska avdelningen, Göteborg

OCEANOGRAPHICAL OBSERVATIONS PERFORMED BY THE SWEDISH COAST GUARD

by

Bertil Öström

November 1972

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Introduction

In 1969 an agreement was made between the Swedish Coast Guard, the Fishery Board of Sweden and the Swedish Meteorological and Hydrological Institute (SMHI) that the Coast Guard would conduct trials with oceanographical measurements aiming at a permanent activity. The administration was to be shared between the Fishery Board (southern and western part of the coastal area) and SMHI (northern part). The Swedish Environment Protection Board has been the economic sponsor. In this paper the Fishery Board part of the project will be described.

The work started on a small scale in the spring of 1970 (Hållsundsudde, see below) and in its full content in the autumn of 1971. The activity for the Coast Guard personnel consists of collecting of water samples with an isolated Knudsen sampler, reading of thermometers and a bathythermograph haul (temperature is recorded on a coated glass slide).

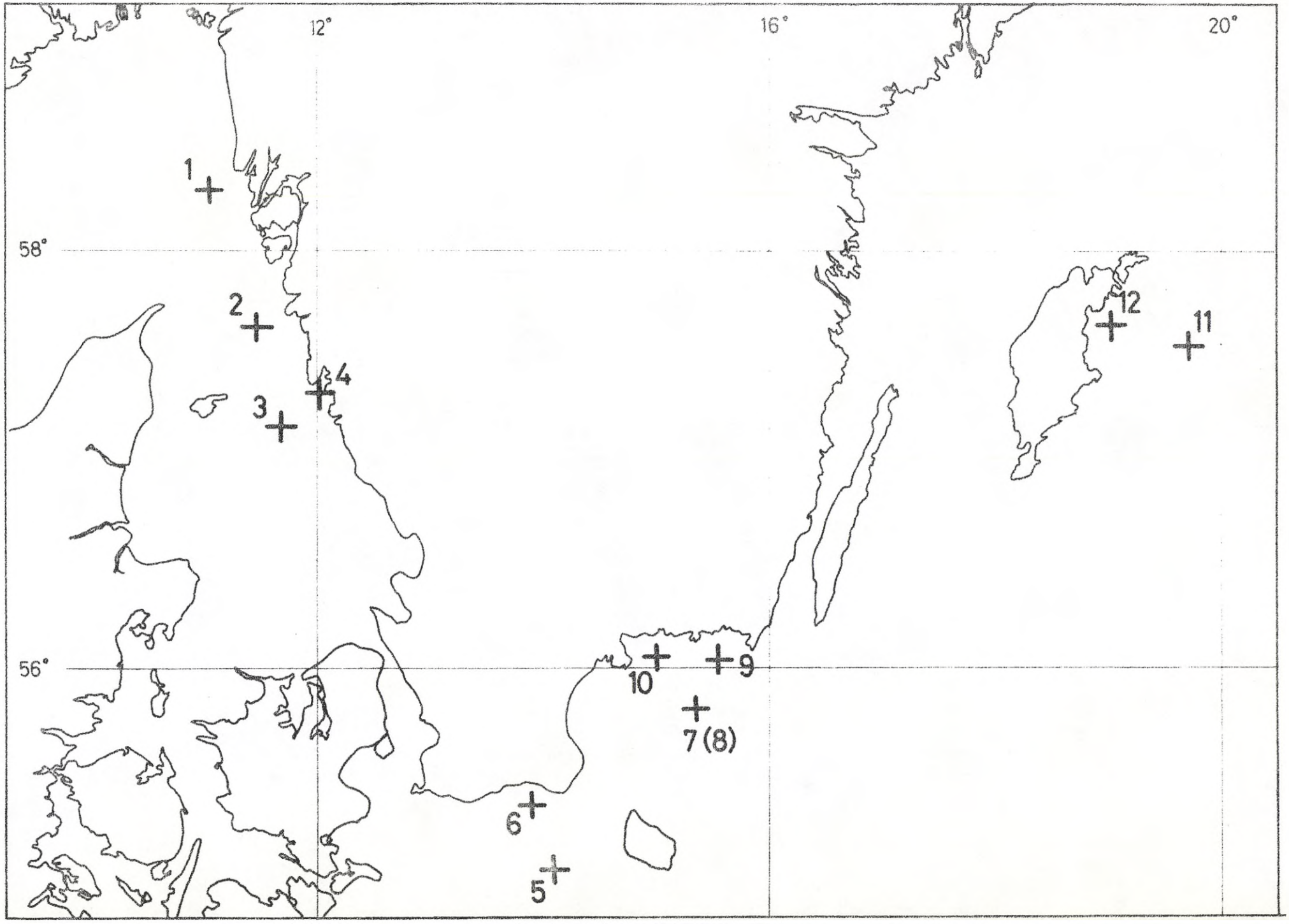
Description of the measurements

The activity now comprehends the following sampling stations (Table I, Map I).

Name of Station	Position		Patrol Boat
Gotland Deep Neighbourhood	57°33.6′ N	19°42.0′ E	TV 116
Slite	57°39.7′ N	19°00.0′ E	-"-
Karlskrona	56°02.2′ N	15°32.5′ E	TV 244
Hanö Bight	55°48.0′ N	15°20.0′ E	-"- /TV 253 [x]
Karlshamn	56°03.5′ N	14°59.0′ E	-"-
Arkona Deep	55°00.0′ N	14°05.0′ E	TV 256
Ystad	55°18.6′ N	13°53.6′ E	-"-
SW Hållö	58°17.0′ N	11°02.0′ E	TV 105
W Vinga	57°39.0′ N	11°27.0′ E	-"-
Fladen	57°11.0′ N	11°40.0′ E	TV 252 [xx]
Hållsundsudde	57°20.0′ N	12°01.0′ E	-"-

x) TV 244 and TV 253 are alternating at this station

xx) The two last stations have been operated for about 2 years and have later been integrated into the present activity.


