

# Tahkoluoto Bird Radar Project

*Birdlife in the offshore wind farm area before and after construction*



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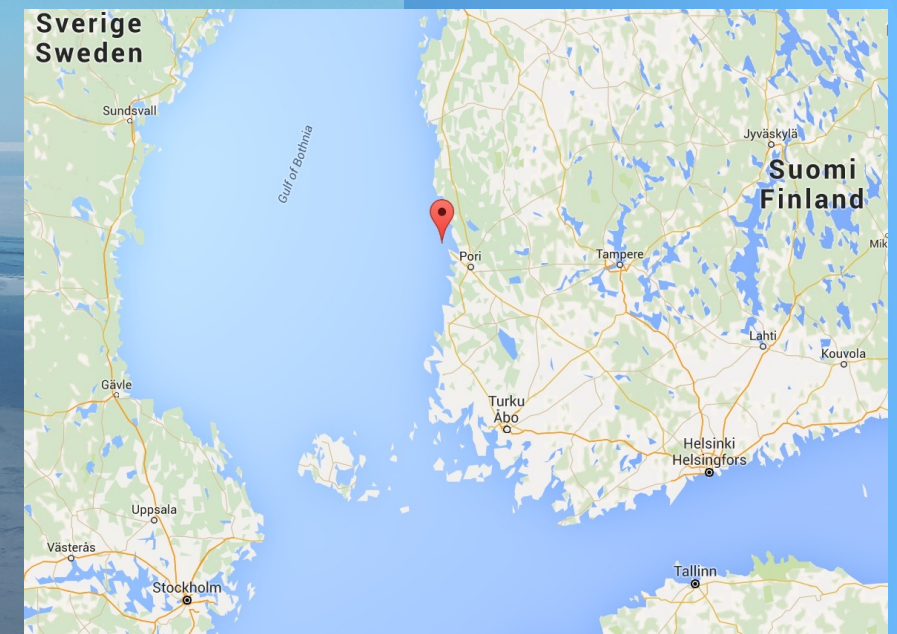
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# BIRD RADAR PROJECT IN TAHKOLUOTO



- LOCATED IN FRONT OF THE TAHKOLUOTO PORT AT PORI, SW-FINLAND
- 11 SIEMENS 4,2 MW OFFSHORE WIND TURBINES
- THE FIRST OFFSHORE WIND FARM IN FINLAND
- THE FIRST ONE BUILT IN ICY CONDITIONS
- ROBIN RADAR 3D-FLEX BIRD RADAR SYSTEM WAS INSTALLED ONSHORE IN MAY 2016
- ENERGY PRODUCTION STARTED IN AUGUST 2017



# WIND TURBINE CONTROL IN NUMBERS



AUTOMATIC RADAR BASED CONTROL SYSTEM WAS IMPLEMENTED TO AVOID BIRD COLLISIONS.

180M FLIGHTS DETECTED 2019-2020 IN TOTAL.  
1 OUT OF 40000 FLIGHTS LED TO A WTG STOP.

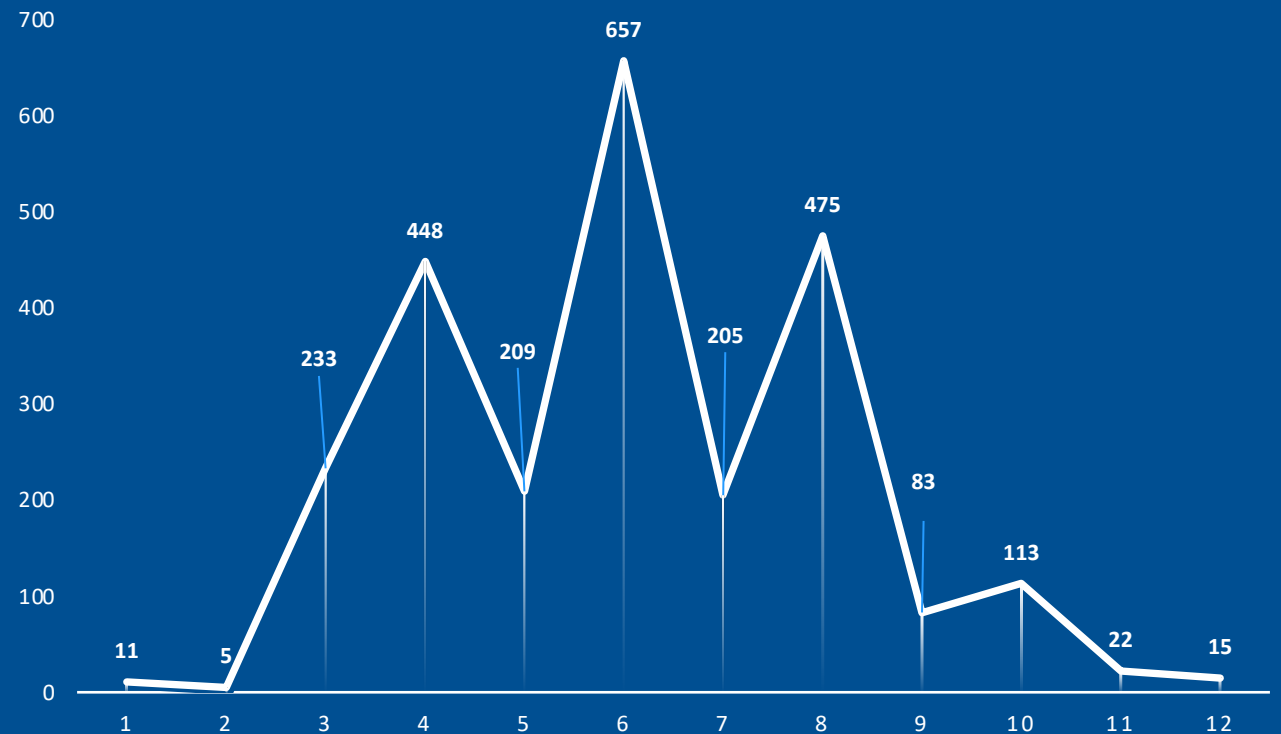
DURATION OF A STOP

- 🌪️ AVERAGE 122 SECONDS
- 🌪️ MEDIAN 70 SECONDS
- 🌪️ RANGE 3 - 381 SECONDS

VALUE OF LOST PRODUCTION AROUND 4000 € PER YEAR.

