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THE SALINITY INTRUSION IN THE SKEENA RIVER

Observations of Salinities, Temperatures and Currents 1979, 1984

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Institute of Ocean Sciences
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Sidney, British Columbia
V8L 4B2

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Canada

Canadian Data Report Of Hydrography and Ocean Sciences

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Les établissements des Sciences et levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports en décembre 1981. Une liste complète de ces publications figure dans le volume 39, Index des publications 1982, du *Journal canadien des sciences halieutiques et aquatiques*. La série actuelle a commencé avec la publication du rapport numéro 1 en janvier 1982.

Canadian Data Report of
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THE SALINITY INTRUSION IN THE SKEENA RIVER:

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CONTENTS

ABSTRACT

Ages, A.B. 1995. The Salinity Intrusion in the Skeena River: Observations of Salinities, Temperatures and Currents 1979, 1984. Can. Data Rep. Hydrog. Ocean Sci. 138: 28 pp.

Observations of salinities, temperatures and currents are presented in the form of vertical profiles at stations in the lower reaches of the Skeena River and in the approaches to the estuary. The data were obtained at freshet conditions in the summer of 1979 and at non-freshet conditions in the spring of 1984.

Keywords: Skeena River, currents, salinities, temperatures.

RÉSUMÉ

Ages, A.B. 1995. The Salinity Intrusion in the Skeena River: Observations of Salinities, Temperatures and Currents 1979, 1984. Can. Data Rep. Hydrog. Ocean Sci. 138: 28 pp.

Ce rapport présente des observations de salinité, de température et de courant dans les sections inférieures du fleuve Skeena et dans les approches de l'estuaire. Les données sont présentées sous forme de profiles verticaux, pour des conditions de crue pendant l'été de 1979, et de non-crue au printemps de 1984.

Mot-Clés: Fleuve Skeena, courants, salinité, température.

ACKNOWLEDGEMENTS

Observations in July 1979 were made from the charter vessel *Pandora* and thanks are due to Captain Robin Jones and his crew for their support. Assistance in the field by Janice Bruce and Stewart Langton is gratefully acknowledged, as well as the cooperation, in this joint venture, of Dr. Leslie Churchland and her staff at Environment Canada.

In April 1984, the Canadian Coast Guard made one of their Alouette helicopters available to continue our work; the enthusiastic and creative support of pilot Gary Dahlgren is appreciated.

Finally, thanks are due to Rosalie Rutka for compiling the report, and to Sharon Thomson for proofreading the text.

INTRODUCTION

Previous oceanographic cruises along the coast of British Columbia have usually included observations of salinities and temperatures in the approaches to the Skeena River (Figure 1) (Hoos, 1975) but have not explored the reaches upstream from the river mouth. This report is an attempt to provide future environmental and engineering studies with a set of preliminary data on the salinity intrusion in the Skeena River itself. Because of the logistics involved and the limited available ship and helicopter time, a large-scale and detailed survey had to be left to a later date.

The report covers two sets of data, the first one for July 26 to 29, 1979 obtained from shipboard, at relatively high river discharges, and the second set (April 3 to 5, 1984) by helicopter, at low discharges. Shipboard observations were taken from the charter vessel *Pandora* achored near the entrance to the Skeena River, and from the Institute of Ocean Sciences (IOS) roving launch *Jaeger* based on the *Pandora*. The survey in the early spring of 1984 was made with a helicopter provided by the Canadian Coast Guard.

The field program in July 1979 was jointly carried out with the Water Quality Branch of the Inland Waters Directorate (Department of Environment). Water quality parameters were measured from the *Pandora* by Dr. Leslie Churchland and her staff. In addition, the Biology Department at the University of Victoria sent out one of its graduate students, Randy Baker, to collect samples of invertebrates in the estuary.

A helicopter was chosen for the observations in April 1984, partly because of the lack of available ship time and partly to assess its possible application in measuring current profiles.

OBSERVATIONS

Time series at Veitch Rock were carried out from the *Pandora* from July 26 to 29, 1979, routinely at one-half-hour intervals whenever the three-member IOS staff was not away on the launch or otherwise occupied. Profiles of salinities and temperatures are presented in the form of plots at 2-m intervals; currents are depth-averaged.

While the time series were in progress, salinity and temperature measurements were taken from the launch *Jaeger* in the Skeena River as far as Snag Point where the river became too shallow (Figure 2).

From April 3 to 5, 1984, salinity and temperature measurements were taken by helicopter, covering the same area, as well as additional stations in the Ecstall River.

INSTRUMENTATION

In July 1979, salinities and temperatures were measured with an Interocean CTD, and a Hydrolab salinometer. Currents were measured with a Marsh McBirney electromagnetic current meter.

During the helicopter survey in April 1984, salinities and temperatures were measured with a Hydrolab salinometer. Current measurements made with a Marsh McBirney current meter were inaccurate and had to be abandoned.

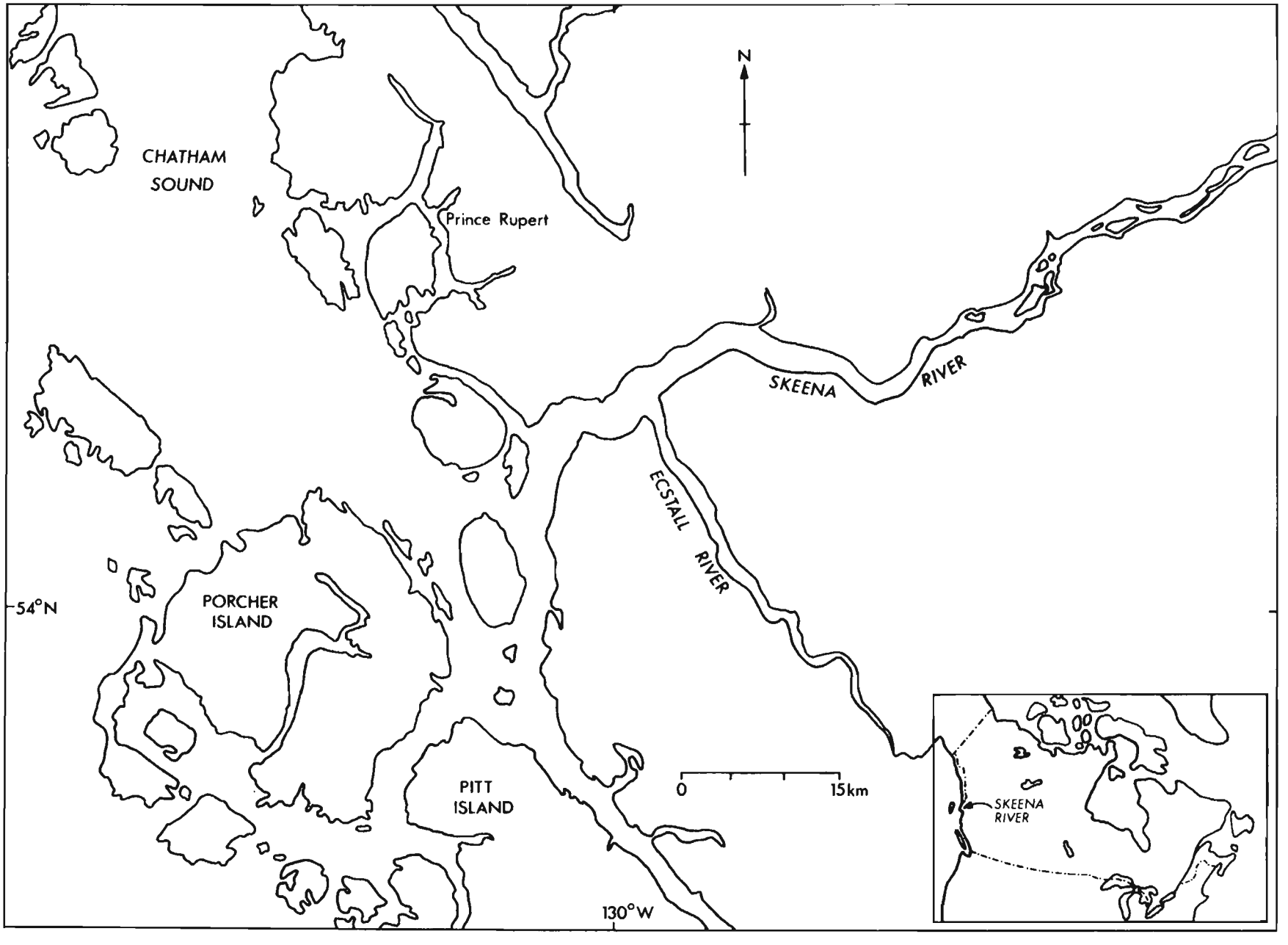

Figure 1. The Skeena River and approaches.

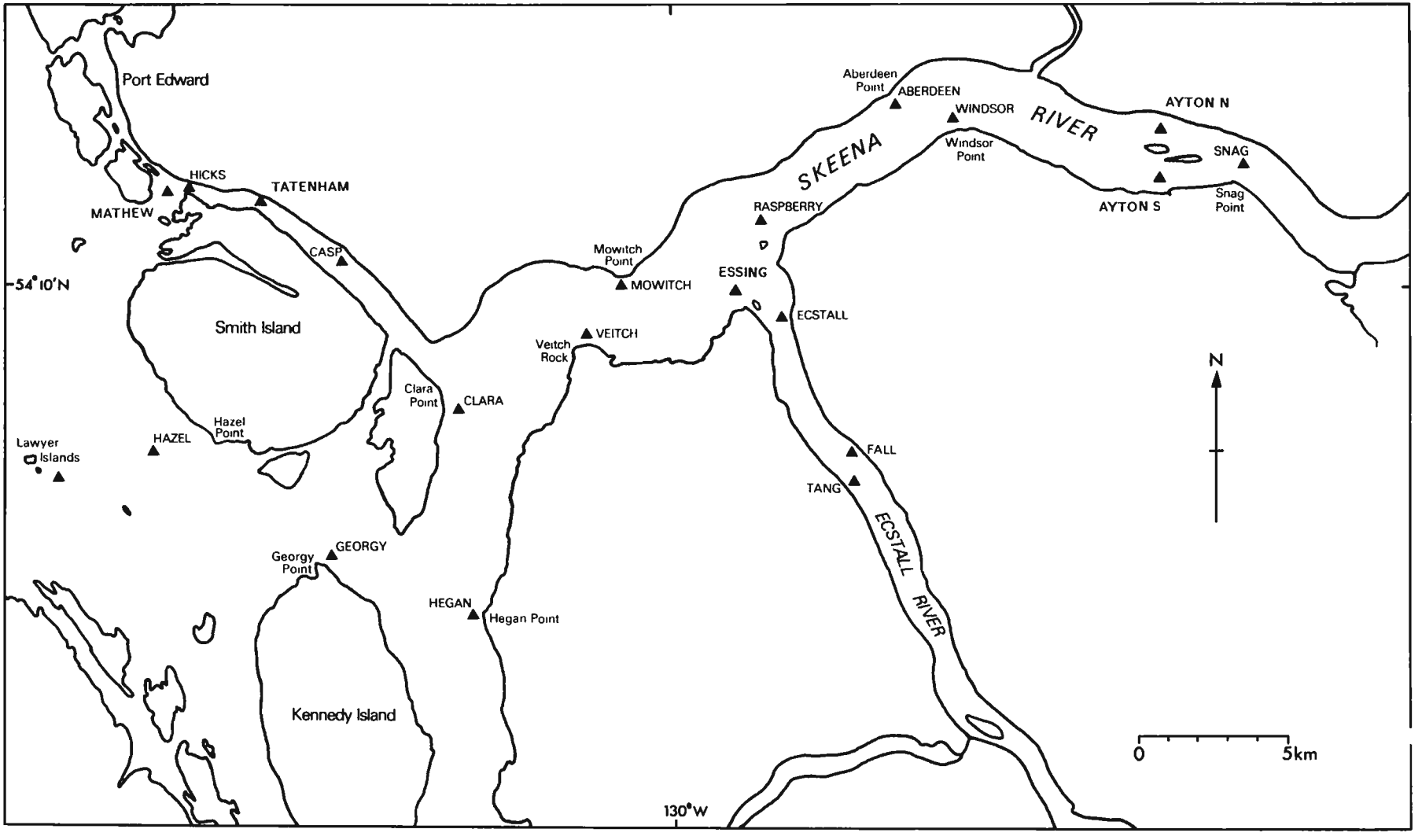

Figure 2. Stations occupied in July 1979 and April 1984.