12°
16°
20°
58°
56°
1
2
3
4
5
6
7(8)
9
10
11
12

The stations are on the map marked with a plus sign. The following table gives names of the stations, operating boats and coastal districts.

Station number	Name of Station	Station operated by boat	Coastal District
1.	SW Hållö	TV 102	Western District
2.	W Vinga	-"-	-"- -"-
3.	Fladen	TV 252	-"- -"-
4.	Hållsundsudde	-"-	-"- -"-
5.	Arkona Deep	TV 256	Southern District
6.	Ystad	-"-	-"- -"-
7. (8)	Hanö Bight	TV 244/TV 253	-"- -"-
9.	Karlskrona	TV 244	-"- -"-
10.	Karlshamn	TV 253	-"- -"-
11.	Gotland Deep Neigbourhood	TV 116	Eastern District
12.	Slite	-"-	-"- -"-

The measurements have been organized so that each patrol boat participating in the activity carries out sampling at two stations: one inner station visited once a week where water samples for determining the salinity are taken, and one outer station visited once a month where samples for determining salinity and oxygen gas content are taken. At the station SW Hållö samples for determining total phosphorous content are also collected. At all stations the water temperature at different depths is determined by thermometer readings and by automatic temperature recording with bathythermograph.

The fact that recordings are carried out at the Gotland Deep Neigbourhood instead of at the Gotland Deep itself is the result of a compromise where the desire from the Fishery Board has yielded to the legitimate demand for reasonably short cruising times from the Coast Guard. Also for the Hanö Bight station, the recordings had been still more valuable if the cruising time could have been extended to a nearby deep basin ENE Simrishamn of 85 meters depth instead of the present position of 67 meters depth. Though TV 256 covers the Arkona Deep, an important international station. Also for the stations covered by TV 252 and TV 102 the positions are satisfactory.

The parameters determined for each station are shown in the following table.

Name of Statio	Parameters by direct determination					Derived Parameters	
	Tempe-rature	Salt content	Oxygen content	Bathy thermo-graph rec.	Total phos-phorus	Sigma t-value	Local sound velocity
SW Hållö	x	x		x	x	x	x
W Vinga	x	x	x	x		x	x
Fladen	x	x	x	x		x	x
Hållsundsudde	x	x		x		x	x
Arkona Deep	x	x	x	x		x	x
Ystad	x	x		x		x	x
Hanö Bight	x	x	x	x		x	x
Karlshamn	x	x		x		x	x
Karlshamn	x	x		x		x	x
Gotland Deep Neighbourhood	x	x	x	x		x	x
Slite	x	x		x		x	x

When preparing samples for oxygen determination expendable ampuls containing the two Winkler reagents are now used whereby the sampling procedure has been considerably simplified (Öström 1972). At the same time the risk for untrained personnel to get in touch with the caustic reagents is eliminated. The ampuls were introduced in consultation with the sampling personnel and the Coast Guard has expressed satisfaction with the method.

The water samples for determination of the total phosphorus content are put into volume marked sample bottles. This means that the sample water can be drawn off directly from the sampler into the sample bottle, without using tilting pipettes or other volumetric devices, which is an advantage at rough sea.

Laboratory work and analyses.

After samples from the Coast Guard boats have arrived at the Fishery Board laboratory, analyses are carried out. By the aid of a time-saving data program (which will be described below) this work is reduced to mainly two instrument readings. One is the titer volume obtained from the oxygen titration. The other is the salinometer reading. Though for the less frequent occurring total phosphorous determinations we still give the calculated values. All analyses are carried out according to the methods in the new Baltic manual (Carlberg, Fishery Board of Sweden, 1972).

Bathythermograph recordings (BT:s)

The bathythermograph recordings are of great importance when investigating the hydrography of the sea as they give a continous detailed information about the temperature with depth, and moreover give a visual sketch of the water temperature stratification. The bathythermograph recordings are also a valuable aid when determining the extension of different water masses. Moreover the BT haul is very quickly performed and it is therefore possible to increase the total amount of data by taking BT:s whenever time permits.

At present we work to improve the way of representing bathythermograph information. Acquisition of a photographic device adapted to the purpose is going on. We also work on a conformable adaption of the bathythermograph readings into the data program presented below where continous calibration will be included and possibly a direct individual station drawing of isopletes by the printer. The result of this will be presented before long.

Data processing

The immediate reason to build up a special program for oceanographical data was the above described measuring activity which under the administration of the Fishery Board, was started by the aid of the Swedish Coast Guard patrol boats and personnel. As this activity now works on the whole as a continous routine, the number of data has grown and the amount of work has increased considerably for the ordinary personnel at our laboratory. This increased load has taken place on the "outside", i.e. the outdata via analyses, calculating work and

transcription of the final reports. In the following is shown how this work instead is laid on the "inside", i.e. key-punching of the indata, while the program takes care of all the computing, arranging and transcription of data. This, at the same time, also means a diminished total amount of work. In fact, the program now is developed so far that key-punching of indata is done directly from the record - sheets written by the Coast Guard personnel out on the sampling stations, with the addition of two instrument readings from the water sample analyses done by us. Thus, for the Coast Guard program there are now only two papers to be dealt with. One is the record-sheet from the station and the other is the final report page transcripted by the computer.

The program has been completely adapted to the working routine on the Coast Guard boats. A general outline was that the instruction for the measurements should not be altered due to the change-over to data processing. (This can also be expressed so that the machine is adjusted to man, and not on the contrary.) That this outline was followed is shown by the fact that it was not even necessary to inform the Coast Guard that the values they report now are computer processed.

The working routine on the station might be best illustrated by the record form. (Fig. 1). The complete data program is given in Appendix I.

The main connections between the form and the ALGOL program are
1. the station statement on the form and corresponding switch procedure in the program which has an auto-selective function for choosing the right station
2. the 'surrounding data part' at top and bottom of the form which in the program consists of position FORTS through MÄT and
3. the measurement data from the form which in the program is represented by the computation part from MÄT through INGA.

The construction details of the program are not discussed here, but anyone who has a particular interest is welcome to contact the author for further information. A detail worth noting, though, is the fact that the program indicates unstable density stratification.