ZERO COLLISIONS DETECTED.

MONTHLY INDIVIDUAL TURBINE STOPS  
2019 & 2020 COMBINED

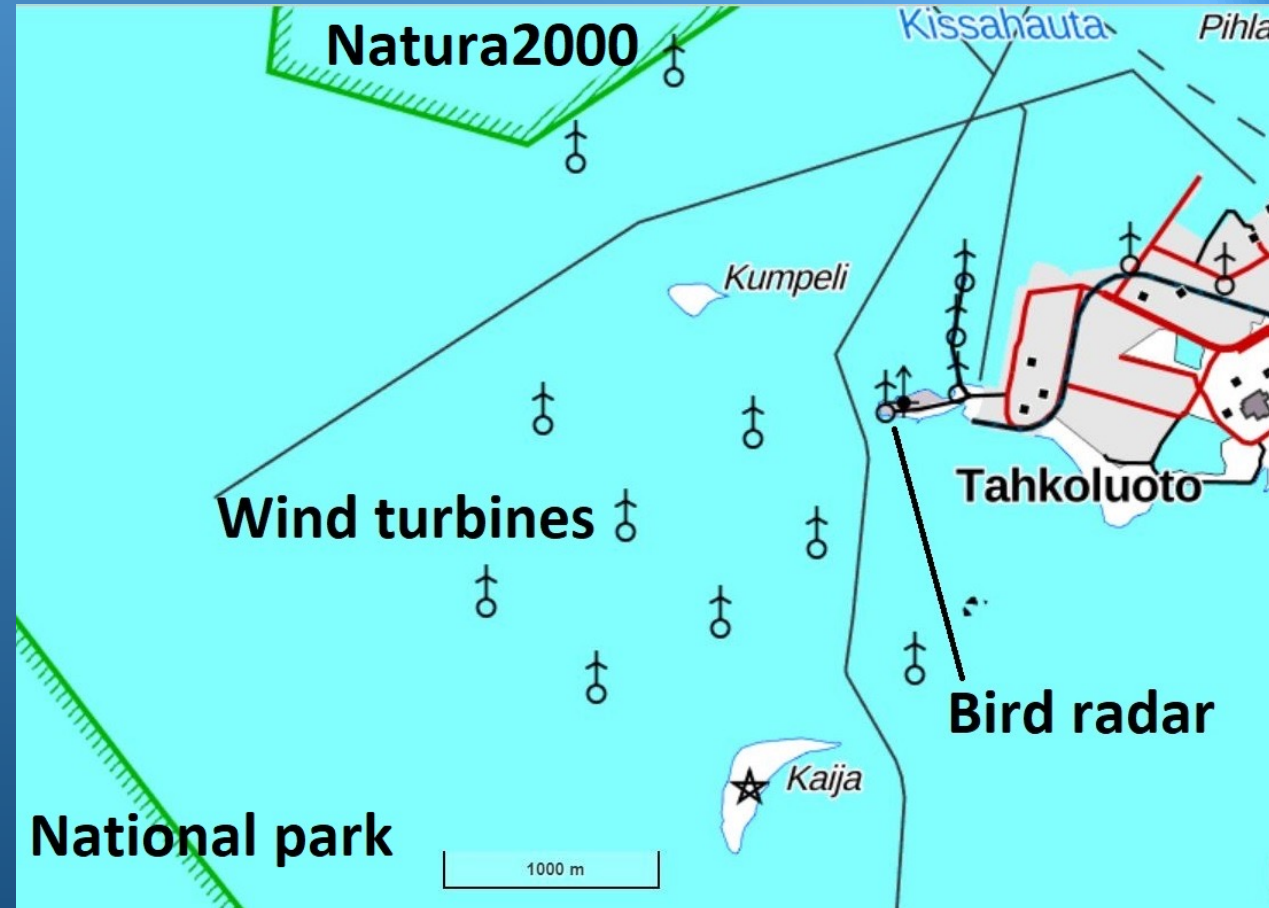


# BIRDLIFE IN THE WIND FARM AREA

## Monitoring



- ✎ TAHKOLUOTO PORT AND ITS WESTERNMOST TIP WHICH ALSO HOSTS THE BIRD RADAR SYSTEM, HAS BEEN A POPULAR BIRD-WATCHING POINT SINCE 1980'S
- ✎ BIRD RADAR SYSTEM WAS INSTALLED ON 25th MAY 2016 – 14 MONTHS BEFORE THE CONSTRUCTION WAS COMPLETED
- ✎ 600M+ TRACKS STORED IN DATABASE
  - ✎ A TRACK = A FLIGHT PATH OF INDIVIDUAL BIRD OR A FLOCK



# BIRDLIFE IN THE WIND FARM AREA

## *Monitoring*

- ✚ SINCE 2012 BIRD-WATCHERS HAVE BEEN RECORDING FIELD OBSERVATIONS ESPECIALLY TO SERVE TAHKOLUOTO OFFSHORE WIND FARMS IMPACT ASSESMENT
  
- ✚ FIELD MONITORING EFFORT ANNUALLY
  - ✚ SPRING AND AUTUMN MIGRATION 500 HOURS
  - ✚ BREEDING BIRDS SURVEY ON NEARBY ISLANDS AND ON CONTROL AREA
  - ✚ BALTIC GULL AND WHITE-TAILED SEA EAGLE MONITORING



# BIRDLIFE IN THE WIND FARM AREA



✚ THE DECLINING BREEDING POPULATION OF ENDANGERED BALTIC GULL AND THE RAPIDLY INCREASING WHITE-TAILED EAGLE WERE CONSIDERED AS THE MOST IMPORTANT SPECIES TO PROTECT BY AUTHORITIES

