Interim summary of findings from bream spawning assessment, Northern Broads system – Rivers Bure, Ant and Thurne & associated Broads April/May 2019

Introduction & rationale:

Previous baseline surveys[1] and comparative fish survey work to inform the fisheries impact assessment & project planning for the Hoveton Restoration Project (HRP) confirmed that HGB and HB are the most important broads for fish within the context of the tidal Bure system above Horning. Subsequent initial results from major fish tracking studies (2018) confirmed that HGB and HB are also important at a catchment-scale for fish, particularly bream, with migrations of tagged fish from the Thurne & to a lesser extent the Ant during spawning. This led to EA fisheries officers raising further significant concerns in December 2018 about the potential impact of the biomanipulation phase (isolation from wider system by installation of barriers to fish movement & intensive fish removal for up to a decade) of the HRP on the Broads fishery[2] [3] and the proposed mitigation.

Following ongoing discussions with project partners and angling stakeholders, it was agreed that an active assessment of bream spawning activity would be undertaken on key river zones of the Northern Broads system during the 2019 spawning season (River Bure, Ant and Thurne - see Figure 1).

The Environment Agency contracted Fishtrack Ltd to work with EA Fisheries Officers to develop a phased multi-method approach[4], enabling extensive priority areas to be rapidly and concurrently assessed. Particular emphasis was placed on identifying key bream aggregations around the system in order to prioritise subsequent intensive surveys for spawning activity, egg deposition and spawning substrate use.

Summary of spawning assessment findings:

- Multiple survey operations were undertaken from 21 April to 24 May 2019 (see Figure 2)
- During this period, significant aggregations of adult bream were recorded within Hudsons Bay (HB) and Hoveton Great Broad (HGB) on multiple occasions (see Figure 3)
- No significant aggregations of adult bream were found anywhere else within the system (Bure, Ant, Thurne zones) during the assessment period
- Bream spawning activity/behaviour was observed on HB from @24 April through to @19 May
- No bream spawning activity was observed anywhere else within the system during the assessment period
- Roach spawning observed in Thurne system (5m length of 30m weed bed on Dungeon Corner), eggs subsequently found in exactly the same location. No eggs found anywhere else in the Thurne system during the assessment period
- Deployed same day to report of potential bream spawning activity on Heigham Sounds (Thurne) – fish confirmed to be carp and not displaying spawning behaviour. No other reports received.
- Extensive & high density egg deposition recorded on a variety of substrates within HB and HGB & on multiple occasions in HB during the assessment period indicating multiple spawning events
- No egg deposition was found anywhere else in the Bure system during the assessment period
- Fry of different sizes found in littoral & open water samples on HB 7 June 2019 confirming multiple spawning events

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[1] e.g. Lane, S. (Environment Agency) and Hindes, A. (Fishtrack Ltd) Presentation to IFM Conference, Norwich 2016

[2] Broads Angling Strategy. BASG, EA, Angling Trust, Broads Authority 2018

[3] The socio-economic importance of ENS fisheries. Lane, S. Environment Agency May 2015

[4] Northern Broads system bream spawning assessment, Fishtrack Ltd for and with Environment Agency, April 2019

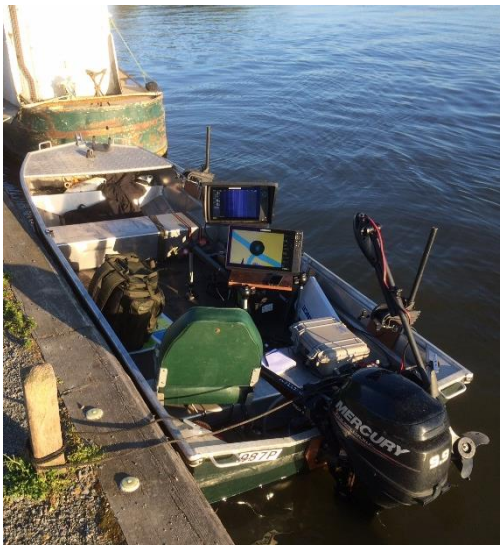
- Localised and limited egg deposition found in the Ant system, but no significant numbers of adult bream observed and no fish observed spawning during the assessment period inferring only limited numbers of fish present (DNA samples taken to assess if eggs are bream or roach)
- Acoustic tracking confirmed fish present in HB/HGB during spawning events from multiple locations around wider system, confirming catchment-scale significance of HB/HGB as bream spawning site[5]
- Acoustic tracking indicates repeat spawning migrations (2018 & 2019) from as far afield as Upper Thurne system (Heigham Sounds, Hickling Broad & Horsey Mere) confirming catchment-scale importance of HB/HGB for bream spawning and recruitment
- Water temperature monitoring indicates HB exhibits significant thermal advantages likely to be critical to fish, fish spawning, recruitment & associated ecology e.g. inverts (warmer and more stable temperature regime c.f. wider system e.g. Woodbastwick Marsh dyke)

