Building with Nature

EcoShape

Field report beach sampling 2011 Smart Nourishments

IMARES is:

- an independent, objective and authoritative institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- an institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- a key, proactive player in national and international marine networks (including ICES and EFARO).

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1. Introduction

Human activity in the North Sea is increasing, involving more motorised cargo shipping, and rapidly expanding construction and operation of oil platforms and wind farms. Furthermore, the North Sea is used on a large scale for fisheries, military purposes and the extraction and suppletion of sand. Sand suppletion is used in the Netherlands to protect the beaches along the coast. In recent years, underwater sand levees or sand suppletion near shore has been performed for coastal protection. It has been suggested that new areas created as the result of sand suppletion offshore can create new opportunities for fish, because of an increase of the suitable habitat. In near future, major sand nourishments are planned at the Dutch coast of the Delfland area ('zandmotor'). In order to study the effect on (mostly juvenile) fish and epifauna, a sampling strategy was designed to monitor the potentially affected species.

Data on fish abundance in the shallow North sea coast are scarce and most data were collected during the beach/coastal zone survey carried out by RIVO along the Dutch coast between 1974 – 1985. A total of 610 hauls were carried out between 1974 and 1985 across 17 areas. The survey consisted of hauls with a 2 meter beam trawl from a rubber boat (1974 – 1981), the Krab (1975 by the Wadden islands) and the Stern (1977, 1980 in Wijk aan Zee, Parnassia and Noordwijk). The survey was not carried out systematically, no work plans were available and fishing only took place when the weather conditions were fine. However, there is still expertise on the methods used available at IMARES so this is the basis for this work plan.

The selection of species and the habitat characteristics that should be monitored is derived from Teal & van Keeken (2011). In terms of planning a survey to understand the distribution and habitat use of the Dutch coastal zone by the named species, Teal & van Keeken recommend that a number of potential limitations must be taken into account:

- Seasonal patterns: as the species exhibit different seasonal use of the area, the time of sampling will determine to some extent which species dominate the catches, whilst other species may be underrepresented in terms of their use of the area during other months.
- Daily migrations: some species exhibit differences in habitat use between the day and night (e.g. burial, diel migrations), so the time of day at which sampling takes place can affect the catchability of different species, e.g. lesser weever bury during the day, sandeel bury at night.
- Sediment preference: different species prefer different sediment characteristics, so a wide scale of sediment types should be sampled.
- Depth: due to the tidal nature of the areas in question, the survey needs to be extended over a depth range, taking into account underwater sand dunes.
- Water visibility: water visibility can influence both fish abundance, as well as the opportunity for fish to notice a fishing gear, and react to it by fleeing.

The aim of this project is:

- to monitor the reference situation concerning fish and epifauna in the shallow coastal waters (2-7 m water depth).
- to monitor the reference situation concerning potential habitat for fish and epifauna in the shallow coastal waters (i.e. depth, grain size, water temperature, salinity, water visibility).
- to link fish abundance to habitat characteristics.

This report only gives a description of the field sampling during July 2011.

2. Materials and Methods

The monitoring took place at four locations along the Dutch coast during three weeks in July. The first location, IJmuiden, was used to test the equipment. Fishing was planned for Vlugtenburg, Texel and Ameland.

The sampling method focuses on the target species plaice, sole, turbot, brill, sprat, sandeel, lesser weever, sand gobies, pipefish and brown shrimp. The timing of the monitoring was in a period in which most relevant species are expected to be present and where sampling should not encounter too many difficulties due to bad weather conditions. In order to sample all species to their maximum it should be worth to sample during day and night. However, from a logistic and safety point of view, this was not possible, so sampling only took place during day time. Influence of tidal phase could be important. It is assumed that during ebb-tide the fish slowly migrate with the tide to deeper areas. During high tide, there is some delay before fish again occupies the area. Therefore sampling mainly took place during the ebb-tide.

Fishing took place using a 2 meter beam trawl which was borrowed from institute Royal NIOZ at Texel. The gear consisted of a meter wide metal frame which was weighted down with lead weights. The fishing net was a small mesh trawl (0.5 cm mesh) which was attached to the metal frame using a mall metal chain at the bottom of the net. An additional tickler chain was also used. Haul duration was set at 10 minutes, but after a few test hauls the haul duration was brought back to 5 minutes, due to increasing catch decreasing the fishability of the net.

The gear was fished from a Bombard C5 inflatable boat with a 25 Hp outboard engine (Picture 2.1) at fishing speed between 1.5-2.5 km/hour at depth ranging from 1.5-6.5 meters. The Bombard C5 has a rather flat bottom and is capable to go fishing under safe conditions in wave heights up to approximately 0.7 meters.