✚ FOUR IMPORTANT ISLANDS FOR BREEDING BIRDS, INCLUDING BALTIC GULL COLONIES WITHIN OR NEARBY THE WINDFARM

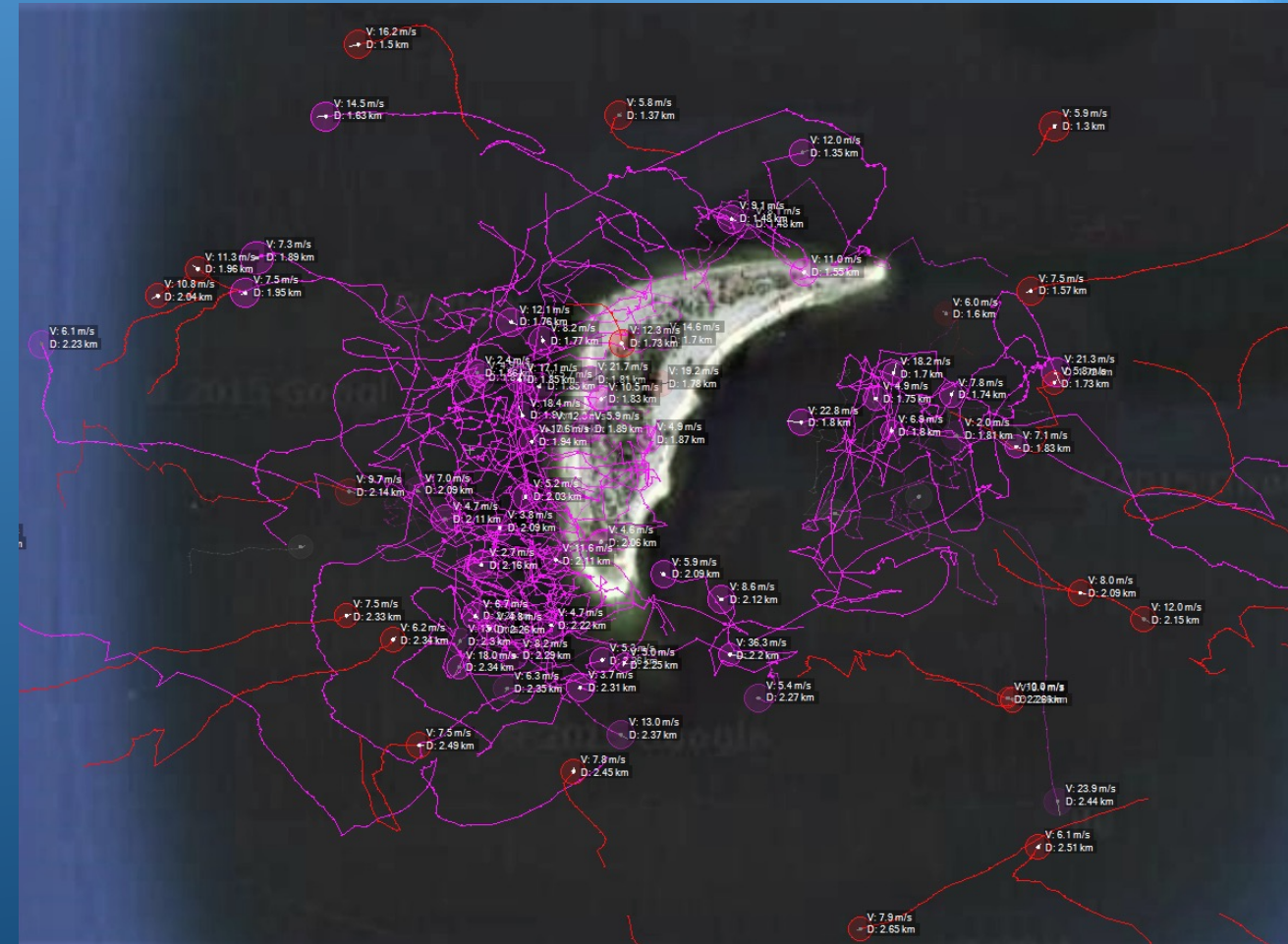
✚ IMPORTANT PATHWAY FOR MANY MIGRATORY BIRDS LIKE VELVET SCOTER, COMMON EIDER, TERNS AND GULLS IS LOCATED NEAR AND INSIDE THE WIND FARM AREA



# BIRDLIFE IN THE WIND FARM AREA

## *Limitations of the data*

- †† THE RADAR SYSTEM IS NOT ABLE TO SEPARATE DIFFERENT BIRD SPECIES, BUT
  - †† IT IS POSSIBLE TO ADD INFORMATION ON TRACKS IN REAL TIME WHILE DOING FIELD MONITORING, AND
  - †† RADAR PROVIDES INFORMATION ABOUT OBJECTS VELOCITY, SIZE CLASS AND SOMETIMES BEHAVIOUR WHICH ARE USEFULL FOR IDENTIFYING BIRDS TO FAMILY OR EVEN IN SPECIES LEVEL
  - †† SEASON AND TIME OF THE DAY ARE ALSO USEFULL CLUES FOR IDENTIFICATION PURPOSES
- †† RADAR SYSTEMS DETECTION RANGE FOR LARGE BIRDS AND FLOCKS IS UP TO 10 km
  - †† SMALL SINGLE PASSERINES GOES MOSTLY UNDETECTED
- †† THE EXACT NUMBER OF BIRDS CAN NOT BE DERIVED FROM THE DATA AS FLOCKS ARE STORED AS A SINGLE TRACK