Naturally the program is provided with common limitations for computed values to give step-out in case of preposterous values caused by indata errors.

Another important feature of a data handling program is the future availability of the computed values. Work on a serviceable data storing technique is still going on and will be presented in a later report, together with the bathythermograph data presentation.

For the reproduction of the required number of copies of the report we use a direct technique, where the computer printer is fed with offset-master instead of ordinary paper.

To illustrate what the program is doing some final report pages which were printed out by the computer, are presented in Appendix II.

Acknowledgement

For the sections of the Swedish seaboard where the activity is administrated by the Fishery Board of Sweden, Hydrographic Department in Gothenburg, the experience is most positive. The activity as a whole is now working satisfactorily as a well established routine. This has been made possible mainly by a good cooperation between the Fishery Board and the Coast Guard in the Western, Southern and Eastern Districts, and by the meritorious way of which the Coast Guard personnel has carried out the work on the sampling stations.

The cost for developing the data program has partly been covered by a grant from the Swedish Environment Board, contract No 7-66/72, project leader Dr. Artur Svansson.

References

Carlberg, S., 1972: New Baltic Manual, ICES Cooperative Research Report series A, No 29.

Öström, B., 1972: Expendable Ampuls for oxygen determination. (In swedish with english summary). Meddelande från Havsfiskelaboratoriet Nr 133.