At each location two hauls were conducted at a certain depth area with a range of a meter (e.g. 2-3, 3-4, 4-5, 5-6 m). Around the shallow areas <2.5 more hauls were conducted during different tidal conditions. Depth was determined using a Tracker fish finder powered by two 12 V batteries and also ckecked manually using an anchor and a marked rope.

Picture 2.1 The Bombard C5 inflatable boat and the small trawl (left) and hauling the gear at sea (right).

After each haul, the catch was put in a plastic bag and labelled with date, time, station and sample. After two to four hauls the catch was brought ashore where it was sorted and measured. The possibility to bring back samples depends on the time sorting takes, since the catch deteriorates quite fast in the sun. The catch was sorted completely and all species were identified to the lowest taxonomical level (species). Fish were measured to the cm below, shrimp were measured to the mm below (Picture 2.2). Other

species such as crabs were only counted. Per sample, a minimum of 50 fish per species and 100 shrimp were measured.
Catch data was registered on a paper sheet and entered at a later stage in the computer program Billie Turf. After the survey, the Billie Turf files were stored a the IMARES network folder and after a check for errors imported IMARES database Frisbe.

Picture 2.2 *Fish were measured to the cm below (left), shrimp were measured to the mm below (right).*

Sediment characteristics and depth are major factors in the habitat description of fish. At each station, a sediment sample was taken with a Van Veen grab (Picture 2.3), which takes a bit of sediment from the bottom of approximately 4-7 cm deep. From this sediment sample, a jar was filled with a subsample taken by hand over the depth range of the sample. The sample was stored in a labelled jar at air temperature. Additionally, the characteristics of the water column was be measured using a Aquadopp hydrolab, which was attached to the top of the fishing gear. This device measures several parameters (Table 2.1). Every day the data was retrieved from the device and stored on a computer. Water depth was also measured using a depth finder and manually. Fishing positions and fished track were recorded using a hand held GPS.

Table 2.1 *Data stored by the hydroplab.*

Parameter	*Date*	*Time*	*Temperature*	*Salinity*	*Dissolved Oxygen%*	*Dissolved Oxygen*
Unit	DDMMYY	HHMMSS	øC	ppt	Saturation	Mg/l
Parameter	Turbidity	Battery	Depth	Conductivity	Conductivity	
Unit	NTU	Volts	Meters	mS/cm	æS/cm	

Picture 1.3 *A Van Veen grab.*

3. Results

3.1. IJmuiden: July 11, 2011

The first day was used to test all equipment at the area just below the south pier in Ijmuiden (Picture 3.1) and for traveling to the second location. Weather conditions were most suitable at IJmuiden with a wind force of 2 BFT (Table 3.1) and hardly any waves. High tide was around 13.00 hours (Table 3.2). A total of 4 hauls were conducted (Table 3.3). Haul duration was tested, with two hauls lasting 6 minutes and two hauls lasting 10 minutes (Appendix A). Because of the increasing catch after several minutes, it got more difficult to tow the net at a constant speed. Therefore it was chosen to fish for 5 minutes hauls during the remainder of the program. The hauls were fished alongside the coast (Figure 3.1), which was the best way to fish considering the current that runs along the beach and the constant depth during each haul.

Table 3.1 *IJmuiden, July 11, 2011. Wind speed (BFT), wind direction and wave height (in meter); data from www.windguru.cz.*

	Wind speed (Bft)			***Wind direction***			***Wave (m)***		
	08h	**14h**	**20h**	**08h**	**14h**	**20h**	**08h**	**14h**	**20h**
11.07.2011	2	2	2				0.3	0.3	0.2

Table 3.2 *IJmuiden, July 11, 2011. Time of high and low tide and corresponding water level in cm NAP. Data from RWS.*

Date	***Time high tide***	***NAP (cm)***	***Time low tide***	***NAP (cm)***
11.07.2011	0:20	81	8:04	-74
11.07.2011	13:05	88	20:44	-62

Table 3.3 *IJmuiden, July 11, 2011. Sampling information with the number of hauls, the time during which fishing took place (sorting still took place after) and crew names.*

Date	***N Hauls***	***Time fishing***	***Persons on boat***	***Persons measuring catch***
11.07.2011	4	10.50-12.40	O. van Keeken, A. Bakker	A. Dijkman, K. Cordery, I. de Boois

Picture 3.1 *IJmuiden, July 11, 2011. Measuring the catch (left) and hauling the net (right) in good wave conditions.*

Figure 3.1 *IJmuiden, July 11, 2011. Fished tracks. Yellow indicator shows the starting position, green indicator shows the end position.*

3.2. Vlugtenburg: July 12-15, 2011

At Vlugtenburg (province of South Holland, just above the city of Hoek van Holland, Figure 3.2), it was attempted to go sampling in the morning of July 12 (Picture 3.2). Wave heights were higher than anticipated and the wind speed increased rapidly in the morning (Table 3.4). Due to the wind conditions it was not possible to go out sampling with the inflatable boat during the remainder of the week (Table 3.5).