# WHOOPER SWAN

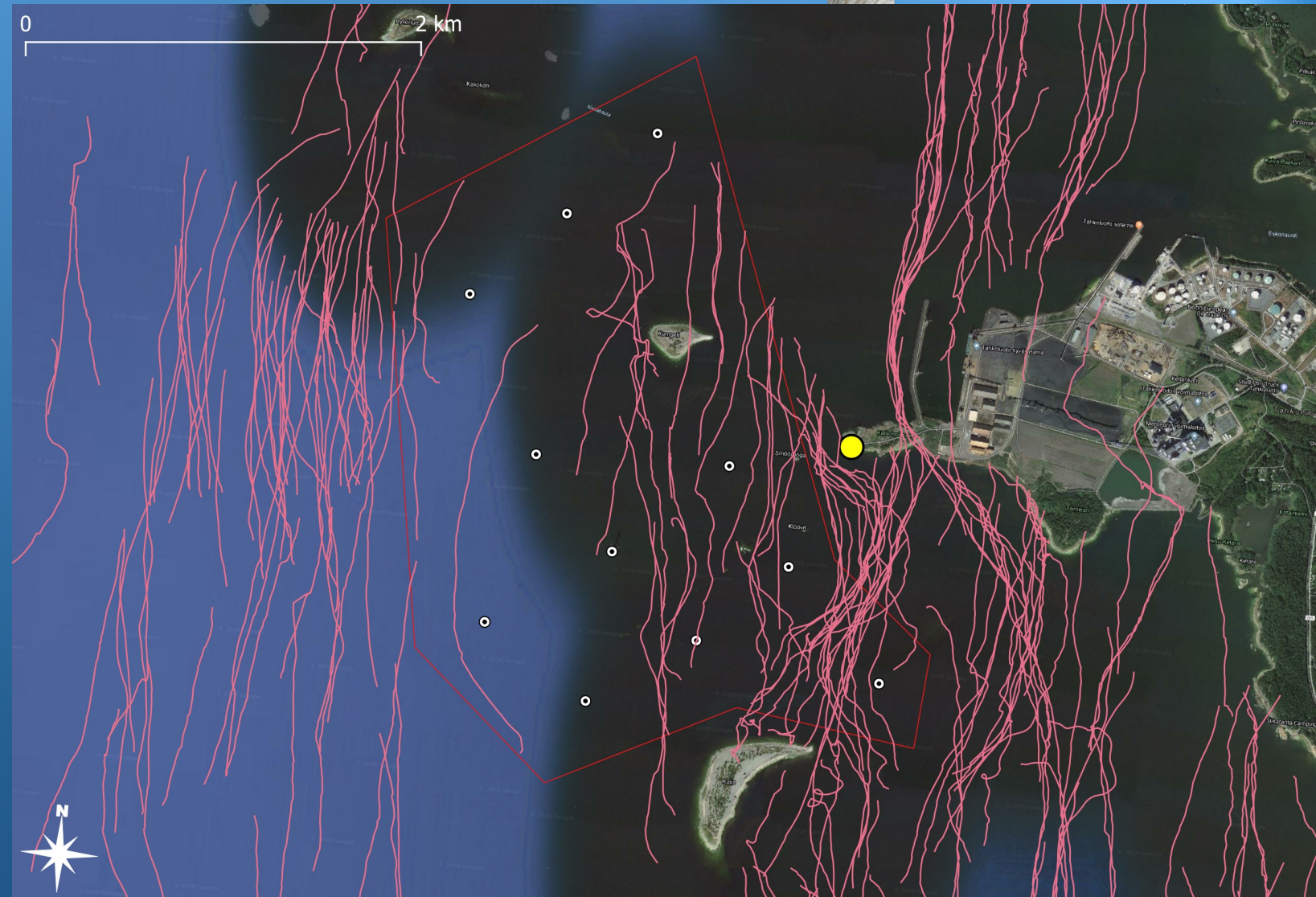


RED LINES ARE TRACKS HEADING NORTH-EAST WITH VELOCITY 10-15 m/s ON 23rd MARCH 2021 FROM 6:00 TO 10:30.

AT THE SAME TIME 450 WHOOPER SWANS ON SPRING MIGRATION WERE OBSERVED FROM TAHKOLUOTO.

WHITE CIRCLES ARE REPRESENTING WIND TURBINES AND YELLOW DOT SHOWS THE RADAR AND WATCHING POINT LOCATION.

THIN RED LINE MARKING THE WIND FARM AREA.



# WHOOPER SWAN



ONE OF THE WHOOPER SWAN FLOCKS FROM THE PREVIOUS IMAGE MIGRATING SAFELY THROUGH THE WIND FARM ON 23rd MARCH 2021.