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AALGOLGENIUSEL
0001          'DATA'
0002          'WORKING STORAGE SECTION'
0003          'STRING'  ANM : 80 ;
0004          'BEGIN'
0005          'COMMENT' SVANSSON379 065;
0006          'COMMENT' KUSTREV ;
0007          'BOOLEAN'  BO, INST, NIX ;
0008          'REAL' Z, TAVL, T, SAVL, RT, DELTA20RT, DELTA1520, SAVL15, S,
0009          TABS, CL, O2AVL, TITER, O2, ALFA, PVAP, O2SAT, O2PROC, SIGMANOLL,
0010          STORASIGMAT, AT, BT, SIGMAT, C, LUFTTEMP, TOTP, NYSIG          ;
0011           'INTEGER'  A, TERMNR, AR, MAN, DAG, TIM, MIN, GMT, BOTTENDJUP,
0012            SKOT   , VINDHAST, MOLN, SJÖ, HJÄLP, FLNR, STATION, BTREG, BTNR;
0013          'REAL' 'ARRAY'  TG, TK(1:50,1:8), FLVOL(1:185)          ;
0014          'SWITCH'   PLATS := HÄLLÖ, VINGA, FLADEN, HÄLLSUND, ARKONA, YSTAD,
0015          HANÖKRONA , HANÖHAMN, KKRONA, KHAMN, NÄRAGOT, SLITE, INGA          ;
0016          PRINTEROPEN(0);
0017          GETREAL(TG(1,1),400)   :   GETREAL(TK(1,1),400)   ;
0018          GETREAL(FLVOL(1),185)   ;
0019          HJÄLP := 1 ;
0020    START:  GETINT(STATION, 1)   ;
0021          NYSIG := -7  ;
0022          'IF' STATION 'GQ' - 100 'OR' STATION < - 113 'THEN' 'GOTO' START ;
0023          'IF' HJÄLP > 0 'THEN' HJÄLP := HJÄLP - 2 'ELSE' HJÄLP := HJÄLP +2;
0024          'GOTO' PLATS('IF' 0 'GQ' ( - 100 -STATION) 'OR'
0025          ( - 100 - STATION) > 13 'THEN' 13'ELSE'( - 100 - STATION))    ;
0026    HÄLLÖ:  PRINTTEXT(//'6SP' 21 'SP' '32' TV 'SP' 102 '32' '20SP' STATION
0027          '19SP' LAT:     '2SP' 58 'SP' 17.0 'SP' N 'CR' '6SP' 77 'SP'
0028          SVERIGE '21SP' SW 'SP' HÄLLÖ '18SP' LONG:     'SP' 11 'SP' 02.0
0029          'SP' E '2CR'//)   ;          'GOTO' FORTS   ;
0030    VINGA:  PRINTTEXT(// '6SP' 21 'SP' '32' TV 'SP' 102 '32' '20SP' STATION
0031          '19SP' LAT:     '2SP' 57 'SP' 39.0 'SP' N 'CR' '6SP' 77 'SP'
0032          SVERIGE '21SP' W 'SP' VINGA '19SP' LONG:     'SP' 11 'SP' 27.0 'SP'
0033          E '2CR' //)   ;          'GOTO' FORTS   ;
0034    FLADEN:  PRINTTEXT(//'6SP' 20 'SP' '32' TV 'SP'252 '32' '20SP' STATION
0035          '19SP' LAT:     '2SP' 57 'SP' 11 'SP' N 'CR' '6SP' 77 'SP'
0036          SVERIGE '21SP' FLADEN '20SP' LONG:     'SP' 11 'SP' 40 'SP' E
0037          '2CR' //)   ;          'GOTO' FORTS   ;
0038    HÄLLSUND:   PRINTTEXT(//'6SP' 20 'SP' '32' TV 'SP' 252 '32' '20SP'
0039          STATION '19SP' LAT:     '2SP' 57 'SP' 20 'SP' N 'CR' '6SP' 77 'SP'
0040          SVERIGE '21SP' HÄLLSUNDSUDDE '13SP' LONG:     'SP' 12 'SP' 01 'SP'
0041          E '2CR' //)   ;          'GOTO' FORTS   ;
0042    ARKONA:  PRINTTEXT(// '6SP' 22 'SP' '32' TV 'SP' 256 '32' '20SP' STATION
0043          '19SP' LAT:     '2SP' 55 'SP' 00.0 'SP' N 'CR' '6SP' 77 'SP'
0044          SVERIGE '21SP' ARKONADJUPET '14SP' LONG:     'SP' 14 'SP' 05.5 'SP'
0045          E '2CR' //)   ;          'GOTO' FORTS   ;
0046    YSTAD:   PRINTTEXT(// '6SP' 22 'SP' '32' TV 'SP' 256 '32' '20SP' STATION
0047          '19SP' LAT:     '2SP' 55 'SP' 18.6 'SP' N 'CR''6SP' 77 'SP'
0048          SVERIGE '21SP' YSTAD '21SP' LONG:     'SP' 13 'SP' 53.6 'SP' E
0049          '2CR' //)   ;          'GOTO' FORTS   ;
0050    HANÖKRONA: PRINTTEXT(// '6SP' 24 'SP' '32' TV 'SP' 244 '32' '20SP'
0051          STATION '19SP' LAT:'2SP' 55 'SP' 48.0 'SP' N 'CR''6SP' 77 'SP'
0052          SVERIGE '21SP' HANÖBUKTEN '16SP' LONG:     'SP' 15 'SP' 20.0 'SP'
0053          E '2CR' //)   ;          'GOTO' FORTS   ;
0054    HANÖHAMN:  PRINTTEXT(// '6SP' 23 'SP' '32' TV 'SP' 253 '32' '20SP'
0055          STATION '19SP' LAT:'2SP' 55 'SP' 48.0 'SP' N 'CR''6SP' 77 'SP'
0056          SVERIGE '21SP' HANÖBUKTEN '16SP' LONG:     'SP' 15 'SP' 20.0 'SP'
