



**International**  
 ART is an international effort both in terms of geographic scope and of nationalities of the founding and participating scientists

**What is ART and why it is unique?**

**Next generation of Arctic marine scientists**

**Temporal Linkages**  
 ART has a unique focus on bridging temporal aspects (paleo-records, current observational studies, modelling efforts)

**Inter-disciplinary**  
 ART fosters communication and data exchange among disciplines and will improve our understanding of the Arctic marine realm as a whole


**Early Career Involvement**  
 ART was conceived, developed, and remains steered by early career scientists, and will continue to support their active involvement

ART  
 Arctic in Rapid Transition



### Current ART Executive Committee

	<b>Carolyn Wegner (chair)</b>		
	<b>Nathalie Morata (co-chair)</b>		<b>Monika Kędra (co-chair)</b>
	Anna Nikolopoulos		Matt O'Regan
	Helen Findlay		Ilka Peeken
	Michael Fritz		Sanna Majaneva
	Kirstin Werner		Alexey Pavlov
	Makoto Sampei		



### ART main activities 2014/2015

- **ART Scientific program**
  - TRANSSIZ research cruise (R/V Polarstern, chief scientist: Ilka Peeken; 19.05-28.06.2015)
- **ART PhD training**
  - ART Proposal to ITN Marie Curie innovative network
- **ART Workshops**
  - ISTAS: Second science workshop in Brest, France, October 2014
- **ART Publications**
  - Future Research Priority Sheets
  - Special issue of Polar Research
- **ART In science conferences**
  - ART session during ASSW in Toyama, Japan
  - ART co-organizer of the Arctic Frontier conference (January 2017)


## ART Scientific Program






## TRANSSIZ Timeline

- **Arctic ASSW, March, 2011** in Seoul Korea,  
 Invitation for draft proposal for a European led ART expedition
- Submitting letter of intend **September 2011**  
 Ecological and biogeochemical studies on seasonal transitions
  - winter- spring, fall-winter
  - In the European Arctic Ocean
- Meeting Copenhagen **November 2011** \*  
 Sketching draft proposal
- Meeting Bremerhaven **March 2012**\*  
 Collaboration with AWI scientists
- Meeting Copenhagen **June 2012**\*  
 Adjustment of proposal, Submitting proposal 30<sup>th</sup> of **July 2012**
- Approval of cruise **summer 2013**
- TRANSSIZ-workshop 1<sup>st</sup> & 2<sup>nd</sup> of **April 2014**\*
- Cruise planning meeting 10<sup>th</sup> of **September 2014**
- **Cruise 19<sup>th</sup> of May to 28<sup>th</sup> of June 2015**




\*sponsored by IASC



## ART Research questions

- How do Arctic Ocean organisms and ecosystems respond to environmental transitions (including temperature, stratification, ice conditions, and pH)?
- **How will biogeochemical cycling respond to transitions in terrestrial, gateway and shelf-to-basin fluxes?**
- How were past transitions in sea ice connected to energy flows, elemental cycling, biological diversity and productivity, and how do these compare to present and projected shifts?

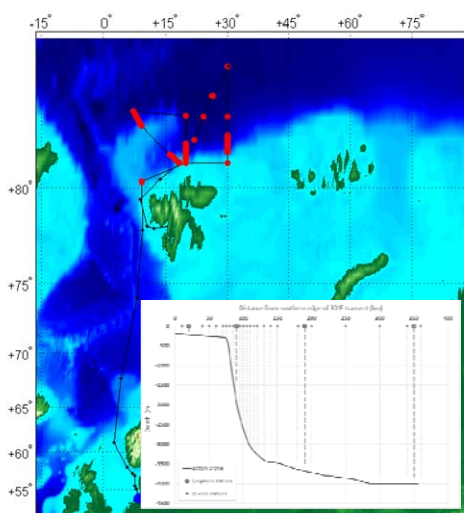


## Specific Research Questions

- Investigate **the cryo-pelagic -benthic coupling** from the Barents shelf to the Nansen Basin and **develop, validate and compare proxies** of sea ice and water masses.
- **Quantify the environmental preconditions** (e.g. nutrients, stratification) for productivity along shelf-to-basin transects to **improve predictions** of the potential annual primary production in a future ice-free ocean.
- Study the **transition of spring to summer** on ecosystem functioning and biogeochemical cycles as well as **transitions in productivity**, sea ice and ocean circulation across the last glacial cycle.