Table 3.4 *Vlugtenburg, July 12-15, 2011. Wind speed (BFT), wind direction and wave height (in meter); data from www.windguru.cz.*

	Wind speed (Bft)			***Wind direction***			***Wave (m)***		
	08h	**14h**	**20h**	**08h**	**14h**	**20h**	**08h**	**14h**	**20h**
12.07.2011	3	5	6	NE	NE	NNE	0.2	1	1.4
13.07.2011	5	5	5	N	N	NW	2	2	1.9
14.07.2011	5	8	6	WNW	NW	WNW	2.1	3.7	3.4
15.07.2011	4	3	2	WNW	W	W	2.1	1.6	1.2

Table 3.5 *Vlugtenburg, July 12-15, 2011. Sampling information with the number of hauls, the time during which fishing took place (sorting still took place after) and crew names.*

Date	***N Hauls***	***Time fishing***	***Persons on boat***	***Persons measuring catch***
12.07.2011	0	nvt	O. van Keeken, A. Bakker	A. Dijkman, K. Cordery

Picture 3.2 *Vlugtenburg, July 12, 2011. Putting the boat in the water (left) and taking it out again (right) after a short trip in conditions not suitable for fishing (or even driving the boat).*

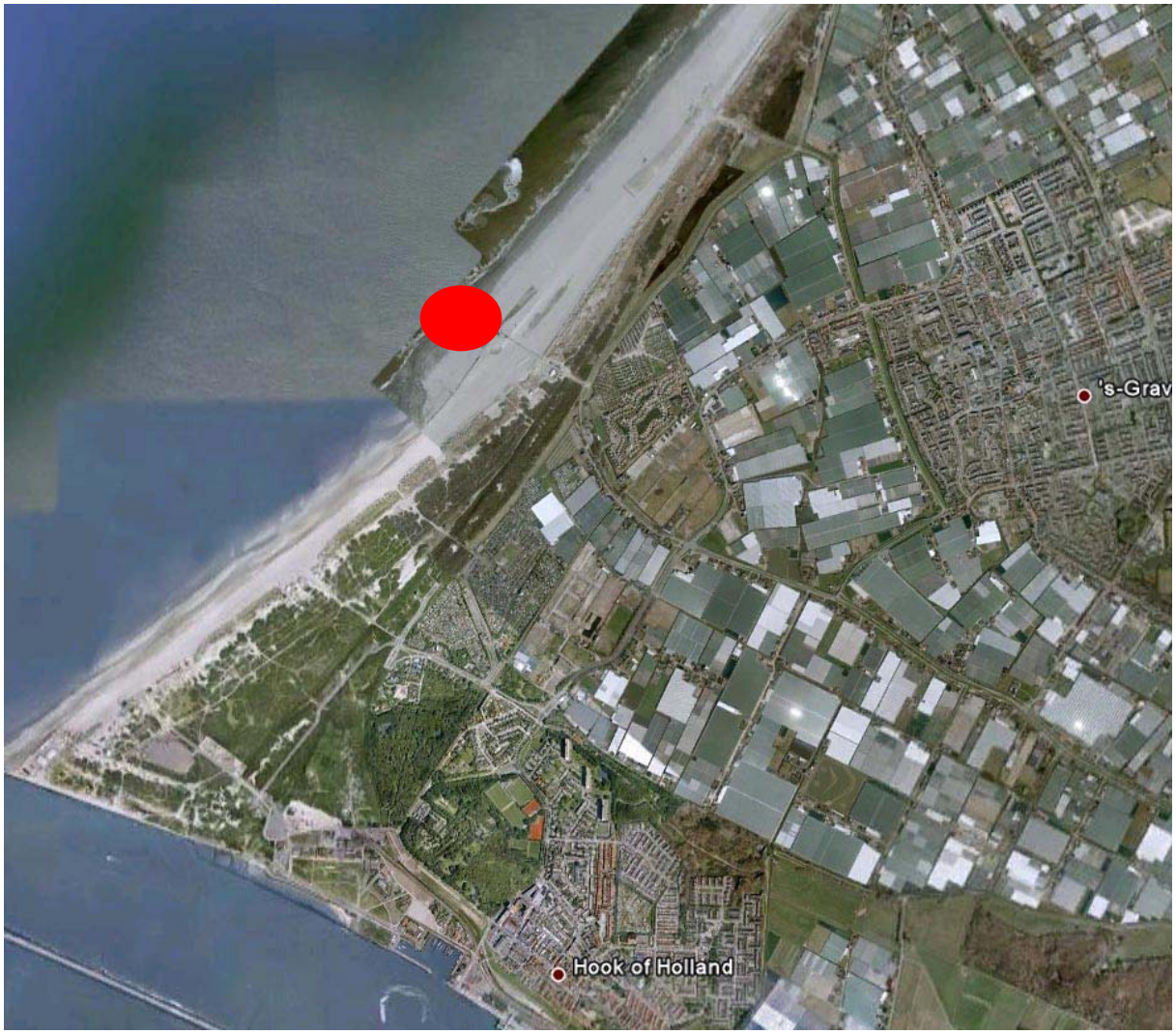

Figure 3.2 Vlugtenburg, July 12-15, 2011. Planned sampling area indicated with the red dot.

