

Title: “Migratory Birds in the Wadden Sea“

Basic Source: WWF Deutschland (Ed., 2012): Pause im Wattenmeer. Zugvögel zwischen Arktis und Afrika. Sekundarstufe I. Berlin. www.wwf.de/fileadmin/fm-wwf/Publicationen-PDF/Pause-im-Wattenmeer.pdf (accessed: 03.02.2014).

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Quality Assessment: Carsten Hobohm (University of Flensburg)

Level: secondary school, year 6 or 7

Type of material: The material consists of nine different elements, which could be used in about three lessons.

Aim: introduction to the life of migratory birds, exposition: the Wadden Sea is a necessary resting ground for birds from all over the world, the importance of conserving the Wadden Sea for the future

Process:

first lesson	A break for me: What does a good break look like?	introduction
	Race and rest: Why do birds migrate and what skills do they need to do so?	migratory birds in four learning stations
	The slow horse reaches the mill: movement vs. weight gain	calculate the gain in weight
second lesson	Menu: power nutrition for mudflat gourmets	food supply in the Wadden Sea
	Price list: What can I afford?	beaks of the migratory birds in the Wadden Sea
	Did you enjoy it? The bill, please.	nutrients and pollutants in the Wadden Sea
third lesson	Rumours are in the air: Are the resting grounds in danger?	global warming, rising sea level and construction areas
	The big resting-grounds check: a ray of hope?	conservation in the national park and world heritage site
	With best regards...: What has to be done?	conservation of the Wadden Sea in our daily life: What can we do?

		Process		Material and methods
FIRST LESSON	1.1 Break for me - what does a good break look like? (about 8-10 minutes, excluding the closing discussion)	preparation	for everyone	general map (Worksheet 1)
			for everyone	motivation sheet (WS 2)
			for a third	mindmap (copy on DIN A3)
				form groups of three
		The pupils get an overview of the topic.		worksheet 1 "General Map"
		introduction: the pupils fill in the motivation sheet		- worksheet 2 "Break for me" - individual work
		Afterwards the pupils compare their answers. Catchwords: feel comfortable, relax, to be undisturbed, etc.		discussion within the groups
		The group think about requirements for a good break / rest for migratory birds und write them down in a mindmap.		- form groups of three - DIN A3 - mindmap for each group
	Subsequently the groups compare their answers with each other.		closing discussion	
	1.2 Race and rest: Why do birds migrate and what skills do they need to do so? (about 25-30 minutes)	preparation	one of each	posters A-D (copy on DIN A3)
			for everyone	motivation sheet (WS 3)
			for a quarter	four short profiles (WS 4), mixed
				- four learning stations - each with one poster - spread around the class room, each station has a different topic - you need: clock and 'change' signal, have an atlas available
		Introduce the pupils to the topic.		initial discussion
The pupils get to know their exercises and decide on one bird.			- take a look at the posters - distribute the worksheets "Race and Rest" (WS 3) and "Profile" (WS 4 - four different kinds)	
One group consists of those working on the same bird.			Each group collects information about their topic at one station: <i>Arctic Tern</i> : poster C	

For the teacher

			<i>Brent Goose</i> : poster A <i>Bar-tailed Godwit</i> : poster B <i>Dunlin</i> : poster D
		The pupils get to work on each poster for three to five minutes, then they proceed to the next one.	Depending on the pupils' progress, the teacher extends the time.
		Afterwards the pupils have five minutes to pass by the posters again to see what the others have added.	Put the posters on the wall.
		The results are presented, if necessary corrected, expanded upon and commended.	closing discussion
1.3 The slow horse reaches the mill: movement vs. weight gain (about 7 minutes)			

SECOND LESSON		Process		Material and methods
	2.1 Menu: power nutrition for mudflat gourmets (about 10 minutes)	preparation	for everyone	motivation sheet (WS 6)
			for everyone	"menu" (WS 7&8), two-sided
		The pupils get to know their tasks.		- Everyone gets the worksheet "power nutrition for mudflat gourmets" (WS 6) and the "Wadden Sea-Fly-In-Menu" (WS 7&8) and folds them in the middle. - individual work
		The pupils fill in their worksheets.		- answer remaining questions - help, if necessary
	The pupils compare their results.		- answer remaining questions with the whole class	
	2.2 Price list: What can I afford? (about 20 minutes)	preparation	for everyone	information paper (WS 9)
			for everyone	motivation sheet (WS 10)
			for everyone	motivation sheet (WS 11)

For the teacher

	The pupils get to know their tasks.	- Everyone gets an information paper "What can I afford?" and the motivations sheets "forceps-poke-peaks" and "Price list with order" - individual or partner work
	The pupils fill in the worksheets.	- answer remaining questions - help, if necessary
	The pupils compare their results.	- answer remaining questions with the whole class
2.3 Did you enjoy it? The bill, please. (about 16 minutes, excluding the discussion)		

		Process	Material and methods	
THIRD LESSON	3.1 Rumours are in the air: Are the resting grounds in danger? (about 10 minutes)	preparation	for everyone	motivation sheet (WS 16)
			for a third	information paper 1-3 (WS 17)
			for a third	motivation sheets 1-3 (WS 18)
		The pupils get to know their tasks.	- Everyone gets the introductory text "Rumours are in the air" (WS 16) for reading. - Everyone decides on one newspaper article (WS 17) and fetches the respective motivation sheet (WS 18). - Pupils with the same topic could work together in groups.	
		The pupils read and answer the questions.	- answer remaining questions - help, if necessary	

		The pupils compare their results.	- answer remaining questions with the whole class
3.2 The big resting-grounds check: a ray of hope? (about 8 minutes, excluding the discussion)	preparation	for everyone	information paper (WS 19)
		for everyone	motivation sheet (WS 20)
	The pupils get to know their tasks.		Everyone gets the information paper “The big resting-ground check: a ray of hope?” and the motivation sheet WS 20 “Your test - opinion”.
	The pupils read and render a judgement.		- answer remaining questions - help, if necessary
	The pupils compare their results.		- answer remaining questions with the whole class
3.3 With best regards...: What has to be done? (about 8 minutes)	preparation	for everyone	motivation sheet (WS 21)
		for everyone	motivation sheet (WS 22)
	The pupils get to know their exercises.		Everyone get the motivation sheet “With best regards” (WS 21) for reading.
	The pupils read and answer the questions.		- answer remaining questions - help, if necessary
	The pupils write a letter addressed to themselves.		- Everyone gets a motivation sheet “I can do something” (WS 22). - individual work
			The teacher collects in the letters and keeps them. After four weeks s/he gives the letters back.





What a migratory bird needs

Mindmap

Break for me 1.1



ADDITIONAL INFORMATION FOR THE TEACHER

	<p>The story of the Dunlin (<i>Calidris alpina</i>) Like little mice the Dunlins run over the soil of the Wadden Sea, when you come near them on a mud-flat hiking tour. When they don't fly off, you only notice them late. Some Dunlins breed in the alpine regions of Scandinavia, where Carl of Linné once found them in the 18th century. The birds are grey-white in winter and have a black belly and a russet back in summer. Carl named them <i>Calidris alpina</i>.</p>
	<p>The story of the bar-tailed godwit (<i>Limosa lapponica</i>) When you see a squad of bar-tailed godwits, you would think there are two different species: The males are bright russet, the females grey-white and even a little bigger. This is one of the species that are seen in great numbers on the East Atlantic Flyway of coastal birds, because of the conserved Wadden Sea. The wide intertidal mudflats region is the natural habitat of the long-legged and long-beaked bird, when they are not in the arctic tundra for breeding.</p>
	<p>The story of the Arctic Tern (<i>Sterna paradisaea</i>) The conservation of the Wadden Sea started 100 years ago for the sake of the Terns. Back then some of the few tourists disturbed the breeding colonies and shot the terns. People used their feathers for ladies' hats. Today this bizarre habit is history and the tern colonies are protected in the Wadden Sea. Other problems have increased for them: the man-made changes in the North Sea have reduced the amount of small fish, which are the main food of the terns. Rising sea levels lead to flooding of their nesting areas.</p>
	<p>The story of the Brent Goose (<i>Branta bernicla</i>) Brent Geese have close family relations. The long-term partners stay with the offspring even on the flyway. Brent Geese can breed successfully especially when there are many lemmings in the tundra. Instead of feeding the eggs and offspring of geese, the Polar Fox decides for the small rodents then. The lemmings are only abundant every third year. Because of a strong chase along the flyway Brent Geese almost became extinct. Since they have been protected the population has recovered well. In the 1950s the population was about 15,000 individuals. Now, between 200,000 and 300,000 are counted. A real story of conservation success!</p>