0057          E '2CR' //)   ;          'GOTO' FORTS   ;
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0058  KKRONA:    PRINTTEXT(// '6SP' 24 'SP' '32' TV 'SP' 244 '32' '20SP'
0059        STATION '19SP' LAT:'2SP' 56 'SP'02.20 'SP' N 'CR''6SP' 77 'SP'
0060        SVERIGE '21SP' KARLSKRONA '16SP' LONG:    'SP' 15 'SP' 32.5 'SP'
0061        E '2CR' //)   ;          'GOTO' FORTS   ;
0062  KHAMN:   PRINTTEXT(//'6SP' 23 'SP' '32' TV 'SP' 253 '32' '20SP'STATION
0063        '19SP' LAT:    '2SP' 56 'SP' 03.5 'SP'N 'CR' '6SP' 77 'SP' SVERIGE
0064        '21SP' KARLSHAMN '17SP' LONG:    'SP' 14 'SP' 59.0 'SP' E
0065        '2CR' //)   ;          'GOTO' FORTS   ;
0066  NÄRAGOT: PRINTTEXT(//'6SP' 25 'SP' '32' TV 'SP' 116 '32' '20SP' STATION
0067        '19SP' LAT:    '2SP' 57 'SP' 33.6 'SP' N 'CR' '6SP' 77 'SP'
0068        SVERIGE '21SP' GOTLANDSDJUPETS 'SP' NÄRH   '6SP' LONG:    'SP'
0069        19 'SP'42.0 'SP' E '2CR' //)   ;          'GOTO' FORTS   ;
0070  SLITE:   PRINTTEXT(// '6SP' 25 'SP' '32' TV 'SP' 116 '32' '20SP'
0071        STATION '20SP' LAT:    '2SP' 57 'SP' 39.7 'SP' N 'CR' '6SP' 77
0072        'SP' SVERIGE '20SP' SLITE '23SP' LONG:    'SP'19 'SP' 00.0 'SP' E
0073        '2CR' //)   ;          'GOTO' FORTS   ;
0074  FORTS: PRINTTEXT(// '48SP' VIND- '19SP' LUFT- 'CR' '34SP'
0075             BOTTEN- 'SP' VIND- 'SP' HAST '2SP' MOLNIG-'2SP' VÅGHÖJD
0076        '2SP' TEMP 'CR''15SP' ÅR 'SP' MÅN 'SP' DAG 'SP' TIM 'SP' MIN 'SP'
0077        DJUP '3/' M '38' 'SP' RIKTN 'SP' '37' M 'DA' S'38' 'SP' HET  '37'
0078        'SP' 'DA' 8 '38''SP';> 'SP''37' M '38' 'SP' < 'SP' '37' GRAD 'SP' C
0079        '38' ' CR'  '6SP' LOK.TID: //)   ;
0080        GETINT(ÅR,1) ;          PRINT(//      //, ÅR, 2, 0) ;
0081        GETINT(MÅN,1) ;          PRINT(// 'SP' //, MÅN, 2, 0) ;
0082        GETINT(DAG,1) ;          PRINT(// 'SP' //, DAG, 2, 0) ;
0083        GETINT(TIM,1) ;
0084        'IF' TIM < 0 'THEN' 'BEGIN' PRINTTEXT(//'SP' EJ 'SP' ANG 'CR'
0085        '33SP' //) ;   'GOTO' SLARV 'END'   ;
0086        PRINT(//'SP'//, TIM, 2, 0) ;
0087        GETINT(MIN,1) ;          PRINT(//'SP'//, MIN, 2, 0) ;
0088        PRINTTEXT(// 'CR' '6SP' TID 'SP' GMT: //) ;
0089        GMT := 'IF' TIM = 0 'THEN' 23 'ELSE' TIM - 1 ;
0090        'IF' GMT = 23    'THEN' DAG := DAG - 1 ;
0091        'IF'  ÅR% 4= 4= ÅR  'THEN'  SKOT := 29 'ELSE' SKOT := 28   ;
0092        'IF' MÅN = 3 'AND' DAG = 0  'THEN' 'BEGIN' MÅN := 2; DAG := SKOT;
0093        'END'   ;
0094        'IF'((MÅN = 5 'OR' MÅN = 7 'OR' MÅN = 10  'OR' MÅN = 12)
0095        'AND' DAG = 0)
0096        'THEN' 'BEGIN' MÅN := MÅN - 1 ; DAG := 30  'END' 'ELSE'
0097        'IF' DAG  = 0 'THEN' 'BEGIN' MÅN := MÅN - 1;  DAG := 31  'END';
0098        'IF' MÅN = 0  'THEN' 'BEGIN' ÅR := ÅR - 1 ; MÅN := 12  'END'   ;
0099        PRINT( // //, ÅR, 2, 0) ;     PRINT(//'SP'//, MÅN, 2, 0) ;
0100        PRINT(//'SP'//, DAG, 2, 0) ;
0101        PRINT(//'SP'//, GMT, 2, 0) ;
0102        PRINT(//'SP'//, MIN, 2, 0) ;
0103  SLARV: GETINT(BOTTENDJUP,1);
0104        'IF' BOTTENDJUP < 0 'THEN' 'BEGIN' PRINTTEXT(//'SP' EJ 'SP' ANG
0105        'SP' //); 'GOTO' PLUMS 'END' ;
0106        PRINT(//'2SP'//, BOTTENDJUP, 3, 0) ;  PRINTTEXT(//'2SP'//) ;
0107  PLUMS: 'IF' GETSTRING(ANM, /2) 'LQ' 0 'THEN' 'BEGIN'  PRINTTEXT(//
0108        EJ 'SP' ANG //) ; 'GOTO'  PUST  'END' LÄSER VINDRIKTN STRÄNG 3POS;
0109        PRINTTEXT(//'2SP'//)   ;
0110        PRINTTEXT(ANM)   ;
0111        PRINTTEXT(// 'SP' //)   ;
0112  PUST: GETINT(VINDHAST,1) ;
0113        'IF' VINDHAST < 0 'THEN' 'BEGIN' PRINTTEXT(//'SP' EJ 'SP' OBS //);
0114        'GOTO' MULET'END'   ;
0115        PRINT(//'SP' //, VINDHAST, 2, 0) ;   PRINTTEXT(// '3SP' //) ;
0116  MULET: GETINT(MOLN,1) ;