3.3. Texel: July 18-22, 2011

At Texel, wind conditions were only favourable during July 20 and 21 (Table 3.6). High tide was at 11:41 and 12:16 during the 20th and 21th (Table 3.7). During July 20, the weather conditions were such that sampling could take place during the entire day (Picture 3.3). During July 21 the wind speed increased and sampling had to be stopped during the afternoon (Table 3.8). During the first day a total of 16 hauls were sampled, during the second day a total of 10 hauls at a more southern location compared to the first day (Figure 3.3). At the location during the first day, most samples were taken on the Southern side of a dam. On the Northern side from this dam, three samples were taken (18-20), which contained quite a lot of seaweed. On the southern side of the dam the catch contained much less seaweed (Picture 3.4).

Table 3.6 *Texel, July 18-22, 2011. Wind speed (BFT), wind direction and wave height (in meter); data from www.windguru.cz.*

	Wind speed (Bft)			***Wind direction***			***Wave (m)***		
	08h	**14h**	**20h**	**08h**	**14h**	**20h**	**08h**	**14h**	**20h**
18.07.2011	6	6	5	SW	SW	SW	2.4	2.5	2.5
19.07.2011	5	4	2	SSW	WSW	VAR	1.5	1.2	0.9
20.07.2011	2	2	2	VAR	VAR	VAR	0.7	0.6	0.6
21.07.2011	2	3	4	VAR	NNE	NNE	0.7	0.7	0.8
22.07.2011	5	5	6	NNW	NW	NW	1.7	2.5	2.8

Table 3.7 *Texel, July 18-22, 2011. Time of high and low tide and corresponding water level in cm NAP. Data from RWS.*

Date	***Time high tide***	***NAP (cm)***	***Time low tide***	***NAP (cm)***
20.07.2011	11:41	97	5:35	-113
20.07.2011	21:14	54	18:11	-96
21.07.2011	12:16	87	6:16	-107
21.07.2011	22:16	56	18:41	-88

Table 3.8 *Texel, July 18-22, 2011. Sampling information with the number of hauls, the time during which fishing took place (sorting still took place after) and crew names.*

Date	***N Hauls***	***Time fishing***	***Persons on boat***	***Persons measuring catch***
20.07.2011	16	10.30-17.45	O. van Keeken, A. Bakker	L. Fassler-Teal, K. Cordery, S. Smith
21.07.2011	10	11.15-14.50	O. van Keeken, A. Bakker	L. Fassler-Teal, K. Cordery

Picture 3.3 Texel, July 20 & 21, 2011. Sorting and measuring the catch.

Picture 3.4 Texel, July 20 & 21, 2011. The catch from two hauls.

Figure 3.3a Texel, July 18-22, 2011. Fished tracks. Yellow indicator shows the starting position, green indicator shows the end position. Locations for both days (upper figure) and Northern locations on July 20 (lower Figure).

Figure 3.3b *Texel, July 18-22, 2011. Fished tracks. Yellow indicator shows the starting position, green indicator shows the end position. Southern locations on July 20 (upper Figure) and locations on July 21 (lower Figure).*

3.4. Ameland: July 25-29, 2011.

At Ameland, wind conditions were only favourable during July 27 and 28 (Table 3.9). During July 27, the weather conditions were such that sampling could take place during the entire day. During July 28 the wind speed increased and sampling had to be stopped during the beginning of the afternoon (Table 3.11). During the first day a total of 16 hauls were sampled, during the second day a total of 8 hauls at a more western location compared to the first day (Figure 3.4). During the first day, some hauls were made in an area between two sandbanks during low tide (hauls 41-42 and 45-46).

At the end of the first sampling day at Ameland (July 27), the Hydrolab came loose from the net. As a result no data could be obtained from that sampling day and neither from the following day July 28 on water temperature, salinity and actual gear depth.

Table 3.9 Ameland, July 25-29, 2011. Wind speed (BFT), wind direction and wave height (in meter); data from www.windguru.cz.