Left: Checking sedges on Decoy Broad (Bure) 22 May 2019

Right: Checking trailing willow root substrates in River Bure adjacent HGB

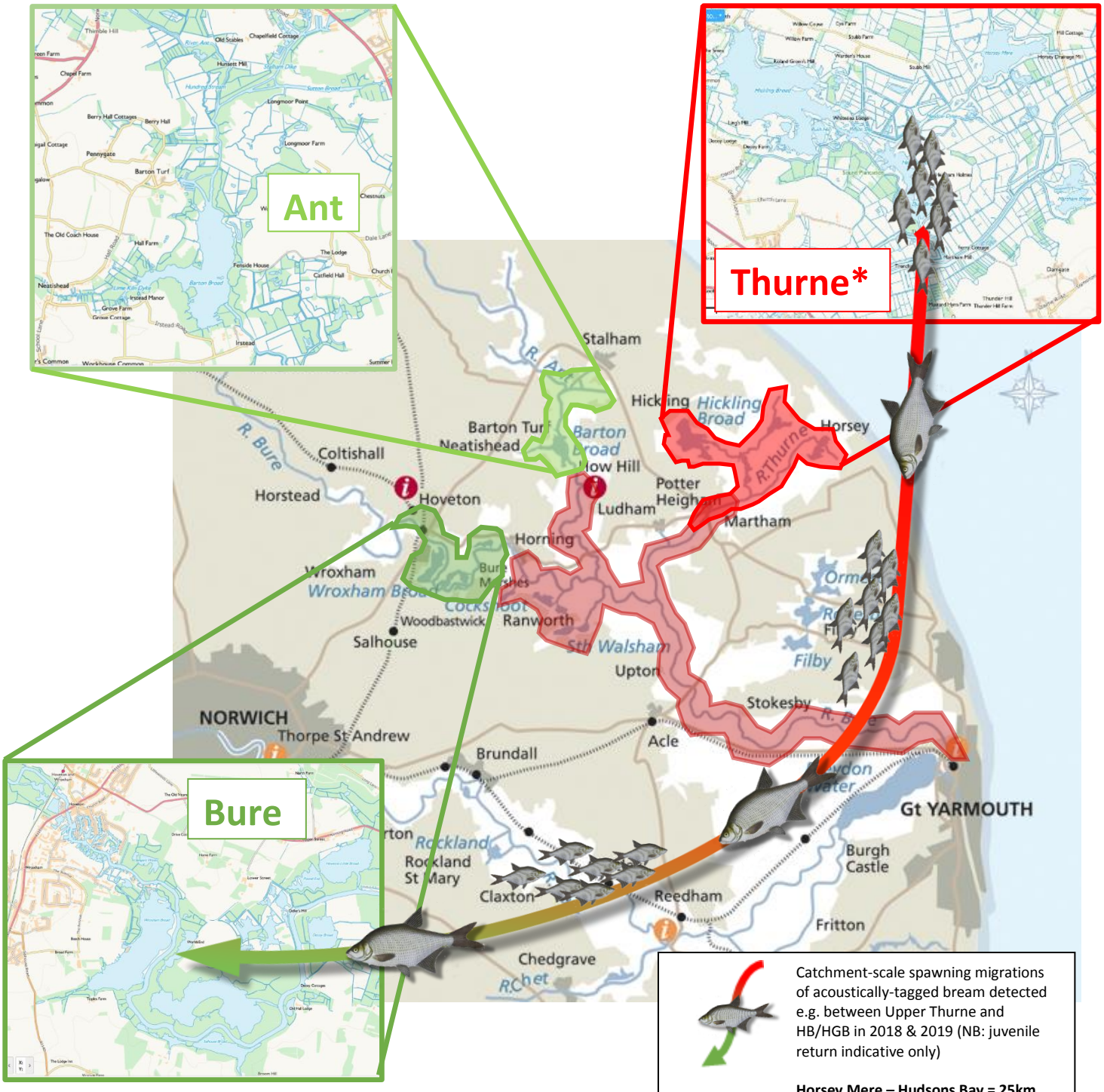
Below left: Checking marginal habitats on Turkey Broad (Ant) 21 May 2019

Below right: Additional voluntary effort expanded coverage – e.g. lower Bure zone inc. S. Walsham/Malthouse/ Ranworth (Steve Lane)