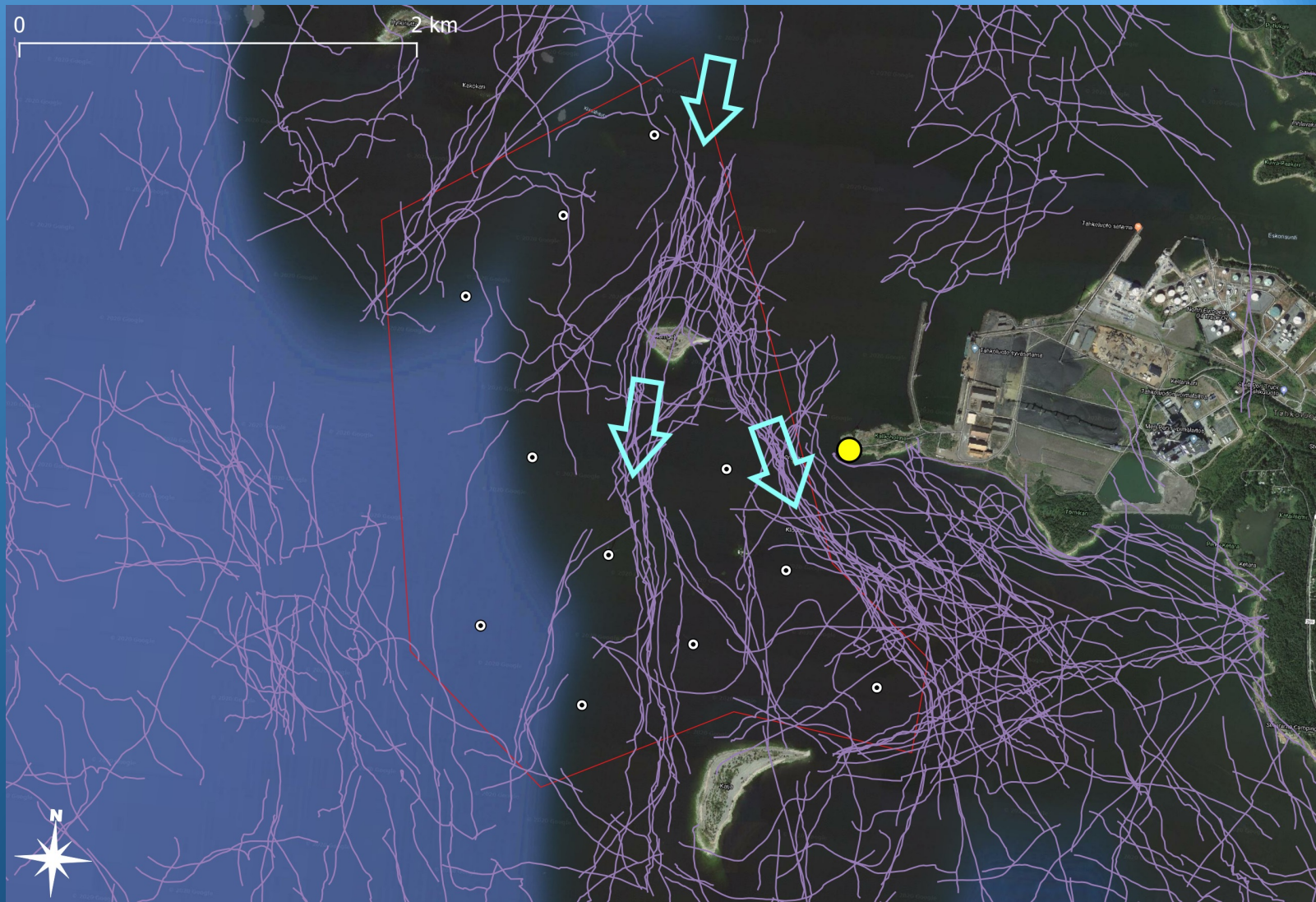
# MUTE SWAN



MUTE SWAN "AUTUMN" MIGRATION  
ON 8th JANUARY 2021, 10:00 – 12:30.

375 INDIVIDUALS FLYING SOUTH-SOUTHWEST WERE NOTED FROM TAHKOLUOTO AND ALSO FROM VESSEL OFFSHORE.

152 BIRDS FLEW THROUGH WIND FARM (BLUE ARROWS).



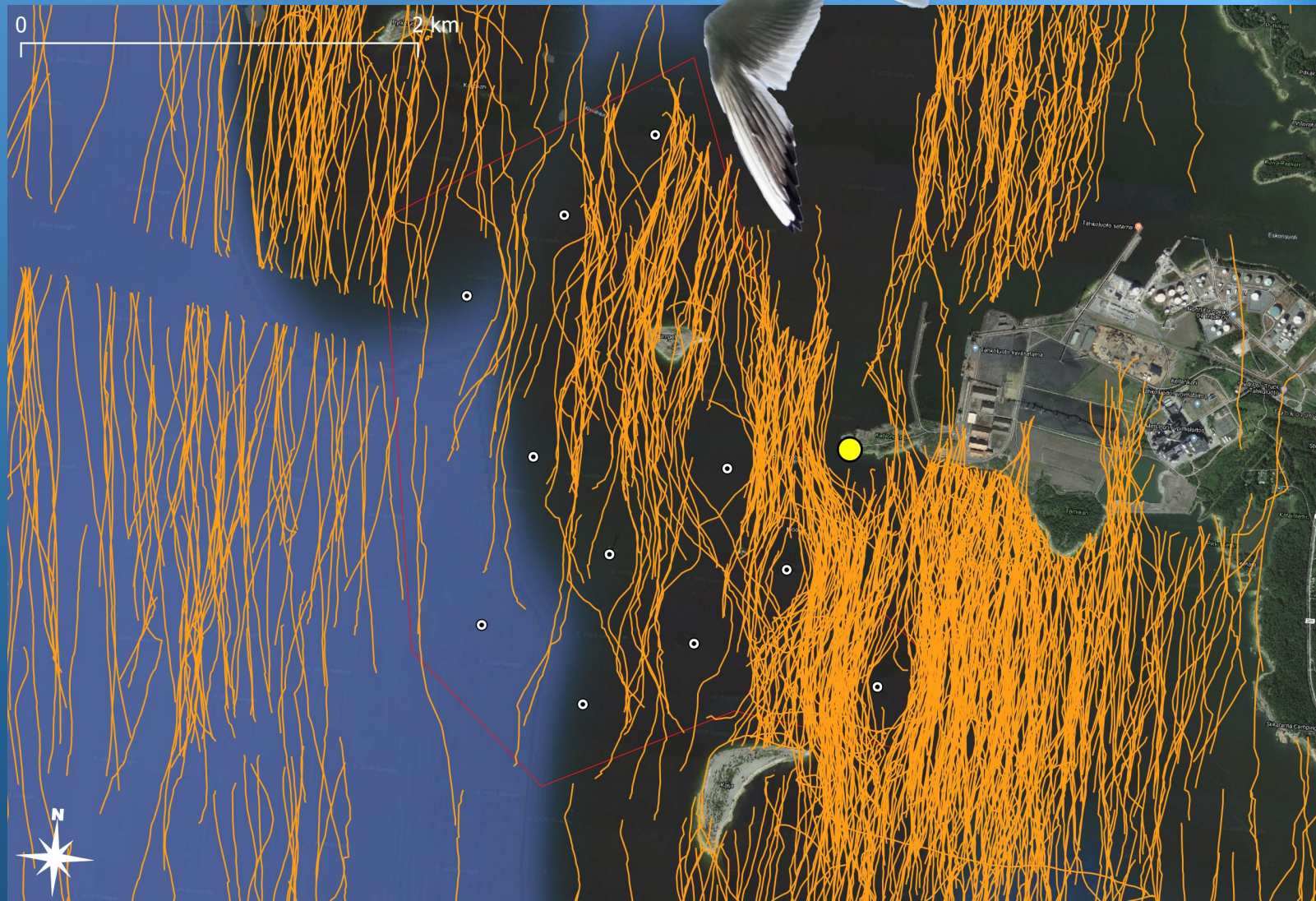
# EIDER & BLACK-HEADED GULL



IMAGE SHOWS NORTHBOUND  
MIGRATION ON 6th APRIL 2020, 6:30 –  
10:40.

2980 EIDERS AND 1400 B-H GULLS  
WERE NOTED FROM TAHKOLUOTO.

LEFT HALF OF THE IMAGE REPRESENTS  
EIDERS AND RIGHT HALF B-H GULLS.