FINAL REMARKS

The observations in the summer of 1979 and those in the spring of 1984 do not represent extreme freshet or extreme non-freshet conditions.

The Skeena River discharge of July 26 to 29, 1979 was slightly more than 1200 m^3/sec, and that of April 3 to 5, 1984 amounted to about 300 m^3/sec (Inland Waters Directorate, 1979, 1984). These discharges were measured by the flow gauge at Usk, which had recorded a maximum daily flow of 9,340 m^3/sec, on May 26, 1946 and a minimum of 52 m^3/sec, on March 1, 1950 (Inland Waters Directorate, 1990). Although the location of this station is nearest the river entrance, it is still 64 km upstream from Veitch Point. Because of the significant tributary discharges below the gauge, its records do not truly represent flow conditions in the study area. More specifically, a numerical model using some of the data in this report would require a number of additional flow gauges for its calibration.

Aside from the absence of reliable upstream boundary conditions for a model, the gravel beds which we observed upstream from Aberdeen Point (Figure 2) would most likely shift continuously in the summer (at high flows) as well as in the winter (because of ice), and thus make it difficult to estimate the bottom friction in a model.

Unlike the very distinct density stratification which we earlier found at an incoming tide in the Fraser and Campbell Rivers, we did not observe a salt wedge in the Skeena River, presumably because of turbulence generated by irregular shallow topography.

Our attempts to simultaneously measure currents, salinities and temperatures from a helicopter were unsuccessful, mainly because it was not possible to keep the current meter cable from swinging as the probe was lowered from the helicopter hovering at an altitude of 10-m above the water surface. Similar experiments with a hovercraft at a later date proved more successful.

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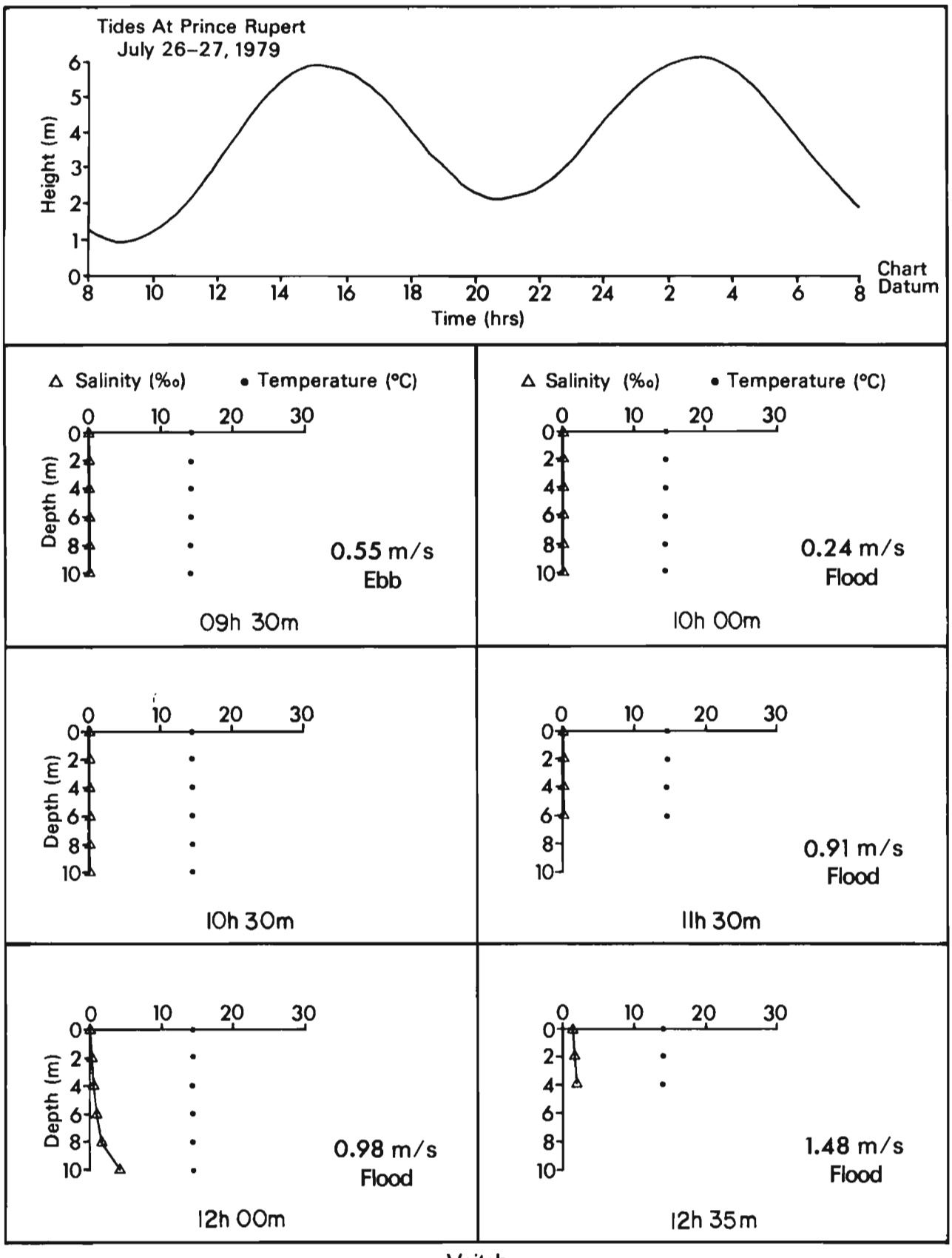
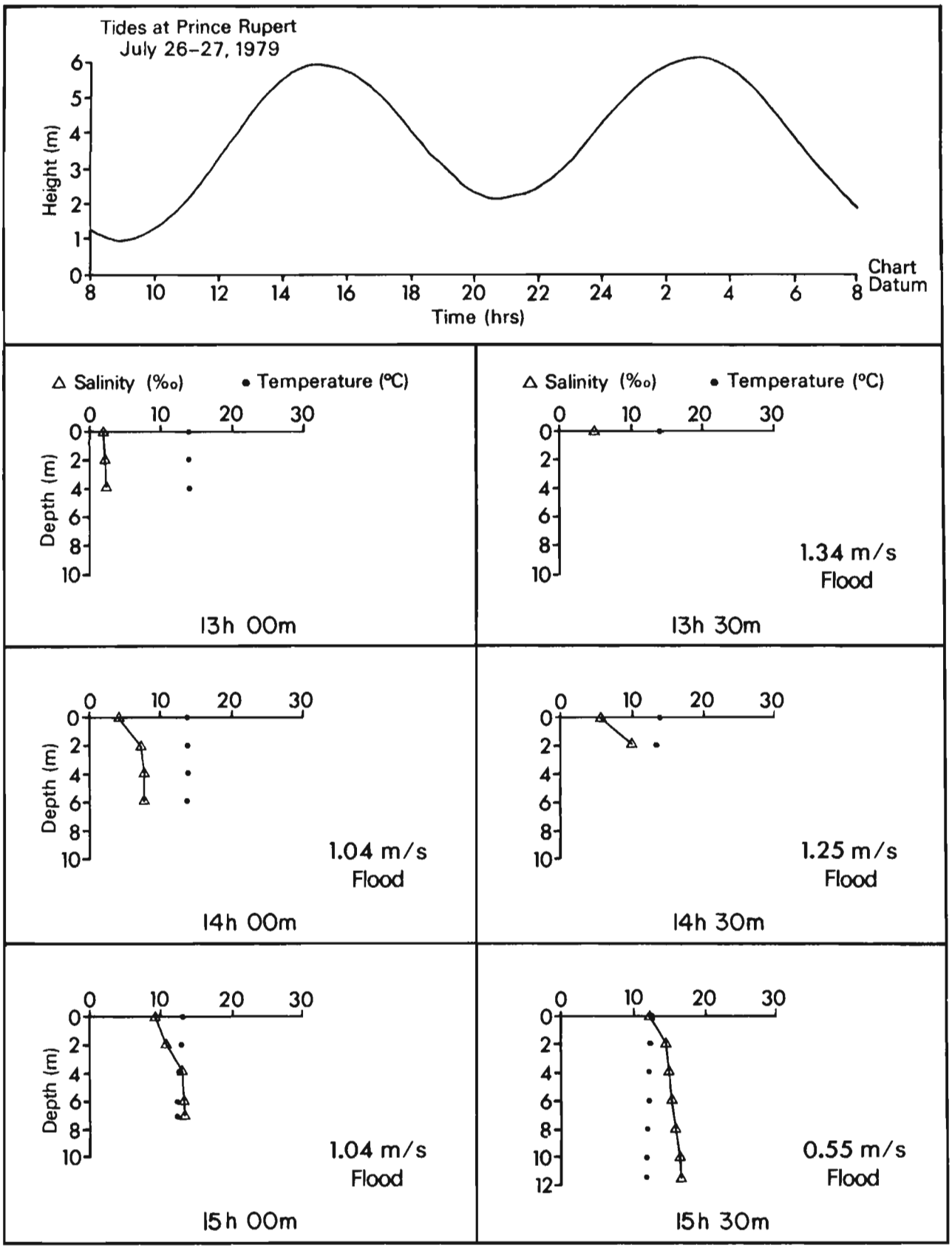
Inland Waters Directorate, 1984. *Surface Water Data, British Columbia.* Water Survey of Canada, Ottawa.

Inland Waters Directorate, 1990. *Surface Water Data, British Columbia.* Water Survey of Canada, Ottawa.

PROFILES


Tides At Prince Rupert
July 26–27, 1979
Height (m)
Time (hrs)
Chart Datum
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
0.55 m/s
Ebb
09h 30m
0.24 m/s
Flood
10h 00m
10h 30m
0.91 m/s
Flood
11h 30m
0.98 m/s
Flood
12h 00m
1.48 m/s
Flood
12h 35m

Veitch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Height (m)
Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
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13h 30m
1.34 m/s
Flood
1.04 m/s
Flood
14h 00m
1.25 m/s
Flood
14h 30m
1.04 m/s
Flood
15h 00m
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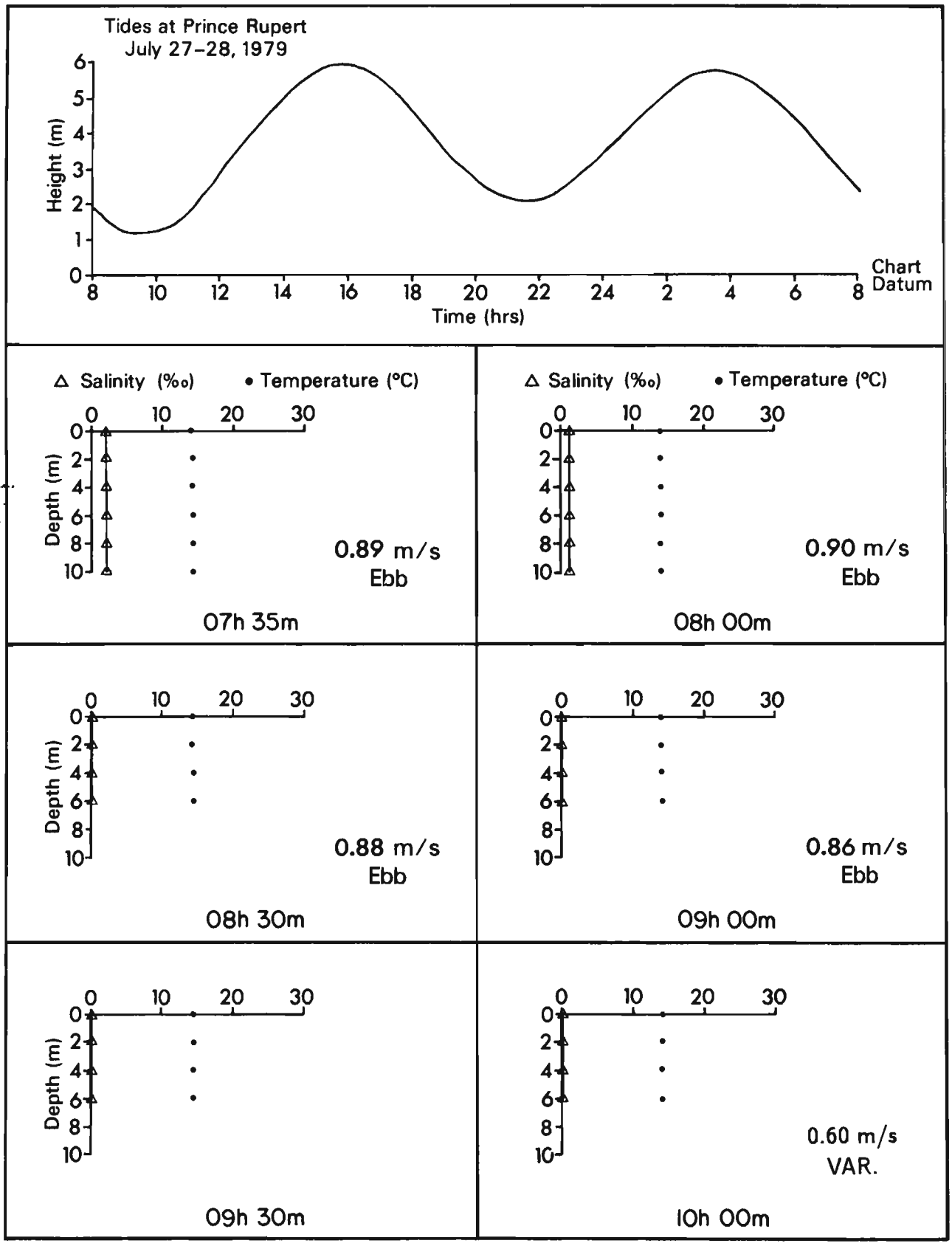
Flood
15h 30m