	Wind speed (Bft)			**Wind direction**			**Wave (m)**		
	08h	**14h**	**20h**	**08h**	**14h**	**20h**	**08h**	**14h**	**20h**
25.07.2011	5	4	4	W	WSW	SW	2.3	2.1	1.8
26.07.2011	2	2	2		SE		1.2	0.9	0.8
27.07.2011	2	2	4		NNE	NE	0.7	0.6	0.7
28.07.2011	3	4	3	ENE	NE	N	0.7*	1.0*	1.0*
29.07.2011	4	4	4	NW	NW	NNW	1.4*	1.4	1.8

- Not available, but estimated at location

Table 3.10 Ameland, July 25-29, 2011. Time of high and low tide and corresponding water level in cm NAP. Data from RWS.

Date	***Time high tide***	***NAP (cm)***	***Time low tide***	***NAP (cm)***
27.07.2011	6:10	64	12:34	-82
27.07.2011	18:46	64		
28.07.2011	7:14	78	1:15	-90
28.07.2011	19:44	73	13:56	-97

Table 3.11 Ameland, July 25-29, 2011. Sampling information with the number of hauls, the time during which fishing took place (sorting still took place after) and crew names.

Date	***N Hauls***	***Time fishing***	***Persons on boat***	***Persons measuring catch***
27.07.2011	16	10.15-17.00	O. van Keeken, A. Bakker	I. Tulp, K. Cordery
28.07.2011	8	09.45-12.05	O. van Keeken, A. Bakker	I. Tulp, K. Cordery

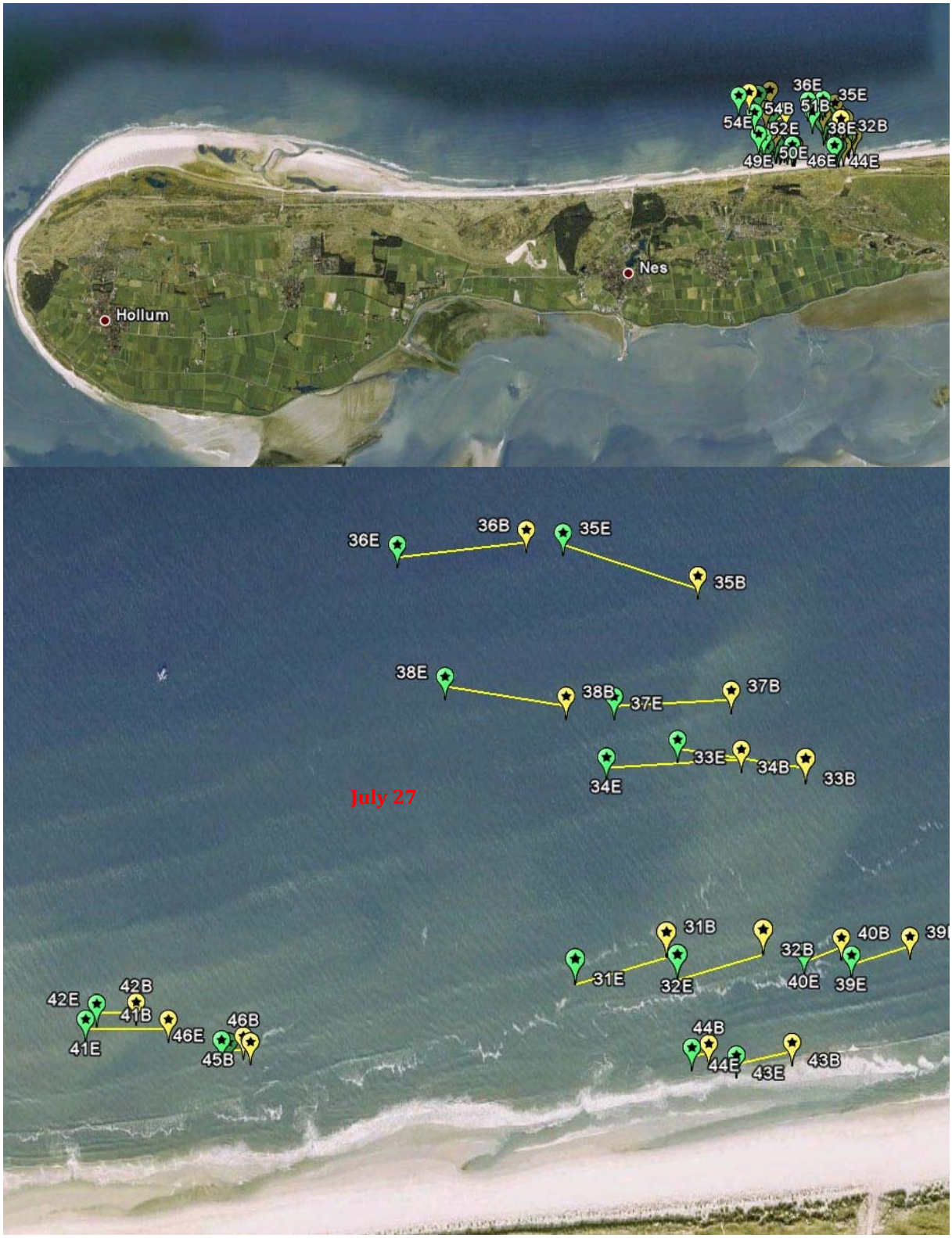

Figure 3.4a *Ameland, July 25-29, 2011. Fished tracks. Yellow indicator shows the starting position, green indicator shows the end position. Locations for both days (upper figure) and locations on July 27 (lower Figure).*