## Approach during TRANSSIZ



Process-based studies of *productivity*, *ecosystem dynamics*, *paleo proxies* and *biogeochemical cycling* along *shelf-to-basin transects* of the European Arctic

- 10 stations (36 hrs) along two main transects
- Additional CTDs in between process studies stations and over Yermak Plateau


19 May – 28 June 2015

Groups	Measurements
Oceanography	CTDs (X-CTD) ,mobile CTD, Microstructure-measurements, ADCP
Biogeochemistry	Radiance/irradiance/reflectance measurements, fluorescence of DOM, Nd-signature, non-algal matter, nutrients, PARAFAC analysis, phytoplankton, REE signature, trace gases, oxygen, and 129Iodine
Sea Ice Physics	Sea-ice thickness measurements (EM-bird) , Sea ice texture, ROV , spectral radiation measurements,
Sea Ice- / Under Ice - Biology	Sea-Ice algae & bacteria rates and variables, optical properties, Biodiversity, Biomarker, Under ice fauna, Polar cod...
Ecosystem/GreenEdge	Biodiversity, Bacteria, Nitrogen cycling ,Phytoplankton Rates and variables, large and small Zooplankton, Experiments, Short term moorings, Imaging Flow Cytobot, Particle cameras, MUCs, Benthos...
Geology	Spatial variation in proxies ; species assemblages, Ostracodes, Granulometry & mineralogy, Mg/Ca , Radiogenic isotopes (Nd, Sr, Pb), Biomarkers (IP25, TEX86, UK37)...
Geologie/Bathymetrie	Hydrosweep and Parasound
Weather	German Weather Service
Helicopter	Pilots and technicians

## Tasks and Persons Involved




- 1.2 SEA ICE PHYSICS (#5)
- 1.3 PHYSICAL OCEANOGRAPHY (#6)
- 1.4. TRACE GASES (#4)
- 1.5 GEOCHEMISTRY
  - 1.5.1 Organic Biomarkers in suspended Particles (#2)
  - 1.5.2 Watermass signatures ( $d^{18}O$ ,  $d^{13}C_{DIC}$ ) (#3)
  - 1.5.3 Suspended particulate matter (SPM) (#2)
  - 1.5.4 Water Mass Proxies - Radiogenic neodymium (Nd) isotopes of seawater (#2)
  - 1.5.5 Source and transformations of chromophoric dissolved organic matter and its role in surface ocean heating (#3)
- 1.6. SEA ICE BIOLOGY
  - 1.6.1. Ecological consequences of climate change in the ranspolar Drift Region (#3)
  - 1.6.2. heterotrophic microbial activity and the fate of ice associated productivity (#3)
- 1.7 SEA ICE ECOLOGY, PELAGIC FOOD WEB AND COPEPOD PHYSIOLOGY- ICEFLUX / PEBCAO – (#8)
- 1.8. ECOSYSTEM
  - 1.8.1 Nutrients, primary production and nitrogen cycling (GREENEDGE) (#6)
  - 1.8.2 Distribution Patterns of protest with special Emphasis on toxic dinoflagellates in the North Atlantic and Arctic Waters (#2)
  - 1.8.3 Nitrogen cycling and microbial ecology in the Arctic: Measurements of dinitrogen fixation rates, characterisation of diazotroph assemblages and NIFH gene expression (#3)
  - 1.8.4 Vertical export and small mesozooplankton (#3)
  - 1.8.5 Benthos ecology (#3)
- 1.9. TRANSSIZ- GEOLOGY AND PALEOCEANOGRAPHY (#16)



## Partners involved


Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung; AquaBiota Water Research; Akvaplan-niva AS; Byrd Polar & Climate Research Center; Cardiff University; Fisheries and Oceans Canada ; Deutscher Wetterdienst; Finnish Meteorological Institute, ; Helmholtz-Zentrum für Ozeanforschung Kiel; Hochschule Bremen; Institute for Marine Resources & Ecosystem Studies; Institute of Oceanology ; Laboratoire des sciences de l'Environnement MARin; Laboratoire des Sciences du Climat et de l'Environnement,; National Taiwan University; Norwegian Polar Institute; Newcastle University; Plymouth Marine Laboratory; Department of Geological Sciences; University of Bristol,; University of Helsinki; University Bremen; University of Hamburg; University of Tromsø; Université de Sherbrooke, ; Universität Trier; Takuvik Joint International Laboratory, Université Laval (Canada) - CNRS (France); Université Laval; Van Dorssen Metaalbewerking bv;