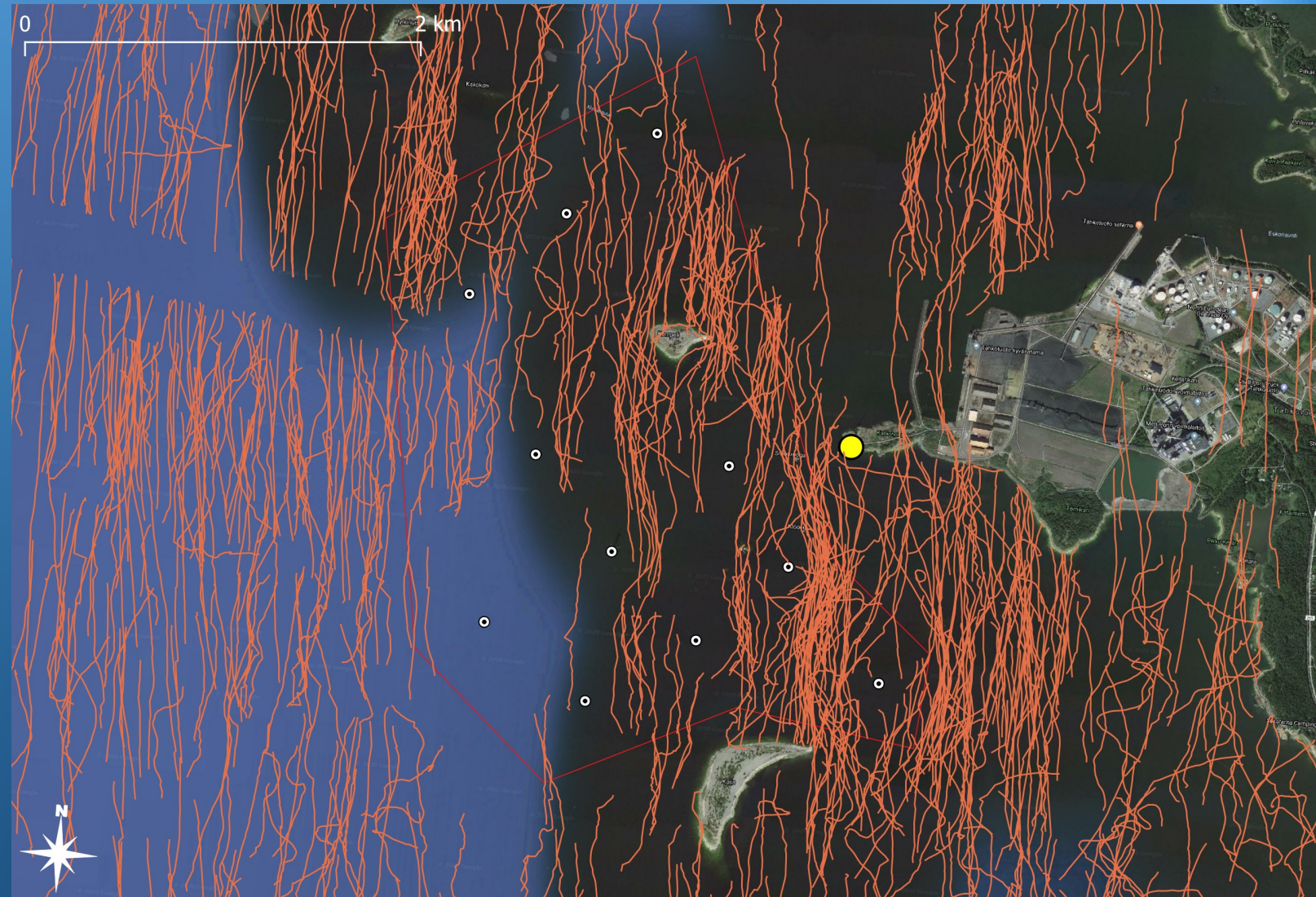
# VELVET & COMMON SCOTER, LONG-TAILED DUCK



EVENING MIGRATION 22.5.2020,  
17:40 – 22:45.

4593 VELVET SCOTERS,  
1724 COMMON SCOTERS &  
3162 LONG-TAILED DUCKS WERE  
RECORDED FROM TAHKOLUOTO.

ON MORNING MIGRATION  
SEADUCKS ARE FLYING LOW ABOVE  
SURFACE AT OPEN SEA BUT IN THE  
EVENINGS THEY COME CLOSE TO  
SHORE AND FLY EVEN ABOVE THE  
LAND AT 100-300 m HEIGHT.



# BLACK-THROATED DIVER (LOON)

BLACK-THROATED DIVERS ARE AVOIDING THE WIND FARM.

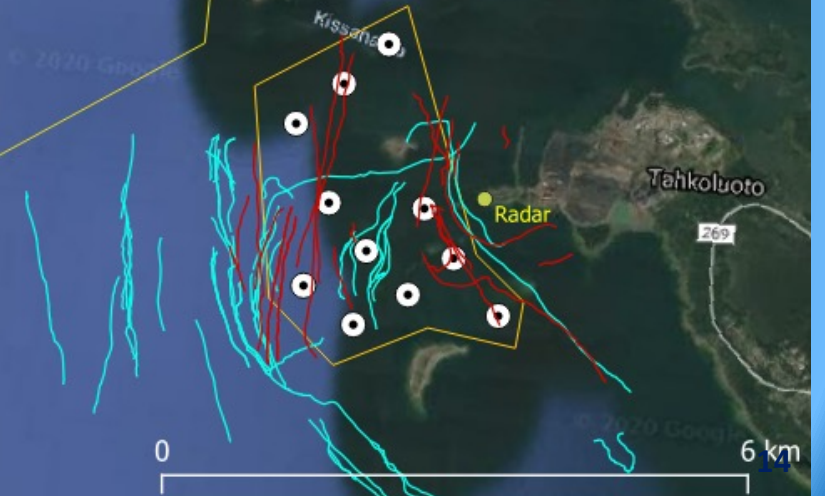
WHEN COMPARING PRE-CONSTRUCTION (2014-2017) AND POST-CONSTRUCTION (2018-2020) OBSERVATIONS, RELATIVE NUMBER OF BIRDS PASSING THROUGH WIND FARM OR FROM THE EAST SIDE DROPPED FROM 13% TO 5% (n=11294).

HOWEVER, THE TOTAL NUMBER STAYED ON THE SAME LEVEL INDICATING TRANSITION ON MIGRATION PATH WAS ONLY SLIGHTLY TOWARDS WEST.



Black-throated Diver (*Gavia arctica*)  
Pre-park: red  
Post-park: cyan

TRACKS FROM THE DATABASE WITH MANUALLY ADDED SPECIES IDENTIFICATION DURING FIELD MONITORING.

