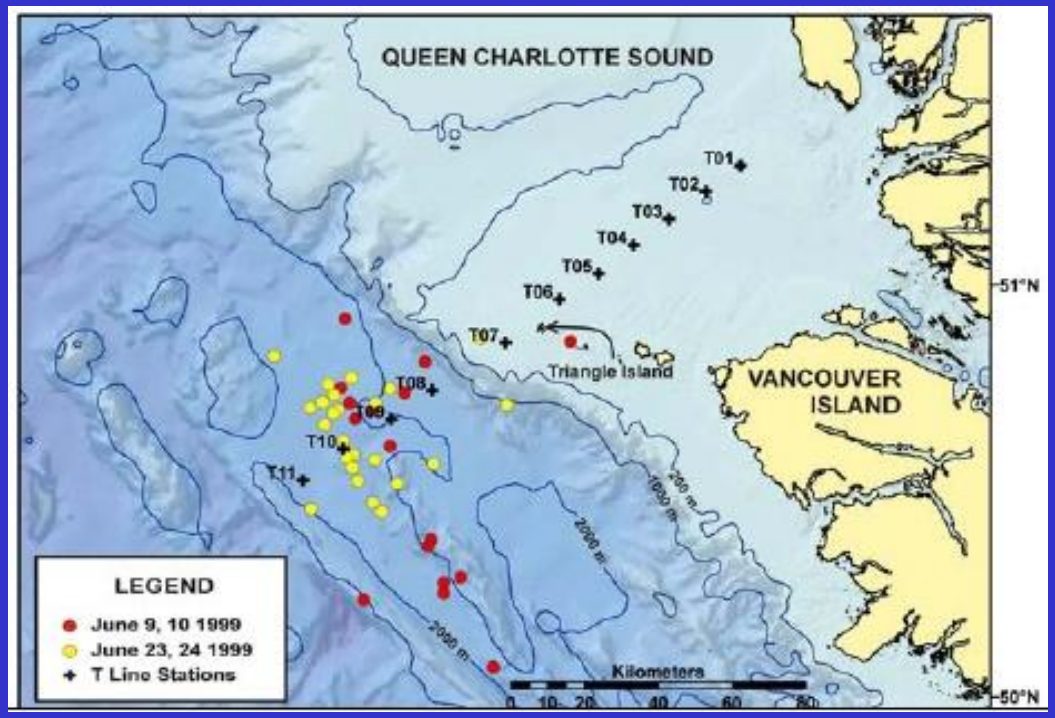
Interannual variation in zooplankton prey distribution determines marine breeding distributions of Cassin's Auklet in the proposed Scott Islands National Marine Wildlife Area in Canada



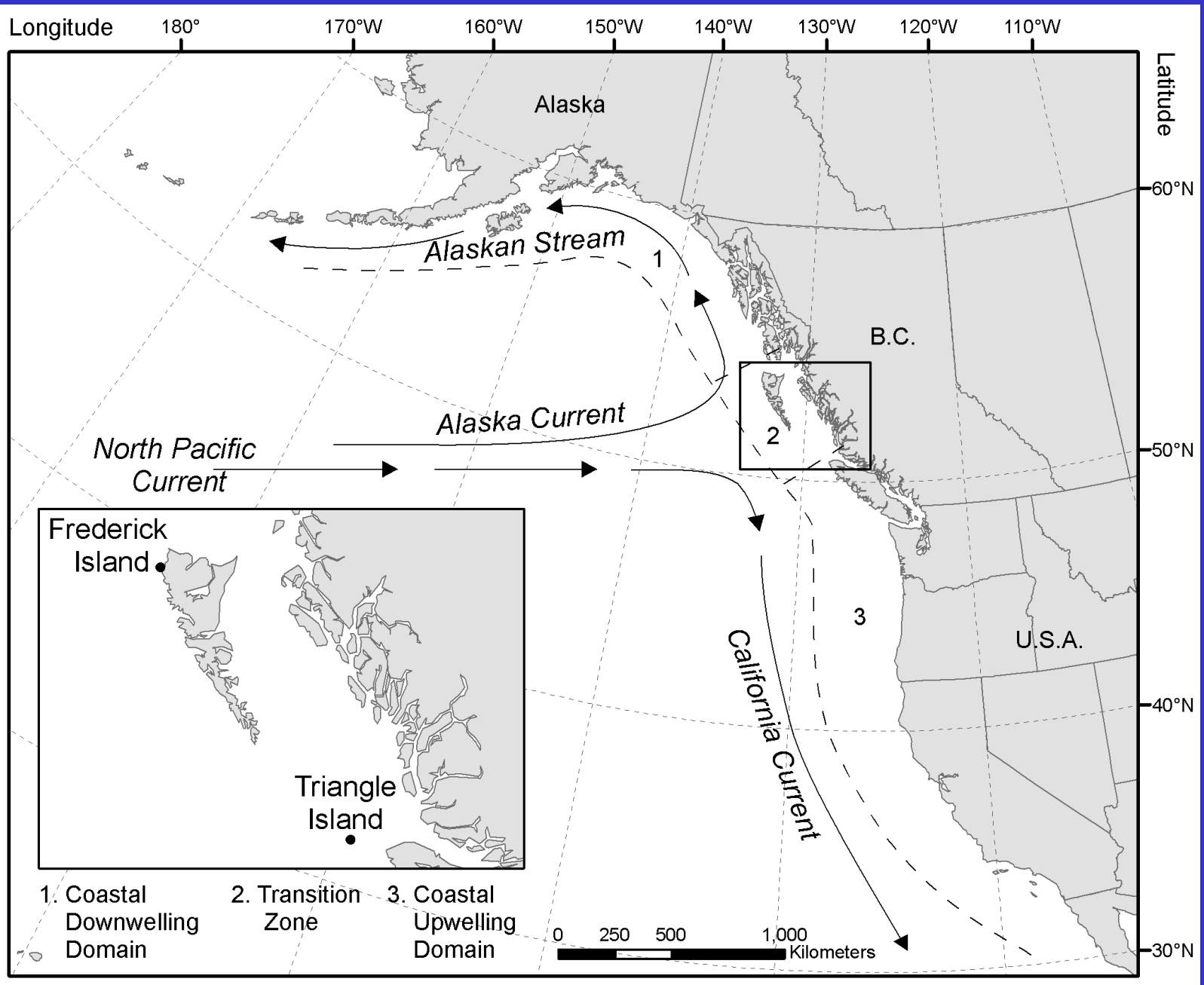
Bertram, Mackas, Boyd, Ryder, Welch Galbraith & Hedd

PICES Meeting, 11 October 2013, Nanaimo,BC, Canada

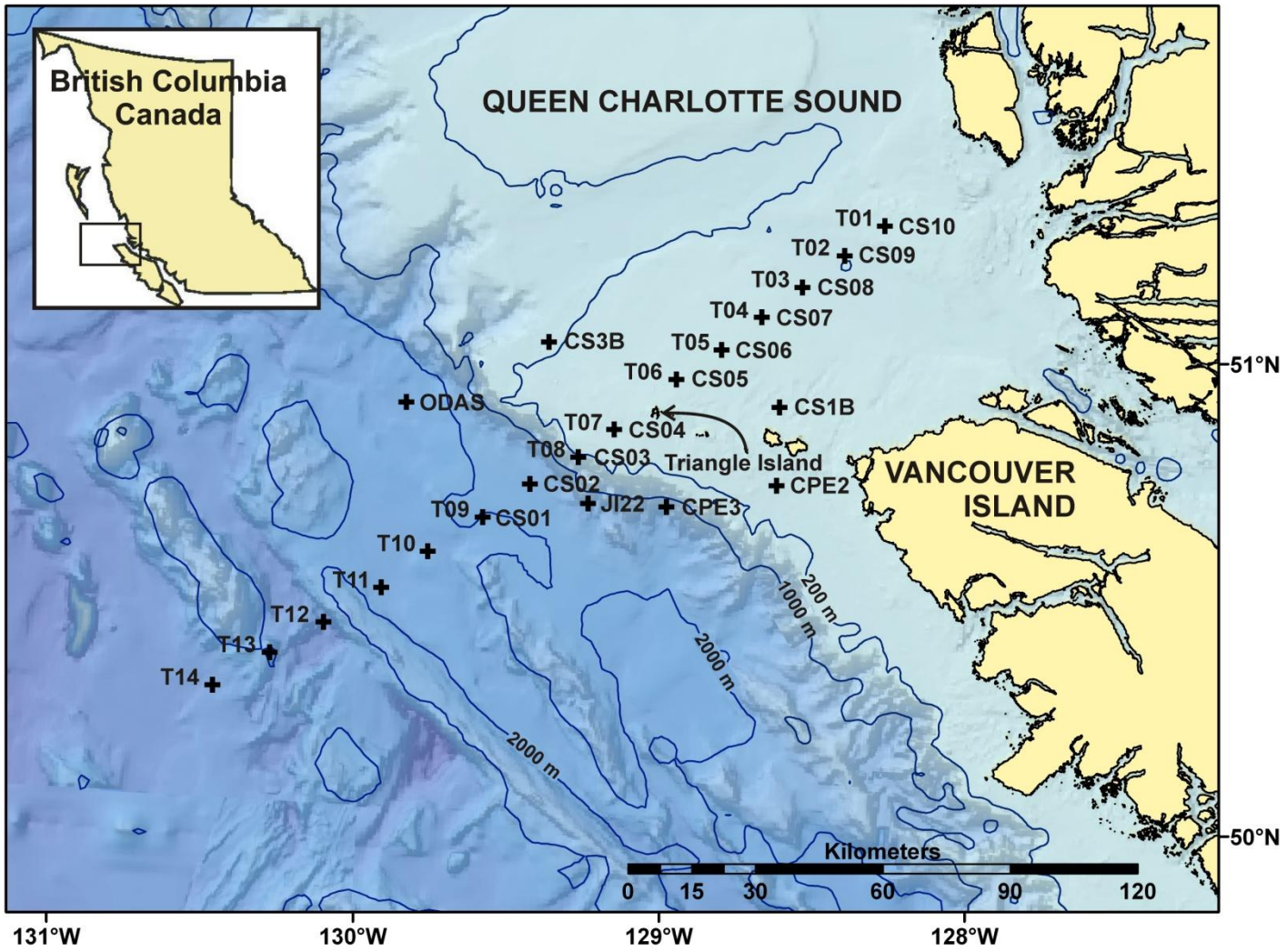
Nestucca Oil Spill Resource Damage Trust Fund