[5] Backs up tracking data from 2018 showing catchment-scale migrations of bream e.g. Thurne fish migrating to HGB/HB during spawning period Apr/May, plus bream tagged in HGB during April migrating to Thurne post spawning. Initial tracking results show some of these tagged fish returned to HGB/HB during the spawning assessment period April-May 2019

Figure 1: Map of Northern Broads system showing a) extent of three principal river zones covered during bream spawning assessment operations April/May 2019 (Ant, Bure, Thurne); b) extent of system impacted by existing environmental threats to fish stocks; c) Acoustic tracking: spawning migrations of bream detected e.g. between Upper Thurne & HB/HGB



Broads/river covered daily during spawning assessment:

BURE ZONE:

- Wroxham Broad
- Bridge Broad
- Salhouse Broad
- Decoy Broad
- Pound End
- Hoveton Little Broad
- Hoveton Great Broad & Hudsons Bay

ANT ZONE:

- Barton Broad
- Turkey Broad
- Sutton Broad

THURNE ZONE:

- Hickling Broad
- Horsey Mere
- Duck Broad
- Martham North
- Heigham Sound

EXTENT OF NORTHERN BROADS SYSTEM ALREADY AFFECTED BY SIGNIFICANT ENVIRONMENTAL THREATS TO FISH STOCKS:

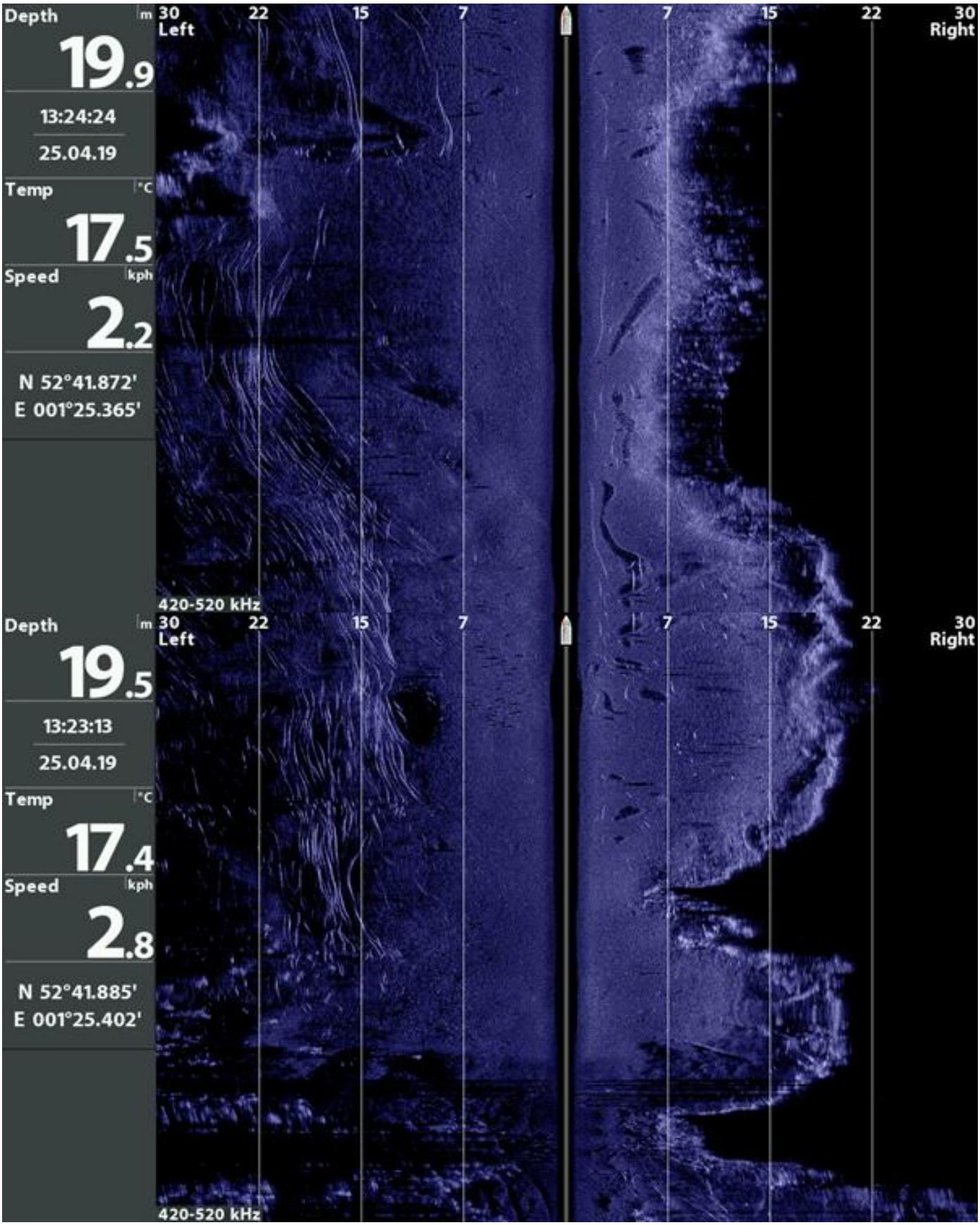
*MINIMUM EXTENT OF NORTHERN BROADS SYSTEM VULNERABLE TO CATASTROPHIC FISH KILLS CAUSED BY THE TOXIC ALGAE *PRYMNESIUM*