Veitch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Time (hrs)
Chart Datum
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• Temperature (°C)
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Ebb
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0.90 m/s
Ebb
08h 00m
0.88 m/s
Ebb
08h 30m
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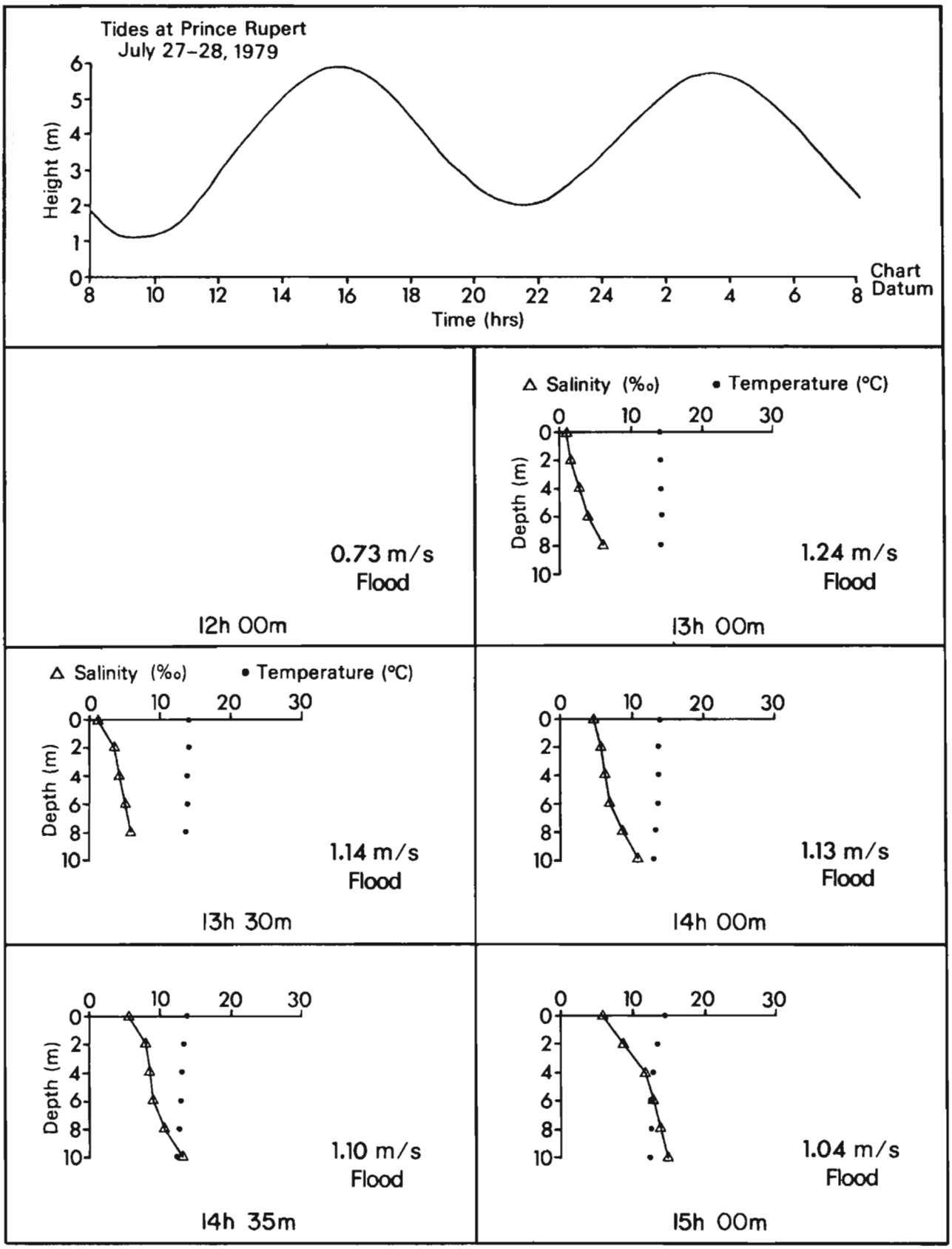
Ebb
09h 00m
09h 30m
0.60 m/s
VAR.
10h 00m

Veitch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Time (hrs)
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Flood
12h 00m
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
1.24 m/s
Flood
13h 00m
1.14 m/s
Flood
13h 30m
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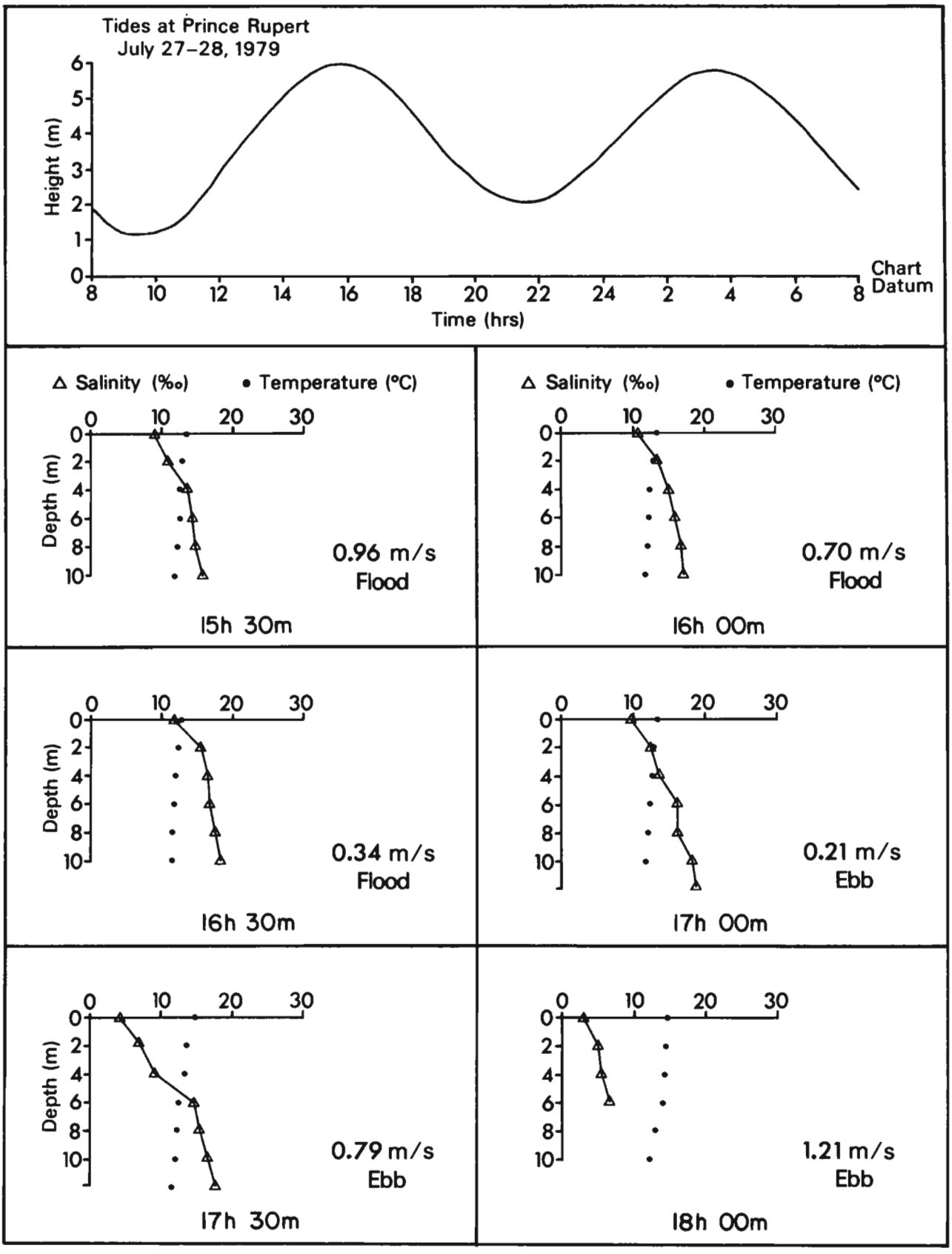
Flood
14h 00m
1.10 m/s
Flood
14h 35m
1.04 m/s
Flood
15h 00m

Veitch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Height (m)
Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
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Flood
15h 30m
0.70 m/s
Flood
16h 00m
0.34 m/s
Flood
16h 30m
0.21 m/s
Ebb
17h 00m
0.79 m/s
Ebb
17h 30m
1.21 m/s
Ebb
18h 00m