SOLUTION FOR WORKSHEET 6

POWER NUTRITION FOR MUDFLAT GOURMETS

... the three countries: **Germany, Netherlands and Denmark**

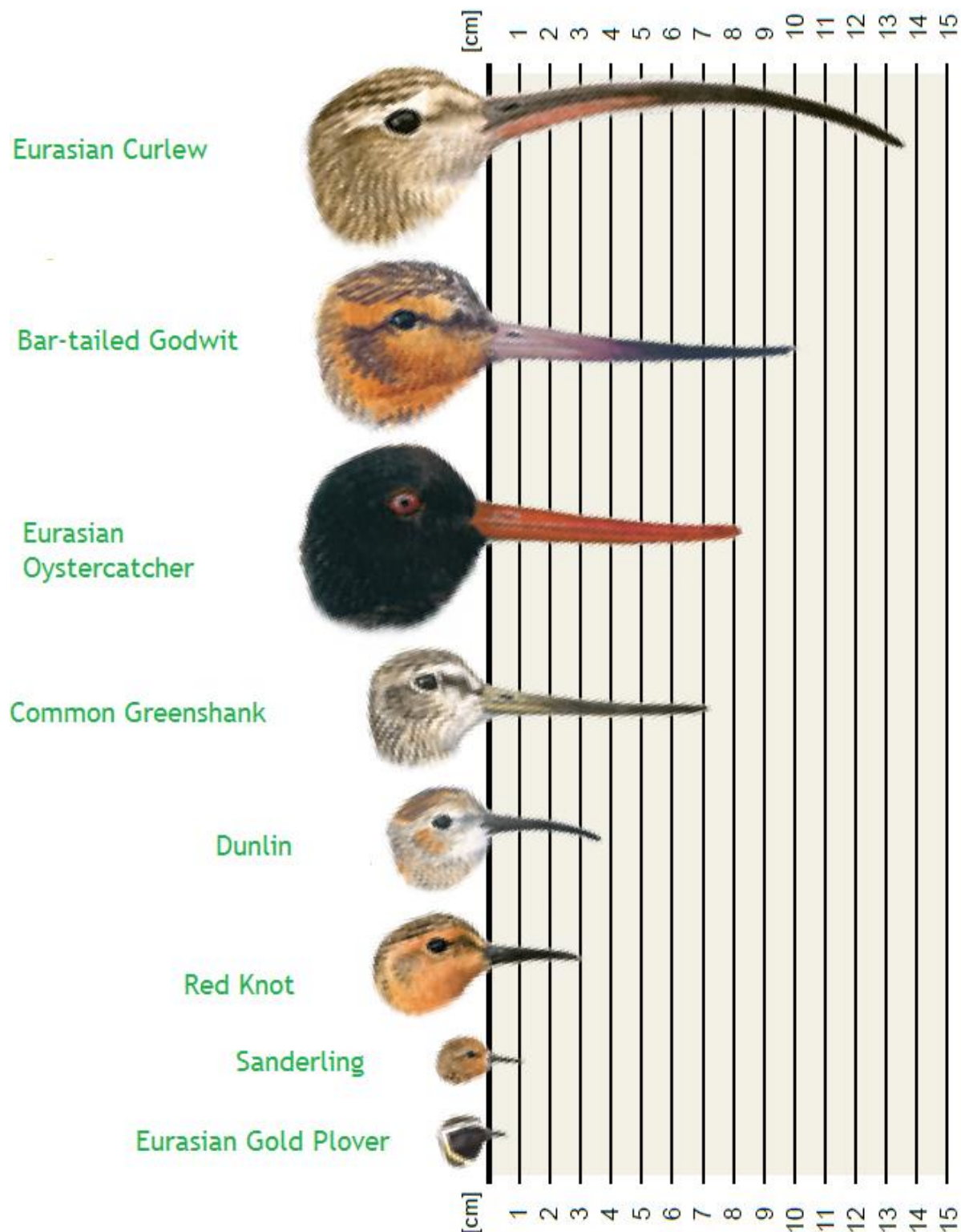
... the cutlery of the birds: **beaks**

... how long one inundation in the Wadden Sea takes: **6.2 hours**

... the two main months of the flatfish-season: **May and June**

D	U	U	R	P	S	K	A	E	B	T	A	X	L
L	P	L	V	V	V	U	S	T	B	Q	N	Q	T
V	M	T	K	G	D	Q	D	U	E	Y	Z	J	N
T	A	X	N	E	T	H	E	R	L	A	N	D	S
Q	Y	X	R	K	G	J	C	V	V	J	U	K	U
V	H	I	T	I	J	F	A	V	B	G	I	P	T
Z	Y	Y	G	R	U	Y	V	K	V	Q	G	V	U
C	S	B	T	U	K	C	G	R	X	I	S	X	H
B	H	E	Z	J	O	C	E	A	O	D	D	M	Y
G	X	G	I	Z	P	B	R	M	K	S	Y	Q	T
E	R	J	I	B	C	P	M	N	W	N	V	G	H
P	U	U	O	R	S	K	A	E	B	G	H	O	H
Q	L	N	D	B	L	J	N	D	Q	A	O	T	H
X	U	E	G	C	M	Q	Y	F	P	G	S	I	W

Solution for worksheet 10



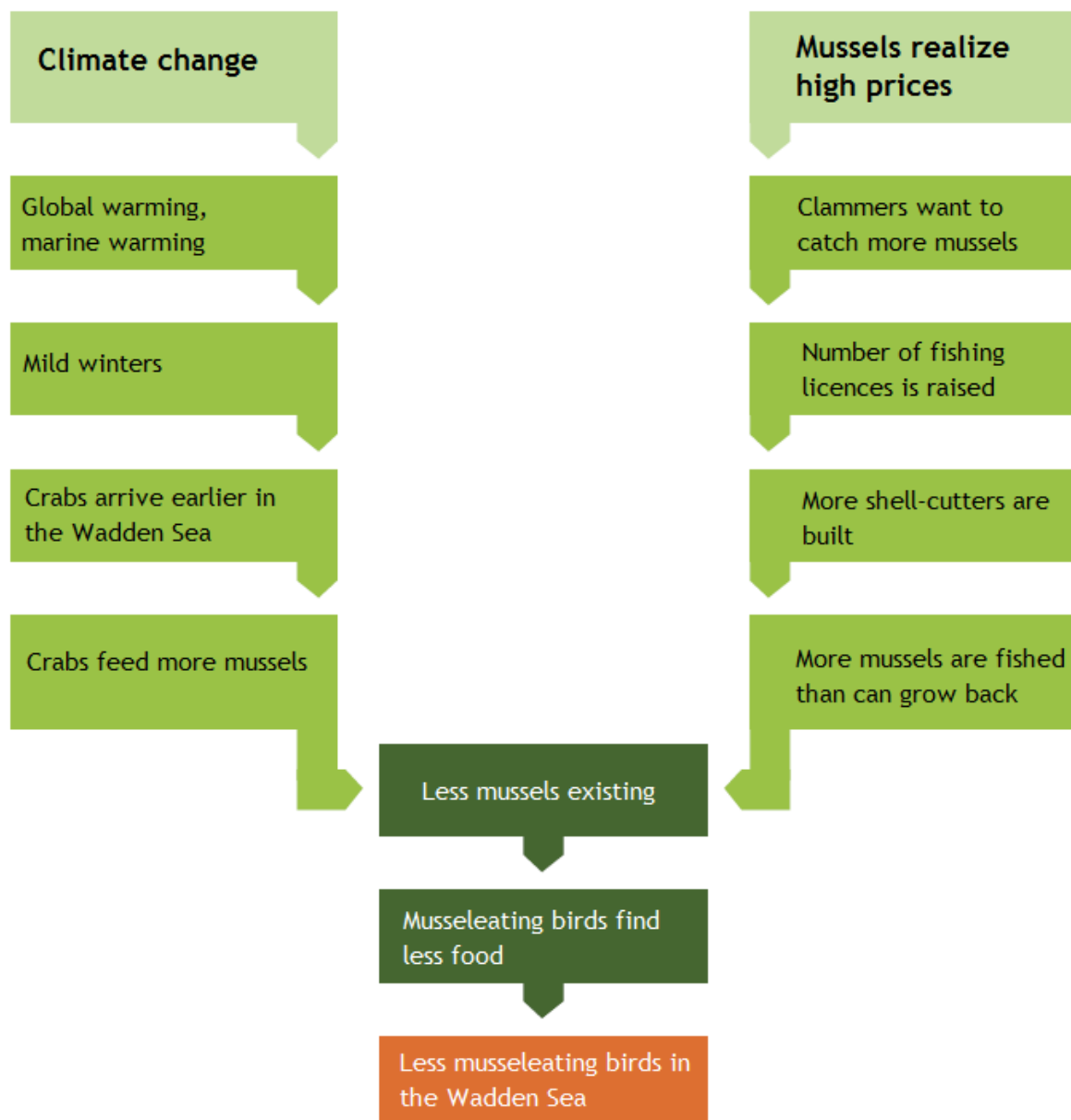
Tab. 1: Solution for worksheet 11 (schematic)

	Laver Spire Shells	Common Shore Crabs	Baltic Tellins	Sandhoppers	King Rags	Peppery Furrow Shells	Blow Lugs
Eurasian Gold Plover	X	X					
Sanderling	X	X	X				
Red Knot	X	X	X	X			
Dunlin	X	X	X	X			
Common Greenshank	X	X	X	X	X		
Eurasian Oystercatcher	X	X	X	X	X	X	
Bar-tailed Godwit	X	X	X	X	X	X	
Eurasian Curlew	X	X	X	X	X	X	X

SOLUTION FOR WORKSHEET 18**„WADDEN SEA-FLY-IN IS UNDER NEW LEADERSHIP“**

A *Where is the connection between climate change and fishing on the one hand and the decreasing numbers of some bird species on the other?*

Starting from climate change on the one hand and high prices for mussels on the other the following solution process is conceivable, based on the text.



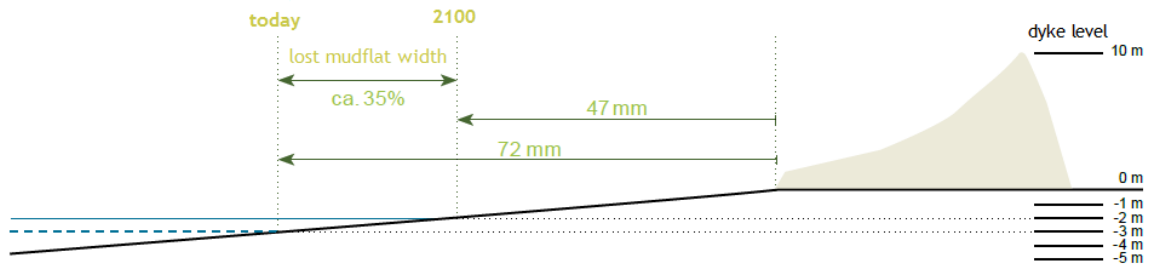
Other ways in which climate change influences the breeding and migratory birds in the Wadden Sea could be worked out in addition to worksheet 18 with the aid of a panel. Two possible solutions are shown below:



B *Who are the new guests in the Wadden Sea?*

European shore crabs, prawns, starfish in winter

SOLUTION FOR WORKSHEET 18 „WADDEN SEA-FLY-IN HAS TO BE PARTIALLY CLOSED“



Width of the Wadden Sea at low tide today: 72 mm (measurements from WS 18)
Width of the Wadden Sea at low tide 2100: 47 mm (measurements from WS 18)

SOLUTION FOR WORKSHEET 18 „WADDEN SEA-FLY-IN: DISRUPTIONS INEVITABLE“

A What dangers do wind-farms represent for the birds?