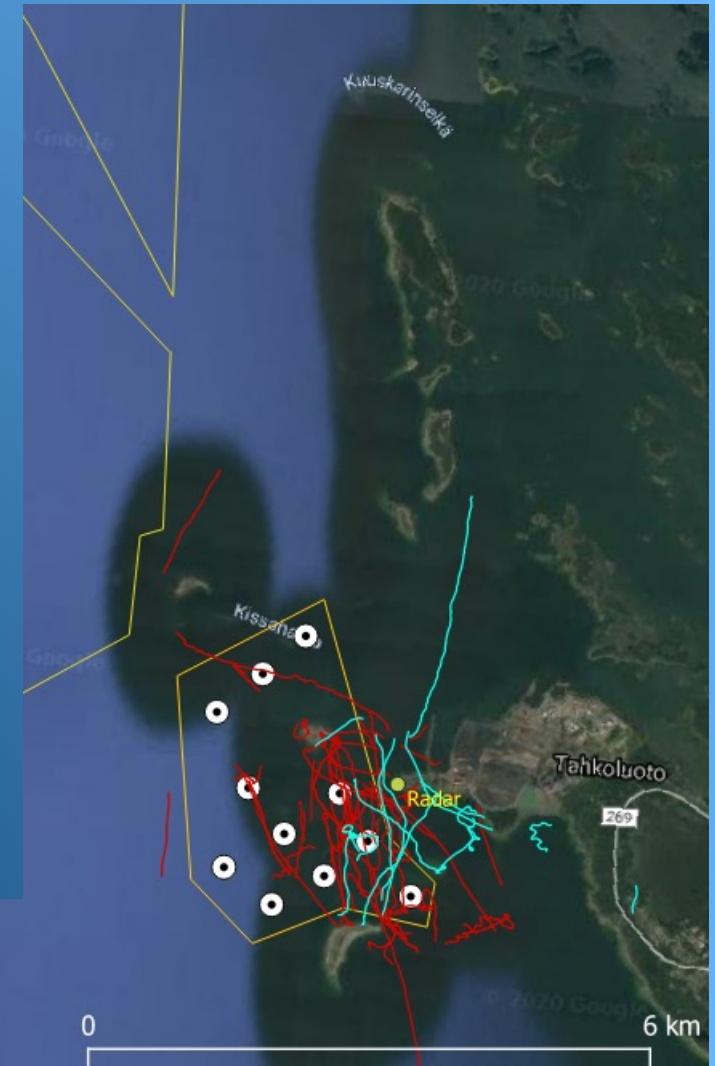


# WHITE-TAILED SEA EAGLE

SEA EAGLE IS A VERY COMMON SIGHT AT TAHKOLUOTO THROUGHOUT THE YEAR. NUMBERS HAVE BEEN INCREASING IN THE AREA AND A PAIR EVEN BUILT A NEST 500 METERS FROM THE NEAREST WIND TURBINE.

SEA EAGLE'S MIGRATION ROUTE MAY HAVE SLIGHTLY SHIFTED TOWARDS EAST AFTER WIND FARM CONSTRUCTION.

PRE-CONSTRUCTION 24% PASSED FROM THE EAST, 46% THROUGH AND 20% FROM THE WEST AND POST-CONSTRUCTION 31% - 39% - 29% (n=426).



White-tailed Eagle (*Haliaeetus albicilla*)  
Pre-park: red  
Post-park: cyan

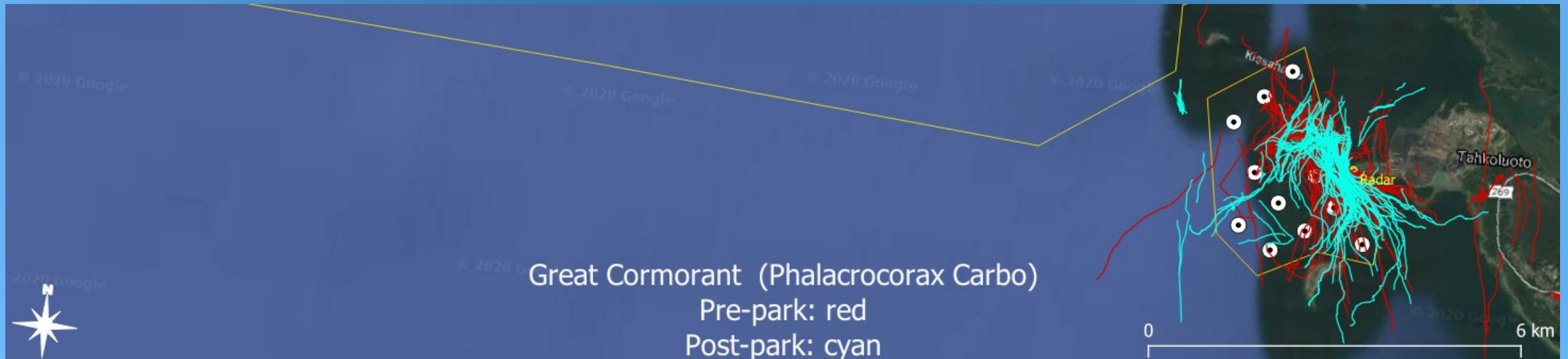
# CORMORANT



CORMORANT HAS LARGE BREEDING COLONIES UP TO 2000 PAIRS WITHIN 50 km RADIUS FROM THE WIND FARM.

COLONIES HAVE BEEN DISPLACED RECENTLY DUE TO PERMITTED DETERRANCE MEASURES, WHICH HAS IMPACT ON THEIR FLIGHT PATHS IN TAHKOLUOTO AREA.

WITHIN THE WIND FARM AREA CORMORANT FLYWAY HAS CONCENTRATED ON MORE NARROW PATH BUT OTHERWISE NO IMPACTS HAVE BEEN RECORDED.