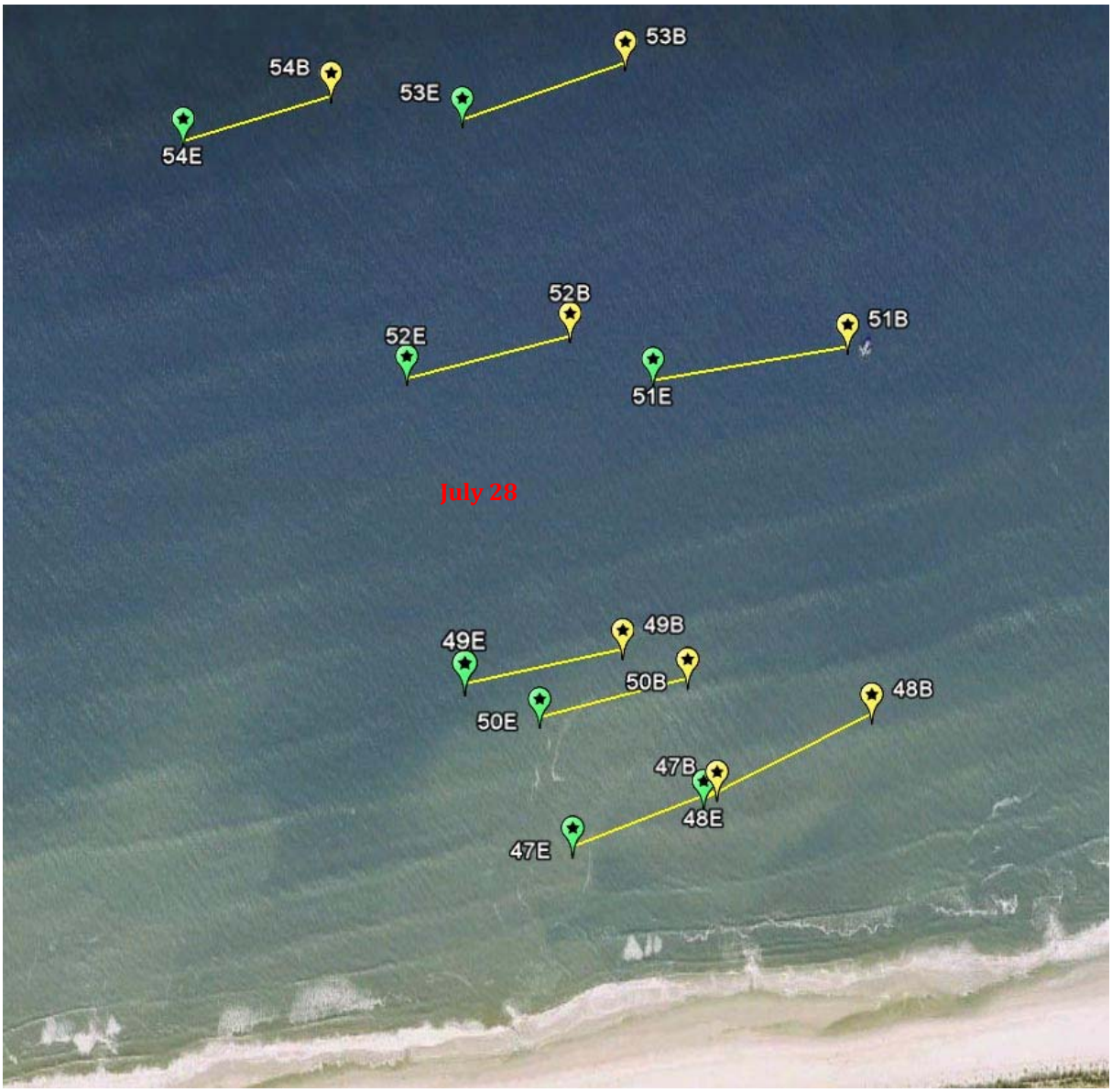

Figure 3.4b Ameland, July 25-29, 2011. Fished tracks on July 28. Yellow indicator shows the starting position, green indicator shows the end position.