- injuries and death due to collisions
- higher consumption of energy due to detours

B What problems does harbour construction on the coast bring with it for the birds?

- more shipping traffic, more pollutants, less food

C What problems are caused by river deepening?

- fewer shallow water areas
- more muddy water
- less food

SOLUTION FOR WORKSHEET 21 „WHAT HAS TO BE DONE“

B What dangers exist from your point of view?

- rising sea level, area loss
 - foreign and invasive species brought in
 - extension of harbours, shipping
 - oil production
-

C *Who* can do *what* to improve the situation of the Wadden Sea? Discuss this point in your class.

- government, shipping, energy industry etc.
 - everyone has to participate in the fight against climate change.
 - fewer products from overseas, fewer containers, fewer ships!
 - produce less plastic waste - concerns everybody.
-

D What can you personally do in your everyday life for the conservation of the Wadden Sea along the coast of the North Sea?

- save more energy
- buy more regional products
- exchange used things
- get more information about the mudflats
- do a mudflat hiking tour

BREAK IN THE WADDEN SEA

GENERAL MAP - AN OVERVIEW

This map will help you to get an overview of the topic “Migratory Birds in the Wadden Sea“. For your orientation you’ll find the titles on the worksheets as well.

first lesson	Break for me: What does a good break look like?	introduction
	Race and rest: Why do birds migrate and what skills do they need to do so?	migratory birds in four learning stations
	The slow horse reaches the mill: movement vs. weight gain	calculate the gain in weight
second lesson	Menu: power nutrition for mudflat gourmets	food supply in the Wadden Sea
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	Did you enjoy it? The bill, please.	nutrients and pollutants in the Wadden Sea
third lesson	Rumours are in the air: Are the resting grounds in danger?	global warming, rising sea level and construction areas
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	With best regards...: What has to be done?	conservation of the Wadden Sea in our daily life: What can we do?

1.1 BREAK FOR ME

WHAT DOES A GOOD BREAK LOOK LIKE?

We compare and discuss our requirements for a good break.

We have at least one thing in common with the birds that rest in the Wadden Sea: From time to time even we need a break, for example in school, at work or on holiday.

Imagine you are going on an exciting hike which takes a whole week. You are going to hike just as far as you can make it each day. Every day you take some short breaks and at night you rest to sleep.

Think about what kind of break is good for you on your hike and rate the statements for yourself. **Tick the box** that applies best to you.

	very important	important	less important	unimportant
1. In my break I like best to be on my own and have some privacy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. In my break I need something to eat and drink.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The resting ground has to be easily accessible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I want to be safe during my break.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The break means especially time to relax.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. In my break I really need to run riot.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I like to meet others in my break.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. My break has to be comfortable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compare your statements to those of your classmates: If they are very different from yours, ask them how they formed their opinion.

Debate: What requirements might be important for a migratory bird? Note down your ideas, you'll need them later!

1.2 RACE AND REST

RACE AND REST

Why do birds migrate and what skills do they do so?

We explore the migration of four different bird species and get to know them.

During their evolution humans settled down. Today, only a very few people rove around and follow water, for example. It is different with birds.

Migratory birds have one breeding ground and another place for wintering. Sometimes they even have several places e.g. for moulting (change of the feather coat), for short or long term breaks or to gain fat reserves by feeding for the oncoming flight. But for now it is enough to distinguish between the breeding ground and the place of wintering. These are kilometres apart and the birds shuttle in an annual rhythm between those two places; this is called “bird migration”.

Many migratory birds leave the northern region of Germany in winter because they prefer warmer places. Apart from that, less food is accessible in the winter. Some Nordic birds (e.g. the Brent Goose) like the winter temperatures around the North Sea and stay there for the winter time.

Basically, migratory birds use places which are rich in food as their breeding grounds. These places offer plenty of plants and insects for them and their offspring. Since Arctic Terns travel a lot to warmer regions, they spend up to eight months a year in the sun. They also need long days in the sun, because they do not eat insects, but fish. As fishing takes a lot of time, long days are helpful.

And now? You will become acquainted with one of these migratory birds and you will learn how it copes with migration.

You need: pen, short profile, your group members

Find your flock (=same birds). There are:

- Arctic Terns
- Bar-tailed Godwits
- Brent Geese
- Dunlins

Read the short profile of your migratory bird, so that you have an idea where you can find which category.

Similar to the migratory birds you will pass from one learning station to the next. You find the order on the profile. At each learning station you will find one poster (A3). The topics are:

A - Special characteristics of the bird's migration

B - Special energy saving strategies


C - Flyway into the breeding region (in springtime)

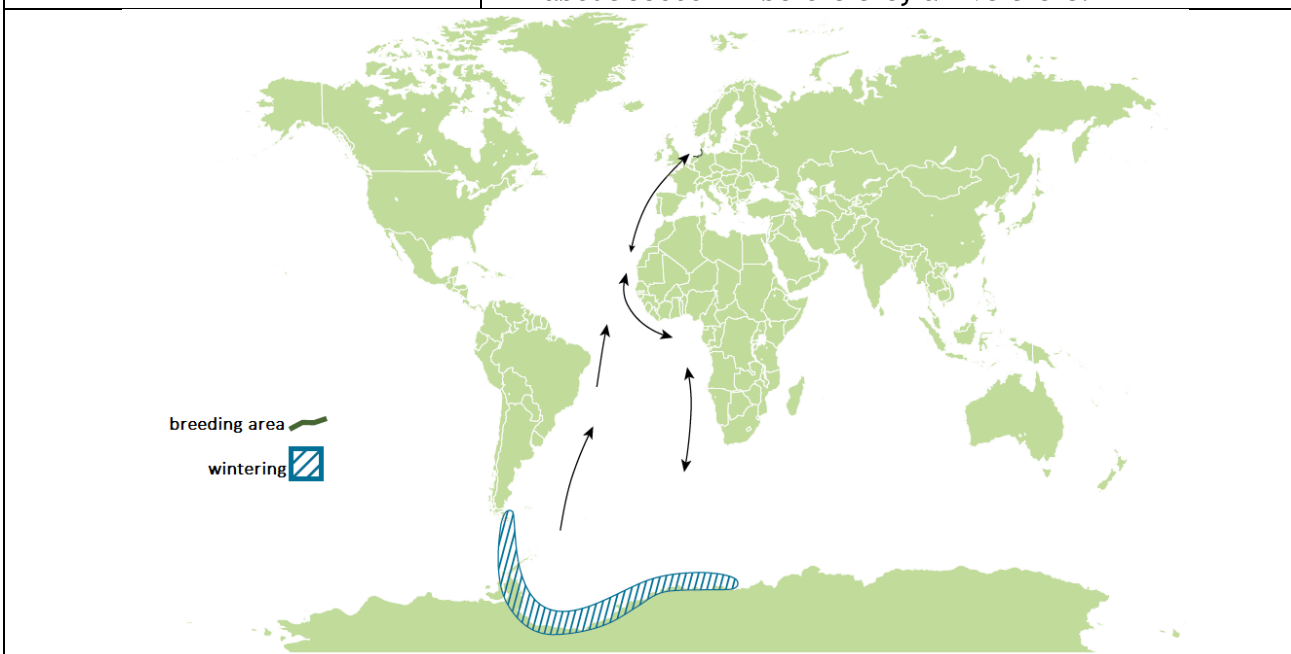
D - Significant physical attributes

Add important information from the profile to the poster in mindmap form. After three to five minutes all of you pass on to the next learning station, read what the other group has written and again add your information.

Finish: All flocks pass by every poster again and look at the overall result on the posters. The posters are put on the wall.

SHORT PROFILE: ARCTIC TERN

 <p>ARCTIC TERN <i>Sterna paradisaea</i></p>	What are the special characteristics of their migration? <ul style="list-style-type: none">➤ Arctic Terns are probably the birds with the longest migration distance worldwide.➤ They do not fly as fast as, for example, Bar-tailed Godwits, but they fly more than a hundred kilometres a day.
	How does the bird save energy? <ul style="list-style-type: none">➤ Their wings are peaked, so that air resistance is kept low.➤ They do not take the shortest routes, but use the tailwinds of the global wind flows.➤ Arctic Terns use every “service station” with a lot of fish to refill their energy.
	Weight, size and appearance <ul style="list-style-type: none">➤ height: 33-35cm, wingspan: 75-85cm➤ weight: approx. 100-125g➤ slender and peaked beak (for fishing)
	Where and how long is the flyway? <ul style="list-style-type: none">➤ They fly in a almost s-shaped route across almost the whole of the Atlantic Ocean.➤ Many breed along the central-European coast, e.g. in the Wadden Sea; many also breed in the Arctic (Greenland, Iceland, North Scandinavia, Siberia).➤ The German Arctic Terns only have a short-term-stay in the Wadden Sea. They arrive in April, breed on the ground of the salt meadows or dunes and leave in summer for the South.➤ For Arctic Terns from Greenland or Iceland the annual flyway averages 71,000km! People have actually measured up to 82,000km a year!➤ The Arctic Terns that breed in the Wadden Sea fly about 35000 km before they arrive there.



SHORT PROFILE: BAR-TAILED GODWIT



BAR-TAILED GODWIT
Limosa lapponica

What are the special characteristics of their migration?

- They are able to fly the longest distance without a break: up to 11,500km in one go! This was discovered using satellite transmitters over the Pacific Ocean.

How does the bird save energy?