Veitch

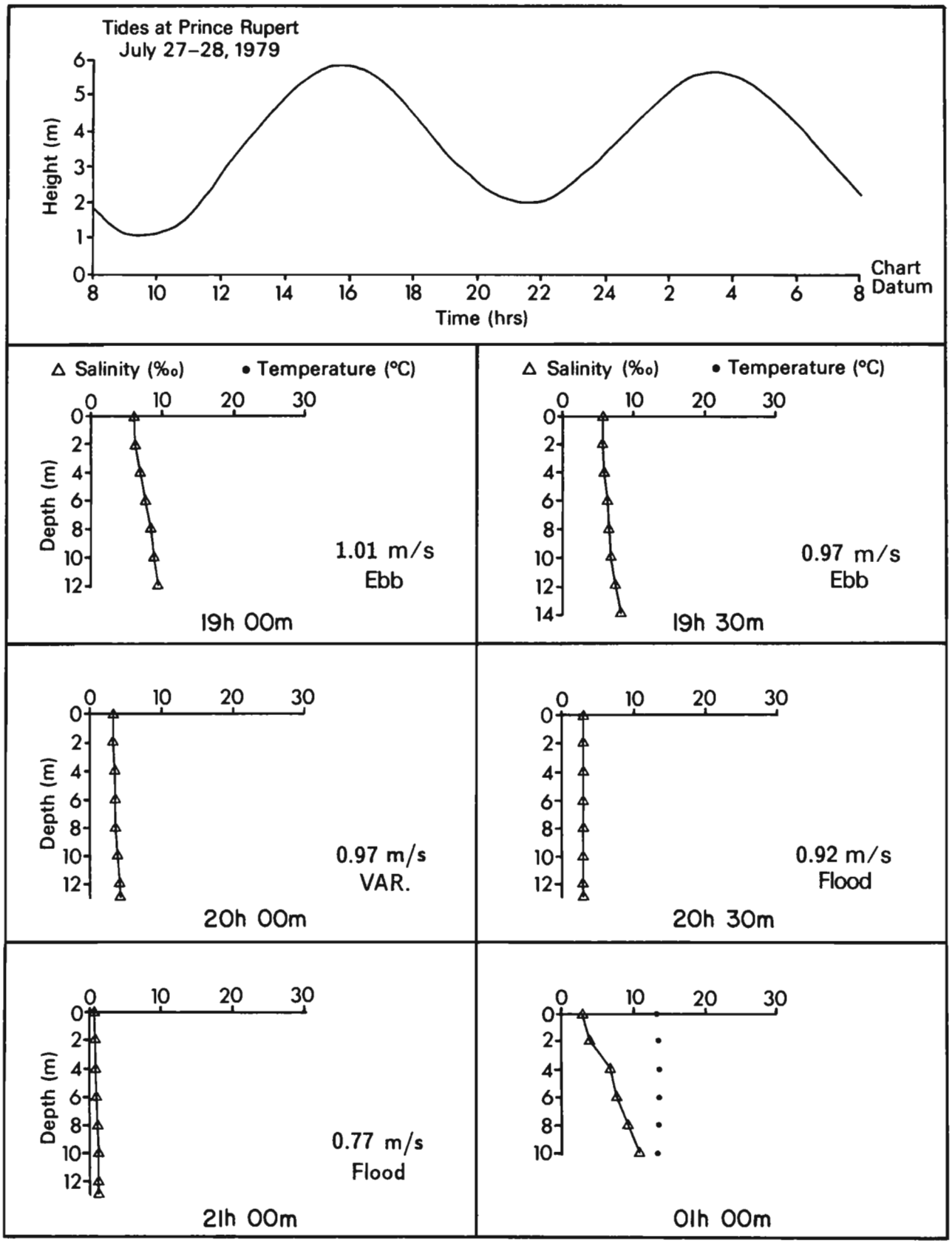
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Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
1.01 m/s
Ebb
19h 00m
0.97 m/s
Ebb
19h 30m
0.97 m/s
VAR.
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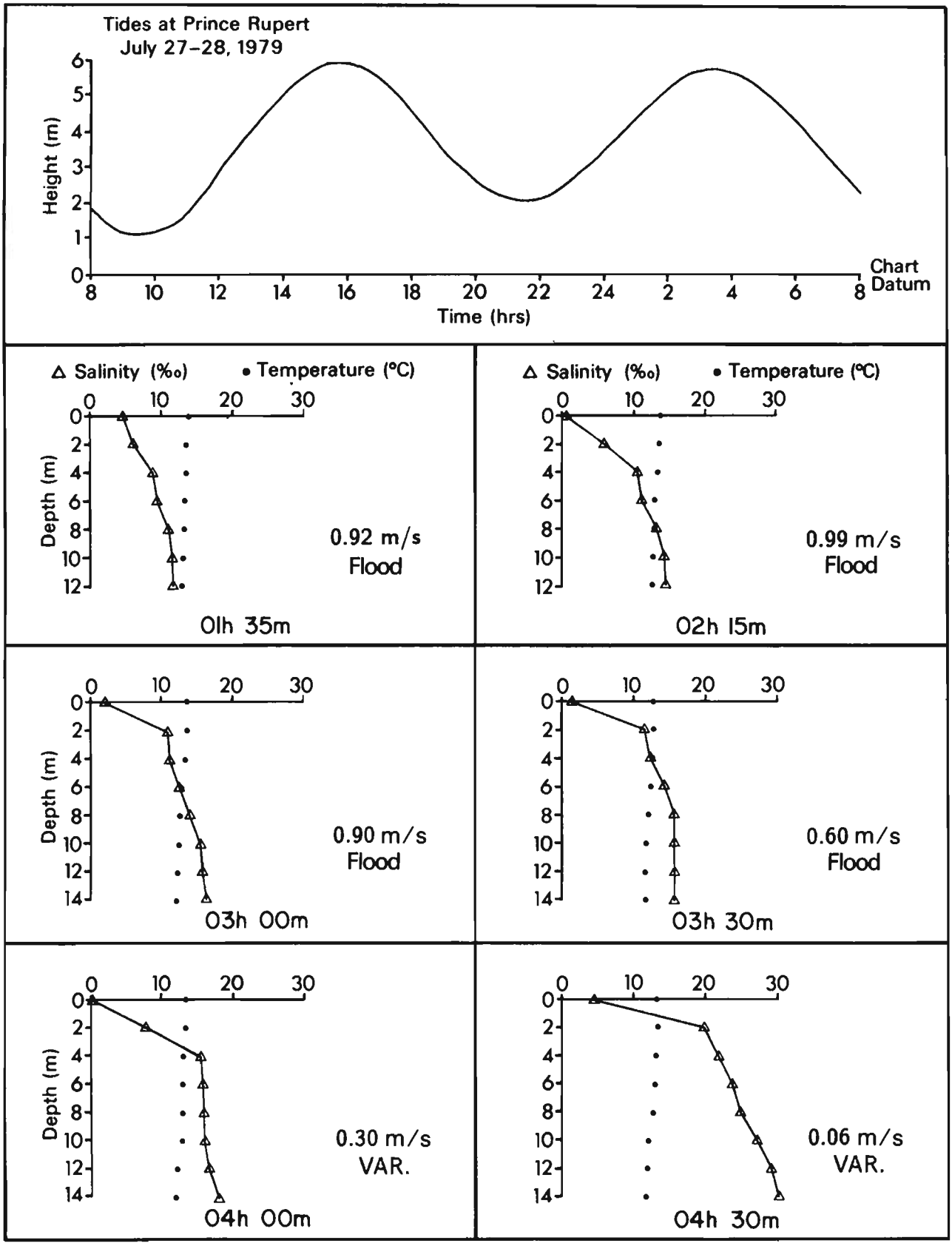
0.92 m/s
Flood
20h 30m
0.77 m/s
Flood
21h 00m
01h 00m

Veitch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July 27–28, 1979
Height (m)
Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
0.92 m/s
Flood
01h 35m
0.99 m/s
Flood
02h 15m
0.90 m/s
Flood
03h 00m
0.60 m/s
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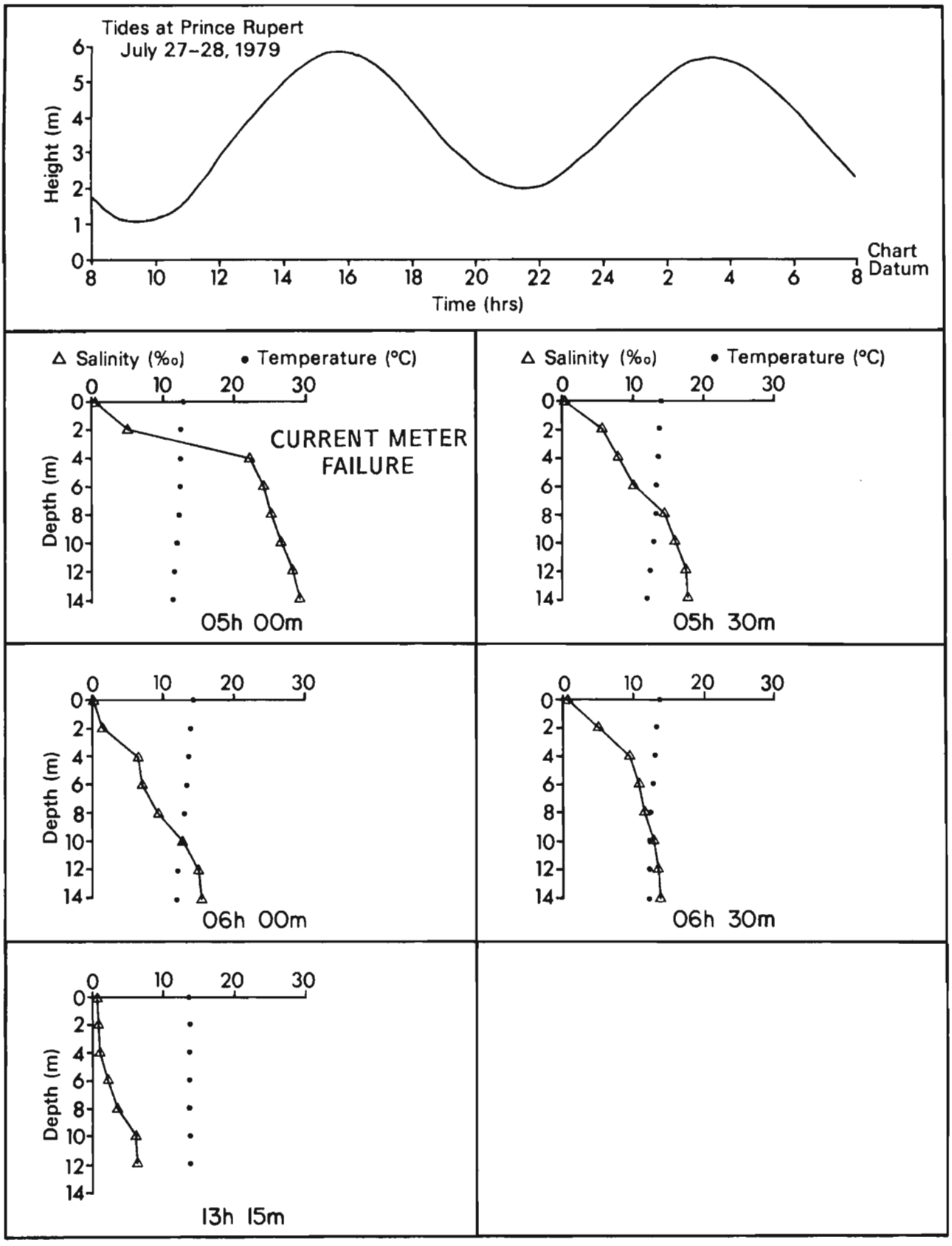
VAR.
04h 30m
Veitch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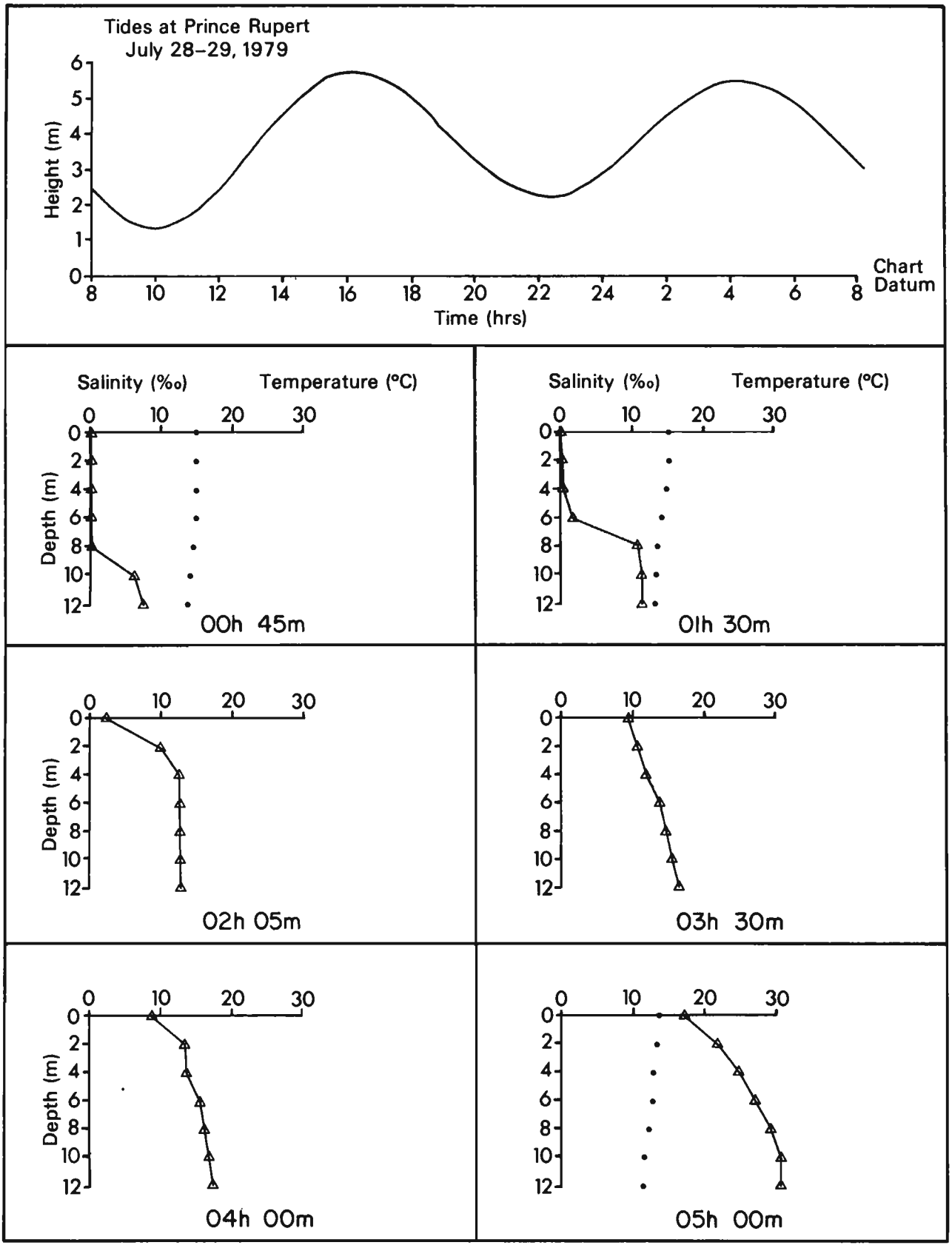
Height (m)
Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
CURRENT METER FAILURE
05h 00m
05h 30m
06h 00m
06h 30m
13h 15m

