

Laboratory results for maximum quantum yield data for *Orbicella faveolata* recruits inoculated with either *Symbiodinium microadriaticum* or *S. minutum* (McIlroy, J. Phycology, 2016) (SymBioSys project)

Website: <https://www.bco-dmo.org/dataset/714412>

Version:

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Project

» [Ontogenic change in Cnidarian-algal symbioses: A genomic and ecologic perspective](#) (SymBioSys)

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Dataset Description

Maximum quantum yield data for *Orbicella faveolata* recruits inoculated with either *Symbiodinium microadriaticum* or *Symbiodinium minutum* and maintained in the laboratory for monitoring. These data were used in McIlroy et al (2016).

Methods, data processing, and results reported in:

McIlroy SE, Gillette P, Cunning R, Klueter A, Capo T, Baker AC, Coffroth MA (2016) The effects of *Symbiodinium* (Pyrrhophyta) identity on growth, survivorship, and thermal tolerance of newly settled coral recruits. *Journal of Phycology* 52:1114–1124. DOI: [10.1111/jpy.12471](https://doi.org/10.1111/jpy.12471)

Related Datasets:

[McIlroy_2016: Growth of *Orbicella faveolata* recruits](#)

[McIlroy_2016: Effective quantum yield for *Orbicella faveolata* recruits](#)

[McIlroy_2016: Symbionts genotypes in *Orbicella faveolata*](#)

Methods & Sampling

Collection of *Orbicella faveolata* larvae was made at Alligator Reef (24°48.7710 N, 80°40.1670 W) and Looe Key (24°32.6930 N, 81°24.5620 W) in 2011. Initial rearing was done at Keys Marine Laboratory (KML), Long Key, FL. Settled corals were then maintained at University of Miami Experimental Hatchery (Virginia Key, Miami, FL). *Symbiodinium* cultures originated from highly concentrated, isoclonal reference cultures maintained at the University at Buffalo – SUNY (BURR Culture Collection: <http://www.nsm.buffalo.edu/Bio/burr/>). The cultures used in the experiments were maintained at the Keys Marine Lab (Florida) in f/2 medium (Guillard 1975), at ~27°C, under a 14:10 h light:dark regime.

Measures of photophysiology for recruits harboring either *S. microadriaticum* or *S. minutum* were determined using an imaging-PAM (WALZ Mess- und Regeltechnik, Germany). All fluorescence parameters were described and abbreviated according to Cosgrove and Borowitzka (2010) and Enriquez and Borowitzka (2010). For the first 6 months following settlement (age in months 1-6) analyses were run monthly on one designated tile per tank (n = 4 tiles). We measured the effective quantum yield ($\Delta Fv/Fm0'$, the efficiency of photochemistry in the light-adapted state) for six randomly selected recruits from each tile repeated monthly for 6 months. Data were analyzed using a two-way ANOVA, with symbiont treatment and time as factors and tile nested within treatment.

Additionally, RLC (rapid light curves) analysis was performed on 2-month-old recruits. RLC analysis measured $\Delta Fv/Fm'$ as a function of increasing irradiance, in this case across eight steps of increasing PAR (0, 11, 21, 36, 56, 81, 111, and 146 $\mu\text{mol photons/m}^2/\text{s}$), each of which was followed by a saturating pulse. RLC analysis examines the way in which algae use light to drive photosynthesis, by converting $\Delta Fv/Fm'$ into a measure of the rate of electron transport through the photosynthetic chain (rETR). Using SigmaPlot (Systat Software, San Jose, CA, USA), we fitted a hyperbolic tangent function (Platt et al. 1980) to the PAR versus rETR data for each of 48 recruits (2 Symbiodinium treatments x 4 replicate tanks x 6 polyps), and calculated the maximum light utilization coefficient (α , the slope of the linear phase at subsaturating light). We used a two-tailed Student's t-test to test for a significant effect of Symbiodinium treatment on α .

Data Processing Description

BCO-DMO Processing:

- original file: DATASET_McIlroyetal2016_Orbicella Maximum Quantum Yield.xlsx
- modified conventional header with dataset name, PI name, version date, reference information
- changed parameter names to be BCO-DMO compatible

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Data Files

File
McIlroy_2016_max_yield.csv (Comma Separated Values (.csv), 12.97 KB) MD5:6b87a921aa83ca829049fff8cfef9353
Primary data file for dataset ID 714412

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Related Publications

McIlroy, S. E., Gillette, P., Cunning, R., Klueter, A., Capo, T., Baker, A. C., & Coffroth, M. A. (2016). The effects of Symbiodinium (Pyrrhophyta) identity on growth, survivorship, and thermal tolerance of newly settled coral recruits. *Journal of Phycology*, 52(6), 1114–1124. doi:[10.1111/jpy.12471](https://doi.org/10.1111/jpy.12471)
Results