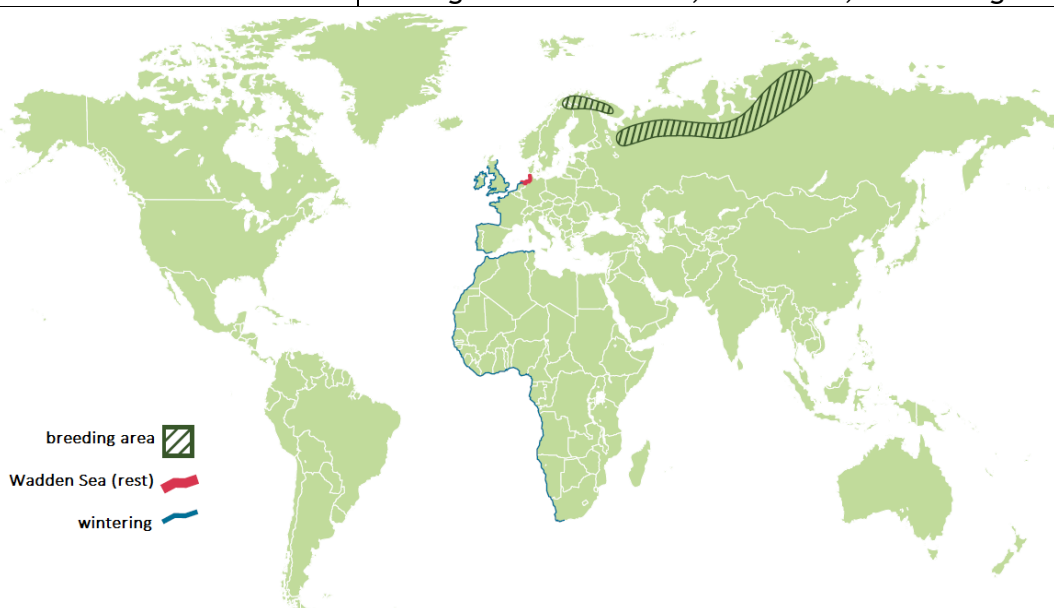
- They fly long distances and avoid landing and starting, because this has a high energy cost.
- They are able to make some of their organs smaller to store more body fat and carry only what is absolutely necessary.
- They handle their energy economically by gliding on favourable wind flows and conserve their reserves.

Weight, size and appearance

- height: 38cm
- weight at arrival in the Wadden Sea: approx. 300-400g
- long beak, which is bent upwards

Where and how long is the flyway?

- They fly from Africa, sometimes even South Africa to the Wadden Sea and rest there from March to April / May.
- Then the journey goes to their breeding regions in Siberia and the north of Scandinavia (April / May).
- way back in late summer
- in autumn: migration to the wintering areas in the direction of Africa
- for most of the Bar-tailed Godwits the route from the wintering areas to the northern breeding regions is between 7,500 and 10,000km long.



SHORT PROFILE: BRENT GOOSE



BRENT GOOSE
Branta bernicla

What are the special characteristics of their migration?

- Brent Geese are in Northern Germany in spring and autumn, breed in Northern Siberia and winter in central Europe.
- They migrate in ordered formations, partly in an interlocking pattern, partly u-shaped.
- The exact route is not given genetically, but it is passed from generation to generation, because the birds stay in their close family relations a long time.

How does the bird save energy?

- The flight in formations enables the birds to fly in the shadow zone of their conspecifics and save energy. The role of the leading goose changes often.
- The flight is preferably made with tailwind.
- Warning system while resting: some individuals watch out for the group to be undisturbed.

Weight, size and appearance

- height: 58cm, wingspan: 110-120cm
- weight: approx. 1300-1600g
- the smallest of the so-called "sea geese" (like e.g. the barnacle goose)

Where and how long is the flyway?

- From March to May all of the Brent Geese are in the Wadden Sea.
- Afterwards they fly with enough fat reserves towards the north of Siberia for breeding (mostly with one resting stop at the White Sea in Russia).
- The first returnees arrive in the Wadden Sea at the end of September. Most of them only stay for a short period and fly on to the British, Dutch and French coasts, where they overwinter, too.
- The geese fly about 5000km to their breeding regions.



SHORT PROFILE: DUNLIN



DUNLIN
Calidris alpina

What are the special characteristics of their migration?

- Dunlins find the same breeding region every year and even use the same resting areas (e.g. they are on the same island in the Wadden Sea every year)
- only wetlands with mud or sand are suitable as a resting area for picking for food
- stops along the coast are more than hundreds, sometimes even thousands of kilometres apart
- most common in the Wadden Sea (approx. 1.3 m individuals)
- older birds leave the breeding region in the high north first and hurry to have their moult in the Wadden Sea; the offspring find their way about four weeks later on their own

How does the bird save energy?

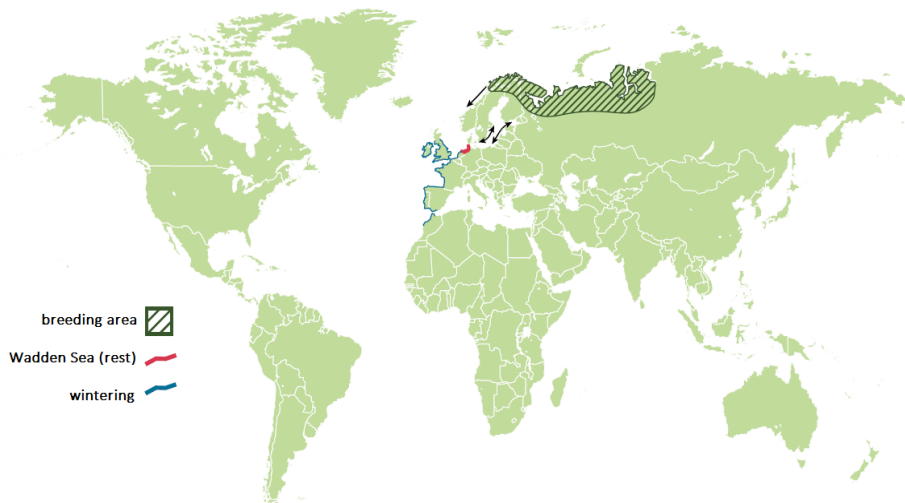
- They start their migration with tailwind, if possible. The direction of the wind depends on the flight height. This determines the height at which the Dunlins fly.
- While resting they protect themselves against cold wind by hiding behind plants, sand ripples or conspecifics to lose as little body heat as possible

Weight, size and appearance

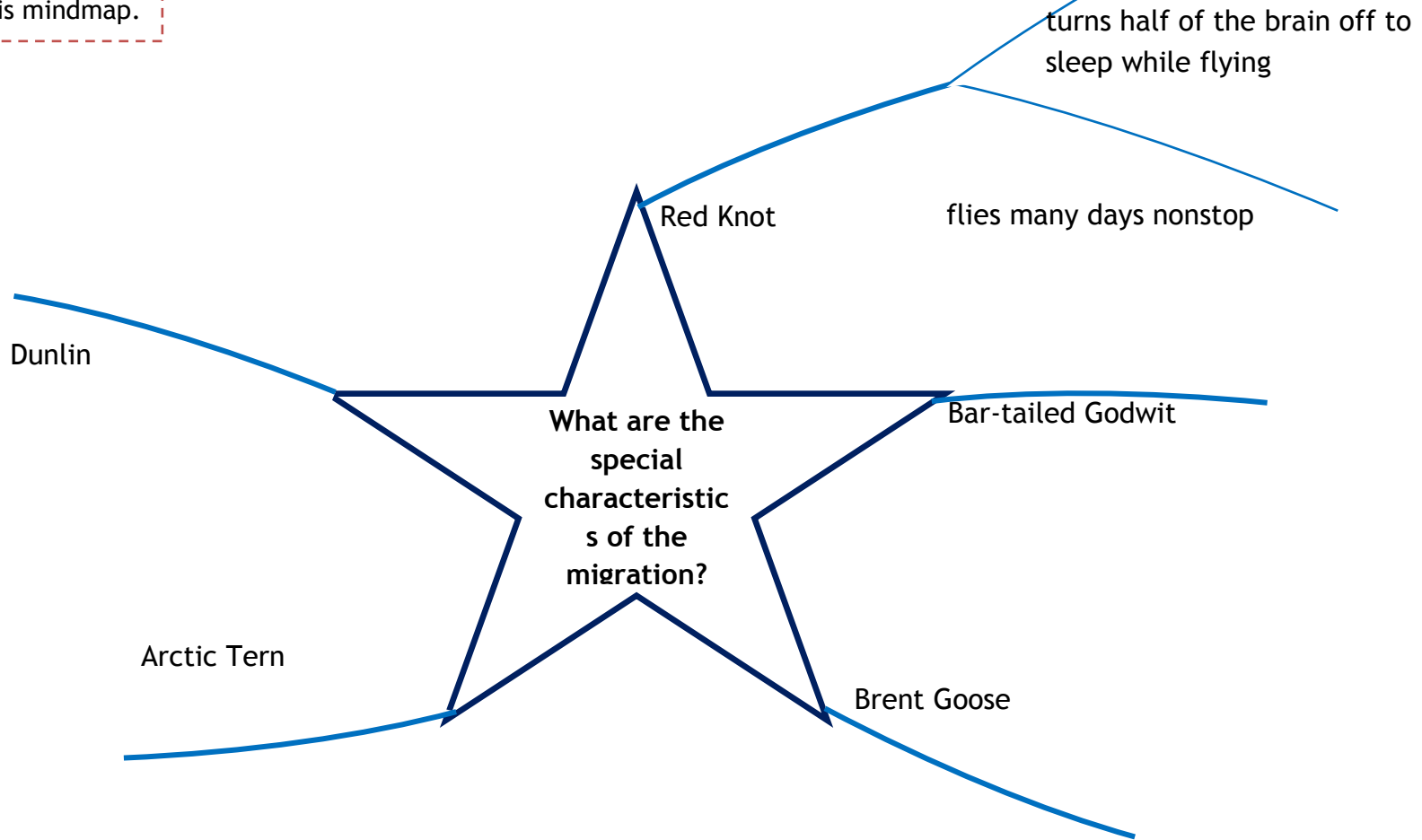
- length: 18-22cm, wingspan: 38-43cm
- normal weight: approx. 50g; before they leave from the Wadden Sea for Siberia: 90g
- relatively long legs and a long beak (typical for "waders")

Where and how long is the flyway?