Veitch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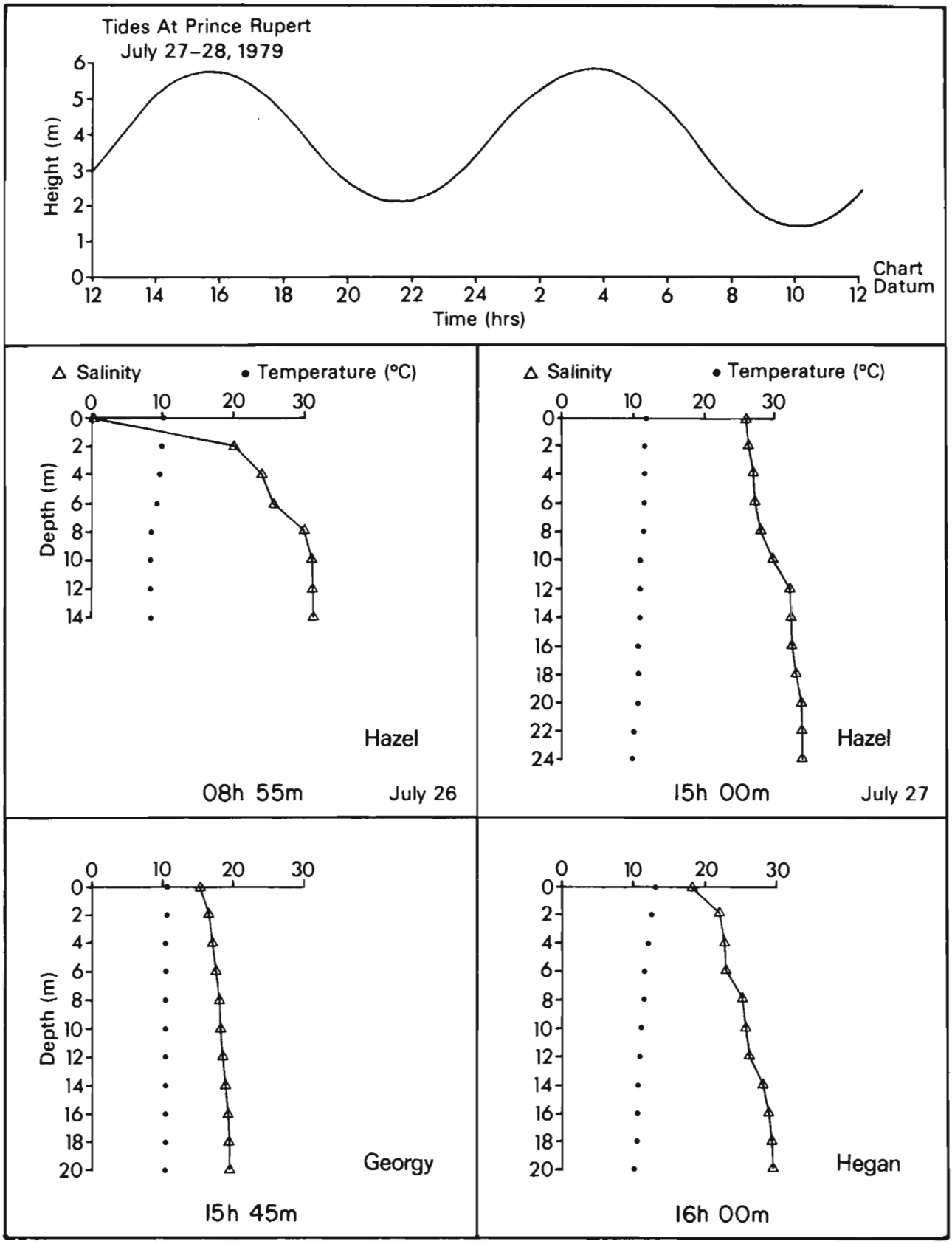
July 28–29, 1979
Height (m)
Chart Datum
Time (hrs)
Salinity (‰)
Temperature (°C)
Depth (m)
00h 45m
01h 30m
02h 05m
03h 30m
04h 00m
05h 00m