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Parameters

Parameter	Description	Units
Symbiodinium	Species of Symbiodinium used for larval inoculation	unitless
Tank	Aquarium Tank replicate for temperature treatments	unitless
Temperature	The temperature at which the recruits were maintained	degrees Celsius
RecruitReplicate	The coral recruit measured	unitless
Days_at_Temp	The number of days recruits were maintained at treatment temperatures. Day 0 was prior to increase in temperature.	unitless
Fv/Fm	Maximum quantum yield (Fv/Fm: maximum quantum yield of PSII) of <i>Orbicella faveolata</i> recruits	unitless

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Instruments

Dataset-specific Instrument Name	imaging-PAM (WALZ Mess- und Regeltechnik, Germany)
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

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Project Information

Ontogenic change in Cnidarian-algal symbioses: A genomic and ecologic perspective (SymBioSys)

Coverage: Florida Keys, Bahamas, Panama, Mexico

PROJECT SUMMARY:

The symbiosis between corals (Cnidaria:Hexacorallia:Scleractinia) and photosynthetic dinoflagellate symbionts (Alveolata: Dinophyceae: Symbiodinium) provides the foundation and structure of the coral reef ecosystem, as well as significant contributions to global carbon and biogeochemical cycles. Given the importance of this symbiosis to the coral-algal holobiont and the reef ecosystem, understanding the mechanisms governing the establishment and long term maintenance of this symbiosis is essential. The overall aim of this project is to identify the mechanisms and selective processes that lead to the final assemblage of symbionts harbored by adult hosts. This question will be approached from two perspectives, ecologic and genomic, with the specific aims of determining (1) if different Symbiodinium strains differentially affect fitness of corals as the adult settles into a mature symbiosis (2) if competition among symbionts or environmental conditions contribute to the final host-symbiont pairing and (3) how host/symbiont transcriptomes vary as the symbiont community within a host is winnowed to the final assemblage found in the adult host. Traits that directly affect coral fitness (i.e. growth, survivorship, energy production) will be measured under different environmental conditions over the ontogeny of coral recruits that are experimentally infected with different types of Symbiodinium. Concurrently, high throughput gene expression profiling will be used to follow changes in gene expression between host and symbiont. Together, these data will be used to validate or falsify the hypotheses that the

final symbiont assemblage found in the adult host is determined by (a) host selection (b) competition among symbionts and/or (c) environmental condition.

This study pools the expertise of two labs that have focused on these aspects of the symbiosis. The Coffroth lab pioneered the studies on early ontogeny of the symbiosis and symbiont diversity and will continue to take the lead in the ecological studies. The Medina lab is at the forefront in the development and utilization of genomic technology to study transcriptomic changes during the establishment and breakdown of the symbiosis. Furthermore, the Medina lab has the coral microarrays to be used in this study and in 2009 will also have oligo arrays for two Symbiodinium species based on 454 EST data. Although several groups have initial studies of the host transcriptome, none have combined an approach that examines the host and the symbiont in a single experiment. This will be a powerful approach as it will allow the investigators to track complementary changes in gene expression between host and symbiont and relate those to turnover in the symbiont community as the final symbiont complement is established.

The data resulting from the study will bridge an important gap in our understanding of the establishment and maintenance of coral-Symbiodinium symbiosis. Understanding the mechanism(s) regulating the establishment of the symbiosis will broaden our knowledge and help to predict the response of this symbiosis to future climate conditions. As in the past, the genomic tools (arrays, ESTs) will be made readily available to researchers via array distribution at cost, microarray analysis training, or sequence data, providing valuable resources to continue exploring these systems.

In conjunction the Aquarium of Niagara, Coffroth will develop educational and outreach programs to train and disseminate information on coral reefs to local area teachers and the general public. The Medina lab will continue to produce science and environment podcasts in multiple languages (English, Spanish and Hmong) with undergraduate students at UC Merced and will continue to collaborate with the California Academy of Sciences (CAS) in their coral reef outreach efforts. Additionally, this work will result in the training and mentoring of a postdoctoral fellow, at least one graduate student and at least 2 undergraduates. Through this project these students will have the opportunity to participate in research in both a lab and field setting, learning a range of ecological, molecular and algal culturing techniques. The extensive culture collection housed at the University at Buffalo is an important resource that is available to researchers worldwide which the proposed funding will help to maintain. Our EST annotations are publicly available through our EST database (<http://montastraea.psu.edu/SymBioSys/>).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0926822

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