4. Discussion

From the three weeks planned for this survey only two full days and two half days could be used for the sampling program (IJmuiden test day excluded). With the small inflatable boat that was used this summer, it is not possible to sample during days with wave heights higher than approximately 0.7-0.8 meter. Some factors can increase (probably slightly) the wave height condition at which still can be worked with a smaller boat. The boat has a rather flat hull. As a result it was quite susceptible to wave action. A boat with a V shaped hull is probably better suited for sampling the inshore area. Also when hauling the net by both persons in the boat, the motor was set in neutral for safety reasons. Because of this, the boat came in a sideways and less stable position to the waves. A third person steering the boat while the net is hauled by two others, can keep the boat in a more stable position. However with higher wave heights above 0.8-1.0 meter, a small boat is really not suitable for this study. For future studies two different approaches can be taken, which both have some advantages and disadvantages:

- Using a small boat during good weather over a longer period of time:

When a longer period is planned for the survey, then days with low wave weights can be used for the sampling. Disadvantages are that personnel have to be standby over a longer period, to be available to go out sampling as soon as a day with good weather comes by. This makes planning of work difficult. Also a location such as Ameland, where a ferry has to be booked in advance and travelling time is rather long, can be difficult to sample. Another disadvantage is that fish are only sampled during days with low waves. Wave height could be a factor influencing fish movement and therefore catchability of fish, which is not accounted for when fishing only during days with hardly any wave action.

- Using a larger vessel

With a larger vessel with a shallow hull, fishing can take place during periods with higher waves. However renting a vessel suitable for fishing in the shallow coastal area will increase costs of the project quite a lot compared to using a small inflatable boat. Also the really shallow areas near the surf zone cannot be sampled with a larger vessel. However personnel cost can be decreased, since hauling the net can be done mechanical, while on board a small boat this has to be done manually. Also it might be possible to use a wider net (e.g. 3 meter instead of 2 meter), and therefore a larger area can be fished.

The net used had a rather small mesh size. It is suitable for catching small fish, but it also produces a lot of drag through the water and a lot of water current in the net. With increasing catch size the catchability decreases because the net fills. Therefore only hauls of 5 minutes were made. Increasing the mesh size would decrease drag and could increase the sampling time.

5. Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

References

Teal, L.R. & O.A. van Keeken, 2011. The importance of the surf zone for fish and brown shrimp in The Netherlands; A literature review. IMARES report C054/11, 82 pp.

Justification

Rapport C110/11
Project Number: 4306111041

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved:	Dr. ir. M.J. Baptist Researcher
Signature:	
Date:	27-09-2011

Approved:	Dr. J. Asjes Department Head
Signature:	
Date:	27-09-2011

Appendix A. Haul information.

IJmuiden, July 11, 2011.

Haul	Start Latitude	Start Longitude	End Latitude	End Longitude	Haul duration	Depth in meters
1	52°27'22.72"N	4°33'2.20"E	52°27'20.63"N	4°33'6.05"E	6	1.5-2
2	52°27'19.98"N	4°33'0.83"E	52°27'16.49"N	4°33'4.00"E	10	2.5-3
3	52°27'25.60"N	4°33'5.83"E	52°27'21.82"N	4°33'7.56"E	10	4-5
4	52°27'20.52"N	4°32'52.40"E	52°27'25.31"N	4°32'50.96"E	6	3.5-4

Texel, July 20, 2011.

Haul	Start Latitude	Start Longitude	End Latitude	End Longitude	Haul duration	Depth in meters
5	53°10'55.55"N	4°50'18.25"E	53°10'56.78"N	4°50'20.54"E	5	2-2.5
6	53°10'49.44"N	4°50'11.29"E	53°10'55.06"N	4°50'19.36"E	10	2-3
7	53°10'53.83"N	4°50'15.00"E	53°10'53.22"N	4°50'13.52"E	5	3-4
8	53°10'51.38"N	4°50'12.37"E	53°10'49.84"N	4°50'9.64"E	5	3-4
9	53°10'49.26"N	4°50'11.62"E	53°10'45.88"N	4°50'8.16"E	5	2-3
10	53°10'50.20"N	4°50'6.68"E	53°10'47.11"N	4°50'3.63"E	3	5-6
11	53°10'51.20"N	4°50'7.08"E	53°10'44.87"N	4°50'2.11"E	5	5-6
12	53°10'41.41"N	4°50'0.46"E	53°10'34.75"N	4°49'55.38"E	5	4-5
13	53°10'50.27"N	4°50'7.22"E	53°10'43.93"N	4°50'0.56"E	5	4-5
14	53°10'22.84"N	4°49'42.56"E	53°10'16.61"N	4°49'36.84"E	5	4-5
15	53°10'13.04"N	4°49'33.28"E	53°10'8.69"N	4°49'26.69"E	5	3-4
16	53°10'4.19"N	4°48'47.20"E	53° 9'58.43"N	4°48'41.22"E	5	4
17	53°10'9.41"N	4°49'31.37"E	53°10'4.76"N	4°49'27.66"E	5	2
18	53°11'9.53"N	4°50'32.89"E	53°11'11.76"N	4°50'39.08"E	5	1.5-2
19	53°11'10.18"N	4°50'28.82"E	53°11'10.54"N	4°50'32.42"E	5	2-3
20	53°11'10.36"N	4°50'26.34"E	53°11'10.25"N	4°50'29.94"E	4	4-5

Texel, July 21, 2011.