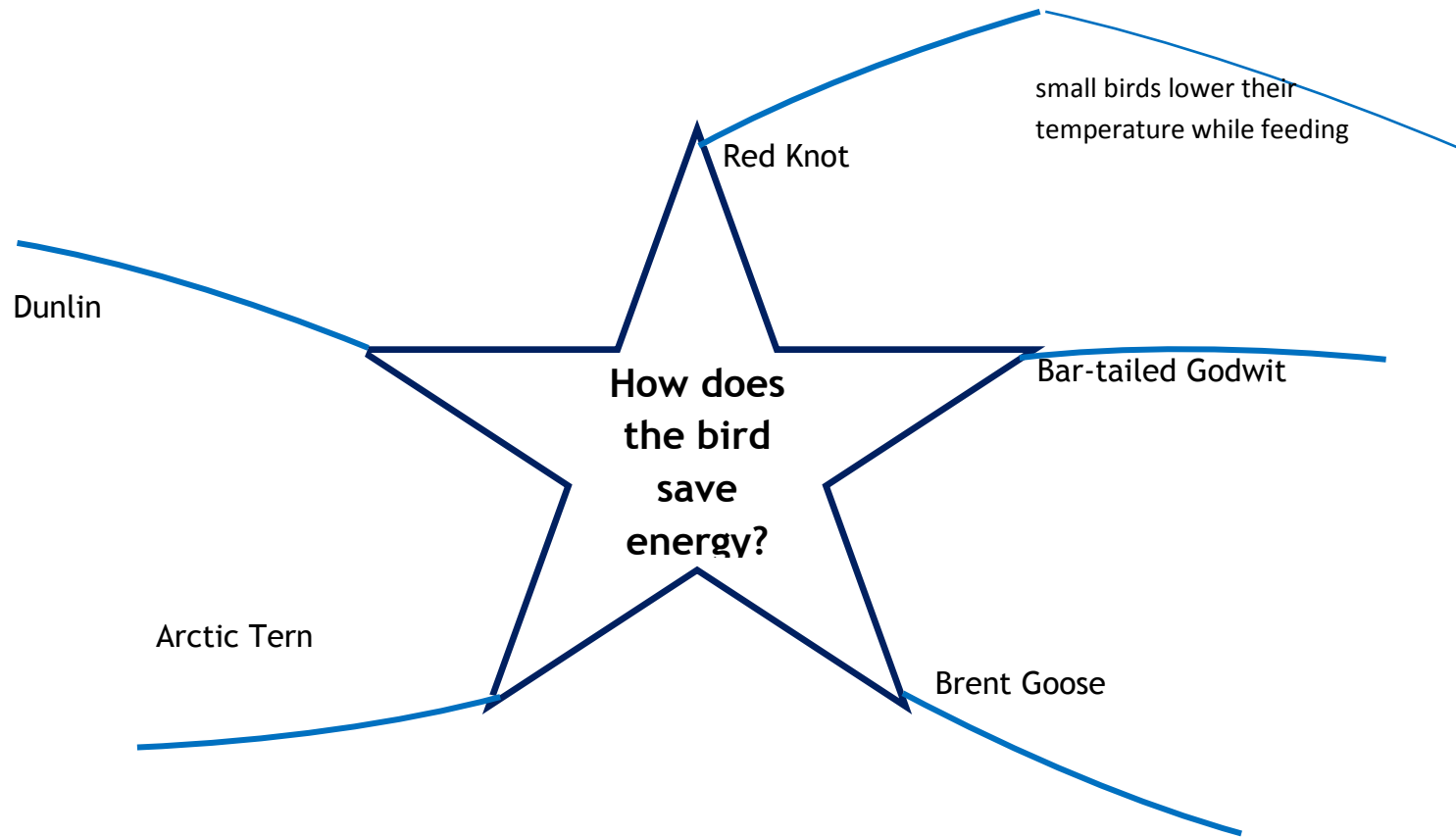
- They fly from the British, French and Portuguese coast to the Wadden Sea (February / March).
- Then on to the breeding regions in Siberia and North Scandinavia (April / May).
- On their way back from the breeding regions (older birds in July, offspring in August) to the Wadden Sea. In September / October most of them have already returned (recovery).
- The route from the European coast to the breeding areas is 3,500-5,500km long.



Which characteristics do you think are special? Write them down in this mindmap.



Which characteristics do you think are special? Write them down in this mindmap.



small birds lower their temperature while feeding

FLYWAY INTO THE BREEDING REGION (IN SPRINGTIME)

Race and rest 1.2

Draw the flyways of the birds - as shown in the explanations - on the map. Who in your group made the longest holiday trip? Draw this route as well. Use an atlas, if necessary.

.....Columbian tourists.....

start _____

destination _____

distance _____

.....Dunlin.....

start _____

destination _____

distance _____

.....Arctic Tern.....

start _____

destination _____

distance _____

.....Bar-tailed Godwit.....

start _____

destination _____

distance _____

.....Brent Goose.....

start _____

destination _____

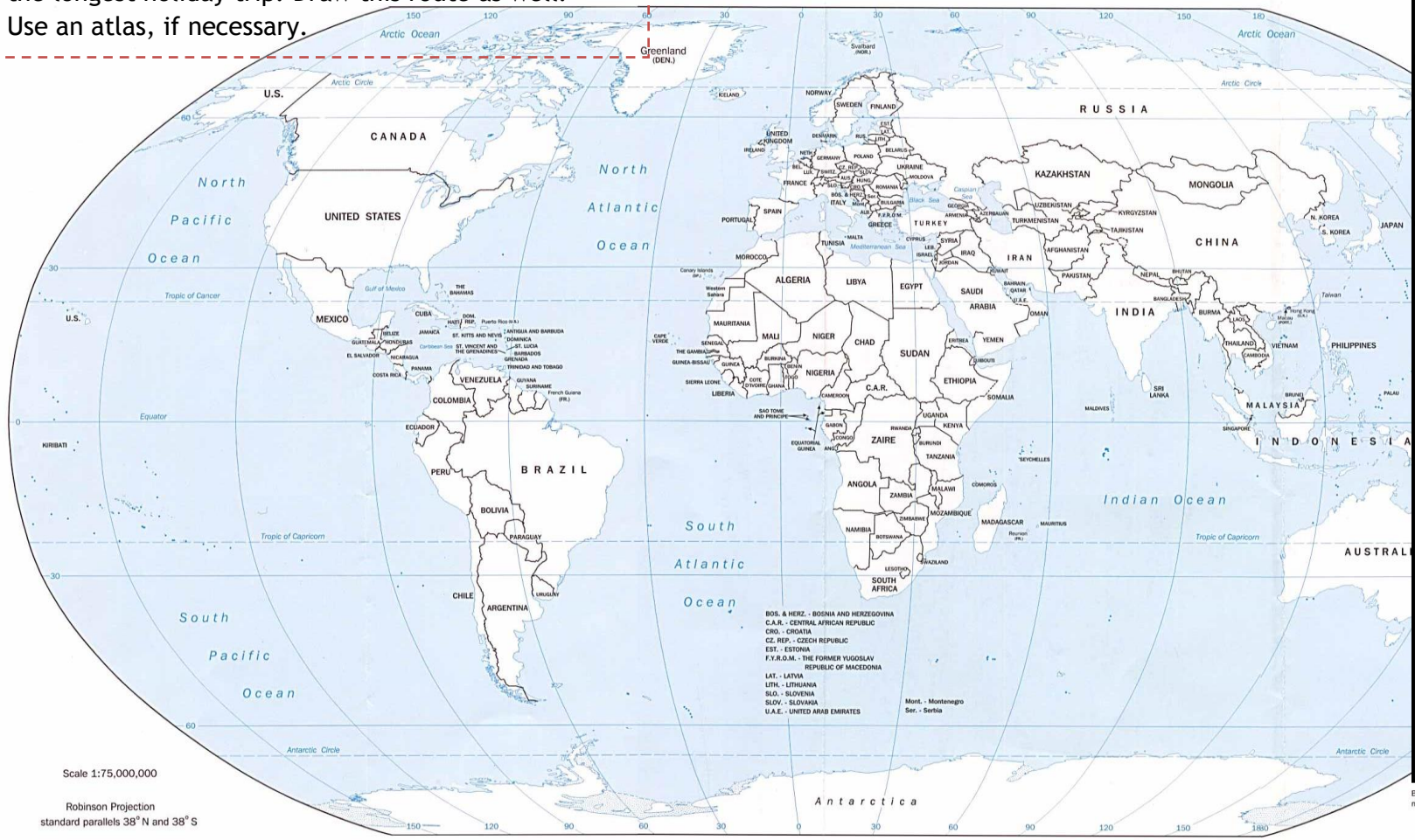
distance _____

● start

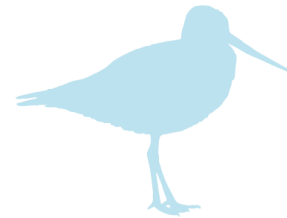
○ break

➤ destination

Boundary representation is not necessarily authoritative.



- Draw in:**
- ✓ position of the eyes
 - ✓ significant attributes of the plumage
 - ✓ colour of the beak and the legs

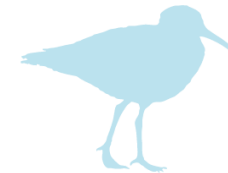


Bar-tailed Godwit
_____ cm
_____ g

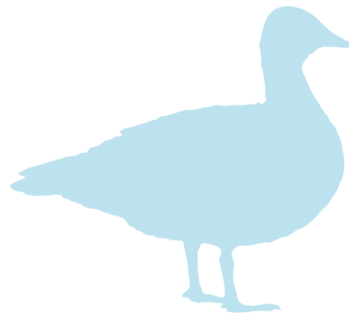


human
_____ 180 _____ cm
approx. 75000 _____ g

Appearance
, size and
weight?