**11 Countries**

- **Post cruise meeting October 2015**
- **Post cruise workshop Spring 2016**
- **Result presentation: Arctic Frontiers 2017**

## ART PhD training




## Marie Skłodowska-Curie Innovative Training Networks (ITN)



**Total budget (2014-2020):  
€ 6.2 billion (current prices)**

*MSCA objective*

Ensure the optimum development and dynamic use of Europe's intellectual capital in order **to generate new skills and innovation**



## MSCA in H2020

Innovative Training Networks	<b>ITN</b>	<b>Support for doctoral and early-stage training Training Networks, Industrial Doctorates, Joint Doctorates</b>
Individual Fellowships	<b>IF</b>	Support for experienced researchers undertaking international and inter-sector mobility: - European Fellowships and Global Fellowships - Dedicated support for career restart and reintegration
Research and Innovation Staff Exchange	<b>RISE</b>	International and inter-sector cooperation through the exchange of staff
Co-funding of programmes	<b>COFUND</b>	Co-funding of regional, national and international programmes: - doctoral programmes - fellowship programmes





## Arctic in Rapid Transition - European Training Network “ART-ETN”

ART aims to bridge **research cruises & programmes**

TRANSARC II






ICE-ARC







Swedish - Russian - US Arctic Ocean Investigation of Climate-Cryosphere-Carbon Interactions - The SWERUS-C3 Program





## Arctic in Rapid Transition - European Training Network “ART-ETN”

ART aims to provide  
**research & opportunities for early-career researchers**

**Project beneficiaries:**

- PML, UK. Lead: Helen Findlay
- Stockholm University, Sweden. Lead: Matt O’Regan
- AWI, Germany. Lead: Ilka Peeken
- Polish Institute of Oceanology (IOPAN), Poland: Lead: Monika Kedra
- Cardiff University, UK. Lead: Caroline Lear
- Danish Technical University, Denmark. Lead: Colin Stedmon
- Digital Explorer, UK.

**Project partners:**

- UiT The Arctic University of Norway, Norway.
- Aquabiota, Sweden.
- Norwegian Polar Institute (NPI), Norway.
- Geomar, Germany.
- SubCTech, Germany.
- UNIS, Norway
- UPMC, France.



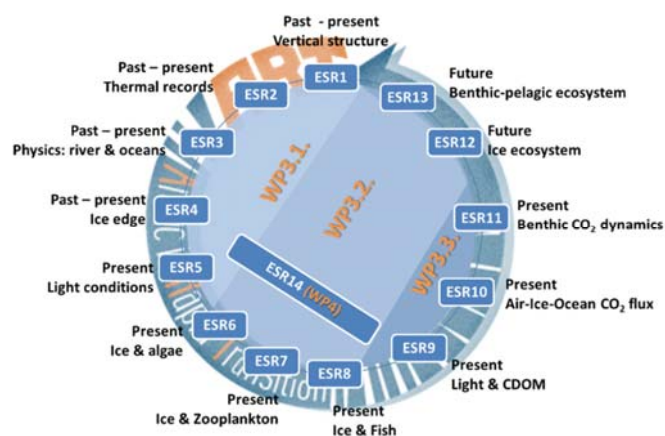
## Arctic in Rapid Transition - European Training Network "ART-ETN"

### ART-ETN: 2014 vs. 2015 proposal



- Good scores in 2014 - 82.2%
- Increased focus on outreach and science communication, with one ESR dedicated to outreach/communication, hosted by Digital Explorer.
- Applied for use of RV Dana (DTU) for a dedicated training and research cruise in late summer 2016.