MINIMUM EXTENT OF NORTHERN BROADS SYSTEM VULNERABLE TO CATASTROPHIC FISH KILLS CAUSED BY SALINE INCURSION

Figure 2: Extent of coverage of principle river zones during bream spawning assessment 21 April to 24 May 2019 (grey rows indicate weekend days)

	RIVER ZONE			
DATE	**BURE**	**ANT**	**THURNE**	**Additional coverage / Comments**
21-Apr	**X**			
23-Apr	**X**			
24-Apr	**X**	**X**		Additional foot search of Woodbastwick marshes. Spawning activity observed: Hudsons Bay
25-Apr	**X**			Spawning activity observed: Hudsons Bay
28-Apr	**X**			
29-Apr	**X**			eggs observed in Hudsons bay
30-Apr	**X**			egg survey + acoustic tracking on HGB and HB
02-May	**X**	**X**		spawning / egg survey on Bure
09-May			**X**	
10-May	**X**			
11-May	**X : X**			Extra Zone Lower Bure SL (Ranworth, Malthouse, S Walsham)
12-May	**X**			HGB & Hudsons (SL)
14-May	**X**		**X**	Thurne- carp activity confirmed (Heigham Sounds): Bure - Hudsons Bay only (SL, acoustic)
15-May	**X**		**X**	
16-May	**X**	**X**		Bure - Hudsons Bay and HGB only Egg sample from Neatishead Arm (Barton Broad) Spawning activity observed: Hudsons Bay
17-May	**X**			
18-May			**X**	
19-May	**X**			Hudsons Bay visual – Bream patrolling territories
20-May	**X**			
21-May	**X**	**X**		Ant - Eggs observed near "Heater" and on willow roots near Irstead shoals. Eggs observed in Hudsons Bay and HGB
22-May	**X**	**X**		
23-May	**X**		**X**	Bure - lower Bure & Thurne from Horning d/s to Oby/Thurne
24-May	**X**			

Figure 3: Example side imaging sonar output[6] (mosaic) showing large adult bream aggregation during spawning activity observed on Hudsons Bay, 25 April 2019. Side imaging sonar enabled rapid assessment of extensive open water & margins to identify significant bream aggregations



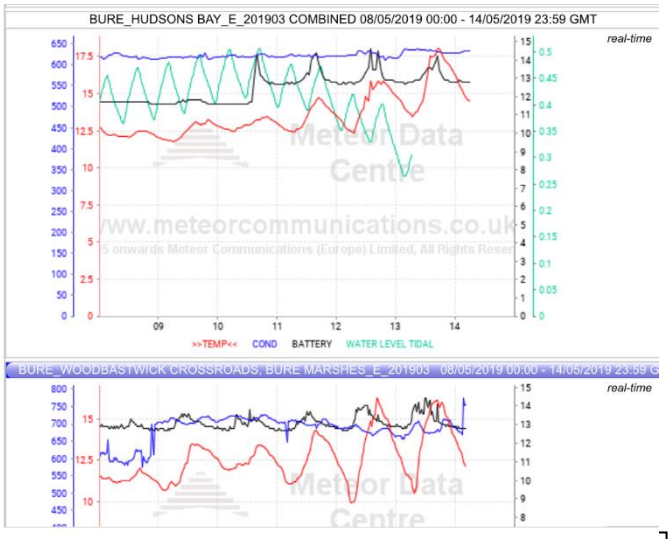
[6] Transect heading south towards Hudsons Bay dyke (top of image). Low frequency, 30m range either side of boat (centre line)

Bream spawning behaviour – including fish hitting the bottom of the boat - Hudsons Bay 25 April 2019

Bream spawning behaviour Hudsons Bay 16 May 2019

Bream eggs on trailing willow roots following observed spawning Hudsons Bay 28 April 2019

Fry sampled from littoral margin and open water. Variance in sizes confirms multiple spawning events Hudsons Bay 7 June 2019



Water temperature monitoring data for Hudsons Bay (top) c.f. Woodbastwick Dyke (bottom)

14 May 2019

Surface cruising activity by carp confirmed following boat deployment – Heigham Sounds (Thurne) 14 May 2019