Dunlin
_____ cm
_____ g



Brent Goose
_____ cm
_____ g



Arctic Tern
_____ cm
_____ g

2.1 MENU

POWER NUTRITION FOR MUDFLAT GOURMETS

We learn more about the flyway-restaurant *Wadden Sea-Fly-In* and study what it has on offer.

The Wadden Sea is rich in food, but the food is not on show. It's hiding in the ground! Greenhorns have to get to know the place first and look around, because obviously there is no written menu from which they could choose, is there? You can read the ground of the Wadden Sea like a menu: The hidden food is alive and leaves traces! There is always fresh food in this restaurant.

Study the menu first to get an idea of what the restaurant *Wadden Sea-Fly-In* has to offer. Answer the questions afterwards:

1. Which three countries run the restaurant *Wadden Sea-Fly-In*?
2. What cutlery do the guests use?
3. How long does a "day off" (one tide) in the *Wadden Sea-Fly-In* take?
4. In which months is the popular flatfish-season with a great selection of plaice, dabs and flounders?

Hint: The answers are hidden - like the food in the ground of the Wadden Sea - in the riddle!

1 _____

2 _____

3 _____, 2 hours

4 _____

D	U	U	R	P	S	K	A	E	B	T	A	X	L
L	P	L	V	V	V	U	S	T	B	Q	N	Q	T
V	M	T	K	G	D	Q	D	U	E	Y	Z	J	N
T	A	X	N	E	T	H	E	R	L	A	N	D	S
Q	Y	X	R	K	G	J	C	V	V	J	U	K	U
V	H	I	T	I	J	F	A	V	B	G	I	P	T
Z	Y	Y	G	R	U	Y	V	K	V	Q	G	V	U
C	S	B	T	U	K	C	G	R	X	I	S	X	H
B	H	E	Z	J	O	C	E	A	O	D	D	M	Y
G	X	G	I	Z	P	B	R	M	K	S	Y	Q	T
E	R	J	I	B	C	P	M	N	W	N	V	G	H
P	U	U	O	R	S	K	A	E	B	G	H	O	H
Q	L	N	D	B	L	J	N	D	Q	A	O	T	H
X	U	E	G	C	M	Q	Y	F	P	G	S	I	W

For a short term stay

Crispy sandhoppers

The best from the sand flat

Blow lug, well matured

For our small guests

Laver spire shell in mud coat

Sandhopper-risotto

Side dishes

Chitin shells

Chalk shells

All-season menu

Mixed blow lugs

Common shrimps

Barnacle scab

Additives

Plastic particles (from tiny ones to big and risky)

Harmful chemical substances in oil

Crop protection products (pesticides and biocides)

Desserts

Insects at the high-tide-rest-area

„After the meal is before the meal!“ ☺

Three-Country-Delicacies

Restaurant Wadden Sea-Fly-Inn

Menu



Welcome

to the three-country restaurant “Wadden Sea-Fly-In”!
Our restaurant is especially suited to big groups, but singles are also warmly welcome. If you are very hungry, you will be satisfied: We have power food for everyone.

Please bring your own cutlery.

We are always keen to make your stay as comfortable as possible. We are open around-the-clock, but unfortunately the restaurant is flooded twice a day. We apologize for that.

We have extra resting places if you want to be undisturbed. Sadly we cannot guarantee that these zones are respected by everyone.

If you notice any disruptions, seek shelter quickly and come back later.

The dishes are extraordinarily fresh and of high quality. We try to offer only seasonal food, which sometimes limits the choice. Nevertheless,



our experience shows that there is a dish for everyone.

Enjoy your meal!

Salads and soups

Green maritime salad on mudflat at the drift line
Laver Spire Shells in mudflat-soup

Rustic delicacies

Tender, young Shore Crab on mixed sediment mudflat
Barnacles on crab shell

For very hungry guests

Mussel banquet

Fresh from the tideway

Mixed Common Shrimps
Strong, rinsed Gapers
Young flatfish (in springtime only)
Quick Gobies

Shellfish

Migrant Baltic Tellin
Sandflat Cockle
Peppery Furrow Shell from the deep

Delicious on the go (without shells)

Ragworms - always work
Young Blow Lugs

Vegetarian

Grass-herbal-salad from the salt meadow
Grass from the grassland behind the dyke
Dwarf eelgrass and stone hair
Diatoms-pudding

2.2 PRICELIST

WHAT CAN I AFFORD?

Now we know the menu of the restaurant *Wadden Sea-Fly-In* and have chosen something delicious. But can we afford what we ordered? Do we have the right cutlery? And how long will we be satisfied with our meal and how much energy will it provide us with?

Most of us who eat their fill in the Wadden Sea have adjusted to what it offers. We, the waders, have long legs to keep our feathers dry. This benefits us when we want to enter the restaurant.

And what about the “cutlery”? Our beak is usually - compared with the rest of our body - quite long, slender and peaked. This helps us to pick for food in the mud and to not let go of it.

To crack shells one bird even uses a hammer. Small fish and crabs are fetched with a kind of lance that it plunges quickly into the water. Other birds catch their food with trawls and filters. Some others work with pressure: They stomp onto the ground, so that the water and tiny animals come out of the mud, which makes it easier to eat them afterwards.

Here you can see some waders that pick in the mud to find food.

Species	Reach of the beak
Eurasian Golden/ Grey Plover	0,5 cm
Sanderling	1 cm
Red Knot	3 cm
Dunlin	3,5 cm
Common Greenshank	7 cm
Eurasian Oystercatcher	8 cm
Bar-tailed Godwit	10 cm
Eurasian Curlew	14 cm

You will need this information to do worksheets 10 and 11.

2.2 PRICE LIST

Tweezers-Pick-Beaks

Key to success

Finish the beaks.
 You will find the lengths on Worksheet 9. Who can reach which food?

Finished? Then take Worksheet 11 and see which bird reaches which food in the Wadden Sea.

The diagram shows the following food items at various depths:

- 1cm: Small pink shells
- 2cm: Small insects
- 5cm: Worms
- 10cm: Clams
- 11cm: Worms
- 12cm: Clams
- 13cm: Worms
- 14cm: Clams
- 15cm: Worms

2.2 PRICE LIST

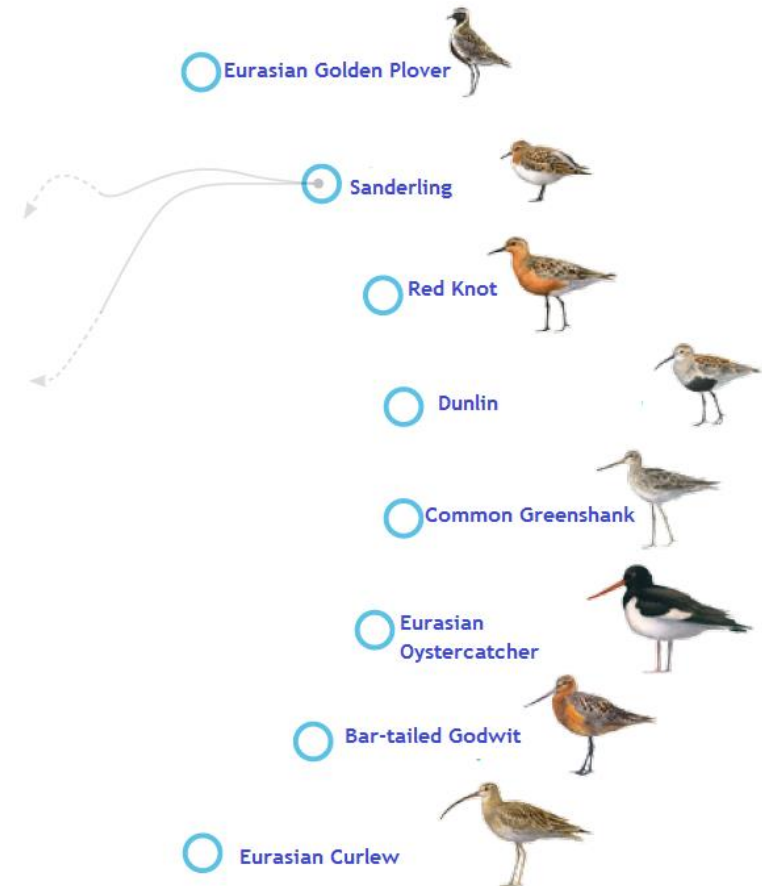
THREE-COUNTRY-DELICACIES

WADDEN SEA-FLY-IN - PRICE LIST

Connect the prey and the correct bird with a line. Which bird has the largest choice?

Recommendations of the day

		<i>Price in €</i>	
	1. Laver Spire Shell in mud coat	from 0,3	<input type="checkbox"/>
	2. Tender Shore Crab on mixed mudflat	from 0,5	<input type="checkbox"/>
	3. Migrant Baltic Tellin	from 1	<input type="checkbox"/>
	4. Crispy Sandhoppers today's special	from 2	<input type="checkbox"/>
	5. Ragworms - always work	from 5	<input type="checkbox"/>
	6. Peppery Furrow Shell from the deep	from 8	<input type="checkbox"/>
	7. Blow Lugs, well matured	from 12	<input type="checkbox"/>



- Eurasian Golden Plover
- Sanderling
- Red Knot
- Dunlin
- Common Greenshank
- Eurasian Oystercatcher
- Bar-tailed Godwit
- Eurasian Curlew

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

(OVERVIEW)

We read the Wadden Sea's fortune and see the hazards that endanger the resting ground of the Wadden Sea and have consequences for the migratory birds as well.