0117        PRINTTEXT( 'IF' MOLN  = 0 'THEN' //' SP' INGEN ' SP'// 'ELSE'
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0118          'IF' MOLN  = -1  'OR'  MOLN  = 9 'THEN' // ' SP' EJ 'SP' OBS
0119          //  'ELSE'  //  //)   ;
0120                    'IF' MOLN > 0 'AND' MOLN < 9 'THEN' 'BEGIN'
0121          PRINT(//'2SP'//, MOLN, 1, 0) ; PRINTTEXT(// '3SP' //) 'END'    ;
0122          GETINT(SJÖ,1)   ;
0123          PRINTTEXT( 'IF' SJÖ  = -1 'THEN'//'2SP' EJ 'SP' OBS 'SP' // 'ELSE'
0124                     'IF' SJÖ  = 0  'THEN' //'5SP' 0 '3SP' // 'ELSE'
0125                     'IF' SJÖ  = 1  'THEN'//'3SP' 0 'SP' - 0.1// 'ELSE'
0126                     'IF' SJÖ  = 2  'THEN'//'2SP'0,1-0.5//'ELSE'
0127                     'IF' SJÖ  = 3  'THEN'//'2SP'0.5-1.2//'ELSE'
0128                     'IF' SJÖ  = 4  'THEN'//'2SP'1.2-2.5//'ELSE'
0129                     'IF' SJÖ  = 5  'THEN'//'2SP'2,5-'SP'4'SP' // 'ELSE'
0130                     'IF' SJÖ  = 6  'THEN'//'3SP' 4 'SP' - 'SP' 6 'SP'//
0131           'ELSE'    'IF' SJÖ  = 7  'THEN'//'3SP' 6 'SP' - 'SP' 9 'SP'//
0132           'ELSE'    'IF' SJÖ  = 8  'THEN'//'3SP' 9 'SP' - 14 'SP'//
0133           'ELSE'                          //'2SP'EJ 'SP' OBS 'SP' // )   ;
0134          GETREAL(LUFTTEMP,1)   ;          'IF' LUFTTEMP > - 90 'THEN'
0135          PRINT(//'2SP'//, LUFTTEMP, 2, 1) ;   PRINTTEXT(//'2CR'//) ;
0136          GETINT(BTREG,1) ;           GETINT(BTNR,1) ;
0137          GETINT(TERMNR,1) ;
0138          GETREAL(RT,1) ;
0139          GETREAL(TITER,1) ;
0140          PRINTTEXT(//'6SP' MÄT- '4SP' TEMPE- '6SP' SALT- '5SP' SYRE- '3SP'
0141          SYRE- '3SP' TOTAL- '4SP' SIGMA '5SP' LJUD- 'CR' '6SP' DJUP '4SP'
0142          RATUR '7SP' HALT '6SP' HALT '4SP' HALT '4SP' FOSFOR '4SP' INDEX
0143          '5SP' HAST 'CR' '7SP' '37' M '38' '4SP''37'  GR 'SP' C '38' '6SP'
0144          '37' O 'DA' 00 '38' '3SP' '37' ML 'DA' L '38' '2SP' '37' PROC '38'
0145          '2SP' '37' UGAT 'DA' L '38' '5SP' T '7SP' '37' M 'DA' S '38'
0146          '2CR' //)   ;
0147          INST := 'FALSE'   ;
0148     MÄT: GETREAL (Z,1) ;
0149          NIX := 'FALSE' ;
0150          'IF' Z < 0 'THEN' 'BEGIN' PRINTTEXT(//'CR' '6SP' BT-REGISTRERING
0151          'SP' NR:  //)   ;
0152          'IF' BTREG < 0 'THEN' PRINTTEXT(// EJ 'SP' ANG //) 'ELSE'
0153          PRINT(//'SP'//, BTREG, 3, 0) ;
0154          PRINTTEXT(//'2SP' BATHYTERMOGRAF 'SP' NR:  //)   ;
0155          'IF' BTNR < 0 'THEN' PRINTTEXT(//'SP' EJ 'SP' ANG//)
0156          'ELSE' PRINT(//'SP'//, BTNR, 5, 0) ;
0157          PRINTTEXT(//'2SP' TERMOMETER 'SP' NR: //) ;
0158          PRINT(//'SP'//, TERMNR, 2, 0)   ;
0159          'IF' INST 'THEN' PRINTTEXT(//'CR' '6SP' ANM: 'SP' 'AS' 'SP' = 'SP'
0160          INSTABIL 'SP' TÄTHETSSKIKTNING //)   ;      INST := 'FALSE' ;
0161          BO := 'TRUE'   ;
0162   BERTIL: 'IF' GETSTRING(ANM,72) < 0 'THEN'  'GOTO'  ÖSTRÖM    ;
0163          'IF' BO 'THEN' PRINTTEXT(//'CR' '6SP' ANM: 'SP' //)   ;
0164          PRINTTEXT(ANM) ;
0165          PRINTTEXT(// 'CR' '6SP'  //) ;
0166          BO := 'FALSE'   ;                          'GOTO'     BERTIL   ;
0167   ÖSTRÖM: PRINTTEXT( 'IF' HJÄLP < 0 'THEN' // '14CR' // 'ELSE' //'12'//) ;
0168          'GOTO'    START  'END'   ;
0169          PRINT(//'6SP'//, Z, 3, 0) ;
0170          GETREAL(TAVL,1) ;
0171          GETINT(FLNR,1) ;
0172          'IF' FLNR > 1400 'AND' FLNR 'LQ' 1430 'THEN' FLNR := FLNR - 1040;
0173          'IF' TAVL < -90 'THEN'  'BEGIN'  PRINTTEXT(// '4SP' EJ 'SP'
0174          OBS //) ; NIX :=  'TRUE' ;  'GOTO' EJ TEMP  'END' ;
0175          A:=0  ;
0176   L:     A:=A+1 ;
0177          'IF' TG(TERMNR, A)  < TAVL 'AND'   TAVL 'LQ' TG(TERMNR, A + 1)
```