- Grant 1**:** 1998-2002. "Oil and Seabirds on Coastal Vancouver Island: The Power of Information for Impact Assessment and Response: A Proposal to Secure a Useful Product from the Remaining Nestucca Trust Funds" Bertram, D. & G. Kaiser (CWS)

- Grant 2: 1998-2002 "DFO/CWS Integrated Ecosystems Investigation of Marine Prey Population Distribution, Availability and Abundance in the Ocean Area off Northern Vancouver Island". Bertram, D., D. Mackas (DFO/IOS) and D. Welch (DFO/PBS)


Longitude
180°
170°W
160°W
150°W
140°W
130°W
120°W
110°W
Latitude
60°N
50°N
40°N
30°N
Alaska
B.C.
U.S.A.
Alaskan Stream
1
Alaska Current
North Pacific Current
2
3
California Current
Frederick Island
Triangle Island
1. Coastal Downwelling Domain
2. Transition Zone
3. Coastal Upwelling Domain
0 250 500 1,000
Kilometers

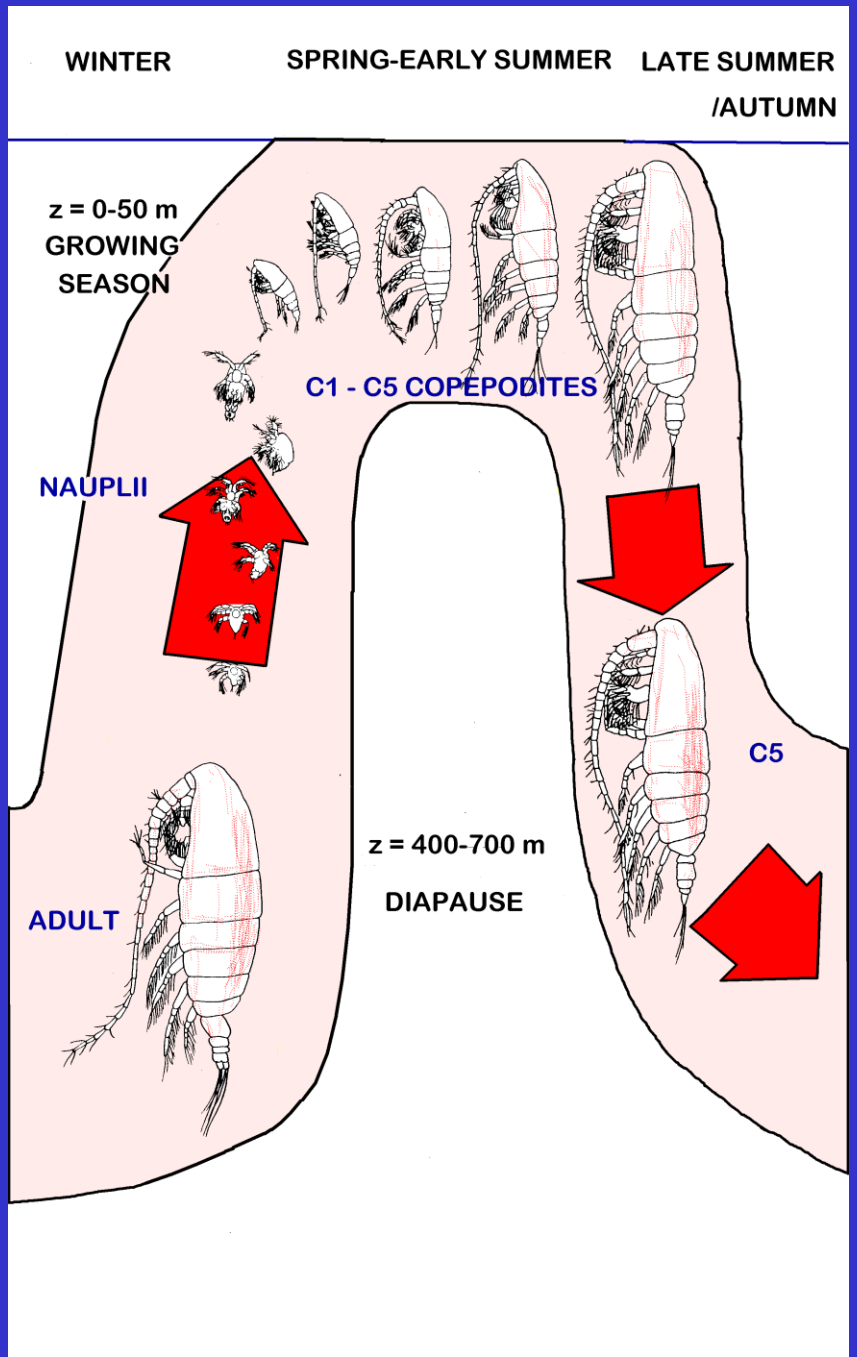
Ship-based DFO zooplankton sampling stations



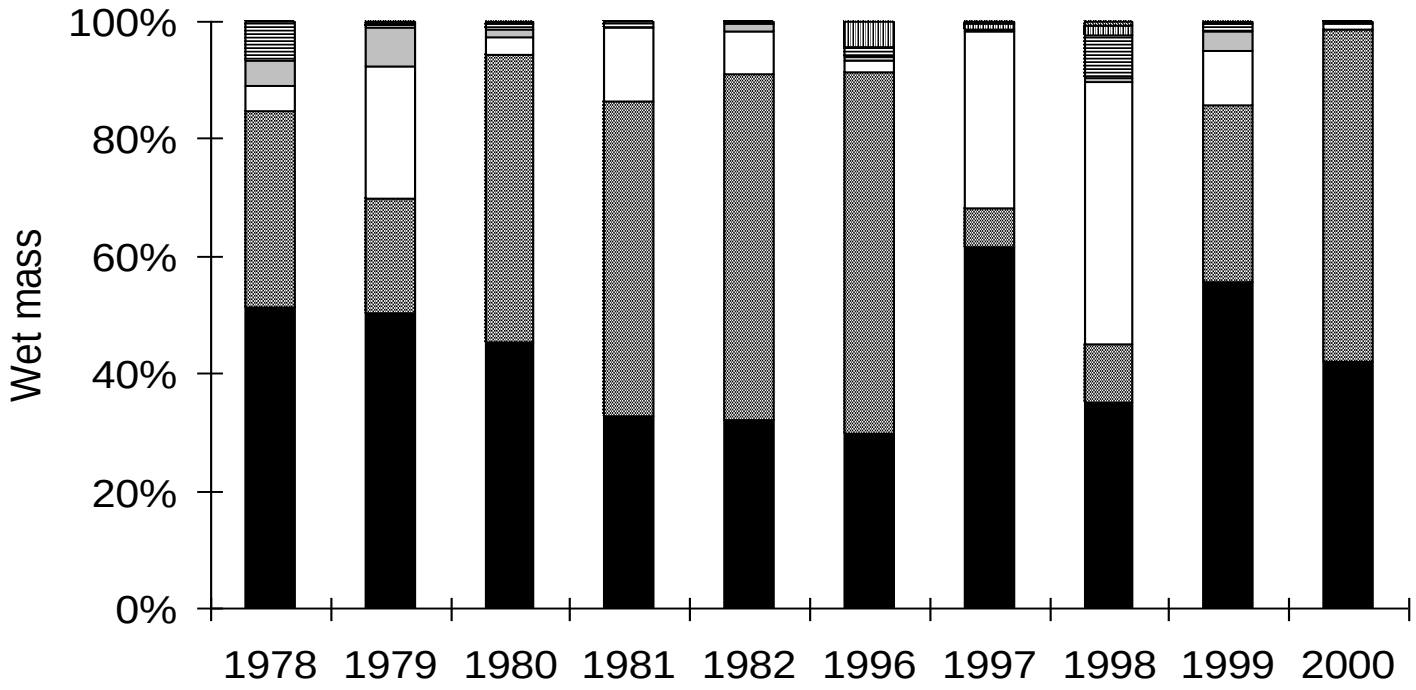
Seasonal life cycle of *Neocalanus plumchrus*

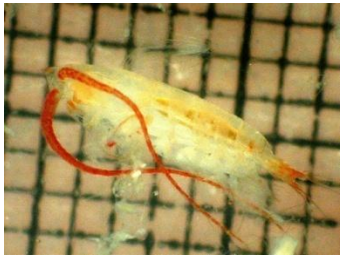
Mackas et al. 1998. CJFAS 55: 1878-1893.

A highly profitable prey for Cassin's Auklet



Copepod *Neocalanus cristatus* is a key prey





99% cV

Radio attachment to breeding birds

tissues forms around the anchor.