Haul	Start Latitude	Start Longitude	End Latitude	End Longitude	Haul duration	Depth in meters
21	53° 9'33.91"N	4°48'40.79"E	53° 9'30.38"N	4°48'41.51"E	5	2
22	53° 9'37.33"N	4°48'36.54"E	53° 9'36.25"N	4°48'31.86"E	5	3
23	53° 9'38.70"N	4°48'30.71"E	53° 9'35.24"N	4°48'31.54"E	5	5
24	53° 9'32.80"N	4°48'41.11"E	53° 9'27.04"N	4°48'36.29"E	5	2-2.5
25	53° 9'38.63"N	4°48'30.10"E	53° 9'33.73"N	4°48'24.80"E	5	5-6
26	53° 9'37.55"N	4°48'23.04"E	53° 9'31.90"N	4°48'21.49"E	5	6
27	53° 9'41.22"N	4°48'28.33"E	53° 9'36.04"N	4°48'23.26"E	5	6
28	53° 9'34.20"N	4°48'30.35"E	53° 9'28.37"N	4°48'24.41"E	5	4
29	53° 9'35.60"N	4°48'35.10"E	53° 9'30.20"N	4°48'28.87"E	5	3
30	53° 9'34.70"N	4°48'35.86"E	53° 9'28.30"N	4°48'30.53"E	5	2

Ameland, July 27, 2011.

Haul	Start Latitude	Start Longitude	End Latitude	End Longitude	Haul duration	Depth in meters
31	53°27'58.80"N	5°49'48.50"E	53°27'57.51"N	5°49'40.69"E	5	3
32	53°27'58.86"N	5°49'56.70"E	53°27'57.66"N	5°49'49.38"E	5	3
33	53°28'8.40"N	5°50'0.54"E	53°28'9.48"N	5°49'49.68"E	5	4
34	53°28'8.94"N	5°49'55.08"E	53°28'8.64"N	5°49'43.62"E	5	4
35	53°28'17.76"N	5°49'51.60"E	53°28'20.04"N	5°49'40.20"E	5	6
36	53°28'20.22"N	5°49'37.08"E	53°28'19.56"N	5°49'26.10"E	5	6
37	53°28'11.94"N	5°49'54.30"E	53°28'11.70"N	5°49'44.34"E	5	5
38	53°28'11.76"N	5°49'40.26"E	53°28'12.84"N	5°49'30.00"E	5	5
39	53°27'59.34"N	5°50'9.18"E	53°27'58.44"N	5°50'4.20"E	5	2
40	53°27'59.34"N	5°50'3.36"E	53°27'58.62"N	5°50'0.18"E	5	2
41	53°27'55.68"N	5°49'6.06"E	53°27'55.74"N	5°48'59.04"E	5	2
42	53°27'56.58"N	5°49'3.36"E	53°27'56.52"N	5°49'0.00"E	5	2.5
43	53°27'54.06"N	5°49'59.04"E	53°27'53.46"N	5°49'54.30"E	5	1.5
44	53°27'54.06"N	5°49'51.96"E	53°27'53.88"N	5°49'50.52"E	5	1.5
45	53°27'54.48"N	5°49'13.02"E	53°27'54.48"N	5°49'11.16"E	5	2
46	53°27'54.78"N	5°49'12.42"E	53°27'54.60"N	5°49'10.56"E	5	2

Ameland, July 28, 2011.

Haul	Start Latitude	Start Longitude	End Latitude	End Longitude	Haul duration	Depth in meters
47	53°27'56.34"N	5°48'55.62"E	53°27'54.18"N	5°48'45.90"E	5	3
48	53°27'59.34"N	5°49'6.06"E	53°27'55.98"N	5°48'54.72"E	5	3
49	53°28'2.04"N	5°48'49.44"E	53°28'0.78"N	5°48'38.82"E	5	4
50	53°28'0.84"N	5°48'53.76"E	53°27'59.34"N	5°48'43.80"E	5	4
51	53°28'14.10"N	5°49'4.80"E	53°28'12.84"N	5°48'51.72"E	5	5
52	53°28'14.70"N	5°48'46.20"E	53°28'13.08"N	5°48'35.22"E	5	5
53	53°28'25.50"N	5°48'50.16"E	53°28'23.34"N	5°48'39.18"E	5	6
54	53°28'24.42"N	5°48'30.42"E	53°28'22.68"N	5°48'20.46"E	5	6

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