Are these just rumours or are these things really going to happen? There are some factors that already represent a threat today. Most of the impacts are unpredictable, which also makes the situation insecure for us humans. There is no one simple truth or guarantee. Everything is changing.

The following newspaper articles show different possible future situations. From the point of view of the migratory birds a lot is going to change. "Dinner4all", the international mudflat-gourmet-gazette, reports in its latest edition:

- ***Wadden Sea-Fly-In is under new leadership!***
Will the new team be able to keep up with the success from the past?
- ***Wadden Sea-Fly In has to be partly closed!***
Thousands move closer together. It's getting cramped!
- ***Wadden Sea-Fly-In: disruptions inevitable!***
Huge construction areas: When will the route be clear again?

Choose one article (worksheet 17) and take the additional worksheet 18. Read the article and answer the questions.

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

Wadden Sea-Fly-In is under new leadership!

Will the new team be able to keep up with the success from the past?



Blow Lug-City. The new team of the most popular restaurant worldwide will soon be relying on exotic ingredients. The whole atmosphere is going to be transformed as well. The aim is to attract a new group of guests. Is this going to work?

Who is in charge of this modern concept? The new cook who wants to thoroughly change the menu is named Globe L. Warming. He is from the upper layer of the atmosphere and has worked at various important places all over the world. Almost unseen by the world's public he has achieved fame quietly. For a while now it is well-known that Globe L. Warming has an assistant, named Rising C. Level. Both of them have a common motto: "Some like it hot!"

Obviously, they boil with hotter water. Due to the higher temperature of the seawater, shore crabs, prawns and starfish are also on offer in winter. It is said that the mussel banquet has already suffered because of this. It cannot be offered at as many places as before since the mussel harvest has been bad in recent years. Many people, including the nature expert W.-W. Eff, say that an important reason for this is

the intensive fishing for mussels. Who is right?

Globe L. Warming says: "The key is the nonstop warm cuisine. We were overrun by winter crabs. In the past they ate at our competitors', but now they dine here. They love the warm water!" But W.-W.-Eff thinks that two facts are combining to cause problems here: the warmer water and a lot of fishing. "It is always complicated with ecosystems, they are difficult to understand!"

And the crabs? Certainly they needed food. The cook has prepared tender, young mussels especially for this group of guests. Since mussels are very soft in winter they can easily be eaten even by small crabs. "Nowadays we have to rush. The guests want a fast and simple cuisine!" Bad luck for the mussels – only a few reach adulthood. Bad luck for the cook and his mussel banquet. And certainly bad luck for mussel-eating guests in the *Wadden Sea-Fly-In* like the Eurasian Oystercatchers, Eider Ducks and seagulls.

Globe L. Warming and Rising C. Level have put the Pacific Giant Oyster on offer. The number of these shells has increased enormously in recent years. They are now the exotic delicacy in the restaurant. But although there are enough of the oysters they are not ordered. They grow big and hard, with the result that no one is able to eat them. "Too expensive!" the guests say. "And too slimy!" They would have to provide special cutlery to open the sharp and concrete-like shells. Preparation of the oysters takes far too long. Some guests have already lost their cutlery or even their lives trying to eat the oyster.

Worksheet 17 - Wadden Sea-Fly-In is under new leadership
3.1

Rumours are in the air

Will the new team be able to hold their ground? We will have to wait and see.

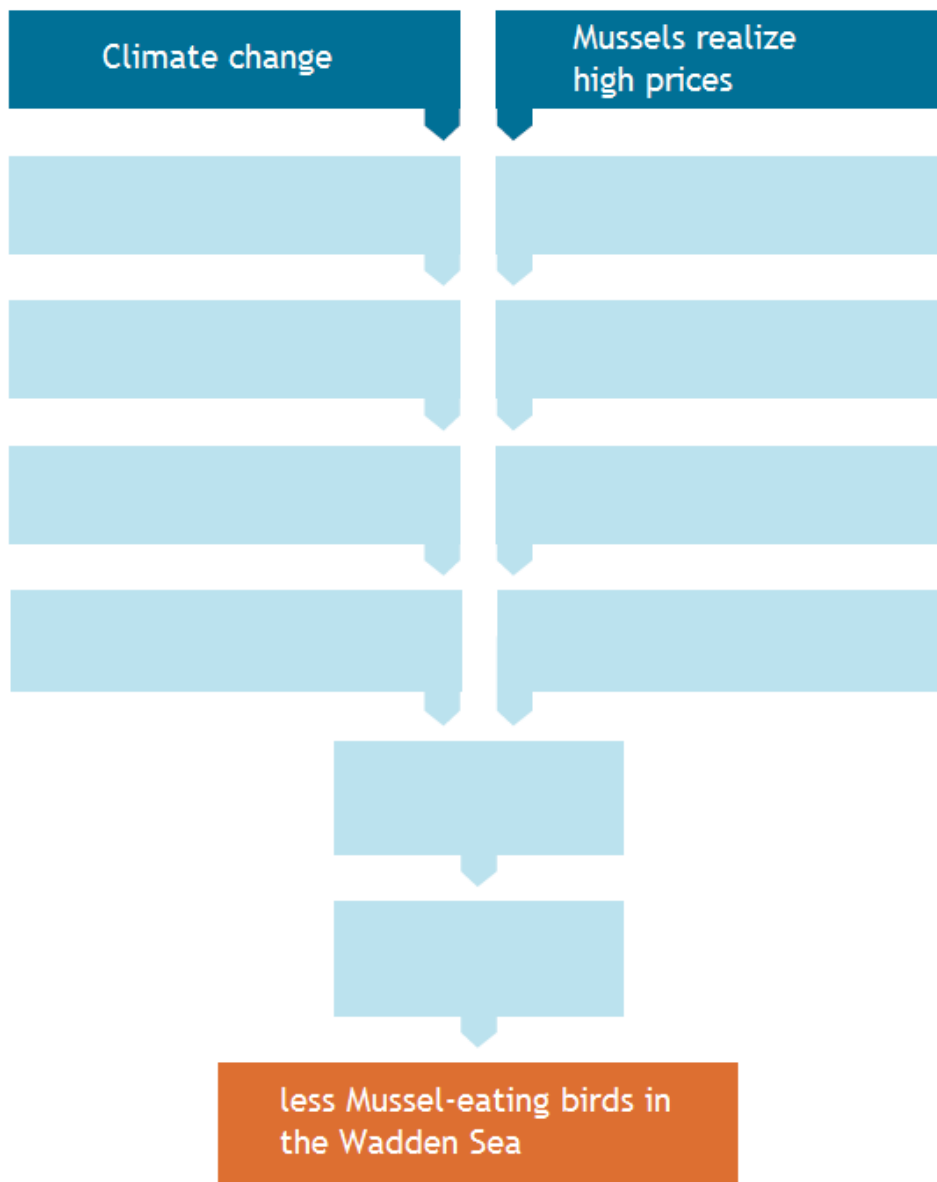
3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

WADDEN SEA-FLY-IN IS UNDER NEW LEADERSHIP

Questions on the article “Wadden Sea-Fly-In is under new leadership”

A What is the connection between climate change and fishing on the one hand and the decreasing numbers of some bird species on the other? Enter your results in the following list.



B Who are the new guests in the Wadden Sea?

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

Wadden Sea-Fly-In has to be partly closed!

Thousands move closer together. It's getting cramped!

Blow Lug-City. In all probability, parts of the most popular restaurant in the south of the North Sea will have to close in the coming decades. This will mean cramped conditions for approximately 10 m. migratory birds. Usually they rest in the Wadden Sea between Denmark and the Netherlands every year. Some of them have already protested in the strongest

terms. Everyone is wondering what the reasons for the closure could be.

Originally it was rumoured that the cook just wanted to redecorate and thoroughly change everything. This was arranged with the boss Clime-Ed Change. But obviously Globe L. Warming had to accept that he cannot manage it all on his own. The area of the three-country-resting ground is at least 10 000 square kilometres. Since the tide inundates 4 500 km twice a day, this area is very instable. Without the help of his neighbours – the North Sea and the dry land – he would have failed. His assistant, Rising C. Level, came just in the nick of time.



Rising C. Level wants to reduce the Wadden Sea-Fly-In area and expand one metre more by 2100. He might even bring off 1.5 metres!

Rising C. Level is overflowing parts of the resting grounds so quickly that they are becoming useless for some guests. What is more, the amount of accommodation for the guests is decreasing because of the erosion near the Fly-In!

“Why don't you build on the land side?” the guests quite rightly ask. The coastal inhabitants are averse to doing that. They started building dykes hundreds of years ago and want to carry on making them even higher.

The coastal inhabitants do not like Rising C. Level at all. With him, the storm tides which rise against the dykes get higher and higher. To continue living behind the dykes the coastal inhabitants need to build more barrages, heighten the dykes and put even more effort into the dewatering of the low-lying land.

This might lead to the loss of the Wadden Sea mudflats. The tiny mud particles in particular would be flushed away by the stronger currents. The Wadden Sea-Fly-In would become steeper and shrink. A dubious success of Clime-Ed Change and Rising C. Level...

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

WADDEN SEA-FLY-IN HAS TO BE PARTLY CLOSED

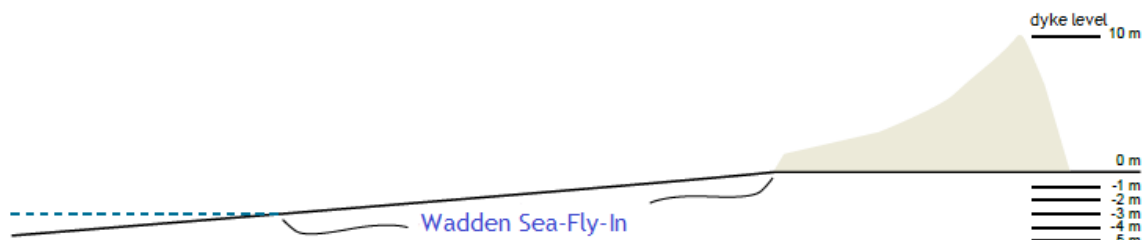
Questions on the article “Wadden Sea-Fly-In has to be partly closed”

In the illustration you see the Wadden Sea-Fly-In and the dyke - both seen from the side and extremely simplified. At the moment it is low tide (ebb) and the sea water has retracted.