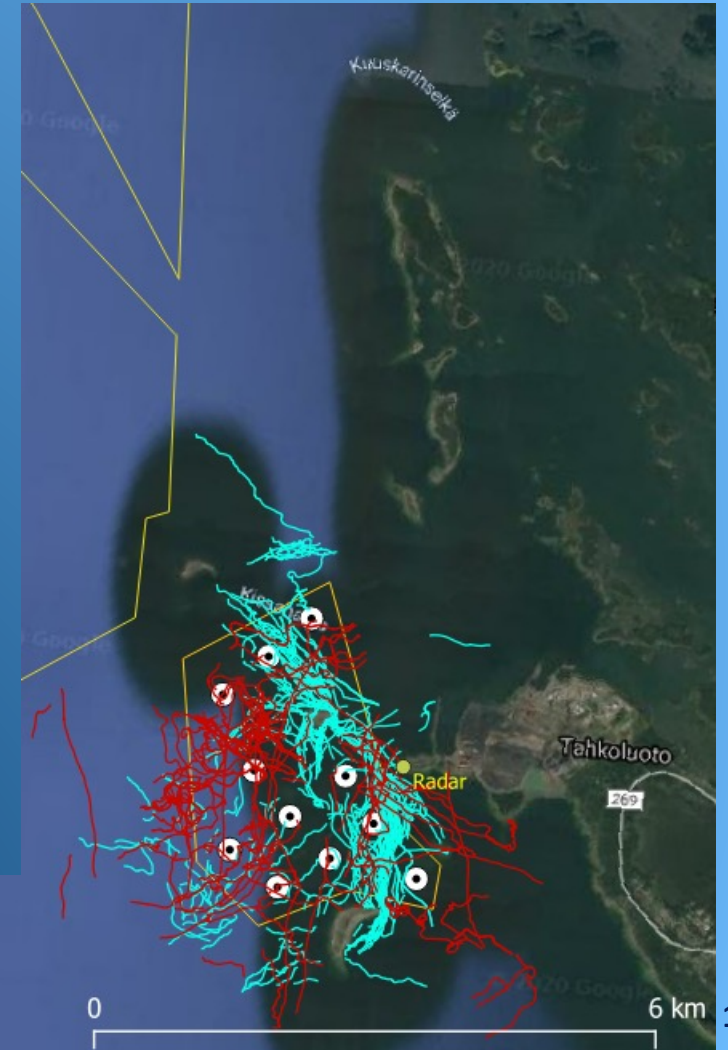
Great Cormorant (*Phalacrocorax Carbo*)  
Pre-park: red  
Post-park: cyan



# COMMON GULL

COMMON GULL IS ABUNDANT IN TAHKOLUOTO WITH 60 BREEDING PAIRS AND THOUSANDS BOTH ON MIGRATION AND IN WINTER.

SIMILAR CONCENTRATION EFFECT TO CORMORANT IS VISIBLE ON THE IMAGE BUT OTHERWISE NO IMPACTS HAVE BEEN NOTICED.



Common Gull (*Larus canus*)  
Pre-park: red  
Post-park: cyan

# RESTING AND FEEDING AREAS



WIND FARM AREA REGULARLY HOSTS RESTING AND FEEDING EIDERS AND GOLDENEYES ON SPRING AND SUMMER TIME. NUMBERS VARY FROM 200 TO 1500 INDIVIDUALS ON EIDERS AND TENS TO HUNDREDS ON GOLDENEYE. EIDERS ARE SPECIALIZED TO MUSSELS BUT GOLDENEYE FEEDS ON DIFFERENT CRUSTACEAN, SMALL FISH AND PARTS OF WATER PLANTS.

COMMON GULLS, ARTIC AND COMMON TERNS ARE FISHING WITHIN THE WIND FARM, SOME TENS TO HUNDREDS OF EACH DAILY ON BREEDING SEASON AND EVEN COUPLE OF THOUSAND COMMON GULLS ON AUTUMN AND WINTER TIME.

NO SHIFT IN FEEDING ACTIVITY OR RESTING AND FEEDING AREAS HAVE BEEN RECORDED.



# BREEDING BIRDS



BREEDING BIRDS SURVEYS HAVE SHOWN THAT TAHKOLUOTO WIND FARM HAS NO SIGNIFICANT IMPACT IN A WAY OR ANOTHER.

CHANGES IN BREEDING POPULATION ARE FOLLOWING NATIONAL AND INTERNATIONAL TRENDS.

SURVEYS HAVE BEEN CARRIED OUT ON FOUR ISLANDS CLOSE OR WITHIN THE WIND FARM AND ON CONTROL SITE AT PREIVIIKINLAHTI – NATURA2000-AREA. TAHKOLUOTO AREA HAS SHOWN EVEN A SLIGHTLY MORE POSITIVE POPULATION TRENDS THAN CONTROL SITE.

HERRING GULL'S BREEDING POPULATION PLUMMETED AFTER CLOSURE OF NEARBY LANDFILL.

Selected sample of species	Pre-construction		Post-construction			
	2008	2012	2018	2020	2021	2022
Mute Swan	4	3	3	5	3	4
Greylag Goose	2	13	15	13	2	7
Barnacle Goose	0	4	24	46	22	31
Eider	166	360	239	306	175	156
Parasitic Skua	3	3	4	5	4	3
Black Guillemot	0	0	0	2	3	2
Caspian Tern	0	0	2	3	3	3
Arctic Tern	119	47	120	157	168	132
Baltic Gull	124	133	107	118	117	111
Herring Gull	380	389	255	259	228	169
<b>Total</b>	<b>892</b>	<b>1006</b>	<b>859</b>	<b>1037</b>	<b>865</b>	<b>749</b>
<b>Total without Herring Gull</b>	<b>512</b>	<b>617</b>	<b>604</b>	<b>778</b>	<b>637</b>	<b>680</b>

# NEXT STEPS IN BIRD RADAR PROJECT



- ✚ BIRD RADAR SYSTEM IN TAHKOLUOTO CONTINUES MONITORING LOCAL BIRDLIFE.
- ✚ TAHKOLUOTO WIND FARM IS PLANNED TO BE EXPANDED WITH 40 WIND TURBINES IN A FEW YEARS.
- ✚ A NEW BIRD RADAR SYSTEM, PROBABLY WITH TWO ANTENNAS IS GOING TO BE INSTALLED OFFSHORE.
- ✚ PARTNERS FOR SCIENTIFIC PUBLICATIONS WILL BE LOOKED FOR.



# THANK YOU FOR YOUR ATTENTION!

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