Veitch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July 27–28, 1979
Height (m)
Chart Datum
Time (hrs)
Δ Salinity
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Depth (m)
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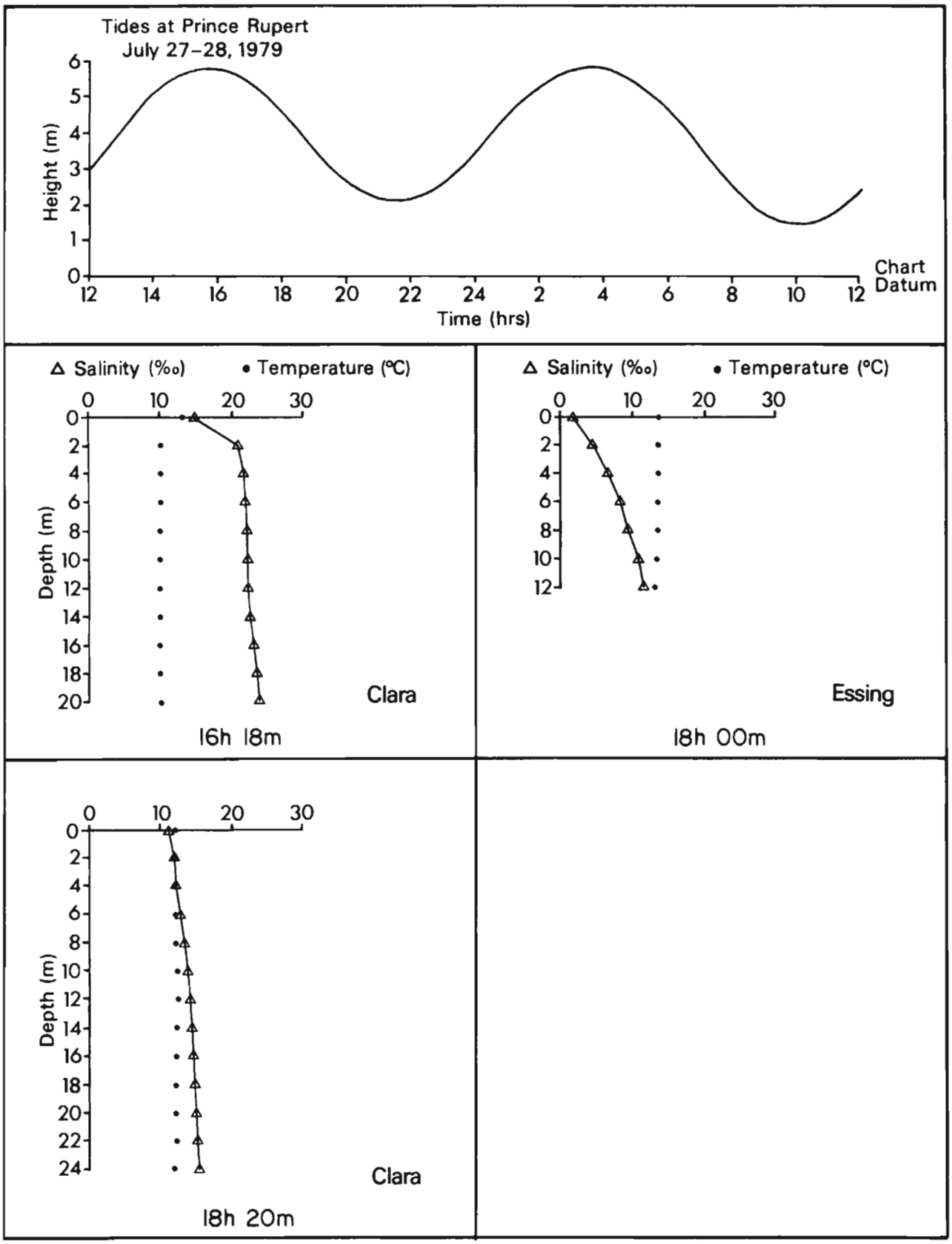
08h 55m
July 26
Hazel
15h 00m
July 27
Georgy
15h 45m
Hegan
16h 00m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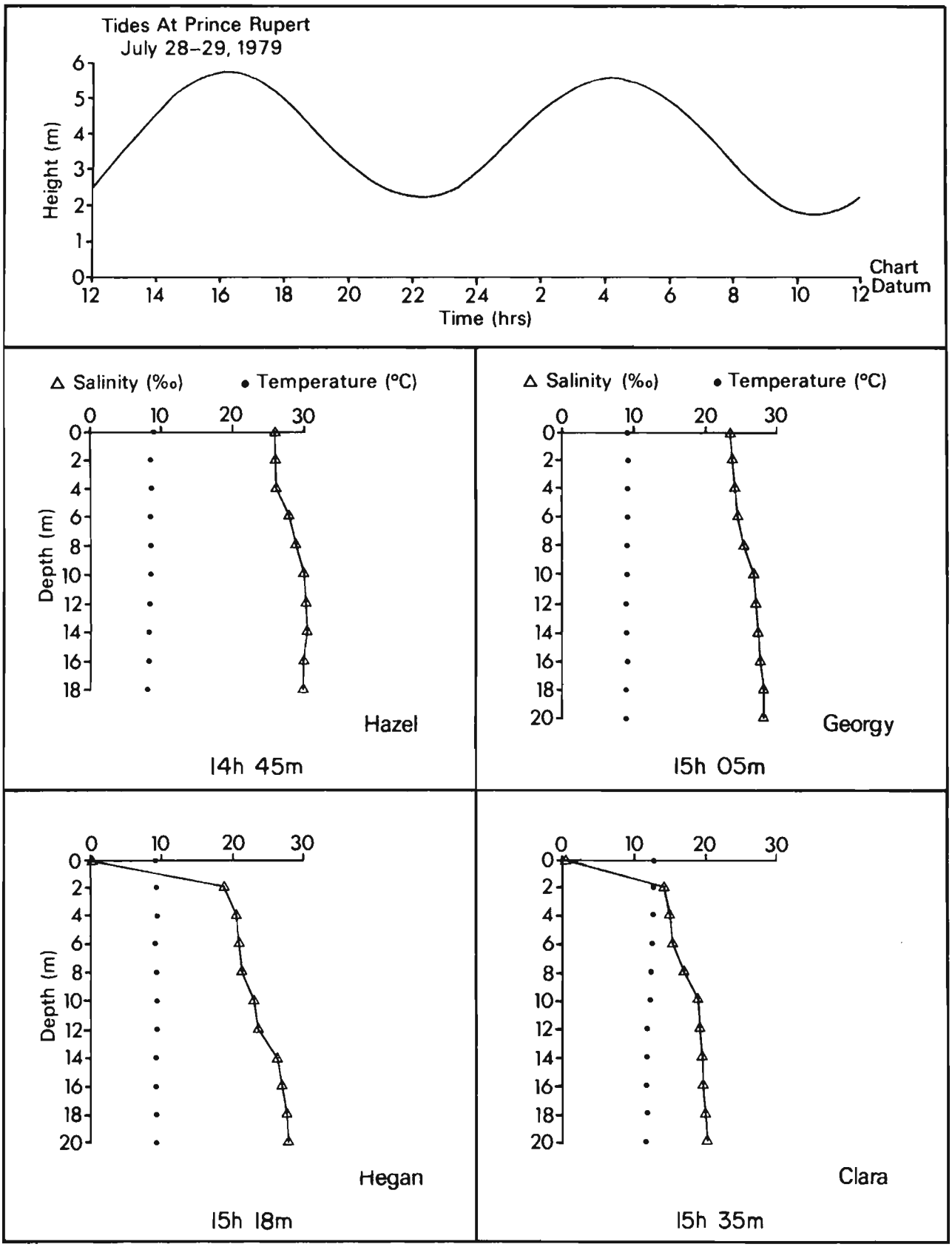
July 27–28, 1979
Height (m)
0
1
2
3
4
5
6
12
14
16
18
20
22
24
2
4
6
8
10
12
Time (hrs)
Chart Datum
Δ Salinity (‰)
• Temperature (°C)
0
10
20
30
Depth (m)
0
2
4
6
8
10
12
14
16
18
20
Clara
16h 18m
Δ Salinity (‰)
• Temperature (°C)
Essing
18h 00m
22
24
Clara
18h 20m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July 28–29, 1979
Height (m)
Time (hrs)
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Georgy
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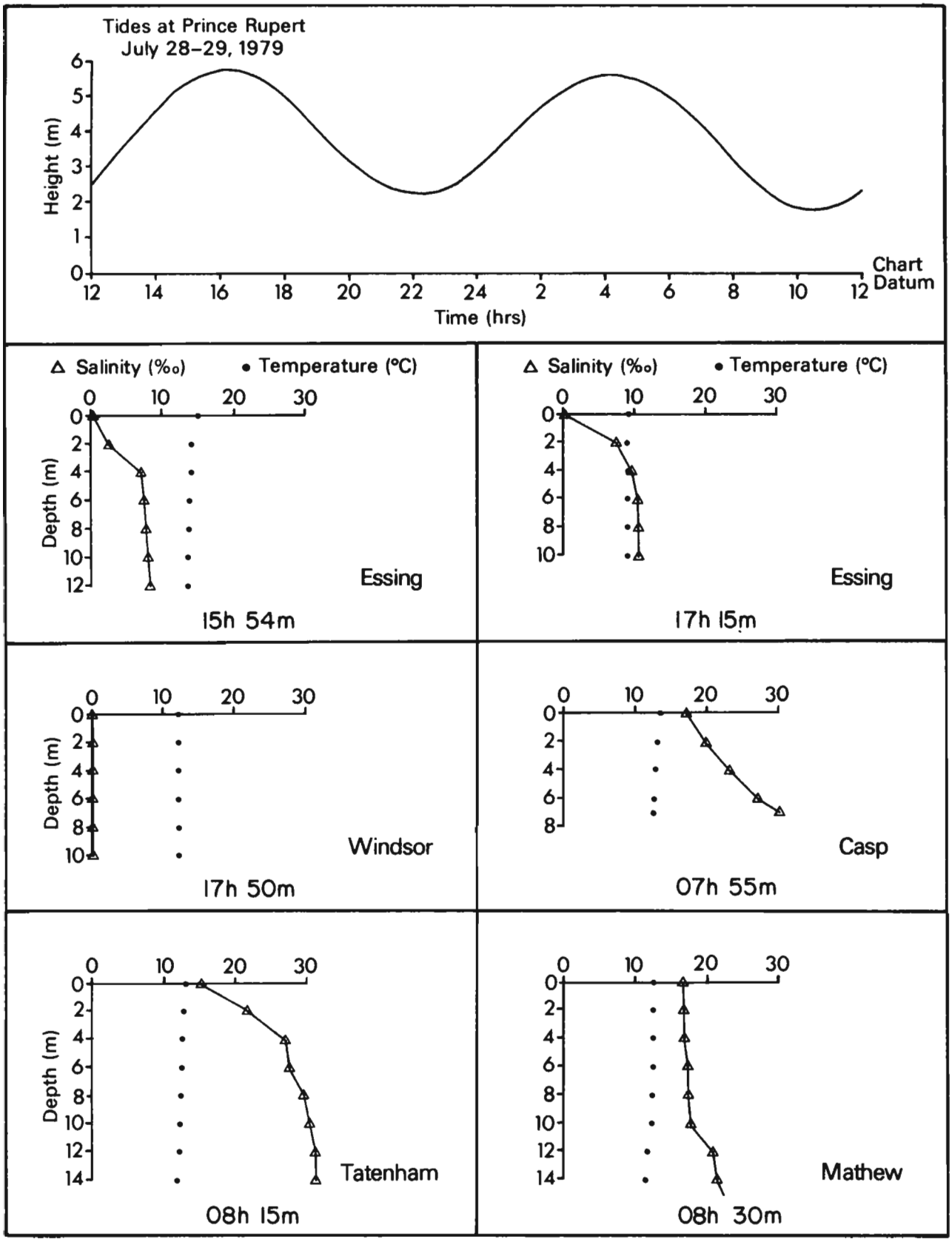
Hegan
15h 18m
Clara
15h 35m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July 28–29, 1979
Height (m)
Chart Datum
Time (hrs)
Salinity (‰)
Temperature (°C)
Depth (m)
Essing
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Essing
17h 15m
Windsor
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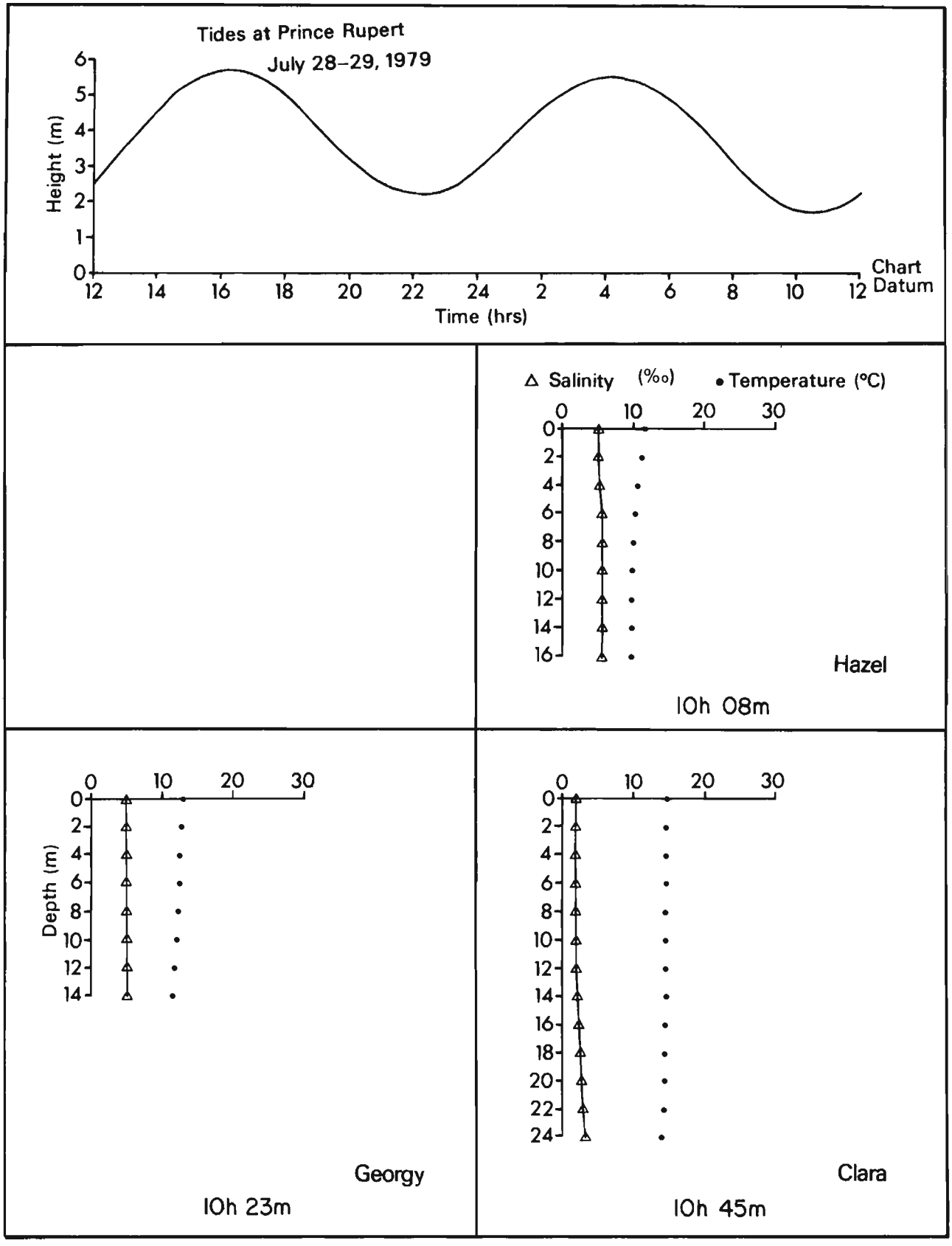
Casp
07h 55m
Tatenham
08h 15m
Mathew
08h 30m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July 28–29, 1979