9. Release bird.

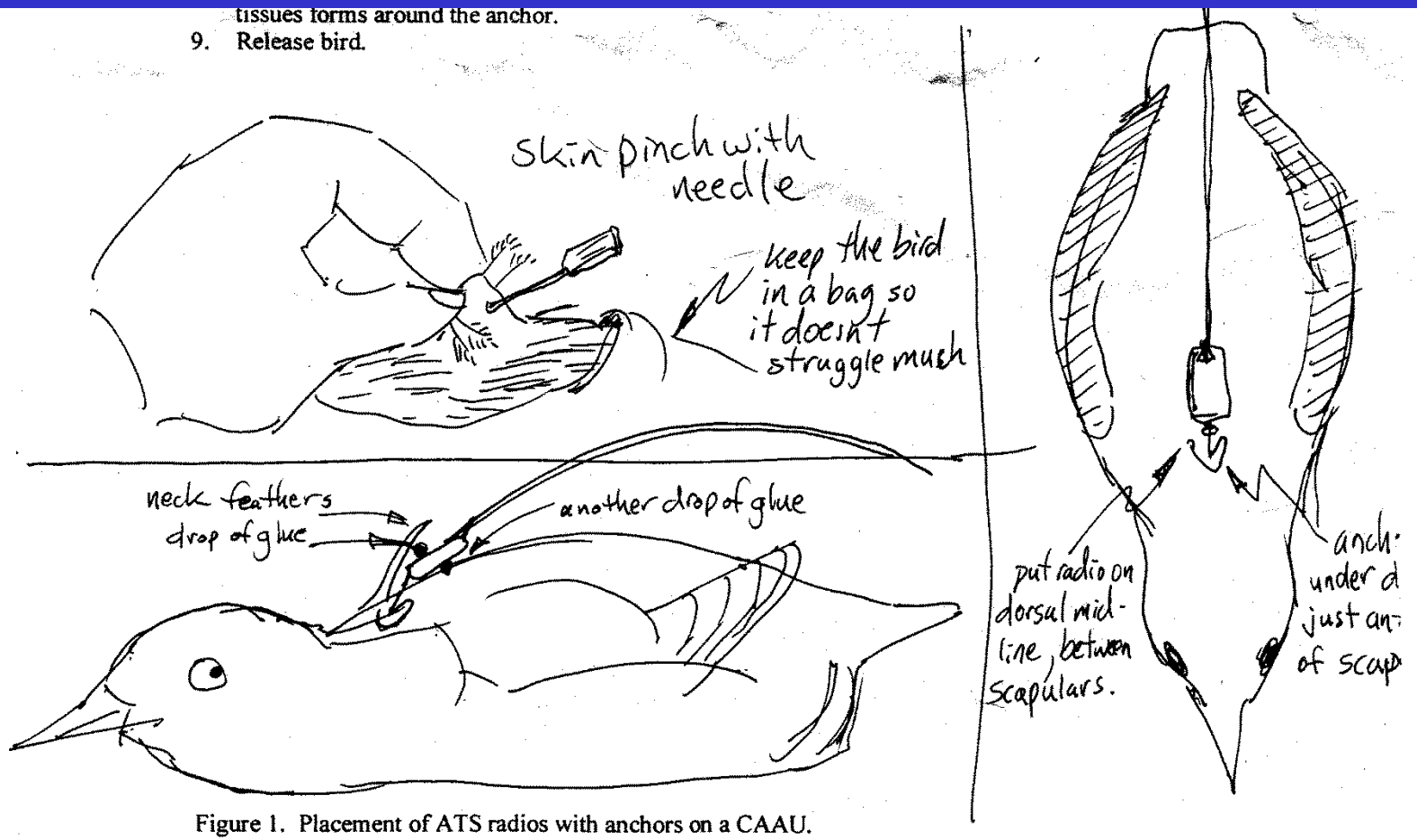
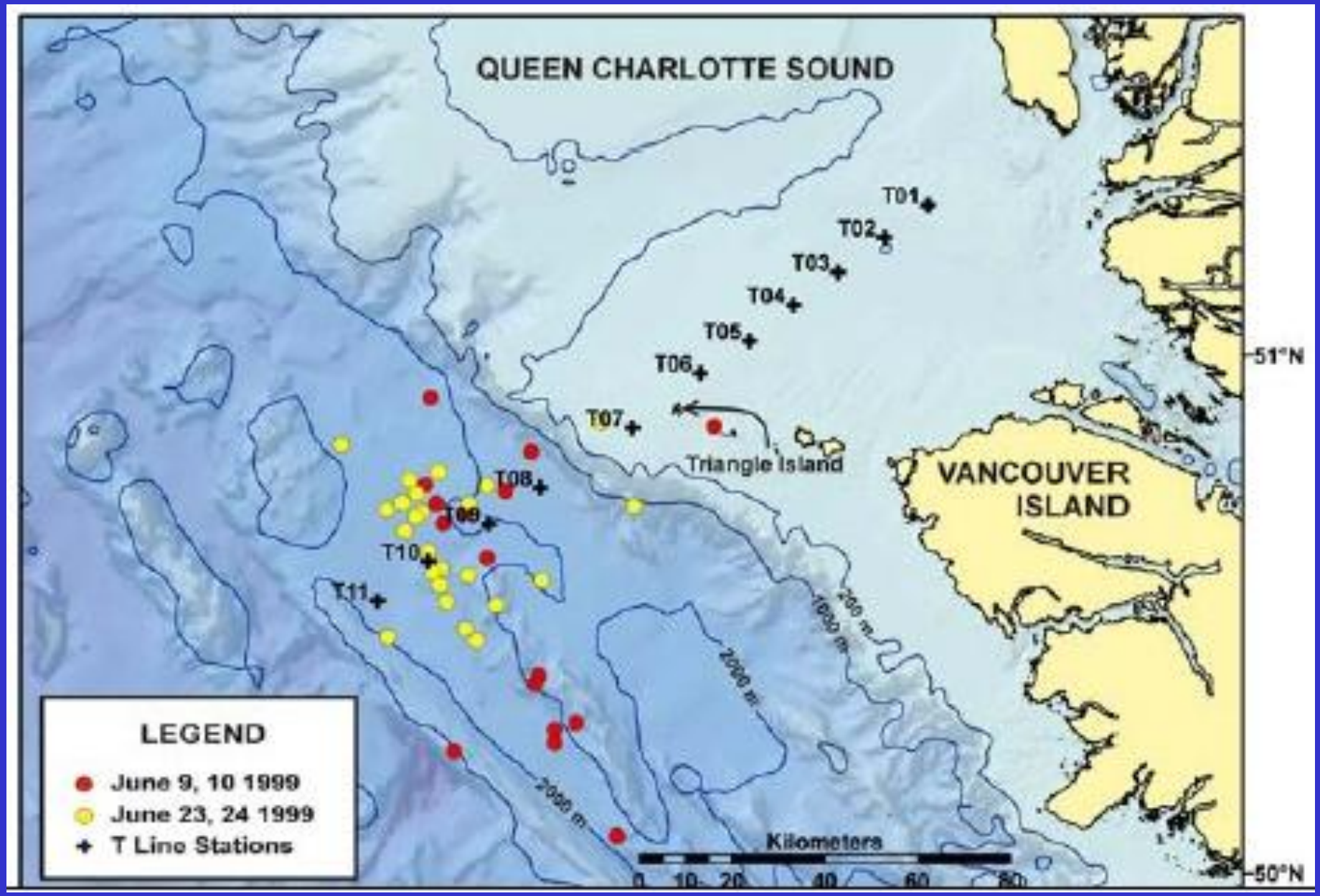
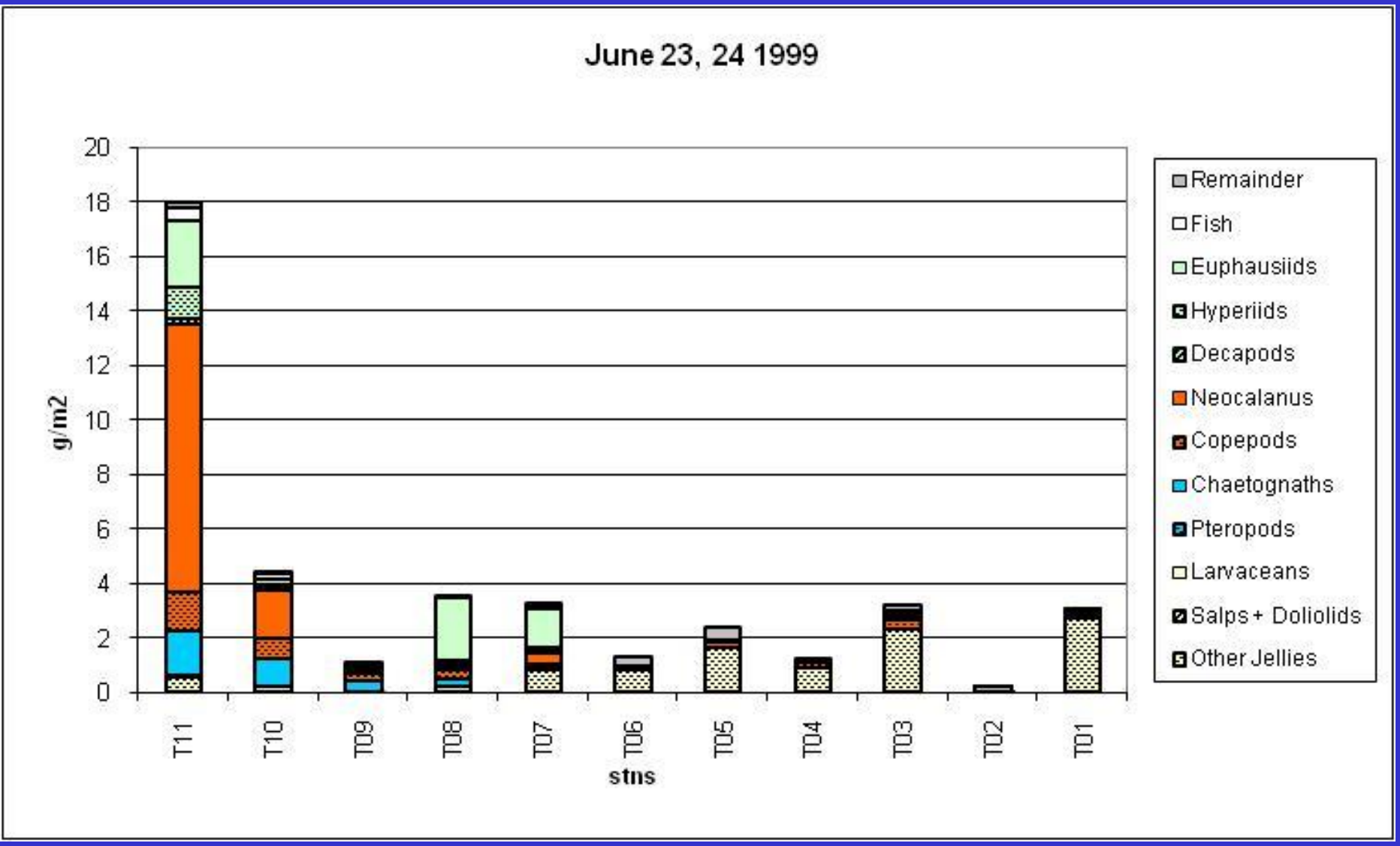