```
0178          'THEN' T := TAVL + TK(TERMNR, A) + (TAVL - TG(TERMNR, A)) *
0179          (TK(TERMNR, A + 1) -TK(TERMNR, A)) / (TG(TERMNR, A + 1) -
0180          TG(TERMNR, A)) 'ELSE' ' GOTO' L;
0181          'IF' - 2 > T 'OR' T > 40 'THEN' 'BEGIN'
0182          PRINTTEXT(//'4SP' FEL 'SP' I 'SP' INDATA 'CR' //) ; 'GOTO' ÖSTRÖM
0183          'END';
0184          PRINT(//'4SP'//, T, 2, 1) ;      PRINTTEXT(// 'SP' //);
0185    EJ TEMP: GETREAL(SAVL,1) ;
0186          'IF' SAVL < 0 'THEN' 'BEGIN' PRINTTEXT(//'6SP' EJ'SP' OBS//) ;
0187          NIX := 'TRUE' ;
0188          'GOTO' EJSALT 'END' ;
0189          SAVL := SAVL* 1E-5 ;
0190          DELTA20RT := 1E-5 * SAVL * (SAVL - 1) * (RT - 20) *
0191          (90.4 - 72.0 *SAVL + 35.2 * SAVL ** 2 -
0192          (0.63 + 0.21 *SAVL ** 2) * (RT - 20)) ;
0193          DELTA1520 := 1E-5 * SAVL *(SAVL - 1) *
0194          5 * (96.7 - 72.0 * SAVL + 37.3 * SAVL ** 2 -
0195          ( 0.63 + 0.21 * SAVL ** 2) * 5) ;
0196          SAVL15 := SAVL + DELTA20RT + DELTA1520 ;
0197          S := - 0,08996 + 28.29720*SAVL15 + 12.80832*SAVL15 **2
0198          -10.67869*SAVL15 **3 + 5.98624*SAVL15 **4
0199          -1.32311*SAVL15 **5 ;
0200          CL := (S - 0.030) / 1.805 ;
0201          'IF' 0 > S 'OR' S > 40 'THEN' 'BEGIN'
0202          PRINTTEXT(//'4SP' FEL 'SP' I 'SP' INDATA 'CR' //) ; 'GOTO' ÖSTRÖM
0203          'END';
0204          PRINT(//'5SP'//, S, 2, 3) ;
0205    EJ SALT: GETREAL(O2AVL,1) ;
0206          'IF' O2AVL < 0 'THEN' 'BEGIN' PRINTTEXT(//'17SP'//) ; 'GOTO'
0207          EJ SYRE 'END' ;
0208          O2 := O2AVL * TITER * 22.4E3 / (4 * (FLVOL(FLNR) - 2 )) ;
0209          'IF' 0 > O2 'OR' O2 > 15 'THEN' 'BEGIN'
0210          PRINTTEXT(//'4SP' FEL 'SP' I 'SP' INDATA 'CR' //) ; 'GOTO' ÖSTRÖM
0211          'END';
0212          TABS := T + 273.16 ;
0213          O2SAT := EXP( - 173.4292 + 249.6339 * 100 / TABS
0214          + 143.3483 * LN(TABS/100) - 21.8492 *TABS / 100
0215          + S * ( - 0.033096 + 0.014259 * TABS / 100
0216          - 0.0017000 * (TABS / 100) ** 2)) ;
 217          O2PROC := O2 * 100 / O2SAT ;
0218          PRINT(//'3SP'//, O2, 2, 2) ;
0219          'IF' O2 'LQ' 0.04 'AND' O2 'GQ' 0 'THEN' 'BEGIN'
0220          PRINTTEXT(//'4SP' H2S '4SP'//) ; 'GOTO' EJ SYRE 'END' ;
0221          PRINT(//'2SP'//, O2PROC, 3, 1) ;
 222    EJ SYRE: GETREAL(TOTP,1) ;
0223          'IF' TOTP < 0 'THEN' 'BEGIN' PRINTTEXT(//'8SP'//) ;
0224          'GOTO' EJ TOTP 'END' ;    PRINT(//'3SP'//, TOTP, 1, 2) ;
0225    EJ TOTP: 'IF' NIX 'THEN' 'BEGIN' PRINTTEXT(//'6SP' EJ 'SP' BERÄKNADE
0226          'CR' //) ; 'GOTO' MÄT 'END' ;
0227          SIGMANOLL := -0.069 + 1.4708 * CL - 0.001570 * CL ** 2 +
0228          0.0000398 * CL ** 3 ;
0229          STORASIGMAT := -(T - 3.98 ) ** 2* (T + 283) /
0230          ( 503.570 * ( T + 67.26)) ;
0231          AT := T * ( 4.7867 - 0.098185 * T + 0.0010843 * T **
0232          2) * 1E-3 ; BT := T * ( 18.030 - 0.8164 * T +
0233          0.01667 *T ** 2 ) * 1E-6 ;
0234          SIGMAT := STORASIGMAT + (SIGMANOLL + 0.1324)* (1 - AT
0235          + BT * (SIGMANOLL - 0.1324)) ;
0236          'IF' - 6 > SIGMAT 'OR' SIGMAT > 30 'THEN' 'BEGIN'
0237          PRINTTEXT(//'4SP' FEL 'SP' I 'SP' INDATA 'CR' //) ; 'GOTO' ÖSTRÖM
```