Height (m)
Time (hrs)
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Temperature (°C)
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10h 08m
Depth (m)
Georgy
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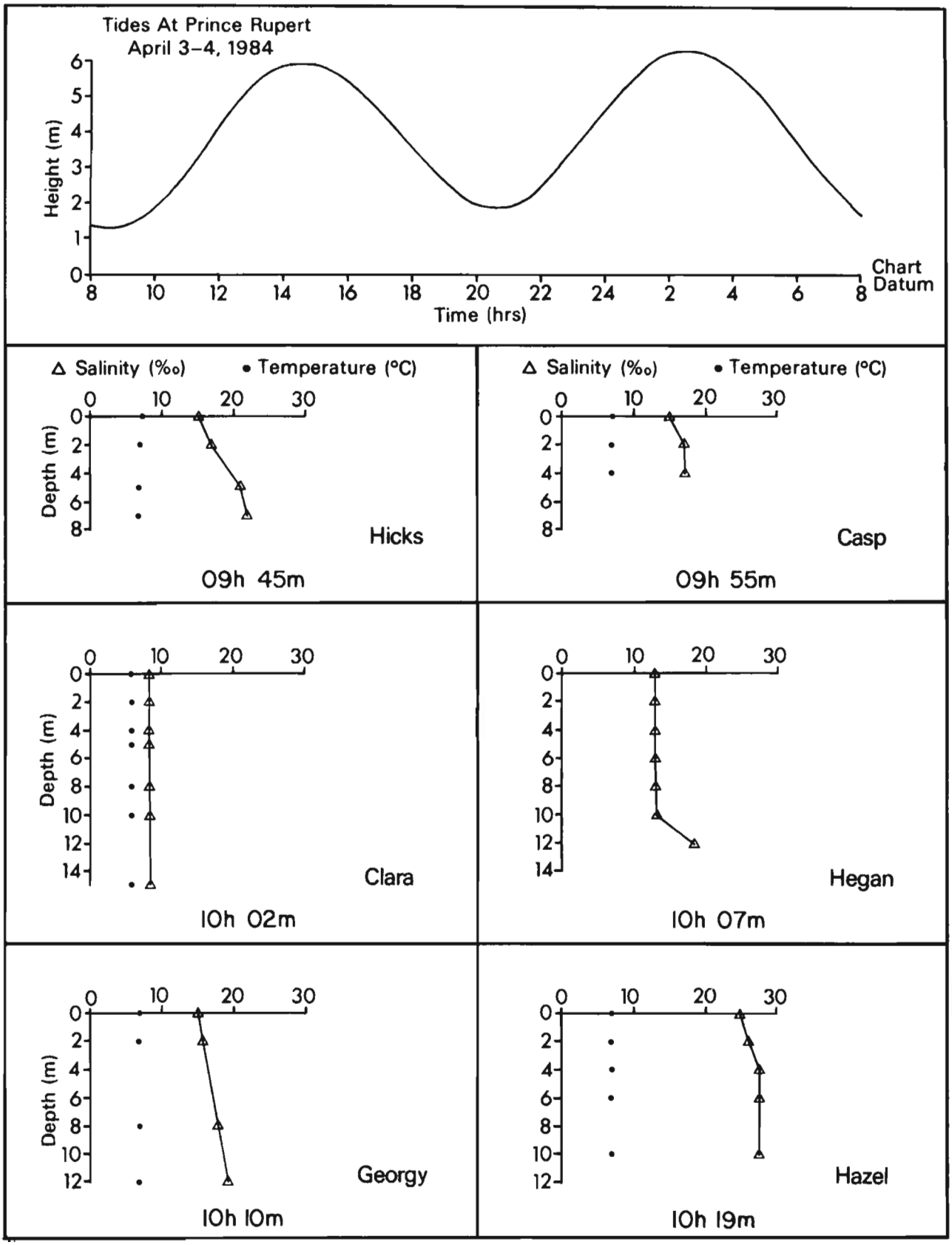
Clara
10h 45m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April 3–4, 1984
Height (m)
Time (hrs)
Chart Datum
Δ Salinity (‰)
• Temperature (°C)
Depth (m)
Hicks
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Casp
09h 55m
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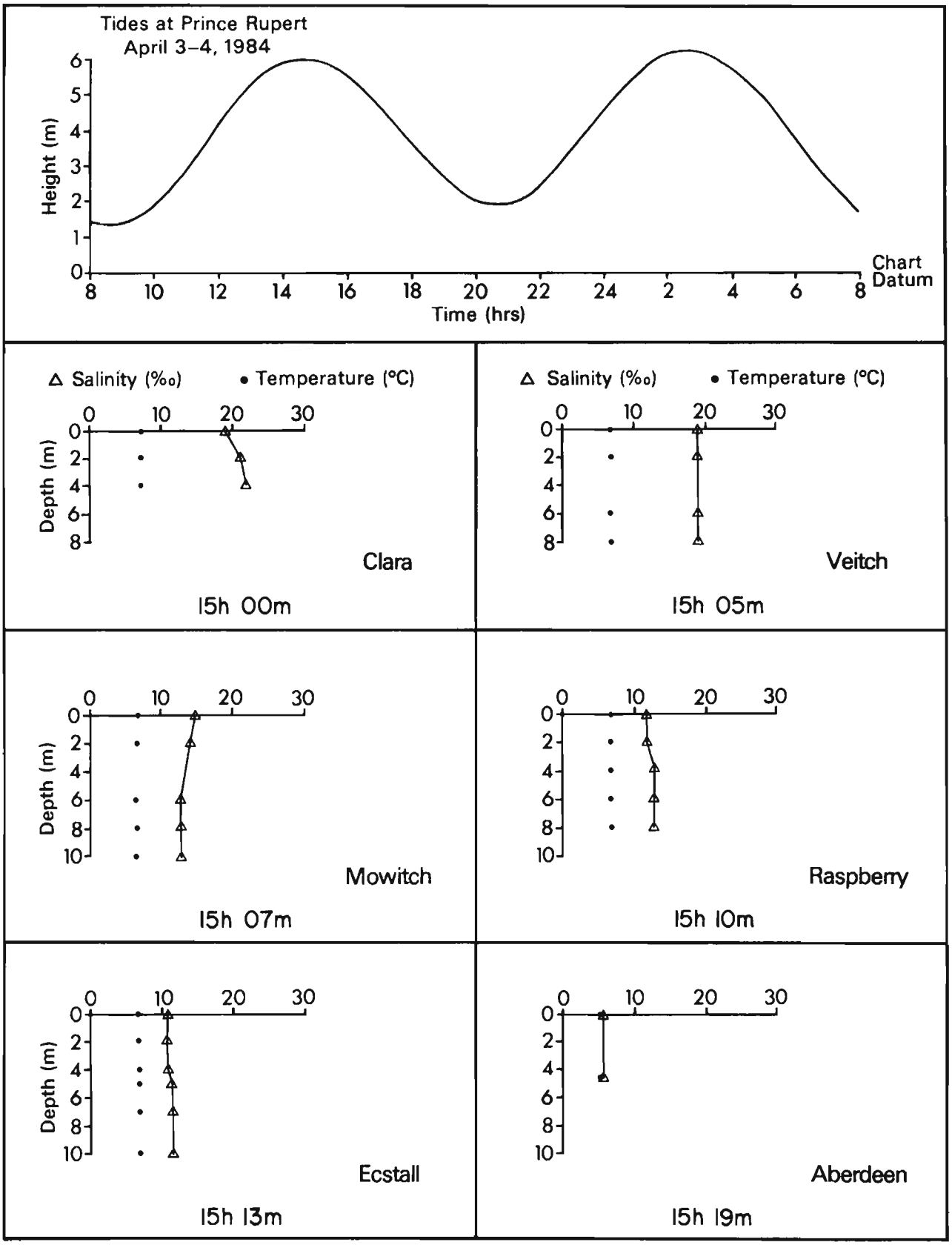
10h 02m
Hegan
10h 07m
Georgy
10h 10m
Hazel
10h 19m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April 3–4, 1984
Height (m)
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• Temperature (°C)
Depth (m)
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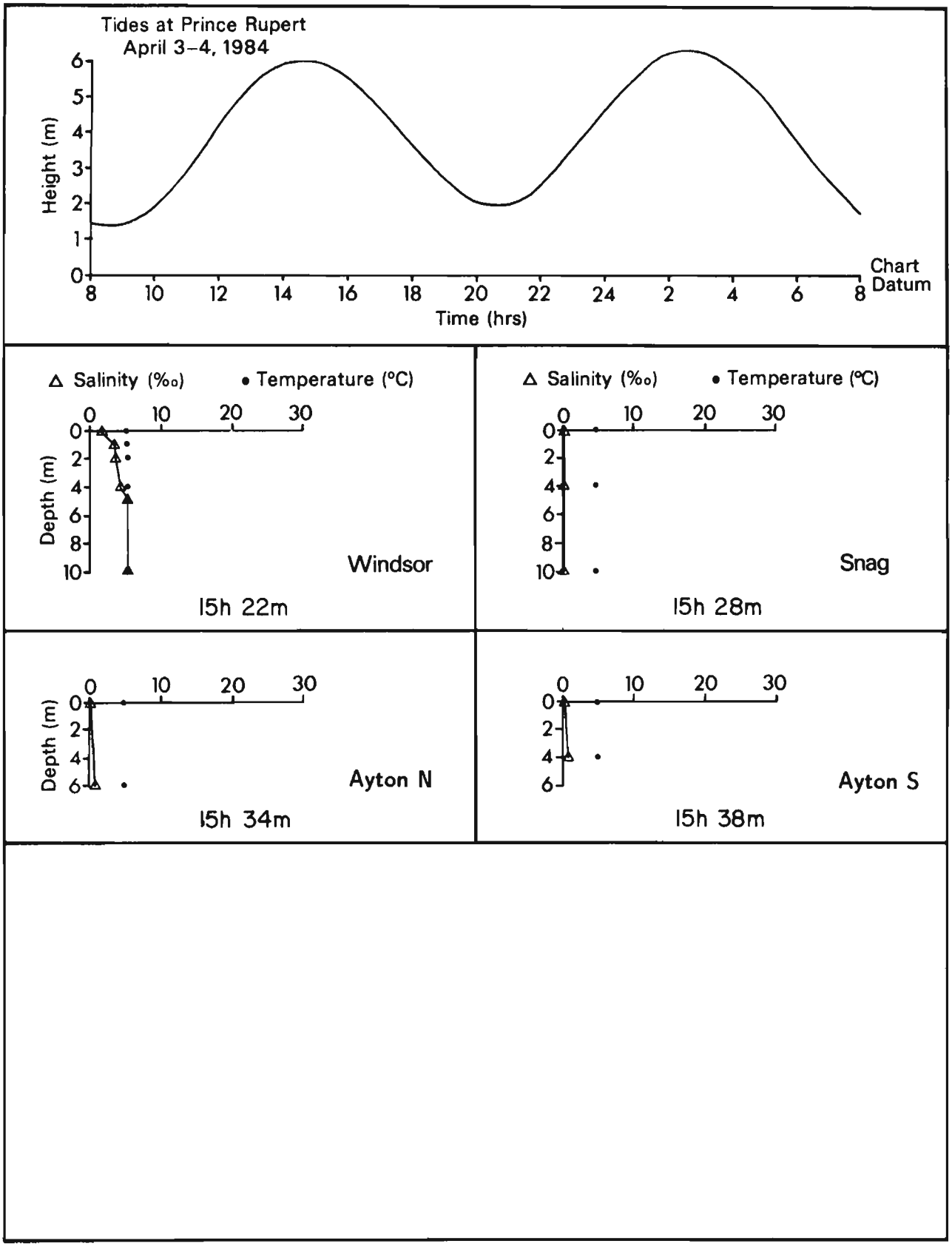
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April 3–4, 1984
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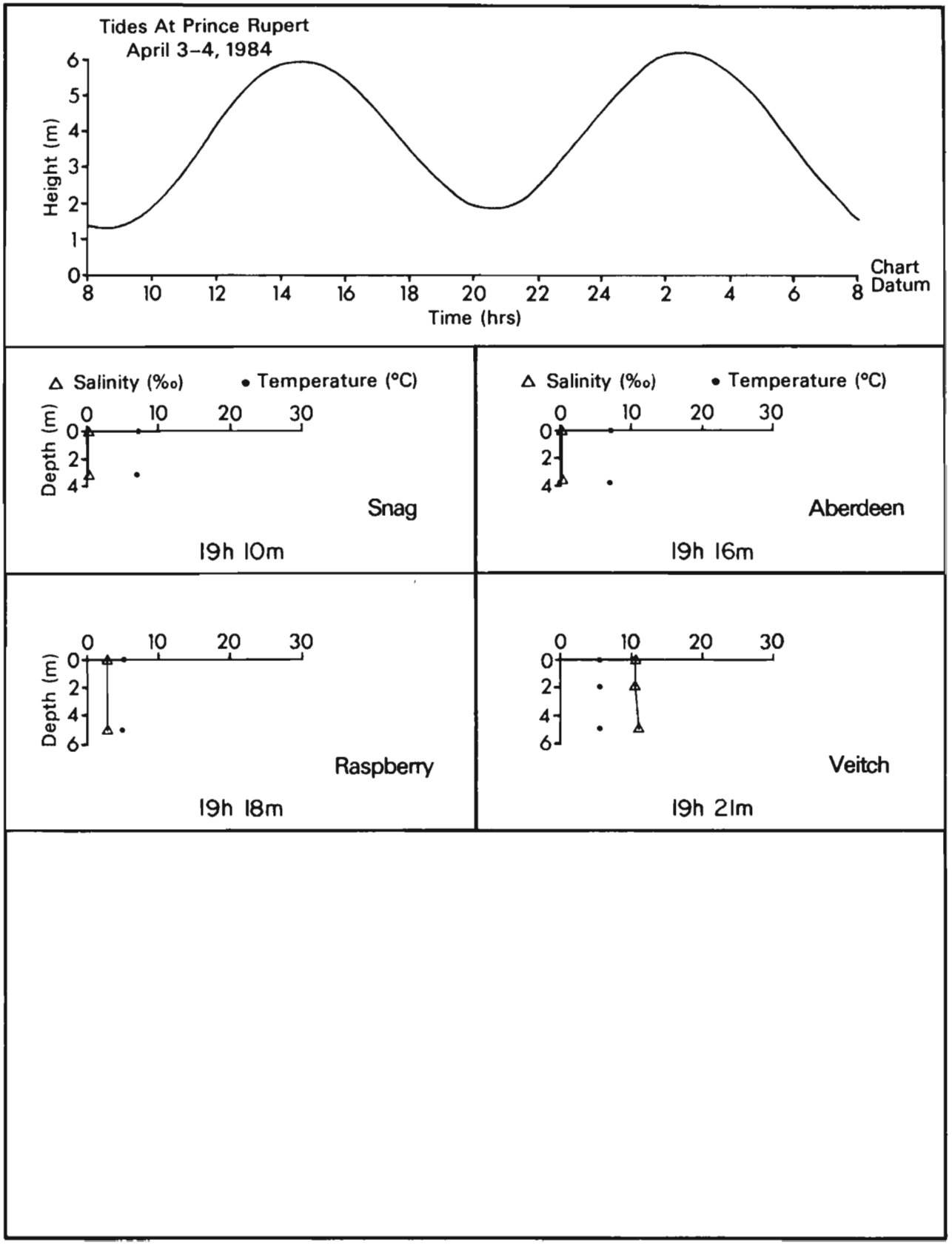
Ayton N
15h 34m
Ayton S
15h 38m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4
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Chart Datum
Time (hrs)
Δ Salinity (‰)
• Temperature (°C)
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Veitch