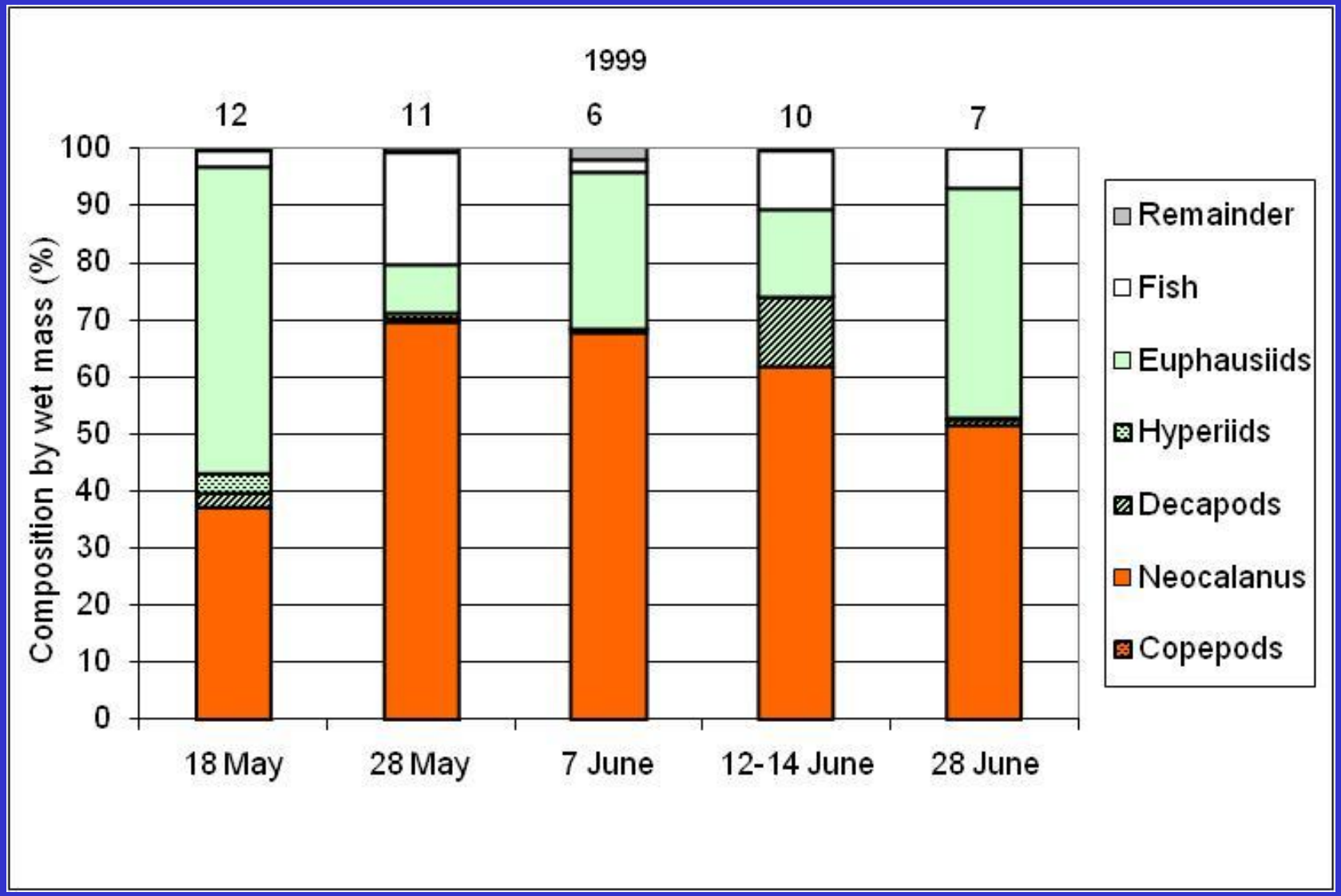
Figure 1. Placement of ATS radios with anchors on a CAAU.