```
0238            'END';
0239            PRINT(//'4SP'//, SIGMAT    , 2, 2 )  ;
0240            'IF'  SIGMAT 'LO' NYSIG 'THEN' 'BEGIN'  PRINTTEXT(//'SP' 'AS'//) ;
0241            INST :='TRUE''END'  'ELSE' PRINTTEXT(//'2SP'//)    ;
0242             NYSIG := SIGMAT ;
0243            C     := 1402.9 + 4.98 * T     - 0.05 *T     ** 2 +
0244            S     * (1.34 - 0.011 * T     ) + 0.018 * Z           ;
0245            'IF'  1390 > C 'OR'  C > 1560 'THEN' 'BEGIN'
0246            PRINTTEXT(//'4SP' FEL 'SP' I 'SP' INDATA 'CR' //) ; 'GOTO' ÖSTRÖM
0247            'END';
0248            PRINT(//'2SP'//, C    , 4, 1 )  ;
0249            PRINTTEXT (//'CR'//)  ;
0250            'GOTO' MÄT ;
0251    INGA:   CLOSEPRINTER ;
0252            'END' ;
```

21 "TV 102"
77 SVERIGE

STATION
SW HALLM

LAT: 58 17.0 N
LONG: 11 02.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	6	10	16	0						
TID GMT:	72	6	10	15	0	100	NE	6	4	0.1-0.5	

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (O/OO)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	13.3	22.624			.57	16.83	1487.2
10	10.9	30.025			.50	22.95	1488.1
20	10.1	32.548			.44	25.04	1488.5
30	10.0	33.528			.78	25.82	1489.5
40	9.3	33.879			.89	26.21	1487.5
50	8.6	34.365			.68	26.71	1485.7
60	8.2	34.482			.70	26.86	1484.5
70	7.1	34.364			1.21	26.93	1480.2
80	7.0	34.352			.88	26.94	1480.0
90	6.8	34.421			1.13	27.02	1479.4

BT-REGISTRERING NR: 17 BATHYTERMOGRAF NR: 10865 TERMOMETER NR: 41

21 "TV 102"
77 SVERIGE

STATION
SW HALLM

LAT: 58 17.0 N
LONG: 11 02.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	7	14	18	30						
TID GMT:	72	7	14	17	30	98	W	1	4	0 -0.1	20.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (O/OO)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	16.8	30.037			.31	21.78	1507.2
5	15.9	30.205			.36	22.11	1504.8
10	14.7	32.575			.53	24.18	1504.0
20	12.3	34.024			.41	25.80	1497.9
30	12.7	34.595			.35	26.16	1500.1
40	12.5	34.661			.31	26.25	1499.7
50	12.5	34.620			.30	26.22 *	1499.8
60	12.1	34.699			.28	26.36	1498.7
70	8.1	34.218			.95	26.67	1483.9
80	8.3	34.346			.78	26.74	1485.0
90	8.4	34.342			.68	26.72 *	1485.6

BT-REGISTRERING NR: 22 BATHYTERMOGRAF NR: 10863 TERMOMETER NR: 41
ANM: * = INSTABIL TÄTHETSSKIKTNING

21 "TV 102"
77 SVERIGE

STATION
SW HÄLLÖ

LAT: 58 17.0 N
LONG: 11 02.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	8	19	13	0						
TID GMT:	72	8	19	12	0	EJ ANG	NNW	10	8	1.2-2.5	

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (0/00)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	16.4	25.780				18.62	1501.1
10	16.3	26.699				19.34	1502.1
20	15.7	33.574				24.73	1508.4
30	14.6	34.004				25.30	1505.7
40	10.4	34.778				26.73	1492.7
50	9.2	34.784				26.94	1488.4
60	9.1	34.795				26.96	1488.3
70	9.0	34.824				27.00	1488.1
80	8.7	34.944				27.14	1487.3
90	8.6	34.977				27.19	1487.1

BT-REGISTRERING NR: 24 BATHYTERMOGRAF NR: 10863 TERMOMETER NR: 41

21 "TV 102"
77 SVERIGE

STATION
W VINGA

LAT: 57 39.0 N
LONG: 11 27.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	5	27	16	30						
TID GMT:	72	5	27	15	30	80	S	6	4	0.5-1.2	

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (0/00)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	9.4	29.530	7.25	109.4		22.81	1481.8
5	8.8	29.830	5.58	83.2		23.13	1480.0
10	9.3	30.671	5.55	84.1		23.71	1483.0
20	8.8	33.493	5.03	76.7		25.99	1484.8
30	8.6	33.886	5.26	80.0		26.33	1484.7
40	8.4	34.050	5.28	80.1		26.49	1484.3
50	7.6	34.195	5.14	76.7		26.73	1481.6
60	6.6	34.425	5.07	73.9		27.05	1478.1
70	5.8	34.624	4.57	65.7		27.30	1475.7

BT-REGISTRERING NR: 14 BATHYTERMOGRAF NR: 10865 TERMOMETER NR: 41

24 "TV 244"
77 SVERIGE

STATION
HANÖBUKTEN

LAT: 55 48.0 N
LONG: 15 20.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	7	17	13	25						
TID GMT:	72	7	17	12	25	58	E	5	5	0.5-1.2	24.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (O/OO)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	15.3	7.601	7.27	108.8		4.96	1476.3
5	15.1	7.557	7.29	108.6		4.96	1475.7
10	15.0	7.557	7.31	108.6		4.97	1475.4
15	11.9	7.594	7.64	106.1		5.46	1464.6
15	EJ OBS	EJ OBS	7.63	106.1		EJ BERÄKNADE	
20	7.2	7.704	7.95	99.0		6.03	1446.3
30	5.4	7.944	7.78	92.9		6.32	1439.2
40	4.7	8.283	7.33	85.9		6.62	1436.4
50	4.3	8.519	7.00	81.4		6.82	1435.1

BT-REGISTRERING NR: 11 BATHYTERMOGRAF NR: EJ ANG TERMOMETER NR: 3
ANM: OMTAGNING. FÖRSTA SYREVÄRDET VID DJUP 15M OSÄKERT

24 "TV 244"
77 SVERIGE

STATION
HANÖBUKTEN

LAT: 55 48.0 N
LONG: 15 20.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	9	26	15	30						
TID GMT:	72	9	26	14	30	59	SW	5	2	0.1-0.5	16.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (O/OO)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	14.6	7.347	6.58	96.9		4.88	1473.7
5	14.6	7.342	6.48	95.4		4.87 *	1473.7
10	14.5	7.344	6.25	91.9		4.89	1473.5
15	14.5	7.344	6.59	96.8		4.89	1473.6
20	14.5	7.354	6.58	96.6		4.90	1473.7
30	14.5	7.360	6.48	95.2		4.90	1473.9
40	7.3	7.881	6.32	79.0		6.16	1447.3
50	6.4	8.175	6.65	81.5		6.45	1444.1
60	6.4	8.248	6.46	79.2		6.51	1444.4

BT-REGISTRERING NR: 18 BATHYTERMOGRAF NR: EJ ANG TERMOMETER NR: 3
ANM: * = INSTABIL TÄTHETSSKIKTNING

23 "TV 253"
77 SVERIGE

STATION
KARLSHAMN

LAT: 56 03.5 N
LONG: 14 59.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	8	16	11	30						
TID GMT:	72	8	16	10	30	38	N	3	5	0.1-0.5	24.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (0/00)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	18.6	7.503				4.26	1486.8
10	18.4	7.532				4.32	1486.4
20	9.4	7.637				5.79	1455.0
30	7.4	7.738				6.04	1447.3

BT-REGISTRERING NR: 18 BATHYTERMOGRAF NR: EJ ANG TERMOMETER NR: 23

23 "TV 253"
77 SVERIGE

STATION
KARLSHAMN

LAT: 56 03.5 N
LONG: 14 59.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIGHET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	8	26	11	30						
TID GMT:	72	8	26	10	30	38	N	4	4	0.1-0.5	20.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (0/00)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
0	EJ OBS	7.515				EJ BERÄKNADE	
10	EJ OBS	7.543				EJ BERÄKNADE	
20	EJ OBS	7.785				EJ BERÄKNADE	
30	EJ OBS	7.863				EJ BERÄKNADE	

BT-REGISTRERING NR: 20 BATHYTERMOGRAF NR: EJ ANG TERMOMETER NR: 23
ANM: TERMOMETERN SJUNDER

25 "TV 116"
77 SVERIGE

STATION GOTLANDSDJUPETS NÄRH

LAT: 57 33.6 N
LONG: 19 42.0 E

	ÅR	MÅN	DAG	TIM	MIN	BOTTEN-DJUP(M)	VIND-RIKTN	VIND-HAST (M/S)	MOLNIG-HET(/8)	VÅGHÖJD > (M) <	LUFT-TEMP (GRAD C)
LOK.TID:	72	7	20	13	0						
TID GMT:	72	7	20	12	0	120	SSE	3	INGEN	0 -0.1	27.0

MÄT-DJUP (M)	TEMPE-RATUR (GR C)	SALT-HALT (0/00)	SYRE-HALT (ML/L)	SYRE-HALT (PROC)	TOTAL-FOSFOR (UGAT/L)	SIGMA INDEX T	LJUD-HAST (M/S)
1	21.8	7.308	7.07	120.4		3.40	1495.8
10	18.9	7.297	7.47	120.2		4.03	1487.7
20	8.1	7.605	8.34	106.1		5.88	1449.9
30	5.0	7.648	8.45	99.5		6.11	1436.9
40	4.7	7.730	8.25	96.5		6.18	1435.8
50	3.2	7.786	8.14	91.6		6.26	1429.3
60	2.8	7.938	7.66	85.4		6.39	1427.8
70	3.1	8.851	4.86	54.9		7.11	1430.6
80	4.4	10.115	.59	6.9		8.08	1438.3
90	4.9	10.723	.75	9.0		8.54	1441.5

BT-REGISTRERING NR: 20 BATHYTERMOGRAF NR: 10068 TERMOMETER NR: 38

Figure 1.

KUSTBEVAKNINGEN HYDROGRAFI

Fartyg △				Station ×			År ×	Mån ×	Dag ×	Kl △	Sign	
Djup	Term nr	Temp	Korr	Salt-fl.nr	Syre-fl.nr		Temp °C	Salt Avl.	J t	Syre Avl.		
×		△		△	△			○		○		
×		△		△	△			○		○		
×		△		△	△			○		○		
×		△		△	△			○		○		

Djup △ m	Vind △ △ m/s	Moln △ /8	Sjö △	Luft.t △	BT-skiva nr △ △
Anm △					

On this form are given:

1. The compulsary information defining the measurement (time and place). ×
2. The observation data, if any, given from the station. △
3. The corresponding instrument readings from the water sample analyses given by us. ○