A Take a ruler and measure the current low water level below zero: _____m.

B Draw a line with a blue pencil to indicate what the situation will be if the sea level (at low tide) rises by one metre, as will probably be the case by 2100.

C What does this change for the Wadden Sea-Fly-In? Measure, calculate or guess how much it loses in width (in this illustration).



Width of the Wadden Sea at low tide today: _____ mm (in this ill.)

Width of the Wadden Sea at low tide 2100: _____ mm (in this ill.)

How much narrower is the Wadden Sea going to be? _____ mm (in this ill.)

If the sea level rises one metre, how much does the Wadden Sea-Fly-In shrink? $\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{2}$

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

Wadden Sea-Fly-In: disruptions inevitable!

Huge construction areas: When will the route be clear again?

Blow Lug-City. Commuters reckon with ongoing disruptions in the popular restaurant “Wadden Sea-Fly-In” the coming years. The continuing maintenance works in the North Sea, the inflows and on the coast are making this into a huge construction area. Everyone able to circumfly this area, should do so.

Awkward arrival: The usual arrival routes are obstructed by so-called wind-farms. These are fields of about 80 wind turbines, located in the sea far away from the coast. One wind turbine can be up to 155 m tall and has a diameter of about 120 m. Watch out: The chance of collisions is quite high. The reason is that there are so many fields in the North Sea that one can only rarely cross the North Sea without an accident.

The wind-farms supply the people living onshore with power, which they need to get rid of nuclear energy. The combustion of coal not an alternative because of its poisonous impact on the climate. This does not make it easier for the birds; unless the wind turbines are built in a way that makes them recognisable for birds even by night and in bad weather.

Noise and diggers:

Energy – also called “power” or “electricity” – goes onshore by cable. Sections of the cables are installed across the resting



ground, which means they are buried in the mudflat. That is why you should reckon on a lot of noise and digger-activity. In particular, one round of digging is not enough: One reason is that more cables need to be laid

and the other is that the cables are washed blank when a tideway moves. And this is something tideways do very often. Other diggers come to do maintenance or repair work. In these regions guests find cheap offers with a short shelf-life, e.g. minced Sandgaper-ragout.

Long-term construction area fossil oil:

Here in the mudflat of all places they produce raw oil. This construction area has been problematic for the last 25 years: platform construction and expansion, seismic analysis, pipeline, power cable, exploratory drilling – the technical terms for



the people searching for the deathly liquid are never-ending!

Civil engineering: There is a lot of shipping traffic along the coast. That is why the harbours need to be deepened and expanded. A lot of sand from the seabed is needed for this constructional work. This harms or dislodges many mussel banks and microorganisms. What is more, the ships emit heaps of pollutants into the sea. The Wadden Sea-Fly-In menu is going to suffer massive restrictions.

Avoidance? One alternative might be the small resting ground in the neighbourhood. But the restaurant chain “Mc Shallow Water” with its branches at Weser, Elbe and Ems, is going to withdraw from the region. The rivers are being dredged for big ships to pass through. This additional depth makes the current stronger than before, so

that one consequence is that these sites are being washed away. From time to time, vehicles with excess width and height pass midway through the resting ground on the Ems. They are called cruise ships and are used for humans to travel around and see different countries. Perhaps they will then be able to understand the importance and value of tidy and undisturbed resting grounds. Unfortunately, these ships consume an incredible amount of incredibly filthy fuel. This way they are helping Clime-Ed Change. Most of the crusaders probably do not even know this!

Please follow the alternative route...

3.1 RUMOURS ARE IN THE AIR

ARE THE RESTING GROUNDS IN DANGER?

WADDEN SEA-FLY-IN: DISRUPTIONS INEVITABLE

Questions on the article “Wadden Sea-Fly-In: disruptions inevitable”

A What dangers does the construction of wind-farms represent for the birds?

B What problems does harbour construction on the coast cause for the birds?

C What problems are caused by river deepening?

3.2 THE BIG RESTING-GROUNDS CHECK

A RAY OF HOPE?

We have seen that the Wadden Sea is threatened. The migratory birds are dependent on this place - the Wadden Sea is the biggest locally connected marine sanctuary in Europe. The location is ideal for a stopover. But the conditions have to be right. Maybe a resting ground-check will help and provide valuable tips? Is there a ray of hope that the Wadden Sea-Fly-In will be able to stay open? The newspaper article below reports on conservation efforts. Afterwards you are asked to express your opinion like a resting ground-tester...

Wadden Sea-Fly-In receives its third star!

A ray of hope: The whole world celebrates with the successful team!

Blow Lug-City. Finally the region has an impressive prizewinning resting ground. The Wadden Sea-Fly-In has already established its reputation at the gourmet-world in the past. The chef Tide S. convinced the testers with the of recent years. She honestly deserves the World Heritage award!

What was the decisive factor? From 1985 to 1990 the resting ground in Germany received the first award and was declared a national park by all three federal states that have a Wadden Sea connection. This was the first step towards conserving nature around the resting grounds. This conservation was not perfect and did not help every problematic situation, but conservation started and is developing! And only this development made it possible to offer the first-class food which is loved by its guests.

The concept of the one-star-cuisine was a focus on service and atmosphere. The passengers were not hunted in the national park any more and generally the number of disruptions has decreased. The short cut grassland has changed over the years to salt meadows that are now cluttered with colourful flowers. A lot has changed for the shellfishes as well: Cockles are on the menu again, because the fishing for them, which destroyed the soil, has stopped.

Later, arrangements were made that were of great benefit to the resting grounds:

national park extension, nomination as an "extra-sensitive marine area" by the international shipping organisation, more information centres and guided tours for the little ones of the three countries and the designation of the Danish Wadden Sea as a national park.

All this came to fruition in 2009, a ray of hope for the resting grounds, which are defined by change and are always facing new perils. The special award with the third star is the recognition of the region as a World Heritage by the UNESCO. This honours the done work in the region.

What can the guests look forward to?

1. A menu of rare diversity. The food comes from many different biotopes. It is always fresh, seasonal and regional. Altogether there are about 10 000 species.
2. Unique delicacies on the menu. Tide S. shows what she is capable of. Her concept of contrasts by sometimes spicing with fresh-, sometimes with salt water is convincing.
3. Young, active and unexpected. The Wadden Sea-Fly-In is a resting ground with juvenile pep. This is the place where salt meadows, dunes, mud flats and sand are able to move around enough. That is why the resting ground looks different at every visit. The reasons are the wind, sand and Tide S.. The proximity to nature is especially important to be able to adjust to marine warming and the rising sea level. Nature is a lot more flexible then.

Finally, the latest good news: environmentalists have succeeded in ensuring that although the cables to the wind farms will indeed become bigger, in return fewer cables will be needed. They have also ensured that no shells will be imported from foreign countries along with any adherent alien species. Further, there is agreement that the deepening of the mouth of a river has to be balanced by renaturation measures.

3.2 THE BIG RESTING-GROUNDS CHECK

YOUR TEST OPINION

How suitable is the Wadden Sea for migratory birds?

Try to think from the point of view of the birds and consider the discussed topics in your decision. Give marks for individual sections according to the following principle by awarding stars:

Mark	Short	Stars	Description
A	very good	★★★★★	Special, exceptionally good. As good as it could be
B	good	★★★★☆	The requirements are fully met.
C	satisfactory	★★★☆☆	The requirements are generally met.
D	adequate	★★☆☆☆	Shows some deficiencies, but meets requirements.
E	inadequate	★☆☆☆☆	The requirements are not quite met, but the deficiencies can be fixed soon.
F	fail	☆☆☆☆☆	The requirements are not met. The deficiencies cannot be fixed even in the future.

In every section you have the full number of stars available. Draw the number of stars that you want to award.

No.	Section	Grading
1	Atmosphere <ul style="list-style-type: none"> • volume (natural and man-made noise) • temperature and wind (water and air temperature) • decoration (natural or man-made?) • light • size of the dining area (enough space for everyone) <u>Overall impression</u>	☆☆☆☆☆
2	Service <ul style="list-style-type: none"> • accessibility, opening hours • attentiveness and protection: How cheerful is the welcome? <u>Overall impression</u>	☆☆☆☆☆
3	Dishes <ul style="list-style-type: none"> • freshness • amount • diversity • food value (how much fat can I store?) <u>Overall impression</u>	☆☆☆☆☆
4	Cost-benefit ratio the price I pay (effort, additives) proportional to the output I get (fat from the food, place for feeding)	☆☆☆☆☆
Your opinion: Of 20 possible stars I give:		

★	0-1	2-5	6-9	10-13	14-17	18-20
Mark	F	E	D	C	B	A

According to this scale it gets the mark:

Compare your result with that of your neighbour. What is the overall opinion of your class?

3.3 WITH BEST REGARDS

WHAT HAS TO BE DONE?

The resting ground-check has helped you to pass your judgment.

A Give reasons for your judgement and write a short recommendation for the future. What could be done to prevent the Wadden Sea and the migratory birds from possible dangers?

B What dangers exist in your opinion?

C *Who* can do *what* to improve the situation of the Wadden Sea? Discuss this point in your class (governments, shipping, energy industry etc.).

D What can you personally do in your everyday life for the conservation of the Wadden Sea on the coast of the North Sea?

3.3 WITH BEST REGARDS

I CAN DO SOMETHING.

Write a letter to yourself. Hand it in to your teacher and you will get it back in one month.

I can do something:

Contribute to the conservation of the Wadden Sea in the future.

Hí,

in school I learnt many things about the topic "Break in the Wadden Sea", which worry me. I want to contribute immediately to conserving the Wadden Sea in the North Sea.

I want to remember the following in my everyday

life:

Best wishes from _____