Aerial telemetry for detection of radio signals

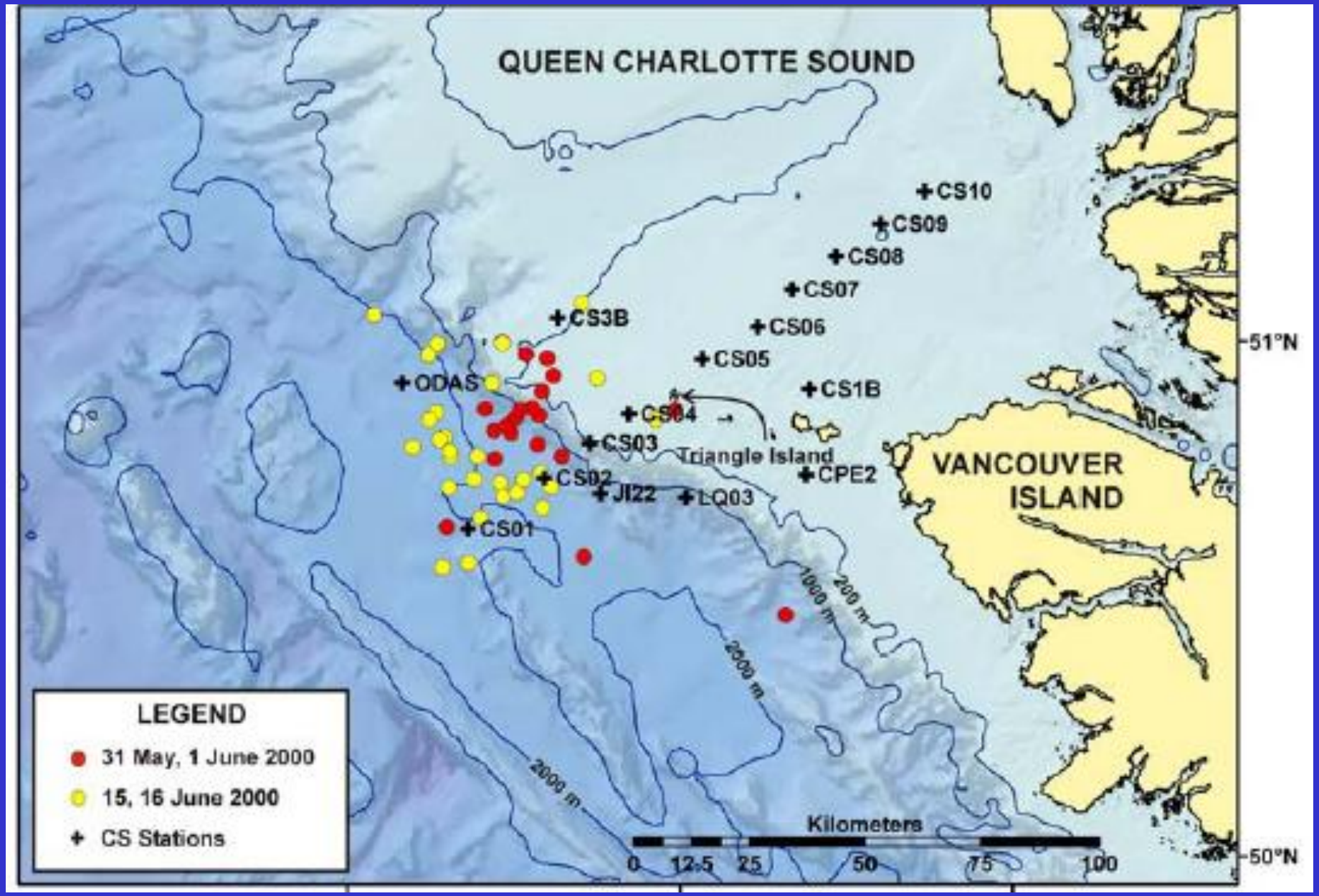
1999 telemetry

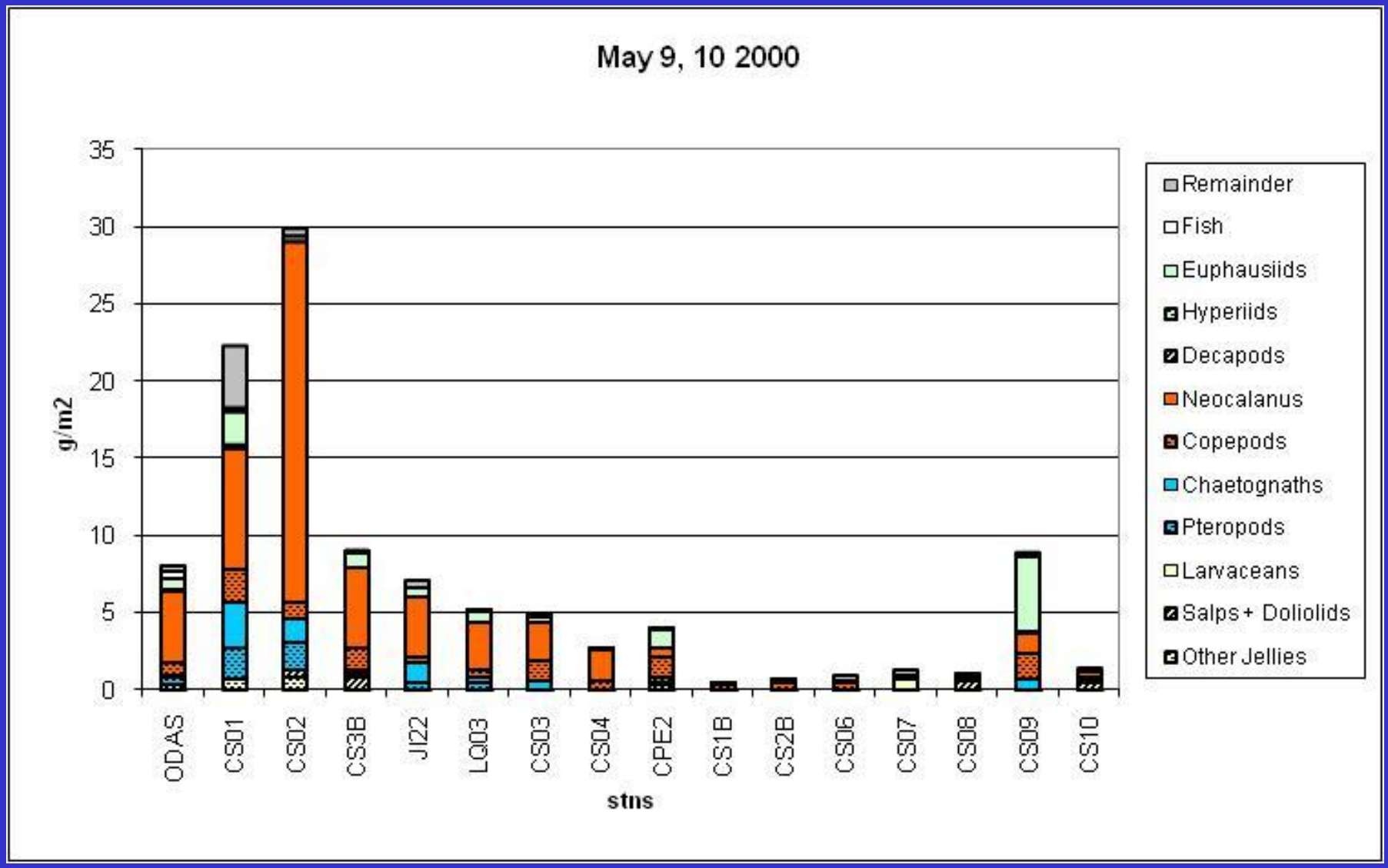


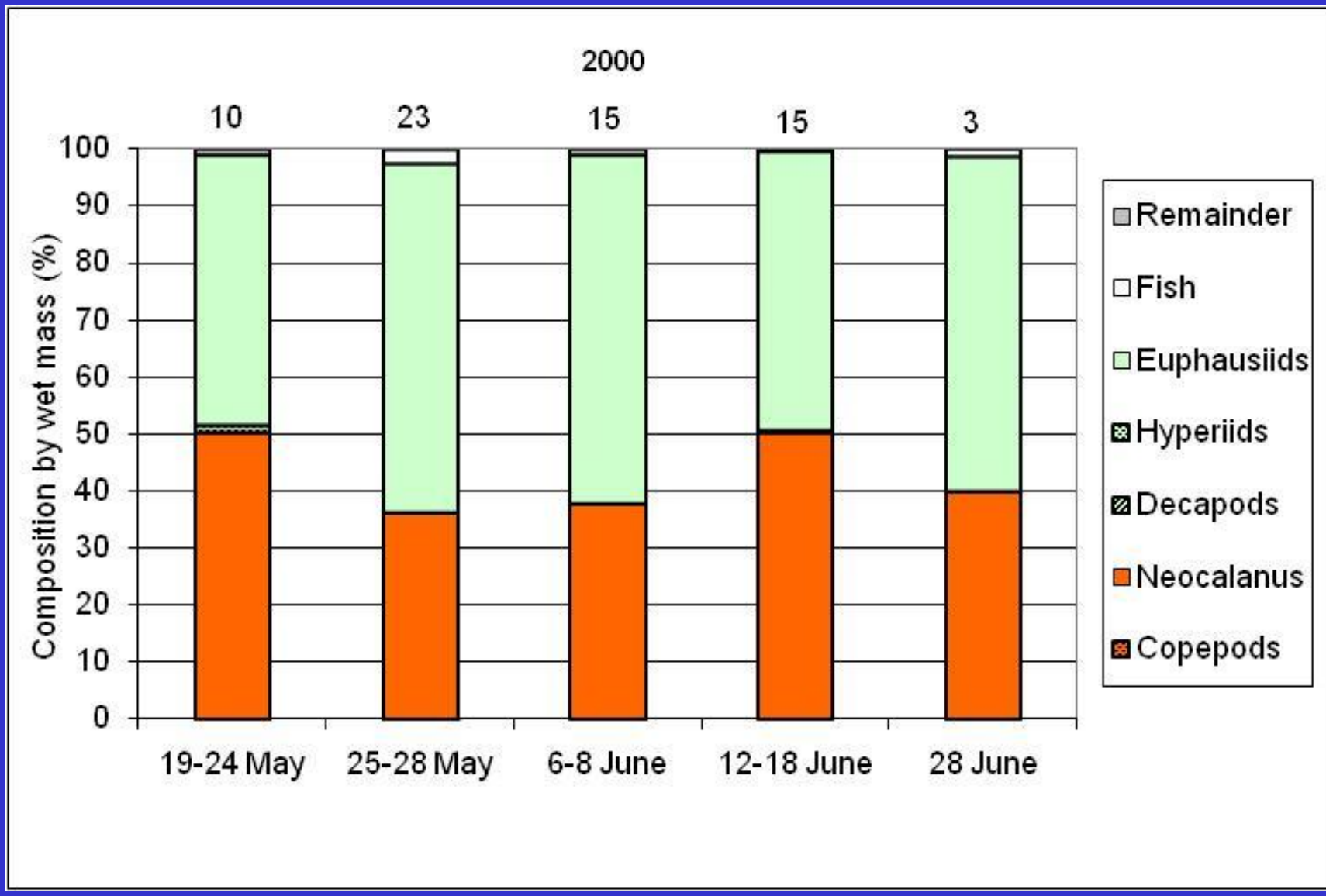

June 23, 24 1999
20
18
16
14
12
10
8
6
4
2
0
g/m2
T11
T10
T09
T08
T07
T06
T05
T04
T03
T02
T01
stns
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods
Chaetognaths
Pteropods
Larvaceans
Salps + Doliolids
Other Jellies


1999
12
11
6
10
7
100
90
80
70
60
50
40
30
20
10
0
Composition by wet mass (%)
18 May
28 May
7 June
12-14 June
28 June
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods

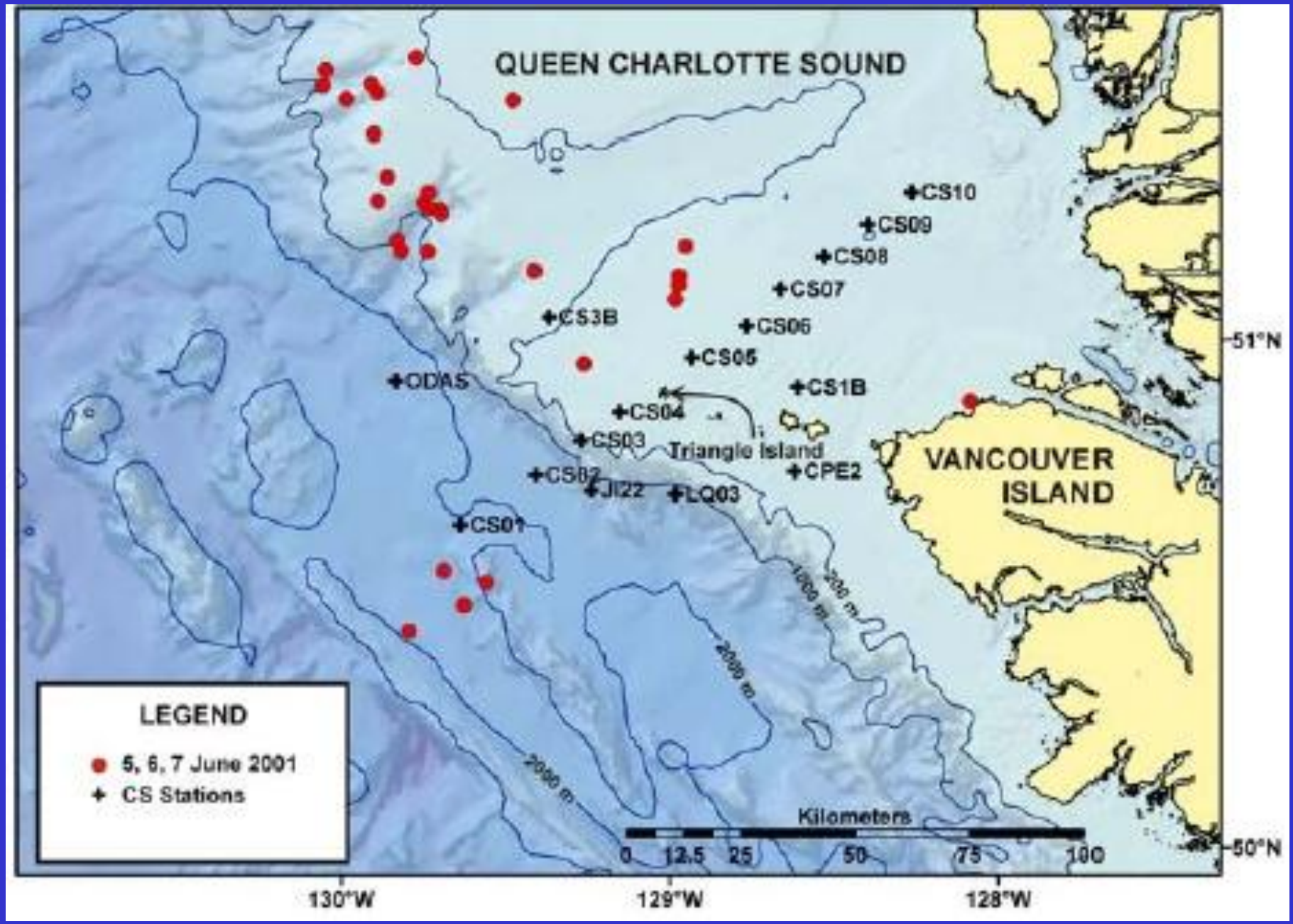
2000 telemetry

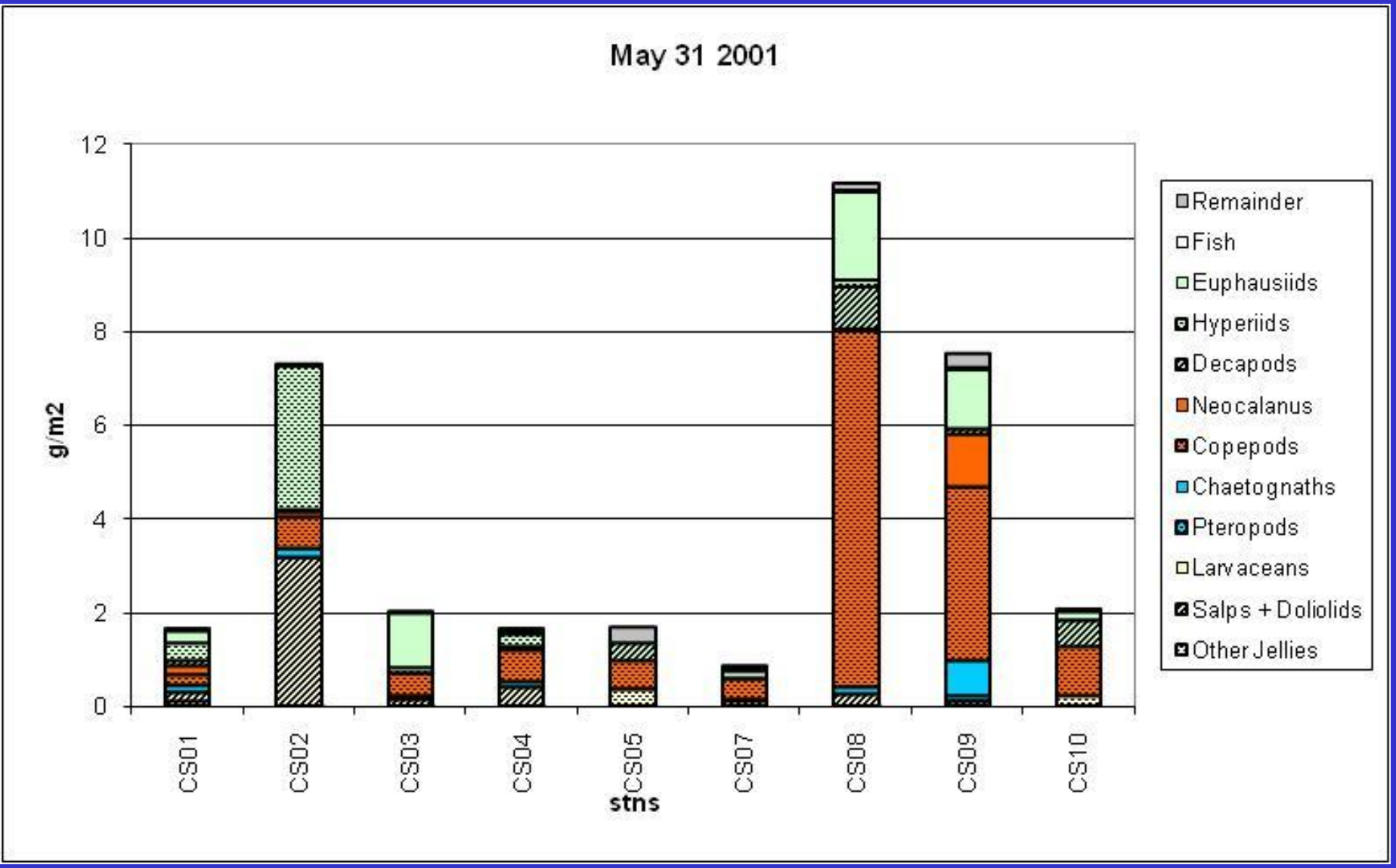


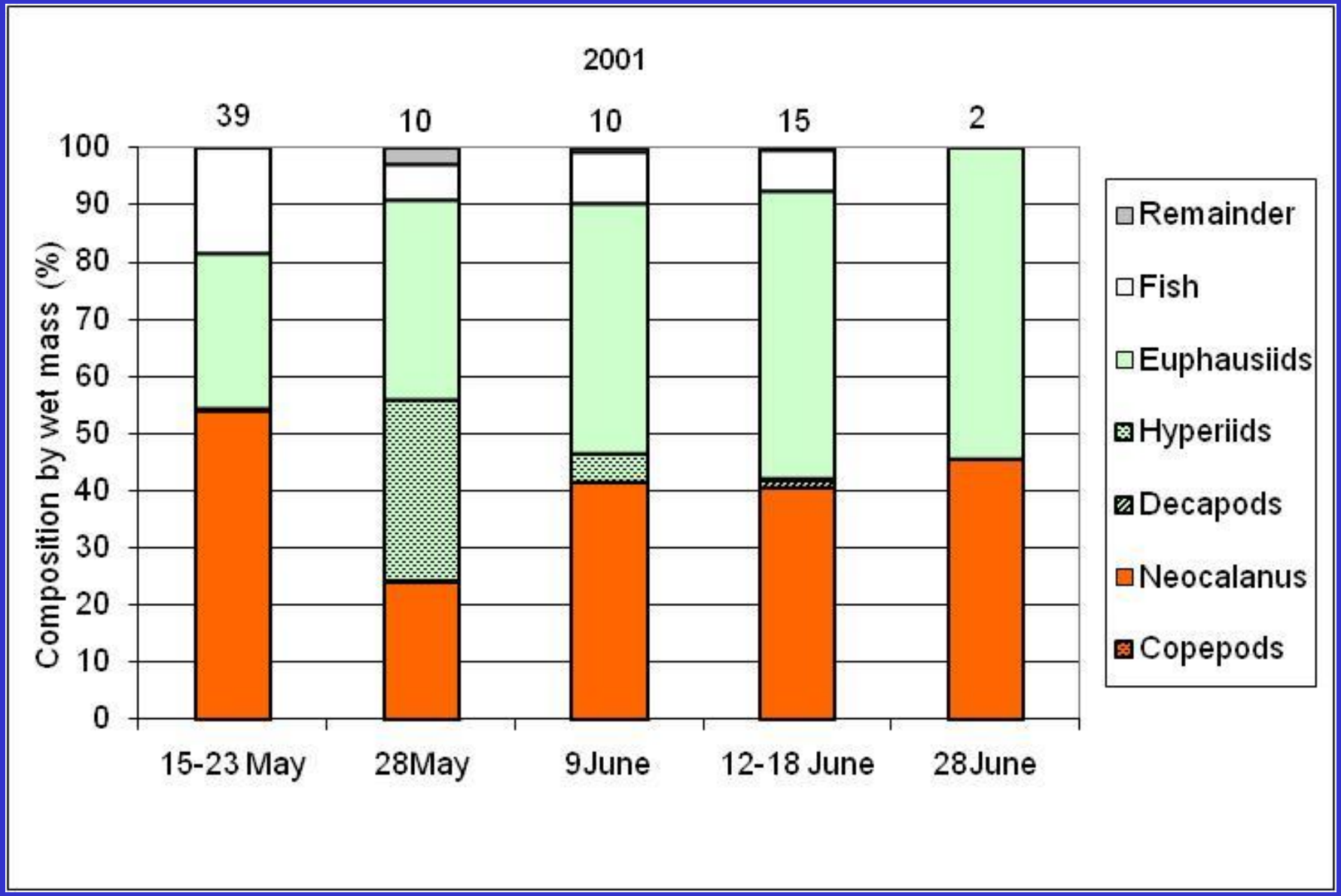

May 9, 10 2000
g/m2
35
30
25
20
15
10
5
0
ODAS
CS01
CS02
CS3B
JI22
LQ03
CS03
CS04
CPE2
CS1B
CS2B
CS06
CS07
CS08
CS09
CS10
stns
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods
Chaetognaths
Pteropods
Larvaceans
Salps + Doliolids
Other Jellies

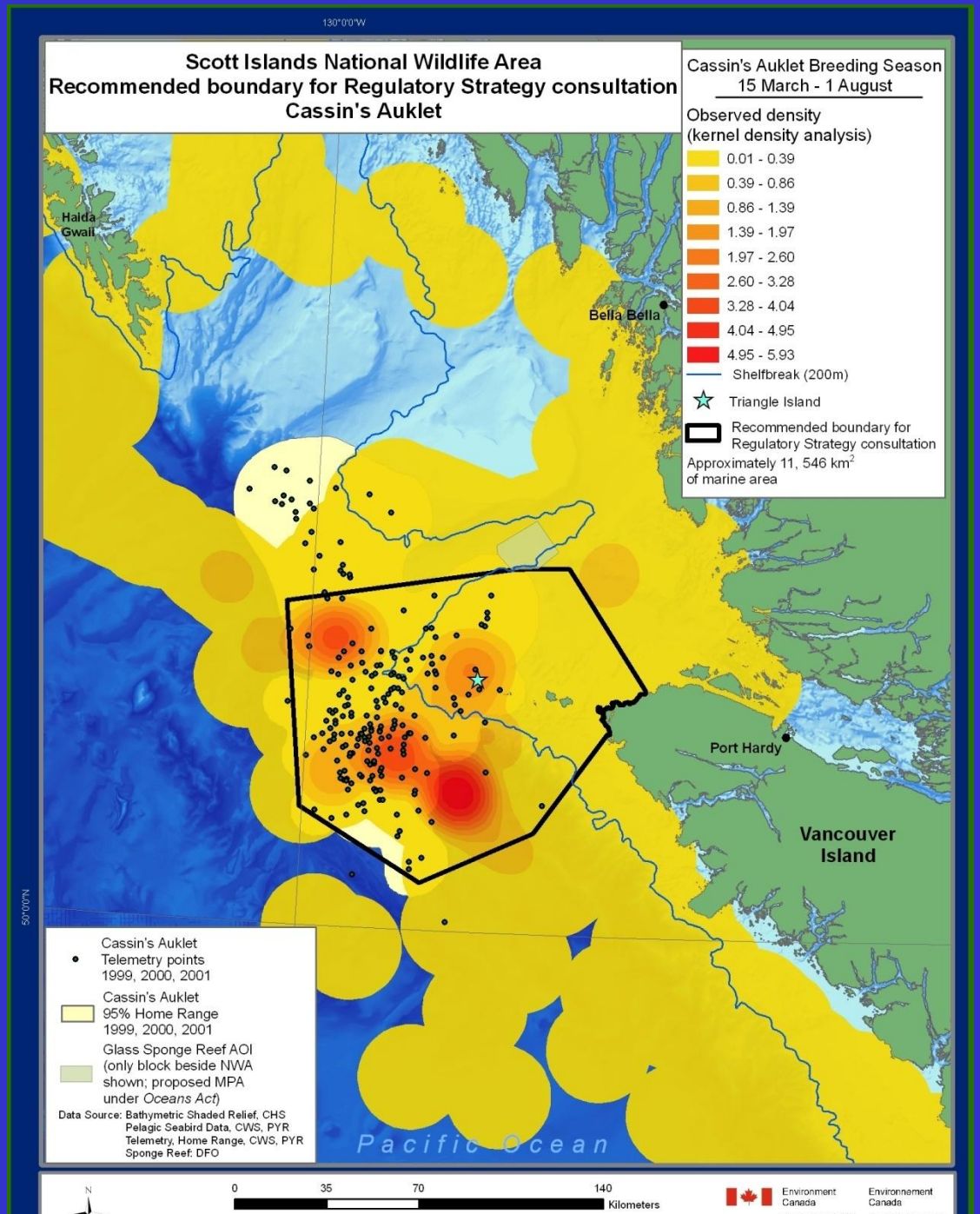

2000
10
23
15
15
3
100
90
80
70
60
50
40
30
20
10
0
Composition by wet mass (%)
19-24 May
25-28 May
6-8 June
12-18 June
28 June
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods

2001 telemetry




May 31 2001
12
10
8
6
4
2
0
g/m2
CS01
CS02
CS03
CS04
CS05
CS07
CS08
CS09
CS10
stns
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods
Chaetognaths
Pteropods
Larvaceans
Salps + Doliolids
Other Jellies


2001
39
10
10
15
2
100
90
80
70
60
50
40
30
20
10
0
Composition by wet mass (%)
15-23 May
28May
9June
12-18 June
28June
Remainder
Fish
Euphausiids
Hyperiids
Decapods
Neocalanus
Copepods

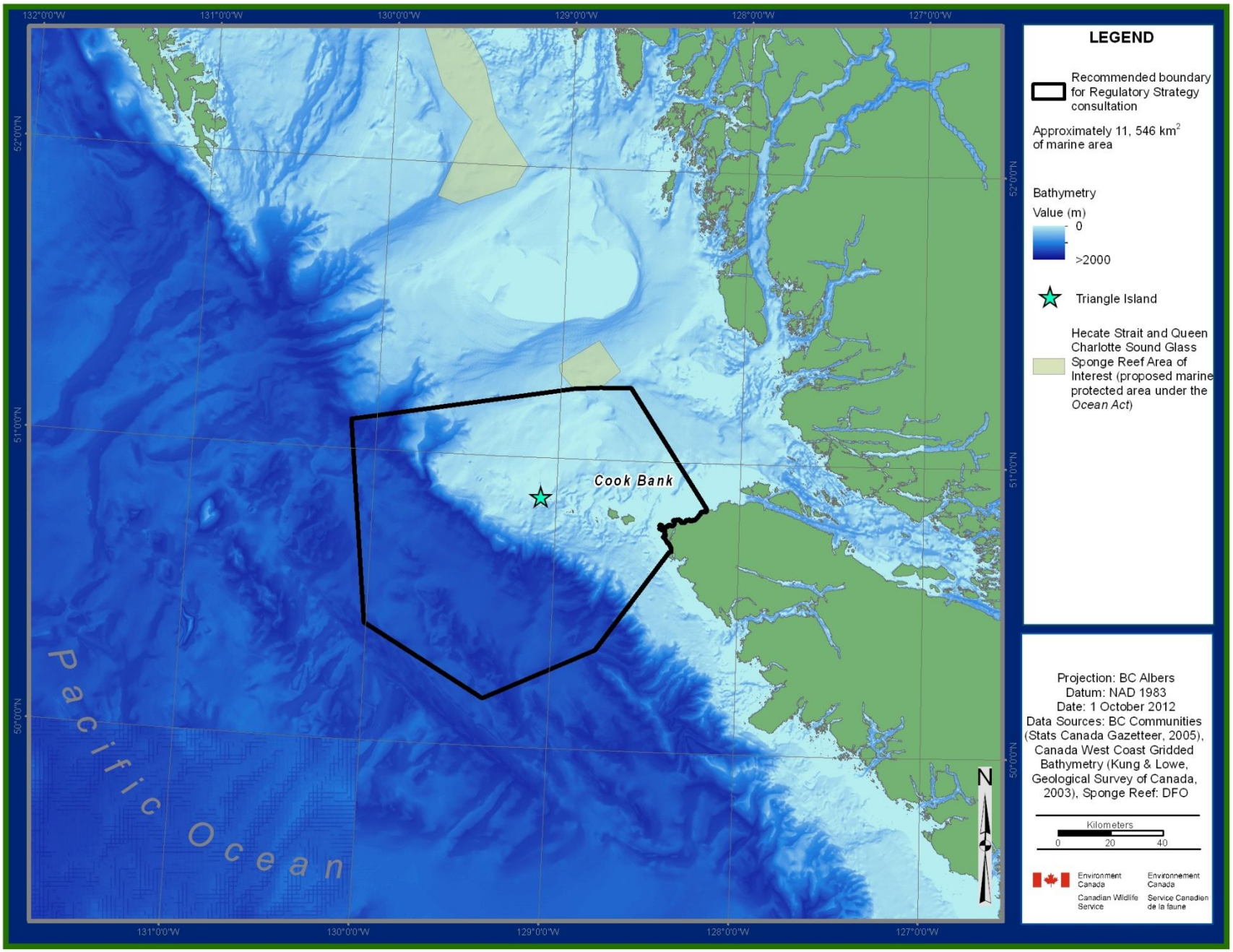


NMWA Regulatory Strategy posted for public comment 25 March -25 May 2013.