## Arctic in Rapid Transition - European Training Network "ART-ETN"




## ART Workshops

**2<sup>nd</sup> ART Workshop:**  
**ISTAS Integrating spatial and temporal scales in the  
 changing Arctic System: towards future research priorities**

- 21-24 October 2014, at IUEM, France
- Co-organised by **ART** (Arctic in Rapid Transition), **IUEM** (European Institute for Marine Studies) and **APECS** (Association of Polar Early Career Scientists).
- Discussion on integration of **spatial and temporal scales in the Arctic** to better understand the changing Arctic system as a whole.
- **Future directions of Arctic research** from an early career scientists' perspective.



IUEM (c) Treguer/CNRS

  **2<sup>nd</sup> ART Workshop:**  
**Integrating spatial and temporal scales in the  
changing Arctic System: towards future research priorities**   
 21-24 October 2014, IUEM, France

- 76 participants, 60% early/mid career scientists, 13 countries.
- **Multidisciplinary** (biological and physical oceanography, sea ice, marine biodiversity, land-ocean interactions, paleo-reconstruction and biological archives, law and economics, sustainability and resources).
- **Keynote** and **breakout sessions**.

## ART Publications



## Future of the Arctic Research - Priority Sheets

**ART Future Research Priority Sheets: outcome of ISTAS workshop and a contribution to the ICARP III process**

- ARCTIC OCEANOGRAPHY
- PHYSICAL PROCESSES IN ARCTIC SEA ICE
- ARCTIC LAND-OCEAN INTERACTIONS
- ARCTIC BIODIVERSITY
- PROXY CALIBRATION AND EVALUATION
- PALEOCEANOGRAPHIC TIME SERIES FROM ARCTIC SEDIMENTS
- LAW IN THE ARCTIC


  
**ARCTIC OCEANOGRAPHY**
  

 ISTAS workshop session:
   
 Oceanography: Atmosphere-Ocean Exchange, Biogeochemistry & Physics
   
 Authors:
   
 Håkan Wehde, Eugénie de la Tour, Anne Cornejo, Mathilde Horeau, Ruth Hirsland, Anna Hildbrandt,
   
 Mathieu Anthon, Christian Mørk, Bernard Quéguiner, Morten Søe Mørk and Sinead Bourque


  
**PHYSICAL PROCESSES IN ARCTIC SEA ICE**
  

 ISTAS workshop session:
   
 Sea Ice in the Arctic Ocean: From Microphysics to Large Scale Dynamics
   
 Authors:
   
 Andrew Turner, Matthias Chirilus-Brukner, Alamy Parke (amy.parke@utoronto.ca), Andrew Prosser,
   
 and Willem Heister


  
**ARCTIC LAND-OCEAN INTERACTIONS**
  

 ISTAS workshop session:
   
 Permafrost Land-ocean interactions in the Arctic:
   
 from coastal to submarine permafrost including gas hydrates
   
 Authors:
   
 Michael Eric Orlandi, Michael Orlandi, Nikolai Ostrowski, Nikolai Ostrowski, Jennifer Trevisan,
   
 Eugene Lantieri



## ART Special issue in Polar Research

**ART special issue in Polar Research (online later in 2015)**

- Submitted (10 papers)
- Accepted (4 papers)
- Under review (3 papers)
- Rejected (3 papers)

+

Intro paper

- Synthesis / review papers
- Standard research papers
- Educational-type papers



## ART in science conferences



### ART Session during ASSW 2015

Session C2: **Arctic in Rapid Transition - future research directions from the perspective of early career scientists**

- 2 time slots allocated in the program
- 18 abstracts submitted for ART session
- 7 oral presentations and 11 posters
- Scheduled discussions: 25 min and 35 min after each part of the session, with a focus on “**ART network suggestions for ICARP III**”



**April 23-30, 2015**

Toyama International Conference Center, Toyama, Japan

## Future plans



### Future meetings

#### Post-TRANSSIZ cruise / EC meetings

- Post-cruise / ART EC meeting in spring 2016 (tentative during EGU)
- Post-cruise workshop in Fall 2016 (**ART will look for a host and/or financial support next year**)

#### Conferences

- ART Sessions at **EGU2016** and **ASLO Ocean Sciences Meeting 2016**
- Science conference co-organizing at **Arctic Frontiers 2017**: ART, CarbonBridge, & Marine night

**Expand our activities into Pacific sector (ART is looking for potential collaboration)**