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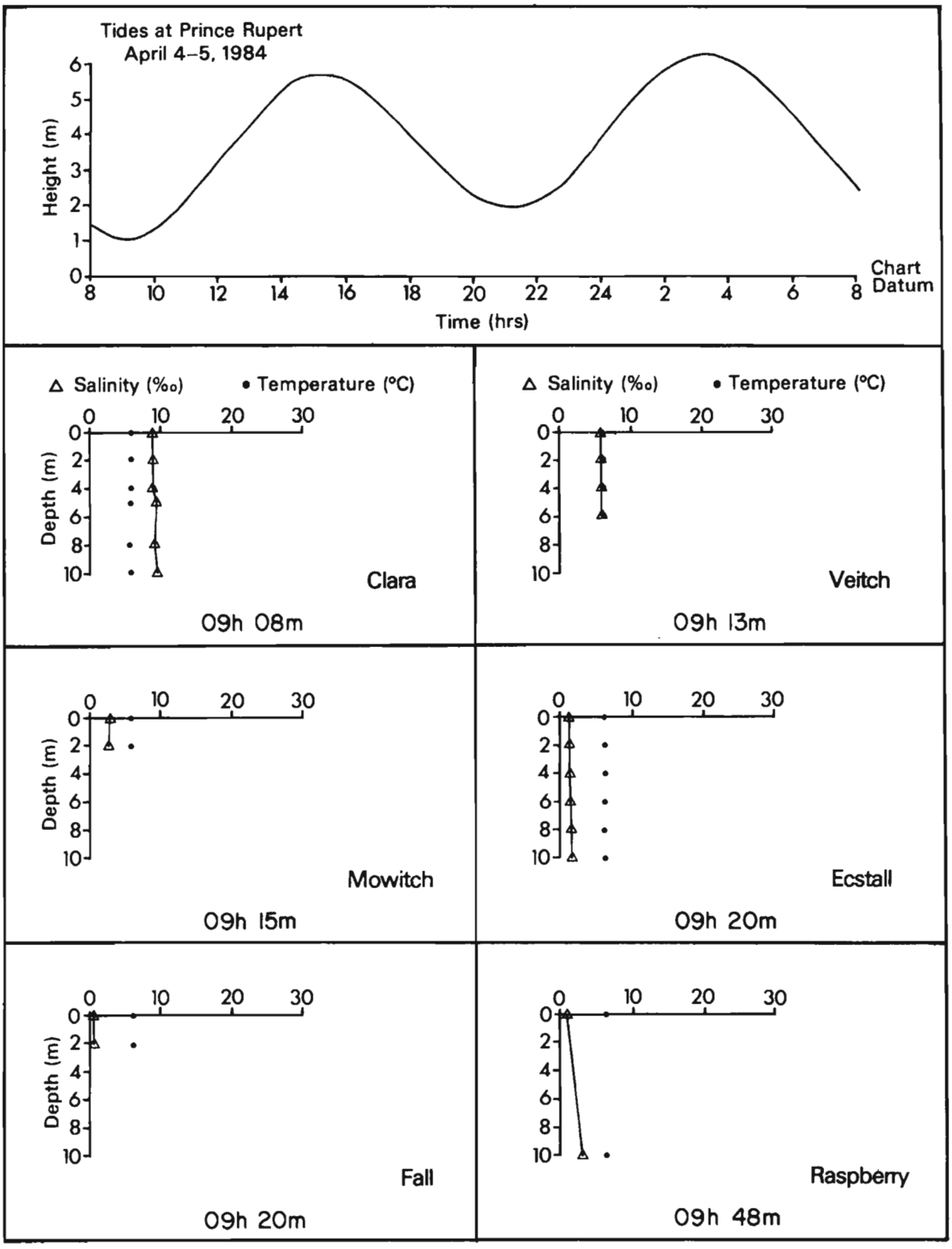
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Height (m)
Time (hrs)
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Depth (m)
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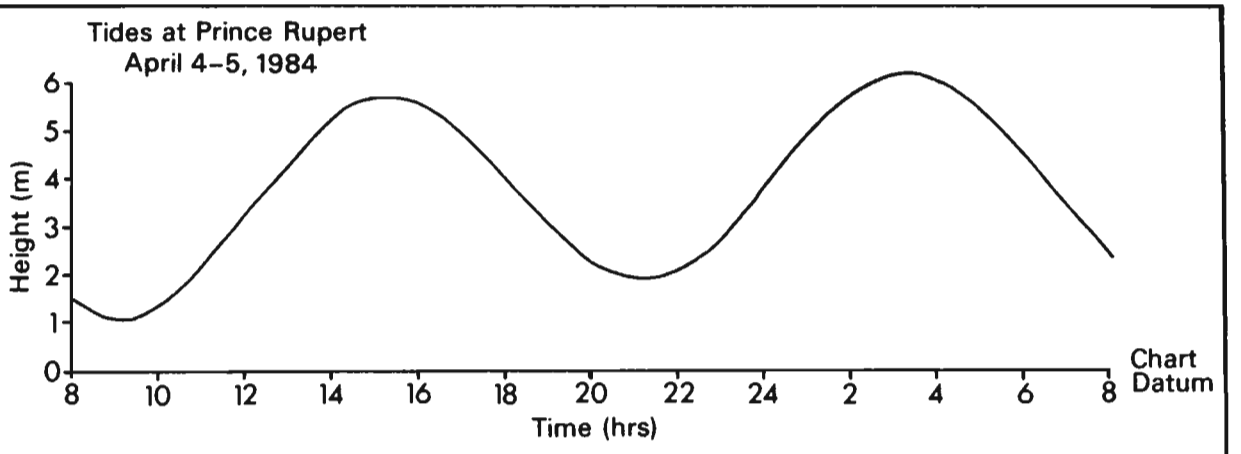
Fall
09h 20m
Raspberry
09h 48m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April 4–5, 1984
Height (m)
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8
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14
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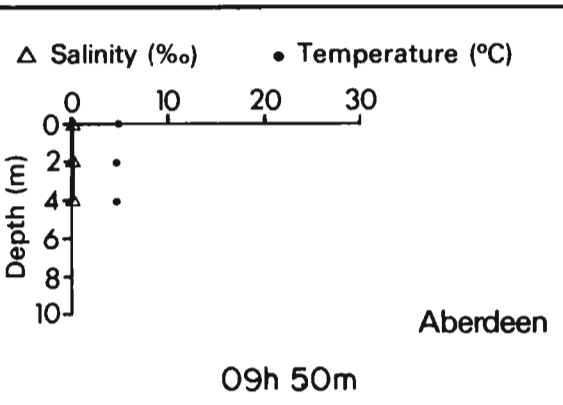
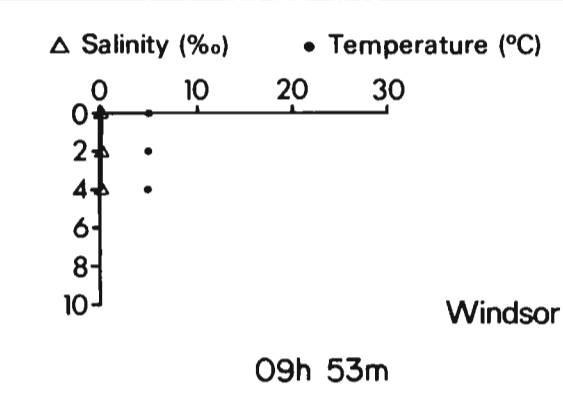
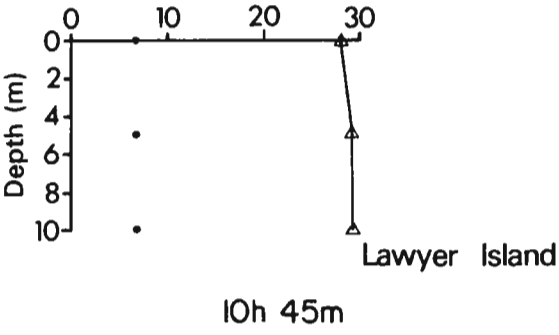
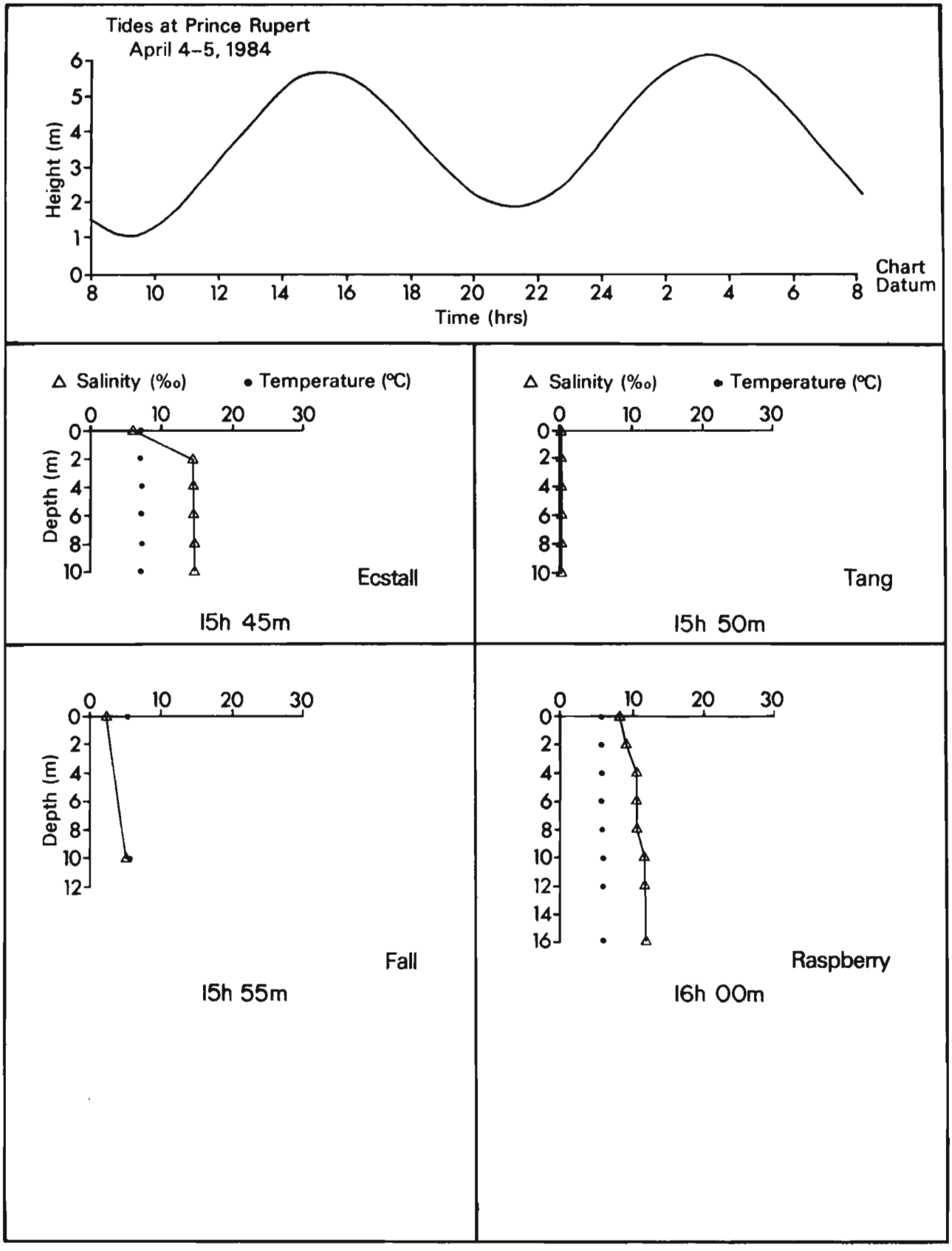
18
20
22
24
2
4
6
8
Chart Datum
Time (hrs)


Δ Salinity (‰)
• Temperature (°C)
0
10
20
30
Depth (m)
0
2
4
6
8
10
Aberdeen
09h 50m


Δ Salinity (‰)
• Temperature (°C)
0
10
20
30
0
2
4
6
8
10
Windsor
09h 53m


0
10
20
30
Depth (m)
0
2
4
6
8
10
Lawyer Island
10h 45m


Tides at Prince Rupert
April 4–5, 1984
Height (m)
0
1
2
3
4
5
6
8
10
12
14
16
18
20
22
24
2
4
6
8
Time (hrs)
Chart Datum
Δ Salinity (‰)
• Temperature (°C)
0
10
20
30
Depth (m)
0
2
4
6
8
10
Ecstall
15h 45m
Δ Salinity (‰)
• Temperature (°C)
0
10
20
30
0
2
4
6
8
10
Tang
15h 50m
0
10
20
30
Depth (m)
0
2
4
6
8
10
12
Fall
15h 55m
0
10
20
30
0
2
4
6
8
10
12
14
16
Raspberry
16h 00m