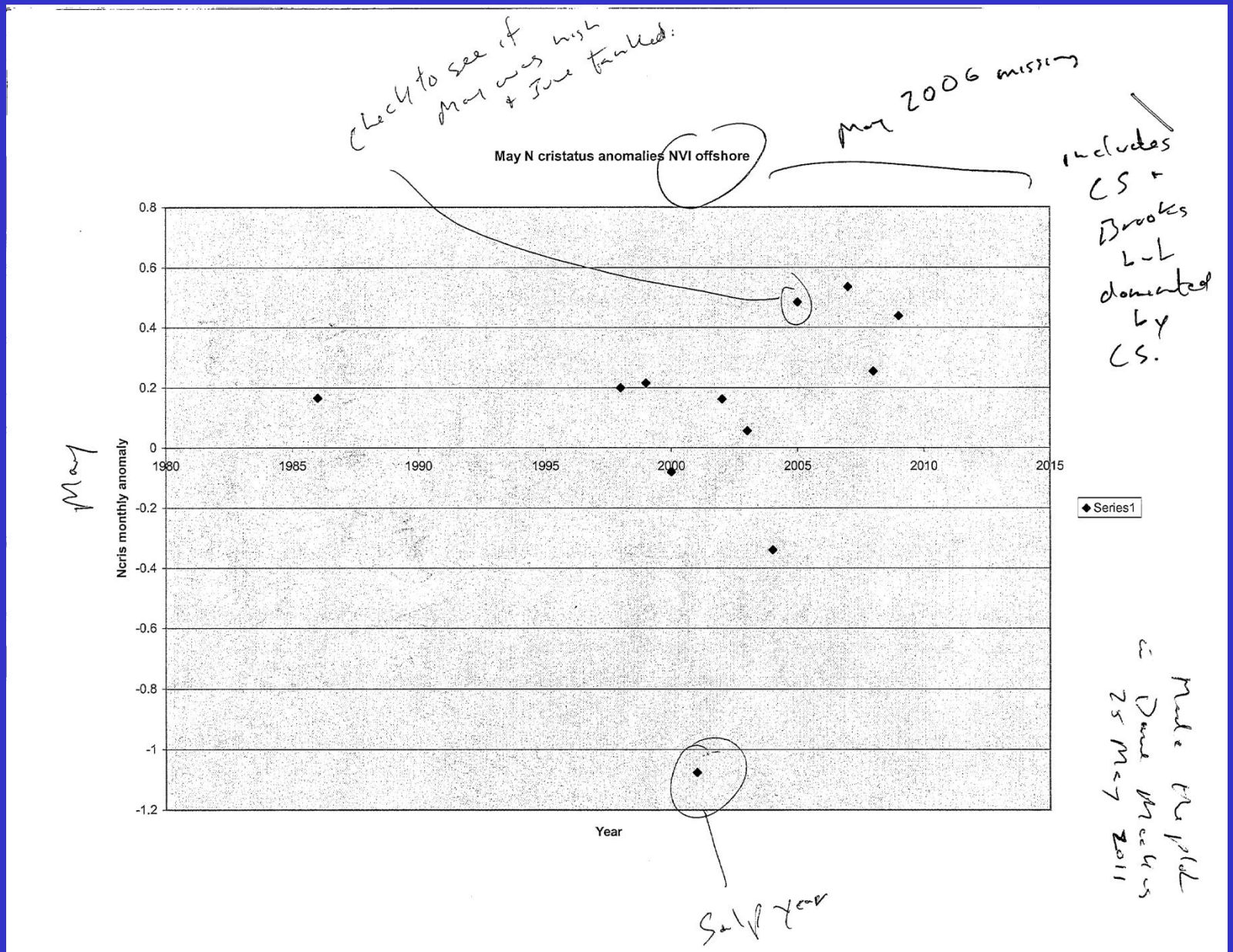
Designation expected Mid 2015

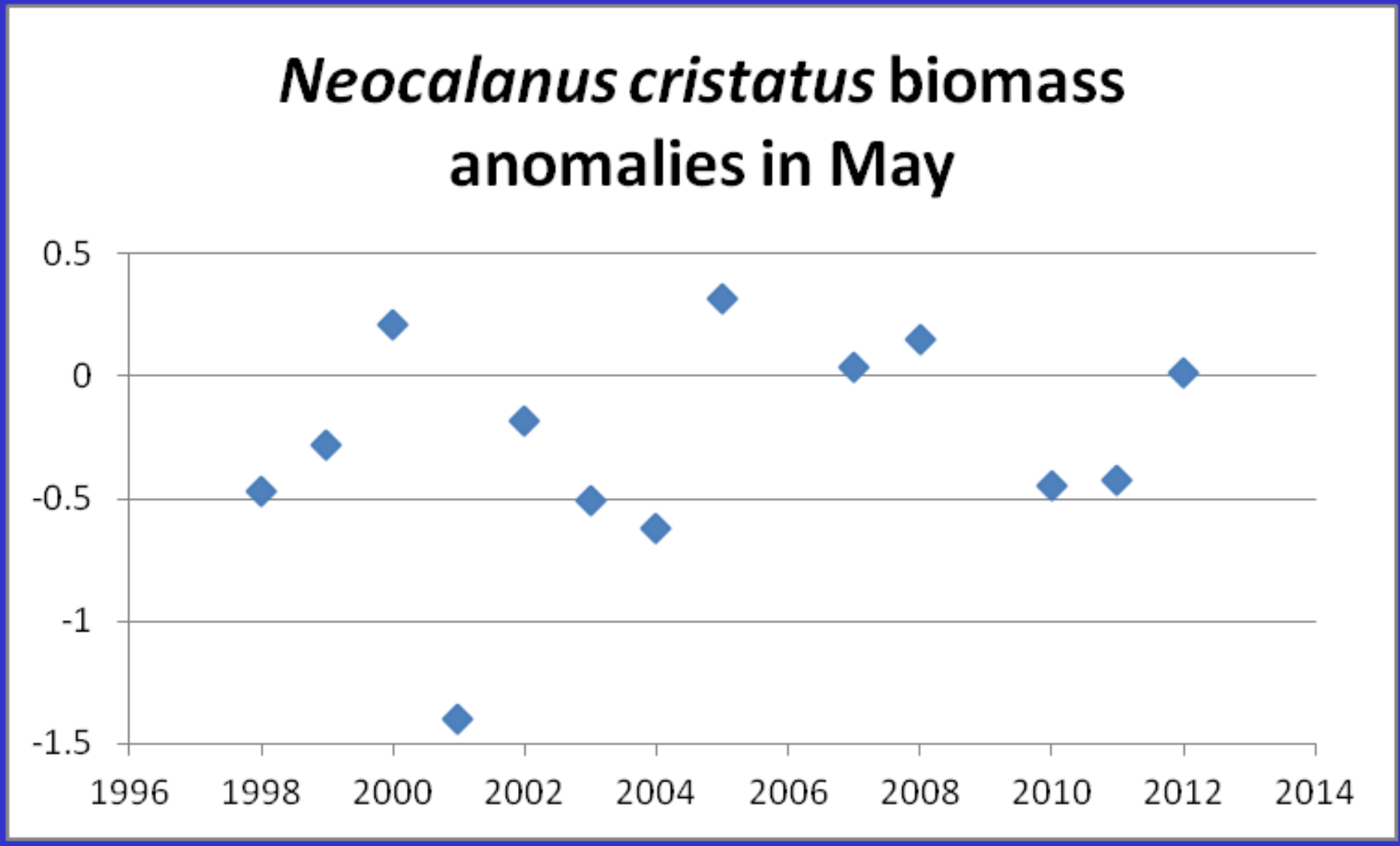
Slide courtesy
Greg Jones, CWS

Proposed Scott Islands National Marine Wildlife Area



Are *N. cristatus* biomass anomalies usually positive offshore?





CS and T lines offshore stations

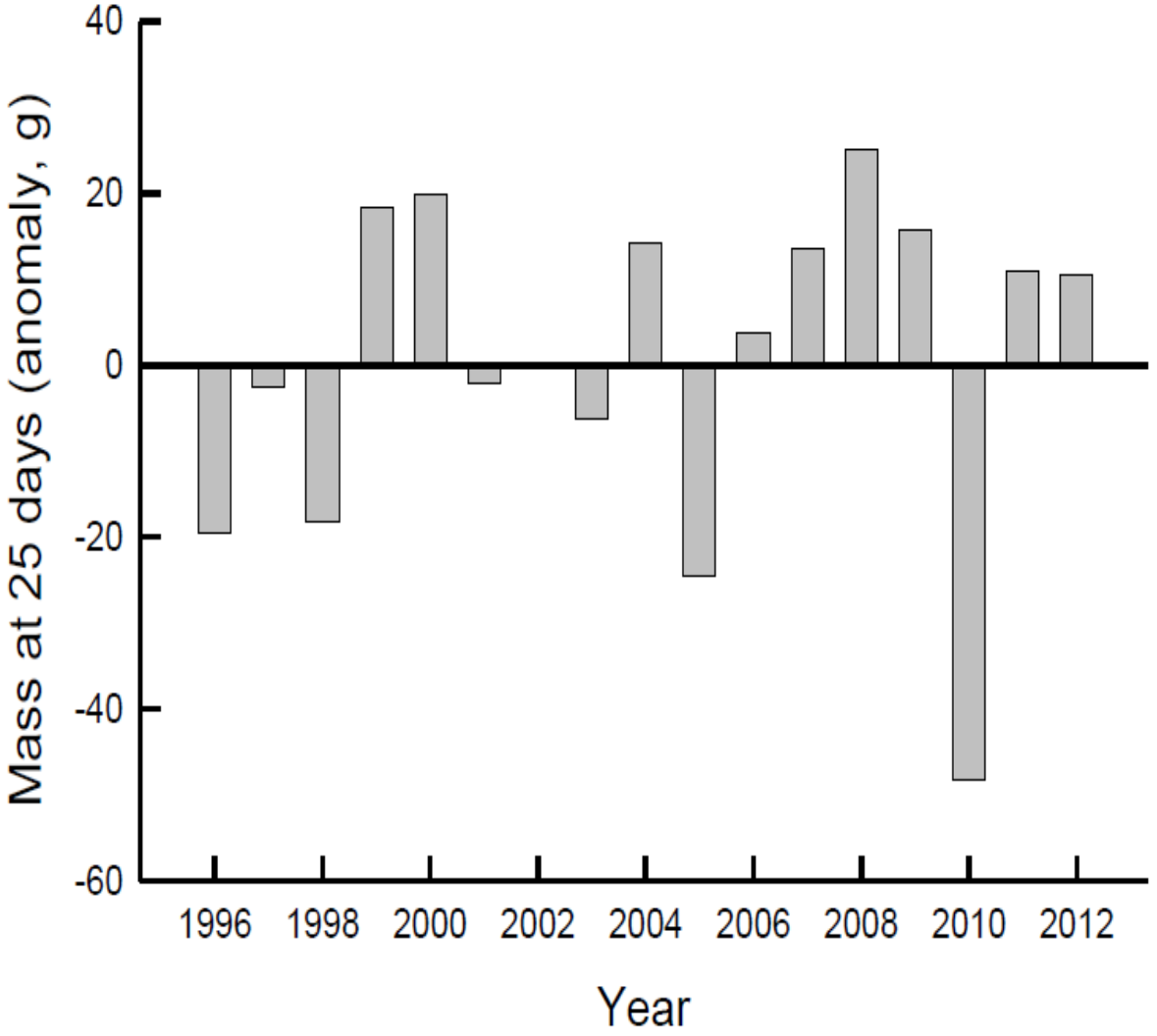
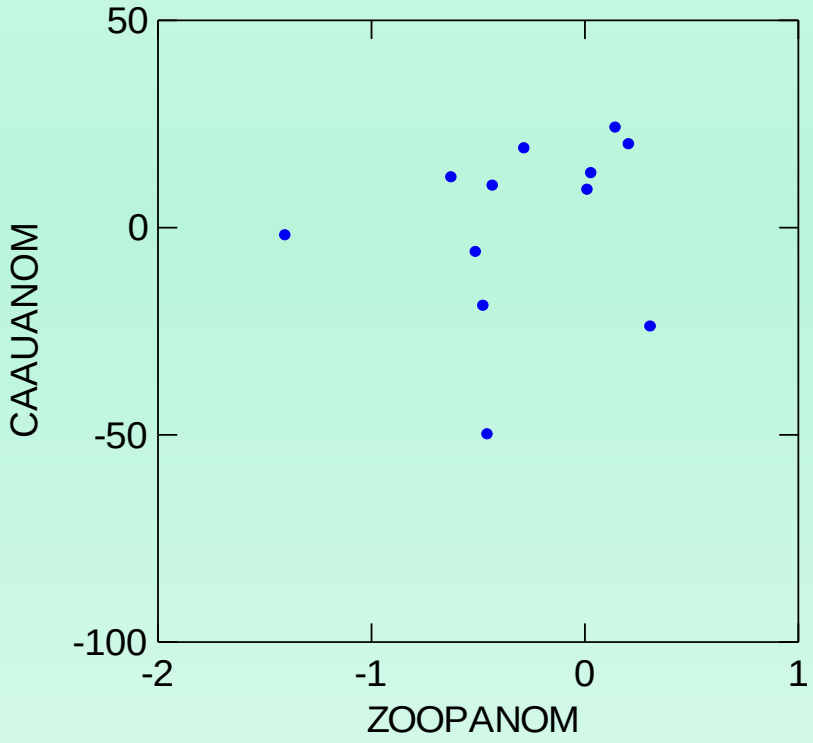


Figure 2. Mass of nestling Cassin's Auklets at 25 days of age, averaged for each year

Source Hipfner report Irvine & Crawford 2013

No relatioship between CAAU performance and zooplankton biomass anomalies at offshore stations



Conclusions

1. Radio telemetry (planes) coupled with zooplankton sampling (ships) and Cassin's auklet nestling diet and transmitters (colony)

2. 1999-2001 Cassin's auklet foraging locations were generally linked to station locations which had *Neocalanus cristatus*.

3. *N cristatus* anomalies offshore were above average in 5 years and below average in 7 years.

4. Breeding performance was not linked to copepod biomass anomalies at the offshelf stations

Acknowledgements

- Field and ship crews
- “Nestucca” Oil spill Trust Fund
- Canadian Climate Change Action Fund
- Canadian Wildlife Service
- Centre for Wildlife Ecology (CWE) @ SFU
- NSERC grants to Fred Cooke (CWE@SFU)
- Canadian Coast Guard
- BC Parks
- Cooper Air
- Deborah Faust